National Marine Fisheries Service
Endangered Species Act Section 7
Biological Opinion

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NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7

BIOLOGICAL OPINION

ENVIRONMENTAL PROTECTION AGENCY'S REGISTRATION REVIEW OF PESTICIDE PRODUCTS CONTAINING METOLACHLOR AND 1,3-DICHLOROPROPENE

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EXECUTIVE SUMMARY

Key Findings

This Biological Opinion (Opinion) evaluated the effects of the Environmental Protection Agency's (EPA) registration of the pesticides 1,3-Dichloropropene (1,3-D, also referred to as Telone) and metolachlor on Pacific salmonids listed as threatened or endangered under the Endangered Species Act (ESA), along with the designated critical habitats of these salmonids. 1,3-D is a soil fumigant used to control nematodes, wireworms, and symphylans. Metolachlor (racemic metolachlor and s-metolachlor) is a broad-spectrum systemic herbicide that controls plants by inhibiting seedling shoot and meristematic growth.

This Opinion addresses the effects of EPA's registration actions on all the listed Pacific salmonids and critical habitats under the jurisdiction of the National Marine Fisheries Service (NMFS). A complete ESA consultation on EPA's registration of 1,3-D and Metolachlor would encompass all ESA-listed species and designated critical habitat under NMFS jurisdiction. However, in this instance, as a result of the 2002 order in Washington Toxics Coalition v. EPA on EPA's registration of 37 pesticides, EPA initiated consultation specifically on listed Pacific salmonids under NMFS' jurisdiction and associated designated critical habitat in the states of California, Idaho, Oregon, and Washington. 1,3-D and Metolachlor are the final set of pesticides identified in the consultation schedule established in the settlement agreement. NMFS' analysis therefore focuses only on the effects of EPA's action on listed Pacific salmonids and their designated critical habitats in the above-mentioned states.

Current product labels permit use on a variety of agricultural and non-agricultural use sites in states relevant to this consultation: Washington, Idaho, Oregon, and California. 1,3-D is applied through drip irrigation or various soil injection methods that require covering the applied product with soil and/or tarping material. Approximately 82% of the 1,3-D products currently available for use also include chloropicrin. Chloropicrin is a broad-spectrum fumigant that can be used as an antimicrobial, fungicide, herbicide, insecticide, and nematocide. Use sites for products containing 1,3-D include vegetable, field crops, fruit and nut crops, nursery crops, mint, and potatoes. Maximum single and annual application rates for general crop categories currently authorized range between 296 and 580 lbs 1,3-D./acre. 1,3-D products that are co-formulated with chloropicrin allow applications of up to 350 lbs chloropicrin/acre.

Metolachlor (racemic metolachlor and s-metolachlor) is a broad-spectrum systemic herbicide that controls plants by inhibiting seedling shoot and meristematic growth. Metolachlor products can be applied pre-plant, pre-emergence, or early post-crop emergence to control seedling grasses or certain broadleaf weeds in a wide range of crops. Maximum single application rates range from 0.64 to 3.75 lbs a.i./A. Labels allow up to two applications per crop cycle, and multiple crop cycles per year, with maximum annual application rates up to 5.97 lbs a.i./A/year in certain crops. Metolachlor products are formulated as emusifiable concentrates, flowable concentrates, soluble concentrates, granules, and ready to use mixtures. Metolachlor products can be applied through a variety of ground applications methods including broadcast sprays, banded applications, soil incorporation methods, and co-application with dry bulk granular fertilizer. Metolachor can also be applied using aircraft and chemigation equipment (EPA 2019).

Current application rates of metolachlor and products containing1,3-D, and application methods are expected to produce aquatic concentrations of both pesticides that are likely to cause some harm to aquatic species and may contribute to some degradation of designated critical habitats. Species and their prey residing in shallow aquatic habitats proximal to these pesticide use sites are expected to be the most at risk.

Analysis and Methods

The assessment approach utilized interagency methods and procedures that were developed based on the recommendations of the National Academy of Sciences. This framework relied upon multiple lines of evidence to determine effects to populations, species, and their designated critical habitats. The Assessment Framework in Chapter 4 provides a description of the methodology used throughout this Opinion.

When determining the effects of the action (i.e., the registration of pesticides containing 1,3-D and metolachlor) on listed species, we considered many pieces of information including: the direct and indirect toxicity of each chemical to aquatic taxa groups (e.g. fish, invertebrates, and plants) and terrestrial plants (i.e. riparian vegetation); specific chemical characteristics of each pesticide (e.g. degradation rates, bioaccumulation rates, sorption affinities, etc.); expected environmental concentrations calculated for generic aquatic habitats and riparian zones; authorized pesticide product labels; maps showing the spatial overlap of listed species' habitats with pesticide use areas; and species' temporal use of those lands and/or aquatic habitats on which each pesticide has permitted uses. The specific sources of information utilized in our analysis are outlined in Chapter 4.

The effects analysis focused around risk hypotheses, or statements of anticipated effects to species. We employed a weight-of-evidence approach to determine for each risk hypothesis whether the expected risk from pesticide exposure to groups of individuals was high, medium or low. To arrive at that rating for each risk hypothesis, we addressed not only the effect and likelihood of exposure, but also our level of confidence in the risk level. We utilized multiple data sources to evaluate both the likelihood of exposure and the magnitude of effect to groups of individuals occupying similar aquatic habitats. This allowed us to assess the body of evidence that either supported or refuted the risk hypotheses. For each species, all identified risk hypotheses were qualitatively combined into a single determination of risk at the population scale (i.e., the effects of the action) and represented graphically. A similar, yet separate, analysis was conducted for designated critical habitats where risk hypotheses were developed based on potential pesticide effects to physical or biological features of critical habitat. Generally, these included effects to water quality, vegetative cover, and species' prey items. Detailed effects analyses for both species and critical habitats can be found in Chapters 12 and 15.

Conclusions

As described in Chapter 7, we consulted on all 28 ESA-listed salmonids within the action area as well as their designated critical habitats. In the Integration and Synthesis chapter, we concluded that EPA's proposed registration of pesticides products containing 1,3-D is not likely to jeopardize any of the listed salmonids nor cause destruction or adverse modification of designated critical habitats for the species consulted on. Similarly, we concluded that EPA's proposed registration of pesticides containing metolachlor is not likely to jeopardize or cause destruction or adverse modification of designated critical habitats for any listed salmonids consulted on. The details of our jeopardy and destruction or adverse modification determinations for each species can be found in Chapters 13 and 16.

Minimizing the Impact of Incidental Take

As prescribed by the ESA, the Opinion includes an Incidental Take Statement (ITS) with reasonable and prudent measures (RPMs) to minimize take to listed species. These RPMs were drafted in consultation with Applicants and with EPA using the best available information on current agricultural practices and pesticide reduction strategies to minimize incidental take (50 CFR 402). The RPMs require label changes for all products containing these pesticides designed to reduce pesticide loading into aquatic habitats; the development of ESA educational materials to increase awareness of sensitive species in adjacent species habitats; reporting of label compliance monitoring; and clarifications regarding methods of reporting ecological incidents. The ITS and RPMs are presented in Chapter 18 of the Opinion along with associated Terms and Conditions.

1 INTRODUCTION

The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat that may be affected by the action that are under NMFS jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action “may affect, but is not likely to adversely affect” endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an Opinion stating whether the Federal agency’s action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes RPMs to minimize such impacts and terms and conditions to implement the RPMs.

The Federal action agency for this consultation is the Environmental Protection Agency (EPA). EPA has requested ESA Section 7(a)(2) consultation from NMFS on its registration of the approved uses of pesticide products containing two active ingredients pursuant to the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). The two active ingredients being reviewed are: metolochlor and 1,3-Dichloropropene. Metolochlor is a seedling shoot growth inhibitor herbicide; 1,3-Dichloropropene is a soil fumigant used to control nematodes and certain soil diseases. This is the tenth biological opinion issued in a series prompted by Settlement Agreements stemming from a 2001 lawsuit (discussed below).

This consultation, opinion, and incidental take statement, were completed in accordance with ESA section 7, associated implementing regulations (50 C.F.R. §§401-16), and agency policy and guidance. This consultation was conducted by NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division (hereafter referred to as “we” or “our”).

A complete ESA consultation on EPA’s registration of metolachlor and 1,3-Dichloropropene would encompass all ESA-listed species and designated critical habitat under NMFS jurisdiction. However, in this instance, as a result of the 2002 order in Washington Toxics Coalition v. EPA on EPA’s registration of 37 pesticides, EPA initiated consultation specifically on listed Pacific salmonids under NMFS’ jurisdiction and associated designated critical habitat in the states of California, Idaho, Oregon, and Washington. Metolachlor and 1,3-Dichloropropene are the final set of pesticides identified in the consultation schedule established in the settlement agreement. This document therefore represents the NMFS Opinion only on the effects of these actions on listed Pacific salmonids under NMFS’ jurisdiction in the above-mentioned states, and the Incidental Take Statement only addresses take of those species. A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on October 28, 2019 [84 FR 44976]. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the Opinion is fully consistent with the updated regulations.

2 BACKGROUND

Pursuant to FIFRA, before a pesticide product may be sold or distributed in the U.S., it must be exempted or registered with a label identifying approved uses by EPA's Office of Pesticide Programs (OPP). Pesticide registration is the process through which EPA examines the ingredients of a pesticide; the site or crop on which it is to be used; the amount, frequency and timing of its use; and storage and disposal practices. Pesticide products (also referred to as "formulated products") may include active ingredients (a.i.s) and other ingredients, such as adjuvants and surfactants. EPA authorization of pesticide uses are categorized as FIFRA Sections 3 (new product registrations), 4 (re-registrations and special review), 18 (emergency use), or 24(c) Special Local Needs (SLN).

Metolachlor was first registered in the United States in 1976 as an herbicide for the control of weeds in a variety of agricultural crops including corn, cotton, potatoes and peanuts, among other uses. 1,3-Dichloropropene was initially registered in 1954 for use as a soil fumigant to control nematodes and certain soil diseases.

In April, 1995 EPA issued a Registration Eligibility Decision (RED) for metolachlor in which EPA concluded: "The Agency has determined that all uses of metolachlor with the exception of potatoes, soybeans, and peanuts as currently registered will not cause unreasonable risk to humans or the environment."

In December, 1998 EPA issued a Registration Eligibility Decision (RED) for 1,3-D in which EPA determined: "The Agency has concluded that 1,3-D, when labeled and used as specified in this RED document, will not cause unreasonable risks to human health or the environment."

On January 30, 2001, the Washington Toxics Coalition, Northwest Coalition for Alternatives to Pesticides, Pacific Coast Federation of Fishermen's Associations, and Institute for Fisheries Resources filed a lawsuit against EPA in the U.S. District Court for the Western District of Washington (*Wash. Toxics Coalition v. EPA*, Civ. No. C01–132C, 2002 WL 34213031 (W.D.Wash. July 2, 2002), *aff'd*, 413 F.3d 1024 (9th Cir.2005)). This lawsuit alleged that EPA violated section 7(a)(2) of the ESA by failing to consult on the effects to 26 Evolutionarily Significant Units (ESUs) of listed Pacific salmonids of its continuing approval of 54 pesticide active ingredients. On July 2, 2002, the court ruled that EPA had violated ESA section 7(a)(2) and ordered EPA to initiate interagency consultation and make determinations about effects to the salmonids on all 54 active ingredients by December 2004. Pursuant to this Court's order, between August 2002 and December 2004, EPA initiated consultations with NMFS on 37 of those pesticides EPA determined "may affect" listed salmonids; the remaining 17 active ingredients were determined to have "no effect" on listed species or their designated critical habitats.

In December 2002, EPA and the U.S. Fish and Wildlife Service and NMFS began interagency discussions for streamlining EPA's court ordered consultations.

On January 24, 2003, EPA and the Services published an Advance Notice of Proposed Rulemaking seeking public comment on improving the process by which EPA and the Services work together to protect listed species and critical habitat (68 FR 3785).

Between May and December 2003, EPA and the Services reviewed EPA's ecological risk assessment methodology and earlier drafts of EPA's "Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs, U.S. Environmental Protection Agency (Overview Document)". EPA and the Services also developed counterpart regulations to streamline the consultation process.

On January 22, 2004, the court in Wash. Toxics Coalition v. EPA, Civ. No. C01–132C entered an injunction vacating EPA's authorization of certain uses of 54 pesticide active ingredients in certain areas and imposing certain other requirements ("Interim Measures"), until issuance by NMFS of a biological opinion or other described termination event. The no-spray buffers in the proposed stipulated injunction extend 300 feet from salmon supporting waters for aerial applications and 60 feet for ground applications for these active ingredients, which include 1,3-D and metolachlor.

On January 23, 2004, EPA finalized its Overview Document which specified how EPA would conduct ecological risk assessment on pesticide registrations.

On January 26, 2004, the Services approved EPA's procedures and methods for conducting ecological risk assessments and approved interagency counterpart regulations for EPA's pesticide registration program.

On January 30, 2004, the Services published in the Federal Register (69 FR 4465) proposed joint counterpart regulations for consultation under the ESA for regulatory actions under the Federal Insecticide, Fungicide, and Rodenticide Act.

On August 5, 2004, the Services promulgated final joint counterpart regulations for EPA's ESA-related actions taken pursuant to FIFRA. These regulations and the Alternative Consultation Agreement (ACA) under the regulations allowed EPA to conduct independent analyses of potential impacts of pesticide registration on listed species and their designated critical habitats. The ACA outlined procedures to ensure EPA's risk assessment approach will produce effect determinations that reliably assess the effects of pesticides on listed species and designated critical habitat. Additionally, EPA and the Services agreed to meet annually, or more frequently as may be deemed appropriate. The intention of these meetings was to identify new research and other activities that may improve EPA's current approach for assessing the potential ecological risks posed by use of a pesticide to listed species or designated critical habitat.

On September 23, 2004, the Washington Toxics Coalition and others challenged the counterpart regulations in the U.S. District Court for the Western District of Washington, Civ. No. 04-1998, alleging that the regulations were not authorized by the ESA and that the Services had not complied with the Administrative Procedure Act and the National Environmental Policy Act (NEPA) in promulgating these counterpart regulations.

On August 24, 2006, the court determined the Services did not implement NEPA procedures properly during their promulgation of the joint counterpart regulations for EPA actions under FIFRA. Additionally, the court determined that the "not likely to adversely affect" and emergency consultation provisions of the counterpart regulations waiving Services' review were arbitrary and capricious and contrary to the substantive requirements of ESA section 7(a)(2). The court determined that EPA may write its own biological opinions under the alternative formal consultation procedures, as they required the Services' concurrence with EPA's conclusions. Washington Toxics Coalition, 457 F.Supp. 2d 1158 (W.D.Wash. 2006).

On November 5, 2007, the Northwest Coalition for Alternatives to Pesticides (NCAP) and others filed a legal complaint in the U.S. District Court for the Western District of Washington, Civ. No. 07 1791, against NMFS for its unreasonable delay in completing the section 7 consultations for EPA's registration of the remaining 37 (of the original 54) pesticide active ingredients.

On July 30, 2008, NMFS entered a settlement agreement with NCAP. NCAP had sued NMFS for failing to complete consultation on 37 pesticide active ingredients (17 of the original 54 active ingredients received "no effect" determinations and thus did not require formal consultation) for impacts to listed salmon ESUs. In the settlement agreement NMFS agreed on a schedule for completion of consultation on each active ingredient, with the final consultation due in early 2013. Subsequent settlement agreements (described below) have revised this schedule, with the consultation on the final active ingredient of the 37 now due by December 31, 2020.

On November 18, 2008, NMFS issued the first biological opinion under this schedule for three organophosphates: chlorpyrifos, diazinon, and malathion. This Opinion concluded that EPA's action was likely to jeopardize all but one of the listed salmonid species, and likely to adversely modify their designated critical habitat. NMFS included a reasonable and prudent alternative

(RPA) that would allow the action to proceed without likely jeopardy and likely adverse modification. The RPA included no-application buffers, as well as other measures.

On April 1, 2009, Dow AgroSciences, LLC, Makhteshim Agan of North America, Inc. and Cheminova Inc., USA, challenged the validity of the OP BiOp under the ESA and the Administrative Procedure Act ("APA"), Dow AgroSciences, LLC v. NMFS, No. 09-cv00824 (D. Md.) ("Dow") (Dkt. No. 1)

On April 20, 2009, NMFS issued the second biological opinion ("Carbamate BiOp") under the NCAP schedule concerning the effects on listed salmonids and their critical habitat of three of the 37 pesticides at issue in Washington Toxics: carbaryl, carbofuran, and methomyl.

On August 31, 2010, NMFS issued its third biological opinion under the NCAP schedule. This third consultation evaluated 12 organophosphate insecticides: azinphos methyl, bensulide, dimethoate, disulfoton, ethoprop, fenamiphos, methamidophos, methidathion, methyl parathion, naled, phorate, and phosmet.

On March 10, 2011, EPA, on behalf of itself and the Departments of the Interior, Commerce and Agriculture, asked the National Academy of Sciences ("NAS") to evaluate the differing risk assessment approaches used by these agencies with regard to pesticides and endangered species. Specifically, the committee was asked to evaluate EPA's and the Services' methods for determining risks to listed species posed by pesticides and to answer questions concerning the identification of the best scientific data, the toxicological effects of pesticides and chemical mixtures, the approaches and assumptions used in various models, the analysis of uncertainty, and the use of geospatial data.

On June 30, 2011, NMFS issued its fourth biological opinion under the NCAP schedule. This fourth consultation evaluated four herbicides: 2,4-D, triclopyr BEE, diuron and linuron; and 2 fungicides: captan and chlorothalonil.

In October 2011, the U.S. District Court for the District of Maryland granted NMFS' cross-motion for summary judgment and denied plaintiff's motion for summary judgment, Dow AgroSciences, LLC v. NMFS, 821 F. Supp. 2d 792 (D. Md. 2011) in regards to DoW AgroSciences' challenge of the 2008 biological opinion for chlorpyrifos, malathion, and diazinon. The dismissed case was subsequently appealed by plaintiffs to the Fourth Circuit (Dow AgroSciences, LLC v. NMFS, 707 F.3d 462 (4th Cir. 2013)).

On May 31, 2012, NMFS issued its fifth biological opinion under the NCAP schedule. This fifth consultation evaluated herbicides: oryzalin, trifluralin, and pendimethalin.

On July 2, 2012, NMFS issued its sixth biological opinion under the NCAP schedule. This sixth consultation evaluated the herbicide thiobencarb.

On February 21, 2013, the U.S. Circuit Court for the Fourth Circuit issued an Opinion which reversed the judgement of the district court (October 2011) and remanded the 2008 OP BiOp (chlorpyrifos, malathion, and diazinon) to NMFS for further explanation on exposure assumptions, reliance on water quality monitoring data, and the technologic and economic feasibility of RPAs.

On April 30, 2013, the NAS issued a report entitled "Assessing Risks to Endangered and Threatened Species from Pesticides". In light of the recommendations in the NAS Report, NMFS, FWS, EPA, and the U.S. Department of Agriculture (USDA) developed a common approach to risk assessment for pesticides. The NAS report contained recommendations on scientific and technical issues related to pesticide consultations under the ESA and FIFRA. Since then, the Agencies have worked to implement the recommendations. Joint efforts to date include: collaborative relationship building between EPA, NMFS, FWS and USDA; clarified roles and responsibilities for the EPA, FWS, NMFS and USDA; agency processes designed to improve stakeholder engagement and transparency during review and consultation processes; multiple joint agency workshops resulting in interim approaches to assessing risks to threatened and endangered species from pesticides; a plan and schedule for applying the interim approaches to a set of pesticide compounds; and multiple workshops and meetings with stakeholders to improve transparency as the pesticide consultation process evolves.

On May 21, 2014, NMFS and NCAP revised the settlement agreement with NMFS to issue a new biological opinion on the organophosphates chlorpyrifos, malathion, and diazinon by December 31, 2017. The agreement noted that NMFS, FWS, and EPA were working to develop a common approach to risk assessment in pesticides consultations that would implement the recommendations of the 2013 National Academies of Sciences report. As part of the settlement NMFS agreed to deadlines for biological opinions which included 1,3-dichloropropene and metolachlor.

On January 7, 2015 NMFS issued its seventh biological opinion under the NCAP schedule. This seventh consultation evaluated the pesticides diflubenzuron, fenbutatin oxide, and propargite.

On December 29, 2017 NMFS, pursuant to the stipulation filed in NCAP v. NMFS, cv-1791-RSL, completed a new nationwide biological opinion for chlorpyrifos, malathion and diazinon.

3 Consultation History

3.1 Metolachlor

On November 29, 2002 EPA submitted to NMFS a request for consultation on the effects of the pesticide racemic-metolachlor, pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

On June 19, 2006 EPA finalized the biological evaluation for metolachlor covering 26 listed salmonid species per Washington Toxics Coalition v. EPA, No. C-01-132 (W.D. Wash. July 2, 2002) Court Order. The 2006 assessment reached the following conclusions regarding metolachlor use and the 26 listed salmonids in California and the Pacific Northwest:

1. Metolachlor is expected to have no direct effect on the listed salmonids.
2. Metolachlor is expected to have no appreciable effect on designated critical habitat for the listed salmonids.
3. Metolachlor is expected to have no effect on the listed salmonid prey.
4. Metolachlor is not likely to adversely affect listed salmonids through effects on aquatic plants.
5. Metolachlor is not likely to adversely affect listed salmonids through effects on riparian vegetation.

On June 23, 2006 EPA withdrew its November 29, 2002 request for formal consultation and requested concurrence on a “not likely to adversely affect” (NLAA) determination for the registration of metolachlor, based on the 2006 biological evaluation.

On June 19, 2007 NMFS responded to EPA’s request for concurrence with a letter indicating that NMFS “does not concur with the effects determinations for Pacific salmonids and steelhead and recommends that EPA initiate formal consultation on the re-registration and use of racemic metolachlor”. NMFS did, however, agree with EPA’s NLAA determination for one species: Ozette Lake Sockeye.

On July 13, 2007 NMFS submitted to EPA a technical review of EPA’s pesticide effects determination for racemic metolachlor on federally listed salmonid species in the Pacific Northwest and California.

On November 5, 2007, the NCAP and others filed a legal complaint in the U.S. District Court for the Western District of Washington, Civ. No. 07 1791, against NMFS for its unreasonable delay in completing the section 7 consultations for EPA’s registration of the remaining 37 (of the original 54) pesticide active ingredients. The resulting settlement, and subsequent related settlements, revised the schedule for completion of consultation on each active ingredient. The court ordered due date for metolachlor was eventually set for December 31, 2020.

On September 29, 2011 NMFS hosted an initial meeting with the previously identified metolachlor applicants: Sipcam, Loveland, and MANA.

On September 19, 2019 EPA released the "Metolachlor/S-Metolachlor: Draft Ecological Risk Assessment for Registration Review."

On December 9, 2019 NMFS requested that EPA identify the applicants relevant to NMFS' Biological Opinion on 1,3-D and metolachlor. NMFS also requested that EPA provide updated Summary Use and Usage Matrix (SUUM) reports for both compounds.

On December 17, 2019 EPA provided NMFS a link to the Pesticide Product Label System for access to active Section 3 labels. EPA indicated that Section 24C labels and SUUM reports would be provided in February and April for 1,3-D and metolachlor, respectively.

On January 14, 2020 NMFS requested that EPA identify and provide a list of applicants relevant to NMFS' Biological Opinion on 1,3-D and metolachlor.

On January 30, 2020 EPA provided NMFS with a list of technical registrants/applicants, including point of contact information for each. EPA recommended that NMFS Biological Opinion evaluate both racemic-metolachlor as well as s-metolachlor.

On January 31, 2020 NMFS contacted the applicants identified by EPA for metolachlor (Adama Agan Ltd.; Drexel; Sipcam Agro USA, Inc.; Sharda Cropchem Ltd.; Albaugh, LLC; Helm Agro; Greenfields Marketing Ltd.; Syngenta; Extremis, LLC; and UPL Delaware Inc.). NMFS informed the applicants that the agency was preparing a Biological Opinion. NMFS requested that the applicants inform NMFS if any of the label information provided in EPA's 2019 draft ecological risk assessment review of metolachlor was incorrect or anticipated to change.

On February 14, 2020 Extremis LLC commented that EPA's draft ecological risk assessment review of metolachlor appeared to be missing some labeled use patterns. Details were provided for follow-up.

On April 30, 2020 EPA submitted to NMFS the "Metolachlor (108801) National and State Use and Usage Summary" report as well as the current collection of 24C labels for metolachlor and S-metolachlor.

On June 4, 2020 EPA submitted to NMFS a revised list of applicants for metolachlor/s-metolachlor which included a new technical registrant: INMES LLC.

On June 5, 2020 NMFS contacted INMES LLC to inform them that the agency was preparing a Biological Opinion. NMFS requested that INMES LLC inform NMFS if any of the label information provided in EPA's 2019 draft ecological risk assessment review of metolachlor was incorrect or anticipated to change.

On June 25, 2020 Syngenta submitted to NMFS a number of toxicological studies regarding metolachlor which had previously been requested by NMFS.

On July 22, 2020 NMFS sent preliminary draft chapters to EPA and metolachlor applicants for review. The draft chapters sent included: introduction, background, consultation history, description of action, action area, summary of LAA determinations, status of the species, and cumulative effects.

On August 17, 2020 Syngenta provided NMFS with three studies which had been requested by NMFS (MRID: 43928911; 46829506; 44995903).

On October 2, 2020 NMFS sent additional preliminary draft chapter to EPA and metolachlor applicants for review. The draft chapters sent included: assessment framework, introduction to the effects analysis; species effects analysis; introduction to habitat analysis; habitat effect analysis; species integration and synthesis, habitat integration and syntheses. The chapters sent included NMFS draft conclusions.

On October 16, 2020 NMFS was granted an extension to the court-ordered deadline of December 31, 2020. The deadline in the settlement agreement was thus amended to read: "NMFS agrees to finalize and publish a biological opinion concerning the effects of 1,3-D and racemic metolachlor by June 30, 2021."

On November 18, 2020 NMFS sent an additional preliminary draft chapter to EPA and metolachlor applicants for review. The draft chapter included: RPMs, ITS, terms and conditions, conservation recommendations, and reinitiation notice.

On December 7, 2020 NMFS met with EPA and metolachlor applicants to discuss the preliminary draft terms and conditions of the RPM. Following the meeting NMFS sent EPA and metolachlor applicants an updated draft of the RPM chapter for review.

On February 17, 2021 NMFS draft biological opinions for bromoxynil, prometryn, 1,3-Dichloropropene, and metolachlor were posted on EPA's docket for a 60-day public comment period, ending on April 20, 2021. NMFS subsequently reviewed all comments received and incorporated them into the biological opinions as appropriate.

On June 30, 2021 Thom Hooper* retired after 23 years of federal service.

3.2 1,3-Dichloropropene

On April 19, 2004 EPA finalized the biological evaluation for 1,3-D. The 2004 biological evaluation concluded that "the use of 1,3-Dichloropropene may affect but is not likely to adversely affect 11 ESUs when used according to labeled application directions and will have no effect on 15 ESUs in this assessment" (see **Table 1**).

*

Table 1. Summary conclusions on specific ESUs of listed Pacific salmon and steelhead for 1,3-Dichloropropene; adapted from EPA's biological evaluation of 1,3-D (Table 27). EPA did not make determinations regarding designated critical habitat.

Species	ESU	Finding (2004)
Chinook Salmon	California Coastal	No Effect
Chinook Salmon	Central Valley spring-run	No Effect
Chinook Salmon	Lower Columbia	May Affect, NLAA
Chinook Salmon	Puget Sound	May Affect, NLAA
Chinook Salmon	Sacramento River winter-run	May Affect, NLAA
Chinook Salmon	Snake River fall-run	May Affect, NLAA
Chinook Salmon	Snake River spring/summer-run	May Affect, NLAA
Chinook Salmon	Upper Columbia spring-run	May Affect, NLAA
Chinook Salmon	Upper Willamette	May Affect, NLAA
Chum Salmon	Columbia River	May Affect, NLAA
Chum Salmon	Hood Canal summer-run	No Effect
Coho Salmon	Central California	No Effect
Coho Salmon	Oregon Coast	No Effect
Coho Salmon	Southern Oregon/Northern California Coast	No Effect
Sockeye Salmon	Ozette Lake	No Effect
Sockeye Salmon	Snake River	No Effect
Steelhead	Central California Coast	No Effect
Steelhead	Central Valley, California	No Effect
Steelhead	Lower Columbia River	No Effect
Steelhead	Middle Columbia River	May Affect, NLAA
Steelhead	Northern California	No Effect
Steelhead	Snake River Basin	May Affect, NLAA
Steelhead	South-Central California	No Effect
Steelhead	Southern California	No Effect
Steelhead	Upper Columbia River	May Affect, NLAA

Steelhead	Upper Willamette River	No Effect

On July 29, 2004 EPA requested NMFS' concurrence on the NLAA determination made in the 2004 biological evaluation.

On November 5, 2007, the NCAP and others filed a legal complaint in the U.S. District Court for the Western District of Washington, Civ. No. 07 1791, against NMFS for its unreasonable delay in completing the section 7 consultations for EPA's registration of the remaining 37 (of the original 54) pesticide active ingredients. The resulting settlement, and subsequent related settlements, revised the schedule for completion of consultation on each active ingredient. The court ordered due date for 1,3-D was eventually set for December 31, 2020.

On December 9, 2019 NMFS requested that EPA identify the applicants relevant to NMFS' Biological Opinion on 1,3-D and metolachlor. NMFS also requested that EPA provide updated Summary Use and Usage Matrix (SUUM) reports for both compounds.

On December 10, 2019 EPA released the "1,3-dichlorpopropene (1,3-D): Draft Risk Assessment (DRA) in Support of Registration Review."

On December 17, 2019 EPA provided NMFS a link to the Pesticide Product Label System for access to active Section 3 labels. EPA indicated that Section 24C labels and SUUM reports would be provided in February and April for 1,3-D and metolachlor, respectively.

On January 14, 2020 NMFS requested that EPA identify and provide a list of applicants relevant to NMFS' Biological Opinion on 1,3-D and metolachlor.

On January 30, 2020 EPA provided NMFS with a list of technical registrants/applicants, including point of contact information for each.

On January 31, 2020 NMFS contacted the sole applicant identified by EPA for 1,3-D, Salt Lakes Holding LLC. NMFS informed the applicant that the agency was preparing a Biological Opinion and requested updated label information.

On February 9, 2020 Salt Lake Holdings LLC provided NMFS with a label summary generated in 2013. Salt Lake Holdings LLC stated that no additional uses had been added since the 2013 summary was generated.

On February 28, 2020 EPA provided NMFS with 35 24C labels relevant to 1,3-D. EPA also provided NMFS with the "Telone (1,3-Dichloropropene) (029001) National and State Summary Use and Usage Matrix" memorandum.

On March 11, 2020 NMFS met with representatives from Salt Lake Holdings LLC to discuss 1,3-D exposure estimate modeling techniques and other components of the consultation.

On April 15, 2020 Salt Lake Holdings LLC submitted to NMFS a number of studies and additional information to support NMFS' consultation on 1,3-D.

On May 21, 2020 Salt Lake Holdings LLC provided NMFS with additional ecotoxicology studies on 1,3-D and its metabolites.

On June 23, 2020 NMFS requested additional information from Salt Lake Holdings LLC regarding 1,3-D application rates as well as information to help inform exposure estimates for chloropicrin, a common co-active ingredient in 1,3-D formulated products.

On June 25 NMFS requested additional information from EPA regarding 1,3-D application rates.

On July 22, 2020 NMFS sent preliminary draft chapters to EPA and 1,3-D applicants for review. The draft chapters sent included: introduction, background, consultation history, description of action, action area, summary of LAA determinations, status of the species, and cumulative effects.

On October 2, 2020 NMFS sent additional preliminary draft chapters to EPA and 1,3-D applicants for review. The draft chapters sent included: assessment framework, introduction to the effects analysis; species effects analysis; introduction to habitat analysis; habitat effect analysis; species integration and synthesis, habitat integration and syntheses. The chapters sent included NMFS draft conclusions.

On October 16, 2020 NMFS was granted an extension to the court-ordered deadline of December 31, 2020. The deadline in the settlement agreement was thus amended to read: "NMFS agrees to finalize and publish a biological opinion concerning the effects of 1,3-D and racemic metolachlor by June 30, 2021."

On November 18, 2020 NMFS sent an additional preliminary draft chapter to EPA and 1,3-D applicants for review. The draft chapter included: RPMs, ITS, terms and conditions, conservation recommendations, and reinitiation notice.

On December 9, 2020 NMFS met with EPA and 1,3-D applicants to discuss the preliminary draft terms and conditions of the RPM. Following the meeting NMFS sent EPA and 1,3-D applicants an updated draft of the RPM chapter for review.

On February 17, 2021 NMFS draft biological opinions for bromoxynil, prometryn, 1,3-Dichloropropene, and metolachlor were posted on EPA's docket for a 60-day public comment period, ending on April 20, 2021. NMFS subsequently reviewed all comments received and incorporated them into the biological opinions as appropriate.

4 Assessment Framework

Section 7(a)(2) of the ESA requires federal agencies, in consultation with the NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 C.F.R. §402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of an ESA-listed species (50 C.F.R. §402.02).

4.1 Effects of the Action

To conduct effects analyses, we follow an ecological risk assessment framework based on the National Research Council National Academies of Sciences report on pesticides and endangered species (NAS 2013). The EPA, USDA, Fish and Wildlife Service (FWS), and NMFS adapted the report's framework to meet the specific needs of an ESA consultation. The framework divides the pesticide ESA consultation process into three steps (Figure 1). Each step builds upon analyses and findings from a previous step. The interagency group worked together to produce a transparent, systematic, and rigorous analysis based on ecological risk assessment principles. Under this framework EPA combines Steps 1 and 2 in their Biological Evaluations (BEs) and the NMFS conducts Step 3 in our Biological Opinions (Figure 1). A "no effect" determination indicates that the stressors of the proposed action will not affect an individual of a listed species or designated critical habitat. A "not likely to adversely affect" (NLAA) determination indicates that the effects of the proposed action on the fitness (survival or reproduction) of an individual of a listed species is expected to be discountable[1], insignificant[2], or completely beneficial[3] (Endangered Species Consultation Handbook). Note that if EPA concludes in its Step 2 determination that its action is "not likely to adversely affect" a particular species or habitat, and NMFS concurs, then the consultation process ends at Step 2. If individuals of a listed species are not adversely affected, then listed species and the populations that comprise them are not adversely affected and no further analysis

[1] Discountable effects are those extremely unlikely to occur.
[2] Insignificant effects relate to the size of the impact, and are effects a person would not be able to meaningfully measure, detect or evaluate. They should never reach the scale where take occurs.
[3] Beneficial effects are contemporaneous positive effects without any adverse effect to the species.

is needed. A "likely to adversely affect" (LAA) determination is made if any adverse effect to any individual of a listed species may occur as a direct or indirect result of the proposed action and the effect is not discountable, insignificant, or beneficial (Endangered Species Consultation Handbook).

EPA wrote separate BEs for 1,3-D (EPA 2004) and metolachlor (EPA 2006) in which EPA made species' effect determinations of either no effect or may affect. When may affect determinations were made, EPA concluded whether projected impacts were LAA or NLAA as shown in Figure 1. Within the Risk Characterization section of the BEs, EPA utilized a risk quotient approach and concluded that 1,3-D and metolachlor is LAA several listed Pacific salmonids. EPA did not make any conclusions regarding potential effects to designated critical habitat. The 1,3-D and metolachlor BEs were produced several years prior to the 2013 NAS report and the procedures implemented do not consistently align with NAS recommendations or interim interagency procedures (EPA 2013). In 2014, in an amendment to the August 1, 2008 settlement agreement, NMFS agreed to finalize and publish biological opinions on 1,3-D and metolachlor incorporating the methodologies developed in response to the NAS Report's recommendations and addressing all species listed under NMFS jurisdiction. However, consultation on all species is currently not feasible as EPA has thus far only sought consultation on the Pacific salmonids and has not provided BEs addressing effects to other species under NMFS jurisdiction. Therefore, NMFS updated the exposure, response, and risk characterization information for the listed salmonids to achieve consistency with the NAS recommendations. This document represents NMFS' Opinion on the impacts of EPA's authorization of pesticide products containing 1,3-D and metolachlor on the listed Pacific salmonids and their designated critical habitats. This is a partial consultation intended to comply with the 2008 settlement agreement. This document does not provide NMFS' Opinion on jeopardy, or any incidental take coverage, for all listed species that may be present in the action area. Consultation with NMFS will not be complete for registration of these active ingredients until EPA makes effect determinations on all other species and designated critical habitat under NMFS jurisdiction and consults with NMFS as necessary.

In Step 3, the Biological Opinion (formal consultation) considers the potential impacts of the federal action to all listed Pacific salmonids and their designated critical habitats, including those that have been listed since the completion of the BEs. With regard to effects on listed species, the fundamental difference between Step 2, Biological Evaluation, and Step 3, Biological Opinion, is that we evaluate whether the anticipated adverse effects to individuals negatively affect populations and the species they comprise. Using the ecological risk assessment framework, described below, we conducted two distinct analyses within an Opinion. The first evaluated the risk to populations of listed species, when identified, and to entire listed species and provided the jeopardy analysis for each species; and the second evaluated the risk to a species' designated critical habitat, and provided the adverse modification of designated critical habitat analysis. The analyses were based on the best commercial and scientific data available.

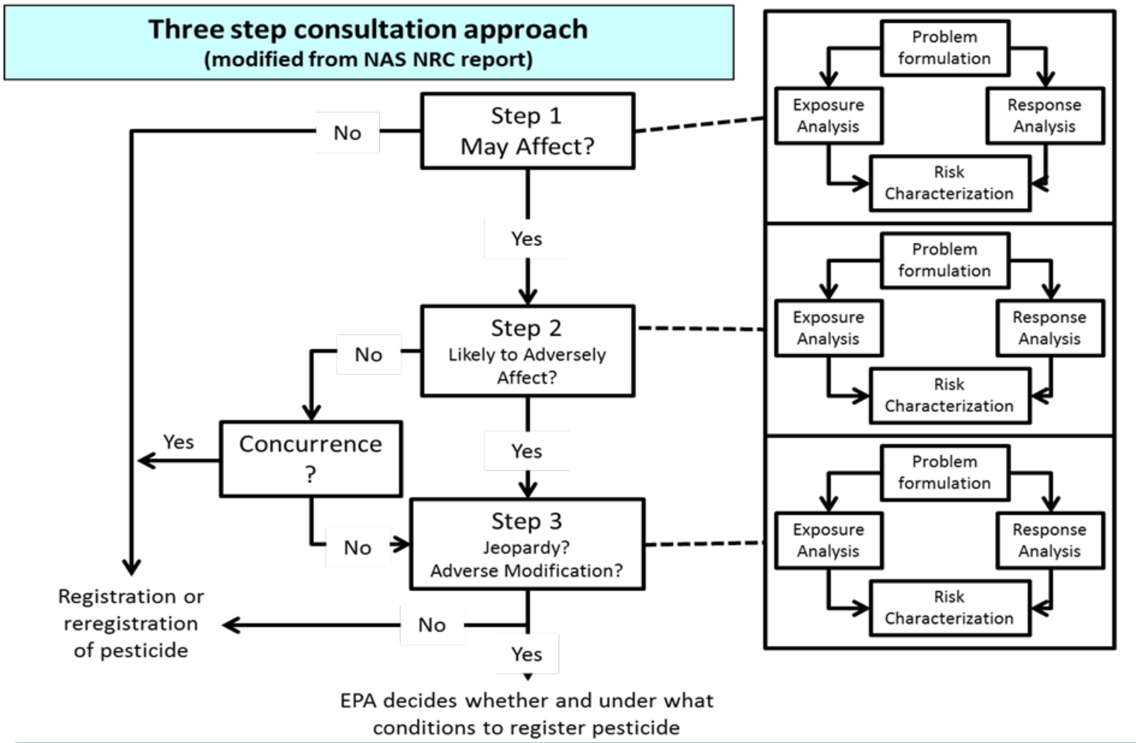

Figure 1. Three step consultation process

4.2 Information used in Biological Opinion

To comply with our obligation to use the best scientific and commercial data available, we collected information from a variety of sources. This Opinion is based on our review and analysis of various information sources, including:

- EPA's Biological Evaluations
  - Pesticide label information found in Description of the Action section
  - Exposure outputs (estimated environmental concentrations) from EPA's fate and transport modeling
  - Toxicity data found in Response sections
- EPA's ecological risk assessments prepared for Registration Review
- EPA's ECOTOX database; contains published scientific studies and pesticide manufacturer studies
- Pesticide usage information including Pesticide Use Reports from California Department of Pesticide Regulation and estimated pesticide usage information from surveys conducted by USDA and proprietary survey information summarized by EPA
- Geographic locations of label authorized pesticide use sites
  - USDA – National Agricultural Statistics Services (NASS) Census of Agriculture
  - USDA/NASS – Cropland Data Layer
  - USGS – National Land Cover Database

- Published Scientific literature
- Other scientific literature, such as reports of government agencies or non-governmental organizations
- Correspondence (with experts on the subject from EPA and others)
- Available biological and chemical surface water monitoring data and other local, county, and state information
- Pesticide registrant generated data and information
- Pesticide exposure models, i.e. mathematical models that estimate exposure of resources to pesticides
    - Salmonid population models
    - Pesticide exposure models
    - Pesticide Water Calculator
    - AgDRIFT
- Risk-Plots; NMFS' tool based on R-code that summarizes exposure and toxicity information by use site and is used to determine likelihood of exposure and effect of exposure to groups of individuals and designated critical habitat (see description below).
- Comments, information and data provided by the registrants identified as applicants
- Comments and information submitted by EPA
- Comments received during the public review period
- Pesticide incident reports and field data

Collectively, the above information provided the basis for our determinations as to whether the EPA can insure that its authorization of 1,3-D and metolachlor is not likely to jeopardize the continued existence of threatened and endangered species, and is not likely to result in the destruction or adverse modification of designated critical habitat.

4.3 Problem Formulation

Problem formulation includes conceptual models based on the initial evaluation of the relationships between stressors of the action (pesticides and other identified chemical stressors) and listed species and their habitats. The conceptual model for 1,3-D and metolachlor pesticides is shown in Figure 2. The model identifies the stressors associated with the proposed actions and the pathways of exposure to Pacific salmonids and their habitats that may lead to effects. Step 2 of the analysis evaluates effects that have implications for individual fitness of the listed species, i.e. any effects that may alter an organisms ability to survive and produce viable offspring. We consider the available toxicity information and toxic mode and mechanism of action of the two pesticide active ingredients (a.i.s) to provide insight into potential consequences following exposure. Identification of the mode and mechanism of action allows us to identify other chemicals that might co-occur and affect species and their habitats (*i.e.,* identify potential toxic mixtures in the environment). 1,3-D has a broad range of toxicity and is used to control pest insects, nematodes, fungi and plants. Metolachlor is a broad-spectrum herbicide that controls plants by inhibiting seedling shoot and meristematic growth. The potential impacts of 1,3-D and metolachlor will be assessed by evaluating the likelihood of direct toxicity to salmon and impacts to their habitat (Figure 2). For example, potential impacts to vascular and nonvascular plants will be evaluated given their relationships to physical and biological features (PBFs) in the designated critical habitat.

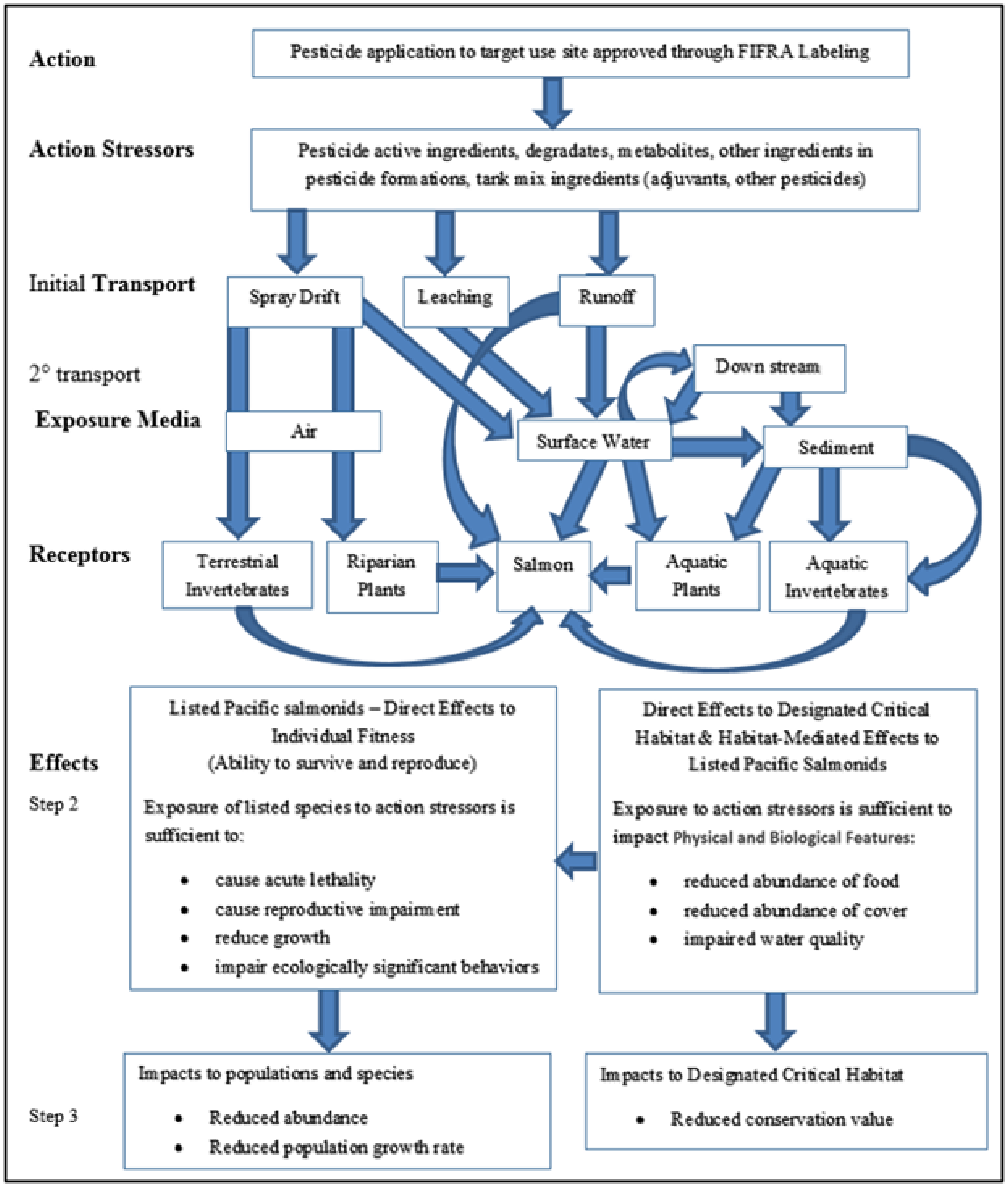

Figure 2. Conceptual model diagraming the relationships between the stressors of the action and listed Pacific salmonids and their Designated Critical Habitats.

Impacts to individual fitness can occur through direct toxicity of the stressors of the action to salmon, including both direct lethality or sublethal effects (e.g. ability of salmon to swim, avoid predation, reproduce, etc.). They may also occur due to impacts to salmon designated critical habitat including impacts to PBFs. For example, effects may include reductions in salmon prey (either through reduction in primary production or direct toxicity) and important cover (including aquatic and riparian vegetation in migration, spawning, and rearing sites).

In Step 3, we evaluate whether the anticipated adverse effects to individuals (described in the BEs) negatively affect populations and the species they comprise. However, we begin our Step 3 analysis by building on the Step 2 analysis. Additionally, we evaluate whether adverse effects to PBFs reduce designated critical habitat's conservation value. Direct deposition of 1,3-D and metolachlor onto treated sites as well as transport via spray drift, leaching, and runoff are depicted in the conceptual models as sources that result in the movement of the pesticides into aquatic and terrestrial habitats. Additionally, secondary transport including conveyance in flowing water and volatilization resulting in atmospheric (including long-range) transport account of additional mechanisms for pesticide distribution in the environment. The movement away from the site of application in turn represents exposure pathways for a broad range of biological receptors of concern (non-target organisms) and the potential attribute changes, *i.e.*, effects such as reduced survival, growth and reproduction.

Where it was determined that individual fitness is likely compromised by the action, the Step 3 analysis evaluated if those fitness reductions are likely to be sufficient to reduce the viability of the populations those individuals represent (assessed using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population's extinction risks). Reductions in a population's abundance, reproductive rates, or growth rates (or increased variance in one or more of these rates) based on effects to individuals represents a *necessary* condition for reductions in a population's viability, which is itself a *necessary* condition for reductions in a species' viability. Finally, our assessment determines if changes in population viability structured as risk hypotheses are likely to be sufficient to reduce the viability of the species those populations comprise. In this step of our analyses, we consider the Environmental Baseline and Cumulative Effects, and consider the species' pre-action condition, established in the Status of the Species.

For designated critical habitat, we determined if adverse effects (primarily, effects on water quality, vegetative cover, and prey availability) are likely to be sufficient to appreciably reduce the value of the critical habitat as a whole for the conservation of the species. To determine whether this occurs, we consider the designated critical habitat's pre-action condition, established in the Status of the Listed Resources, as well as Cumulative Effects and the Environmental Baseline.

4.4 Analysis Plan

Our analysis plan applies information from EPA's Biological Evaluations and more recent information presented in EPA's risk assessments for Registration Review (EPA 2019a; EPA 2019b) to develop an assessment plan to conduct Step 3 population level analyses within the risk characterization section of this Opinion. We took the exposure and response information directly from EPA's ecological risk assessments and updated them to account for changes in the action, new information, and to bring them into alignment with the NAS recommendations (NAS 2013). In the Exposure Section we describe species life history information; describe the chemical and physical properties that influence the persistence and movement of the pesticides in the environment; and present estimates of exposure to the species and their designated critical habitat.

In the response section, we present the mode and mechanism of toxic action for each pesticide; identify the other stressors of the action such as other chemicals within pesticide formulations; and identified key assumptions and associated uncertainties of the analytical tools and models used in the effects analyses.

The risk characterization section includes the bulk of our Step 3 analyses where we integrate the exposure and response information. We employed a weight-of-evidence approach to determine for each risk hypothesis whether the risk from the action (without consideration of the species status, the environmental baseline or cumulative effects) was high, medium or low. A risk hypothesis is a statement of anticipated effects to a species such as reductions in a population's abundance or productivity following exposure to the stressors of the action. To arrive at that level of risk for each risk hypothesis, we addressed not only the effect of exposure and the likelihood of exposure, but also our level of confidence in the risk level. We developed rule-based criteria to provide a systematic approach for assessing the likelihood of exposure and the effect of the exposure. We constructed risk hypotheses for the listed Pacific salmonids and their designated critical habitats (shown in Table 2).

Table 2. Risk hypotheses for listed Pacific salmonids and their designated critical habitat

Risk Hypotheses for species:
Exposure to the pesticide is sufficient to reduce abundance via acute lethality.
Exposure to the pesticide is sufficient to reduce productivity via impairments to reproduction.
Exposure to the pesticide is sufficient to reduce abundance via reduction in prey availability.

Exposure to the pesticide is sufficient to reduce abundance via impacts to growth (direct toxicity).
Exposure to the pesticide is sufficient to reduce abundance and productivity via impairments to ecologically significant behaviors.
Mixtures: Formulated products and tank mixtures containing the active ingredient are anticipated to increase risk to direct and indirect effects to fish in freshwater habitats.
Risk hypotheses for designated critical habitat:
1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration and rearing sites.
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

To evaluate risk hypotheses we used Risk-plot graphics, and when available and warranted, salmon population modelling. The Risk-plots are a NMFS' analytical tool that overlays toxicity data, i.e. values at which adverse effects are detected, with exposure information, i.e. estimated environmental concentrations (EECs) in differing types of aquatic habitats. The physical characteristics assumed in modeling the aquatic habitats were developed to reflect differences in habitat volume and flow rates used by the species that could contribute to different exposure ranges. We describe the Risk-plot tool immediately below.

4.4.1 Risk-plots

Risk-plots are used to summarize several types of information used in the Risk Characterization section. Risk-plots display expected environmental concentrations (i.e. EECs) of pesticides for different habitats and toxicity data. We use the data presented in the Risk-plots to determine whether the effect of exposure to 1,3-D and metolachlor is low, medium or high for each use. We also use Risk-plots to aid in evaluating the likelihood of exposure for species and critical habitat. The sample Risk-plot below shows data for Puget Sound Chinook salmon (Figure 3). The R code used to generate the plots and additional information on the code is included in Appendix F.

A Risk-plot graphic is read by (1) selecting an EEC for a use from the center of the plot; (2) reading up to effect concentrations associated with an endpoint e.g., mortality, to determine the level of effect predicted from the EEC; and (3) looking on the left side of the plot to identify the acreage and percentage of area that overlaps with the species range for a given use site (vegetables, corn, etc).

The EEC data can come from various exposure estimates. For aquatic habitats, they are based on the output of EPA's Pesticide Water Calculator (PWC, available from https://www.epa.gov/endangered-species/provisional-models-endangered-species-pesticide-assessments, accessed on 8/1/2019) and from available field-scale monitoring of runoff (Heim et al. 2002) as described in Chapter 11. For terrestrial habitats, they are based on EPA's AgDRIFT and TerrPlant models (also available from EPA at the above URL). EECs can be generated for specific uses based on information on the label. Details of the exposure modeling are presented in Chapter 11.

The Effect Concentration rows can summarize the available toxicity data in different ways, depending on the assessment endpoint and the number of toxicity studies. For endpoints with limited data, individual studies may be represented by a single concentration such as a LOAEC (Lowest Observable Adverse Effect Concentration) or an EC25 (the concentration producing an effect in 25 percent of the exposed population). Alternatively, a toxicity endpoint may be summarized using a dose-response relationship based on an LC50 and slope selected from either a single study or a species sensitivity distribution (SSD) if enough studies are available. In this case, the toxicity row can display different concentrations on the dose-response relationship (e.g. the concentrations producing 1 percent, 10 percent, and 50 percent mortality). Details regarding the derivation of the toxicity rows will be presented later in Chapter 11.

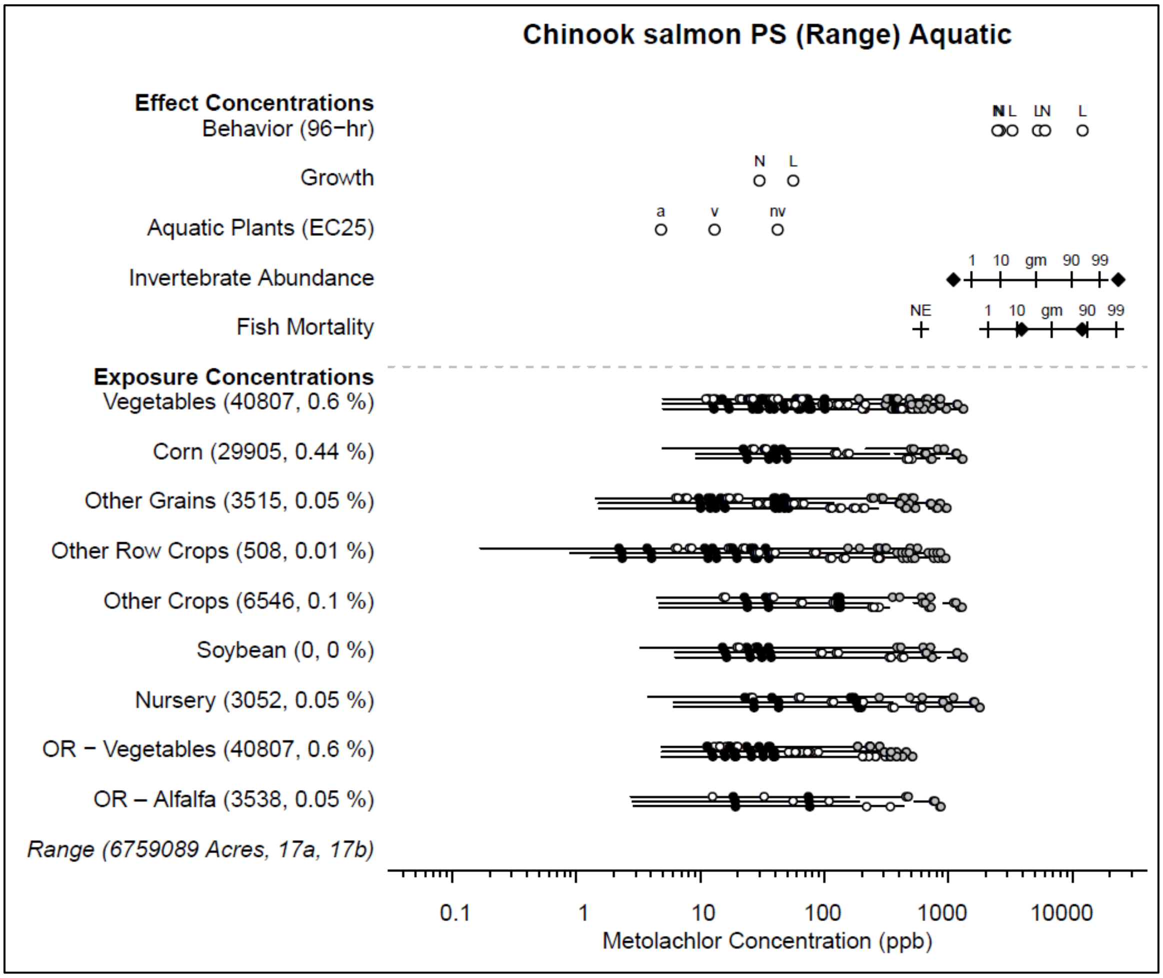

Figure 3. Example Risk Plot: Puget Sound Chinook Salmon and Metolachlor

The remainder of the plot is organized into several components:

1. The upper portion of the plot presents the toxicity data in a series of rows based on toxicological endpoints e.g., growth, mortality, etc under the heading Effect Concentrations. The concentrations displayed may represent different toxicity summaries (e.g. EC25 or LC01) and either a single study or a summary of multiple studies (e.g. from a SSD). Annotations associated with each point will indicate the nature of the toxicity value.

2. The lower portion of the plot shows EECs grouped by use under the heading Exposure Concentrations. For aquatic data, the EECs are further divided by aquatic habitat (bin), and averaging period (i.e., 1-d (one day), 4-d (four day), 21-d (twenty-one day). For this example for metalachlor, the EPA Pesticide Water Calculator (PWC) runs for each use

are shown as the median EECs with the 5-95 percent confidence intervals[4] depicted as a horizontal line. Each aquatic bin is shown as a different symbol. The three rows of points for each use show the different averaging periods for the aquatic EECs. From bottom to top, they are 1-d, 4-d, and 21-d. For terrestrial data, the EECs are further divided by application method (ground or air) using different symbols and exposure model (AgDRIFT or TerrPlant) using different rows.

3. The lower left portion of the Y-axis displays the overlap of pesticide use sites with the species range; shown in the parentheses following each use site (vegetables, corn, etc.). The first value represents the total median acres of the particular use found within the species range across the six years of Cropland Data Layer (CDL)[5] data. The second value represents the median percent overlap of the particular use site with the species range using the same data and timeframe.

4. The bottom row of the Y-axis identifies the total area of the species range (in this case 6759089 Acres) and the species range location at the HUC 12 sub-watershed(s) level (in this case HUC 17a and 17b).

4.4.2 Effect of Exposure Using Risk-plots

Each use site is evaluated to determine whether the effect of exposure is low, medium, or high based on the EECs and the toxicity information. Consideration was given to the duration of exposure when determining which EECs were relevant for comparison.

We apply the following rules when dose-response relationships (i.e. LC_{50} and corresponding slope) are available:

<u>When evaluating acute lethality to Pacific salmonids</u>

- A “none expected” rank is achieved when all EECs are below the calculated one-in-a-million sensitivity level.
- A “low” rank is achieved when all EECs are below the one percent effect level.
- A “medium” is achieved when any EEC falls between the one percent and the median effect level.
- A “high” is achieved when any EEC exceeds the median effect level for a given toxicity range.

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[4] the 5-95% confidence interval line represents the range of values within which we are 95% confident that the true value falls, given the variability of the data.

[5] National Agricultural Statistics Service GIS data layers on cropland for all the lower forty -eight conterminous states.

When evaluating reductions in Pacific salmonid prey abundance

- A "none expected" rank is achieved when all EECs are below the calculated one percent effect level.
- A "low" rank is achieved when any EECs fall between the one percent and ten percent effect level.
- A "medium" is achieved when any EECs fall between the 10 percent and the median effect level.
- A "high" is achieved when any EECs exceed the median effect level for a given toxicity range.

We apply the following rules when dose-response relationships are not available:

- A "none expected" rank is achieved when all EECs are below all available no effect endpoints (e.g. NOEC).
- A "low" rank is achieved when any EEC falls between a no effect endpoint and corresponding lowest effect endpoint (e.g. LOEC).
- When EECs exceed the lowest effect endpoints we examine the effects reported at those concentrations to determine whether a "medium" or "high" characterization is appropriate.

We apply the following rules when evaluating effects to terrestrial vegetation:

- A "low" rank is achieved when all EECs are below all EC_{25} values available.
- A "medium" rank is achieved when EECs exceed up to half of the EC25 values available.
- A "high" rank is achieved when EECs exceed more than half of the EC25 values available.

4.4.3 Likelihood of Exposure

The likelihood of exposure assessment allows us to consider whether effects may occur to the species by taking into consideration the extent of exposure, species locations and movement, chemical properties, potential for repeated application, as well as the proximity of use sites to known areas of importance to the species. The six factors are:

1. Percent overlap of a species' U.S. range with a pesticide's approved uses. Each use is assigned a category of 1, 2, or 3 depending on the degree of geographic overlap of use acreage with the species' U.S. range acreage (aggregation of HUC-12s that delineate the species range). In order to evaluate the full extent of EPA's approval, we assume that treatment may occur to any authorized use site at some time during the 15 year period of the action. We do not assume that usage will occur at every authorized use site, nor do we assume that all usage occurs at the same day and time. Instead, we assume that if EPA has authorized pesticide application for a particular site, that site may receive one or more pesticide applications during the course of the 15-year action. This distinction, between

“will be applied to every” and “may be applied to any”, is important in understanding the assumptions of our analysis. When we consider the extent of authorized use sites within a species range (e.g. acres of corn), we do not make the assumption that pesticides will be applied to every acre of corn. Instead, we assume that: 1) the pesticide may be applied to any acre of corn 2) the greater the extent of corn acres in the species range equates to a greater chance that application may occur in close proximity to species habitat. While we do not expect every site to be treated, it is imperative to consider the potential responses to treatments that may occur in close proximity to ESA-listed species locations to insure existing controls (i.e. product labeling) are adequate to avoid jeopardy and adverse modification.

Our interpretation of the percent overlap values was cognizant of the reality that all registered use sites are not likely to receive application of the pesticide active ingredient, and certainly not all at the same time. We considered the percent overlap value as one of six factors which qualitatively determines the likelihood of exposure. Our use of the percent overlap values was predicated on the assumption that a species chance of being exposed to a particular active ingredient would increase if that active ingredient was approved within greater portions of the species range. We assumed that, all else being equal, there is a positive relationship between the amount of land authorized for pesticide application and the chance that a species will be exposed. In recognition of the uncertainties in this relationship, as well as the numerous other factors influencing the likelihood of exposure, we developed a systematic but qualitative framework to help characterize risk. In this way, the percent overlap serves as a proxy for informing the potential for pesticide application in close proximity to species habitats.

Acreage of authorized use sites were provided by EPA (https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment) and are based largely on USDA’s Cropland Data Layer; this information is presented on the left Y-axis of the Risk-plot. Species range comes from NMFS listing documents. In evaluating percent overlap we considered how well the available use-data-layer represented the labeled uses and, where feasible, made adjustments to the percent overlap value. Some 1,3-Dichloropropene labels approve applications to broadly defined use sites, which required the evaluation of multiple GIS layers. For example 1,3-Dichloropropene is approved for use on “field crops” which we assessed by evaluating 6 different CDL layers: corn, cotton, other grains, pasture, soybeans, and wheat. These GIS overlap layers are not always mutually exclusive of each other. This was taken into consideration when evaluating those labels which are represented by multiple GIS layers. The uncertainties associated with acreage and percent overlap values were considered when making our risk and confidence characterizations. When estimating the extent of 1,3-Dichloropropene authorized uses we associated labeled uses to geospatial layers according to Table 3; for metolachlor, we associated labels to geospatial layers according to Table 4.

Table 3. 1,3-Dichloropropene crosswalk for percent overlap estimates

Label Authorized Use Site	GIS Overlap Layer
Vegetable Crops	Vegetables and Ground Fruit
Field Crops	Corn, Cotton, Other grains, Pasture, Soybeans, Wheat
Fruit and Nut Crops	Orchards and vineyards, Vegetables and ground fruit
Nursery Crops	Nursery
Mint	Vegetables and Ground Fruit
California – Containerized nursery stock	Nursery
Idaho potato – USDA Potato Cyst Nematode Eradication Program	Vegetables and Ground Fruit
Unspecified cropland in Idaho – certain weed control	Cultivated
Unspecified cropland in Oregon – certain weed control	Cultivated
Unspecified cropland in Washington – certain weed control	Cultivated

Table 4. Metolachlor crosswalk for percent overlap estimates

Label Authorized Use Site	GIS Overlap Layer
Beans and other pod crops; Horseradish; Potato; Pumpkin; Rhubarb; Tomato	Vegetables and Ground Fruit
Corn	Corn
Safflower; Sorghum;	Other Grains
Soybean	Soybean
Sugarbeets; Sunflower	Other Row Crops
Turf – commercial, residential, sod farms	Other Crops

Nursery and landscape plantings	Nursery
California Only: Pepper; Seeded and transplanted tomato; Swiss chard; Spinach; Dry bulb onion; Celery; Subgroup 1-B (beet, carrot, turnip, etc.) and 1-C (artichoke, ginger, yam, etc.)	Vegetables and Ground Fruit
California Only: Cotton	Cotton
Idaho Only: Carrot, collard, radish, beet, kale, mustard, parsnip, rutabaga, turnip; Dry bulb onion; Pepper	Vegetables and Ground Fruit
Oregon Only: Seed crops including radish, spinach, beets, and Swiss chard; Transplanted bell pepper; blueberry, blackberry, and raspberry; Sweet potato; Strawberry	Vegetables and Ground Fruit
Oregon Only: Alfalfa for seed	Pasture

2. Seasonal analysis based on allowable application timing overlaid with species' timing to determine co-occurrence. Application timing is based on authorized label restrictions (*e.g.* language indicating applications are restricted to the pre-emergence period). Species timing of occupancy for aquatic areas is provided in the Status of the Species section. The co-occurrence addresses whether pesticides are allowed to be applied during species presence. We answer "yes" to the question of co-occurrence in cases where the pesticide may legally be applied when a species-life history suggests it may be present.

3. Persistence of the pesticide based on environmental fate issues. We evaluated the environmental fate information provided in the BE and EPA ecological risk assessments to determine whether the pesticide is considered persistent. As a rule of thumb, we answered "yes" to persistence if the pesticide has a half-life greater than 100 days.

4. Number of applications allowed. We assume that an increase in the number of authorized applications increases the likelihood of an exposure and the potential of effect. We reviewed EPA's updated description of the action, as well as authorized labels, to

determine whether multiple applications were allowed on each use site. When answering "yes" or "no", we considered the relative risk of a single application at the maximum allowed rate versus multiple applications at a reduced rate. Most of the 1,3-D and metolachlor labels do not explicitly state the number of repeat applications authorized, instead the labels specify a maximum single application rate as well as a maximum annual application rate. If, for the majority of labels in a given category (e.g. other grains), the maximum single application rate equals the maximum annual application rate then we answered "no" for this factor. Although it is possible that multiple applications could occur at lower rates, assuming a single application at the maximum rate allows us to capture and assess the potential for risk as authorized by the label.

5. Proximity analysis: for use sites with less than 1 percent overlap within a species range. We used GIS maps to determine: 1) whether use sites were within 300 meters of listed species aquatic habitats at sub HUC-12 scales, and 2) whether up-stream use sites were likely to substantially increase exposure via downstream transport. This allowed us to visually assess whether species habitats could be substantially exposed to a use site with <1 percent overlap.

6. Duration of species occupancy in aquatic systems. We review the species life history to determine the approximate duration for residency and migration.

Table 5. Criteria used to determine likelihood of exposure

Factor	Criteria Description	Criteria
Percent overlap of use site within species HUC-12 watersheds	low overlap = <1 percent = category 1 Medium overlap = 1-5 percent = category 2 High overlap = >5 percent = category 3	category (1;2;3)
Seasonal Analysis (proportion of year life stages are potentially exposed)	Are any species life-stages present in overlapping areas when pesticide application are allowed? (Y/N)	Yes or No
Persistence of pesticide	Is pesticide considered persistent? (Y/N) Rule of thumb: pesticide has a half-life greater than 100 days.	Yes or No
Number of applications	Are multiple applications authorized per year? (Y/N)	Yes or No
Proximity Analysis: Use sites proximal to sensitive areas	Are use sites within 300 meters of sensitive areas? (Y/N) Or	Yes or No

Factor	Criteria Description	Criteria
Or Potential for exposure from upstream sources	Are upstream use sites likely to substantially increase exposure via downstream transport? (Y/N)	
Time spent occupying aquatic areas	Species residency: Days, months, years <30 days=1 ; 1-6 months(1-2 seasons) = 2; multiple years = 3 Species migration: Days <7 days =1; 7-21 days =2 ; >21 days = 3	category (1;2;3) category (1;2;3)

For each species assessed, NMFS has characterized the "likelihood of exposure" relative to each use site (e.g. corn, wheat) within that species' range. The likelihood of exposure for each use site is characterized as either low, medium or high depending on the criteria determined for each of the six likelihood factors. Unique combinations of the six likelihood factors result directly in the likelihood of exposure being characterized as either low, medium, or high according to the decision key in Table 6.

The likelihood factor, "Proximity Analysis" was assessed qualitatively for each use site layer that represented less than 1 percent of the species range. NMFS used GIS mapping and species distribution/life history information to determine whether sites were aggregated in proximity to sensitive areas (e.g., known spawning areas). When evaluating a map, we classified use sites as "in proximity" when they either: 1) were within 300 meters of the sensitive habitat and exposure was deemed likely due to runoff or drift; or 2) when chemical fate, hydrologic properties, and the proximity of use sites upstream from sensitive habitat suggested exposure was likely through the downstream transport pathway. For many of the salmonids assessed, NMFS determined sensitive areas by identifying those streams which support populations that have been identified in recovery plans as "core populations."

Table 6. Likelihood of exposure decision key. The combinations provided in this key are not exhaustive of all possible combinations, rather they represent only those combinations which were encountered in this Opinion.

Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
3	yes	yes	yes	NA	3	**High**
3	yes	yes	yes	NA	2	**High**
3	yes	yes	yes	NA	1	**High**
3	yes	no	yes	NA	3	**High**
2	yes	yes	yes	NA	3	**High**
1	yes	no	yes	yes	3	**High**
1	yes	yes	yes	yes	3	**High**
3	yes	no	yes	NA	2	**Medium**
3	yes	no	no	NA	3	**Medium**
3	yes	no	no	NA	2	**Medium**
2	yes	no	yes	NA	3	**Medium**
2	yes	no	no	NA	3	**Medium**
2	yes	no	yes	NA	2	**Medium**
1	yes	no	yes	yes	2	**Medium**
1	yes	no	no	yes	3	**Medium**
1	no	yes	yes	yes	3	**Medium**
2	yes	no	no	NA	2	**Low**
1	yes/no	yes/no	yes/no	no	1/2/3	**Low**
1	yes/no	yes/no	yes/no	yes/no	1	**Low**
1	yes	no	no	yes	2	**Low**
1	no	no	yes	yes	3	**Low**

At this point in the analysis, we've determined the "likelihood of exposure" and the "effect of exposure" for each category of use (use site) or habitat bin, for the identified toxicity endpoints. For example, for each species, the above determines the effect of exposure and likelihood of exposure by use/ use site (e.g., "Wheat"), and each toxicity endpoint (e.g., "Growth").

4.4.4 Risk Determination for Each Risk Hypothesis

In this step, we evaluate each risk hypothesis using the combined results of the "likelihood of exposure" and "effect of exposure" determinations. As noted earlier, risk hypotheses are based on population level effects (abundance and productivity) which manifest when a group of individuals exhibit compromised fitness. For example, a risk hypothesis might be: "Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability". The use-specific "likelihood of exposure" and "effect of exposure" evaluations are compiled to rate each risk hypothesis as posing a high, medium, or low risk. This is illustrated in Figure 6. A "high" risk determination for a risk hypothesis is concluded when, for any toxicity endpoint relevant to a risk hypothesis, use sites had a high "effect of exposure" and a high "likelihood of exposure" ("high/high") and/or use sites with a high/medium combination (red squares in Figure 4). For example, taking the above example of a risk hypothesis involving "reduction in prey availability", if the uses showed a high "likelihood of exposure" and a high "effect of exposure" for "Prey" we would conclude that there was a "high" risk associated with this particular risk hypothesis for this particular species. If the uses showed a high "likelihood of exposure" and a high "effect of exposure" for such an endpoint, we would conclude that there was a "high" risk associated with this particular risk hypothesis for this particular species. In similar fashion, a medium risk determination for a risk hypothesis stems from likelihood of exposure and effect of exposure combinations of high/low; medium/low; and medium/ medium (yellow squares in Figure 4). A low risk determination for a risk hypothesis stems from likelihood of exposure and effect of exposure combinations of low/low, low/medium, or low/high (green squares in Figure 4). In cases where a single use category (e.g. other grains) is identified as leading the risk characterization, we take an additional step to ensure that our risk characterization is accurate. For example, if "other grains" is the only use category signaling high risk, the overall risk may be characterized as medium if we determine that a high risk is not appropriate. Information considered during this step includes that which informed the original "effect of exposure" and "likelihood of exposure" characterization as well as information used to determine the confidence.

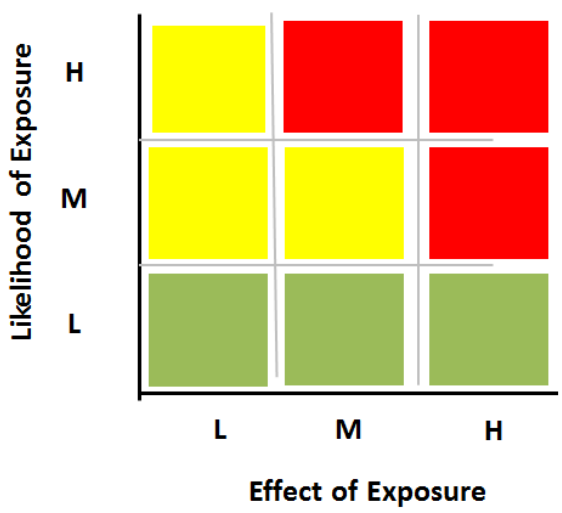

Figure 4. Ranking Risk Hypotheses Based on Uses. Each use is plotted based on Likelihood of Exposure finding and Effect of Exposure finding. L=low, M=medium,

H=high; Red squares indicate a risk hypothesis has high risk; yellow squares indicate medium risk; and green squares indicate low risk.

4.4.5 Confidence Ranking for Each Risk Hypothesis

Once we have determined the risk ranking for a risk hypothesis, we then evaluate the level of confidence we have in that ranking. The confidence underscores the level of certainty or strength we have in the risk determination. The confidence level in the risk determination is evaluated and assigned a low, medium, or high level of confidence after evaluating five general factors:

1. Number of similar combinations of likelihood of exposure and effect of exposure e.g., the more uses and toxicity endpoints for which there is the same combination of "likelihood of exposure" and "risk of exposure" (e.g., "high/high," ("low/medium"), the more confidence we have in the low/medium/high risk assignment for the associated risk hypothesis.

2. Percentage of use site overlapping with species' range (e.g., the greater the percentage of overlap between use sites and the species' range, the more confidence we have in a risk hypothesis ranking of "high risk"; and the lower the percentage, the greater confidence we have in a risk hypothesis ranking of "low risk").

3. Evidence that registered uses within the species range are probable (e.g. they have previously occurred within the species range), or improbable (e.g. the registered use/crop cannot be cultivated within the species range). The percent overlap estimates presented in the Risk-plots are based on overlap between species range and Cropland Data Layer (CLD) class groupings (e.g. vegetables and ground fruit). The CLD has over 100 different cultivated classes which were grouped by USEPA in order to reduce the likelihood of errors of omission and commission between similar crop categories (see attachment 1-3 in EPA 2017a; https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment). CDL groupings were designed to minimize uncertainties, however they also introduce the possibility that overlap percentages include uses for which 1,3-D and metolachlor have not been registered. Whether or not there is additional evidence, beyond the CDL, that registered uses have occurred in a species range will be considered in characterizing confidence. Sources of information used to assess this factor include USDA's NASS Census of Agriculture, monitoring data, incident data, and available usage information.

4. Representativeness of pesticide estimates as realistic exposure values for species' habitats (see Chapter 11 for a description of the habitats and the uncertainties associated with exposure estimates).

5. Representativeness of toxicity information for threatened and endangered species. We reviewed the available toxicity information in light of our data quality standards (see

Chapter 11) to evaluate the level of confidence in the toxicity information used to determine effects to a listed species and its habitats. For example, we would ascribe higher confidence for a toxicity endpoint when a robust species sensitivity distribution (SSD) is available and lower confidence when SSDs are not available. Relatively few toxicity studies were available for 1,3-D and metolachlor and SSDs were not generated. We evaluated the number of studies and the representativeness of test species to assess the confidence. Species from the same genera as the species being assessed were assigned a higher level of confidence. For sublethal effects, we evaluated confidence by reviewing the distribution of LOECs and the number of studies. The narrower the distribution of LOECs, the higher confidence we had in the effect and the more studies that were conducted the higher our confidence.

4.4.6 Overall Risk

Once we assessed each individual risk hypothesis for its level of risk and confidence, we then translated these values into an assessment of the overall risk posed to the species (low, medium, or high) based on all of the risk hypotheses. To make this conclusion, we plotted the risk hypotheses on a graph based on the risk and confidence determinations for each risk hypothesis. This is illustrated in Figure 7 below. For the acute lethality risk hypothesis we also consider evidence provided by the salmonid population models (see Appendix A). For example, if one or more risk hypotheses had high risk and high confidence then we determined that the overall risk to the species was high, placing it in the red squares in Figure 7. We also determined the overall risk to the species as “high” if, for any risk hypothesis, one of the variables (level and confidence of risk) was high and the other was medium. If all risk hypotheses landed in the yellow and green squares in Figure 7, then the conclusion was determined to be medium risk for the species. If most risk hypotheses landed in the green squares the conclusion was determined to be low risk for the species.

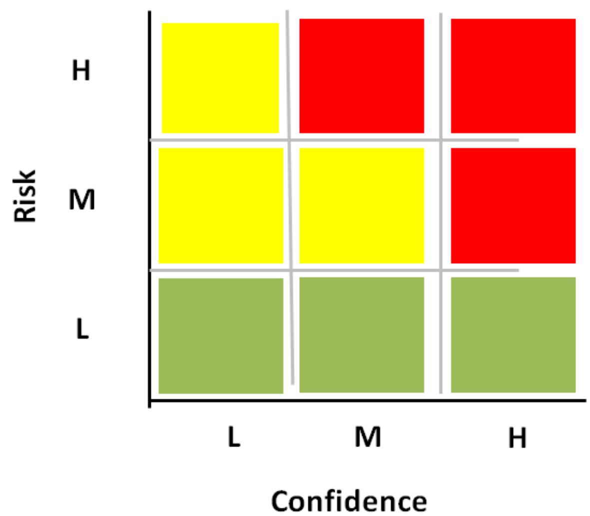

Figure 5. Each individual risk hypothesis is plotted based on its associated risk and confidence. Overall Risk is determined based on where the risk hypotheses fall within the matrix.

4.4.7 Salmon Population Models

For certain salmon, we applied a peer-reviewed, published population model as a tool to estimate population level responses to the two herbicides (see Appendix A). The salmon model outputs were used as an additional source to evaluate whether or not the acute lethality risk hypotheses were supported.

Sufficient data were available to construct population models for four Pacific salmon life history strategies. We ran life-history matrix models for ocean-type and stream-type Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and sockeye salmon (*O. nerka*). The basic salmonid life history we modeled consisted of hatching and rearing in freshwater, smoltification in estuaries, migration to the ocean, maturation at sea, and returning to the natal freshwater stream for spawning followed shortly by death. For specific information on the construction and parameterization of the models, see Appendix A. Potential impacts resulting from freshwater exposure to pesticides were integrated into the models as alterations in the first year survival rate. Population level impacts were assessed as changes in the intrinsic population growth rate and quantified as the percent change in population growth rate. Changes that exceeded the variability in the baseline (*i.e.,* one standard deviation) were considered significant.

Acute toxicity models were constructed that estimated the population-level impacts resulting from sub-yearling exposure to 1,3-D and metolachlor. The model did not consider multiple exposures, effects to other life stages, or any sublethal or habitat-related effects. We determined population outcomes when different percents of sub-yearlings are exposed (10, 25, 50, 80, and 100 percent exposed) to EECs sufficient to cause lethality to different percents of the individuals exposed (0 to 100 percent mortality in 5 percent increments), the approximate range of mortality corresponding to maximum EECs on 1,3-D and metolachlor Risk-plots. The models assessed impacts to population growth rates for ocean-type Chinook, stream-type Chinook, sockeye, and coho salmon.

The Risk-plot and population modeling results are considered when determining whether a risk hypothesis is supported or not. If results from one of the tools indicated that abundance or productivity would be reduced, then we answered "yes": the risk hypothesis was supported. In this manner, we gave the benefit of the doubt to species. If results from both tools indicated that neither abundance nor productivity were reduced, we answered "no". We followed this systematic approach for each species. We reported findings for each species in a summary table (Table 7).

Table 7. Example summary table of risk hypotheses

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	Medium	No significant reductions in population growth rate. See Appendix A for details.	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Medium	Low	Not modelled	No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	Medium	Not modelled	No
Exposure to metolachlor is sufficient to reduce productivity via impairments to reproduction.	Low	Medium	Not modelled	No

4.4.8 Summary of Effects Analyses

Each risk hypothesis and associated risk and confidence assignments are presented in a summary table along with results from population modeling (see Table 7 for example) Based on the arrangement of risk and confidence pairings of the risk hypotheses (indicated in Figure 5), a bar is placed along a risk continuum (less risk to more risk) to graphically denote the overall risk identified in the effects analysis section of the species or designated critical habitat. Each pesticide and chemical pairing receives a risk bar. An example is shown in Figure 6 . We also ascribe an overall level of confidence to the risk finding based on the aggregation of confidence rankings for the individual risk hypotheses.

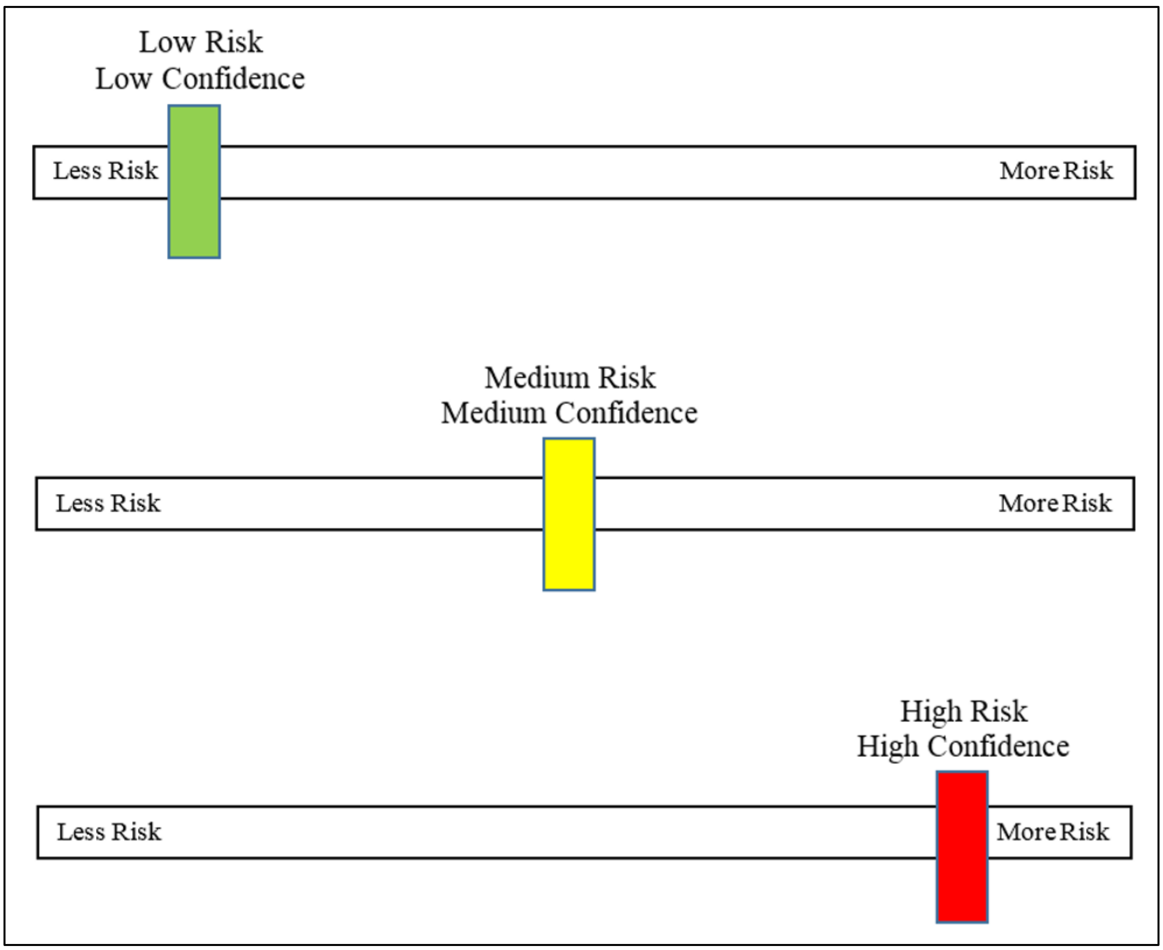

Figure 6. Depiction of risk associated with the stressors of the action

We conclude the Effects of the Action analysis for species and designated critical habitat by composing a narrative to summarize our evaluation and findings of risk hypotheses. The statement of risk for a species and chemical is carried forward in the Integration and Synthesis where it is presented as a horizontal bar to denote the overall finding for risk and confidence found at the top of a scorecard. The possible permutations for risk and confidence are High Risk/ High Confidence; High Risk/ Medium Confidence; High Risk/Low Confidence; Medium Risk/ High Confidence; Medium Risk/ Medium Confidence; Medium Risk/ Low Confidence; Low Risk/ High Confidence; Low Risk/ Medium Confidence; Low Risk/ Low Confidence.

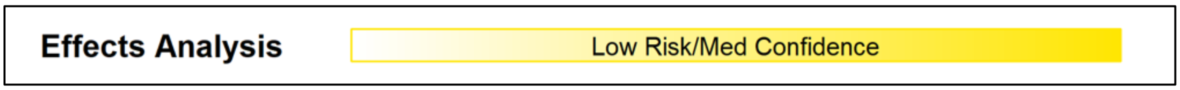

Figure 7. Example statement of risk summarizing results of effects analyses

4.4.9 Designated Critical Habitat Analyses

We translated each PBF into a risk hypothesis (Table 8) to assess potential impacts on designated critical habitat. The assessment first considers the "effect of exposure", and then considers whether that effect may occur at a larger scale by evaluating the "likelihood of exposure". By combining the effect of exposure and likelihood of exposure we arrive at an overall determination of risk and confidence for each of the risk hypotheses.

Table 8 Example summary of designated critical habitat risk hypotheses

	Risk-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration and rearing sites.	low, medium, high	low, medium, high	Yes/no
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no

To determine the effect of exposure, we used Risk-plots, when available, to evaluate the support for effects to species' PBFs. As with the species assessment, each use site is evaluated to determine whether the effect of exposure is low, medium, or high based on the EECs and the toxicity information. Consideration was given to the duration of exposure when determining which EECs were relevant for comparison.

To determine the likelihood of exposure, we evaluated four factors to arrive at a low, medium, or high finding. Unique combinations of the four likelihood factors result directly in the likelihood of exposure being characterized as either low, medium, or high according to the decision key in Table 5. The likelihood of exposure assessment allows us to consider whether effects may occur across the critical habitat by taking into consideration the extent of exposure, the chemical properties (e.g. persistence), as well as the proximity of use sites to PBFs (when spatial data are available). The four factors considered are:

1. Percent overlap of a designated critical habitat range with a pesticide's approved uses. Each use is assigned a category of 1, 2, or 3 depending on the degree of geographic overlap of use acreage with the species' U.S. range acreage (aggregation of HUC-12s that delineate the species range). Use acreage comes from EPA-derived GIS layers and is presented on the left Y-axis of the Risk-plot. Designated critical habitat range comes from NMFS listing documents.

2. Persistence of the pesticide based on environmental fate issues. We evaluated the environmental fate information provided in the BE to determine whether the pesticide is considered persistent. As a rule of thumb, we answered yes to persistence if the pesticide has a half-life greater than 100 days.

3. Number of applications allowed. We reviewed EPA approved labels to determine whether multiple applications were allowed on each use site.

4. Proximity analysis: for use sites with less than 1 percent overlap within designated critical habitat. NMFS used GIS mapping and critical habitat information to determine whether sites were aggregated in proximity to sensitive areas (e.g., known spawning areas). When evaluating a map, we classified use sites as "in proximity" when they were either: 1) within 300 meters of the sensitive habitat and exposure was deemed likely due to runoff or drift; or 2) chemical fate, hydrologic properties, and the proximity of use sites upstream from sensitive habitat suggested exposure was likely through the downstream transport pathway.

Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
3	yes	yes	NA	**High**
3	no	yes	NA	**High**
2	yes	yes	NA	**High**
1	yes	yes	yes	**High**
1	no	yes	yes	**High**
3	no	no	NA	**Medium**
2	no	yes	NA	**Medium**
1	no	no	yes	**Medium**
2	no	no	NA	**Low**
1	yes/no	yes/no	no	**Low**

Figure 8. Decision key for likelihood of exposure finding for designated critical habitat

The effect of exposure and likelihood of exposure determinations are then combined for each use site to determine the overall risk associated with the risk hypothesis. This is done following the same criteria as with the species assessment (described earlier). Once we have determined the risk ranking for a risk hypothesis, we then evaluate the level of confidence we have in that ranking. The level of confidence underscores the level of certainty we have in the risk determination for each risk hypothesis. The confidence level in the risk determination is evaluated and assigned a low, medium, or high level. The factors evaluated in characterizing confidence in the critical habitat assessment are similar to those used in the species assessment (described above).

Similar to the effects of the action on the species, the arrangement of risk and confidence pairing of the risk hypotheses dictated the placement of a risk bar along a risk continuum. The graphic denotes the overall risk identified in the effects analysis section of designated critical habitat (see Figure 6). Each pesticide and designated critical habitat pairing receives a risk bar.

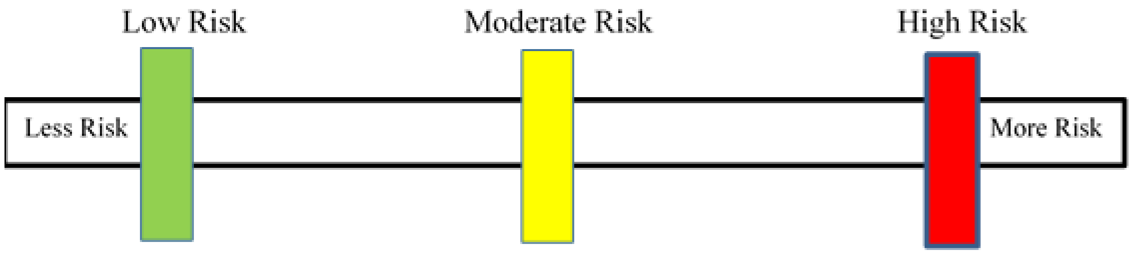

Figure 9. Depiction of risk to designated critical habitat from the stressors of the action

We conclude the Effects of the Action analysis for designated critical habitat by composing a narrative to summarize our evaluation and findings of risk hypotheses. The statement of risk for a species and chemical is carried forward in the integration and synthesis section. The risk statement is presented as a horizontal bar to denote the overall finding for risk and confidence found at the top of a scorecard.

4.5 Integration and Synthesis

The integration and synthesis section is the final step in our assessment of the risk posed to critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action to the status, baseline and the cumulative effects to formulate the agency's biological opinion as to whether the proposed action is likely to appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species.

The effects analysis (Chapter 16) evaluated the effects of the action on the primary and biological features of the designated critical habitat for each species. This analysis included the evaluation of risk hypotheses. The effects analysis concluded with a determination of risk posed to the primary and biological features by the effects of the action, as well as a characterization of confidence. In this section, these effects analysis conclusions are considered in the context of the status, baseline and cumulative effects to determine whether the effects of the action will appreciably diminish the conservation value as a whole.

We treat the information from the status, environmental baseline, and cumulative effects, as "risk modifiers," in that the effects described in the effects analysis section may be modified by the condition of the environmental baseline, and anticipated cumulative effects. To help guide our risk assessors in making transparent and consistent determinations, we developed several key-questions which were examined for each species and critical habitat (see Chapters 8, 9, 10). However, the ultimate consideration of increased or decreased risk attributable to the status of the species, environmental baseline, or cumulative effects is not restricted to the consideration of the key questions alone. Additional relevant factors were considered depending on the species or critical habitat being assessed.

Once each of the above sections is evaluated, the effects of the action and the risk modifiers are depicted graphically on a "scorecard." The influence of each modifier on the effects of the action is represented by an arrow. The magnitude of influence (low or high) is represented by the length of the arrow (short or long). The direction an arrow is pointed indicates the directionality of the risk modifier, increasing or decreasing risk. For example, an environmental baseline arrow pointing towards more risk may indicate that environmental mixtures and elevated temperatures occur in the Environmental Baseline, which further stresses the species in question. The level of confidence in the magnitude of modification is indicated by bolding (high confidence) or unbolding (low confidence) the arrow.

An additional arrow representing the influence on risk is graphically depicted on each of the designated critical habitat scorecards. The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar ("Effects Analysis") of the scorecard. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the critical habitat, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard, the bar labeled conclusion shows the overall risk and adverse modification determination (the colored bar beginning with green (less risk) to red (more risk)). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The no adverse modification/adverse modification determination for each species designated critical habitat is ultimately an informed best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles (see Chapters 3 and 14).

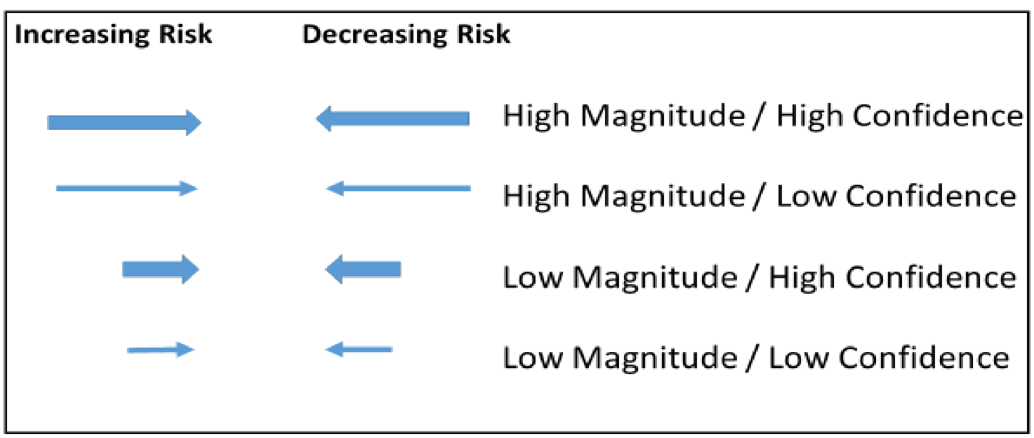

Figure 10. Example of arrows to represent direction, magnitude, and confidence of risk modifiers

4.6 Conclusion

With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or

- Appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

A "scorecard" is generated for each species and designated critical habitat (Figure 11 and Figure 12). The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar ("Effects Analysis") of the scorecard, using the analytical process already described. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the species, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard, the bar labeled Conclusion shows the overall risk and jeopardy determination (the colored bar beginning with green (less risk) to red (more risk)). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The No Jeopardy/ Jeopardy determination and the No adverse modification/ Adverse modification determination for each species or designated critical habitat is ultimately a best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles.

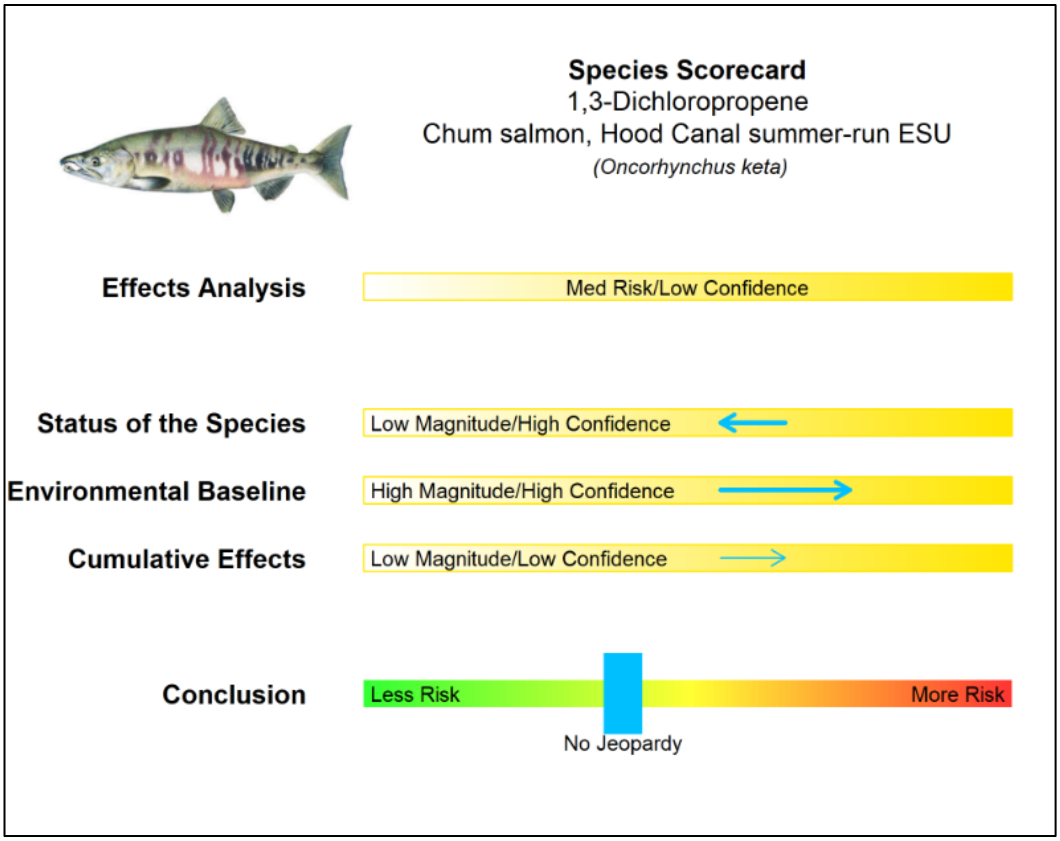

Figure 11. Example species scorecard

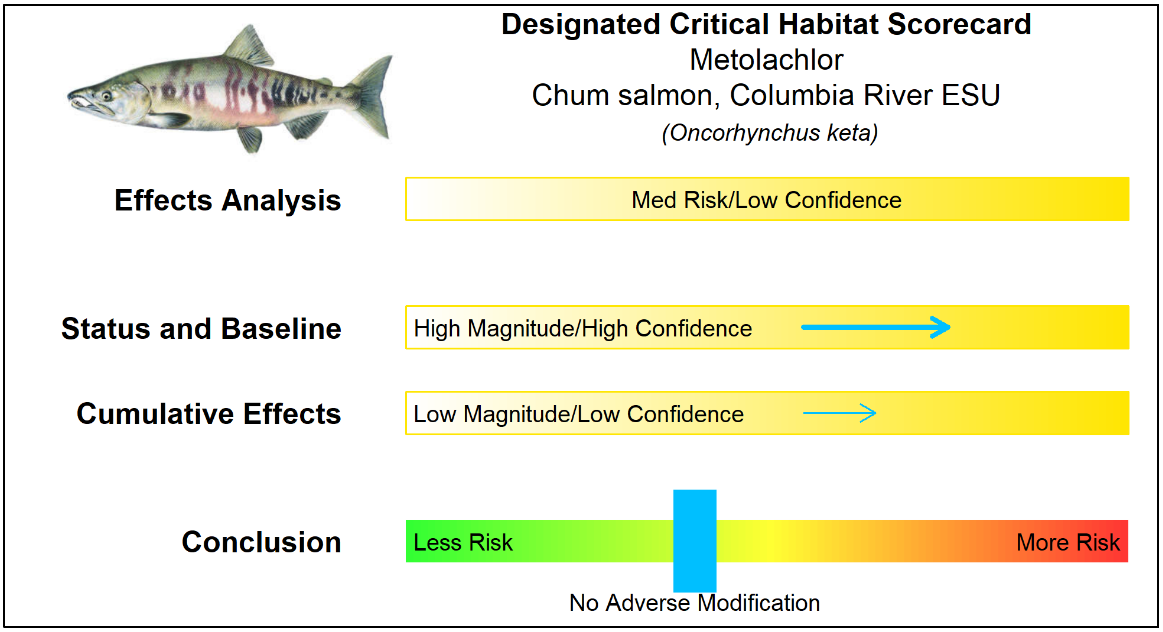

Figure 12. Example critical habitat scorecard

If, in completing the last step in the analysis we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (See 50 C.F.R. §402.14).

In addition, we include an ITS that specifies the impact of the take, RPMs to minimize the impact of the take, and terms and conditions to implement the RPMs (ESA section 7 (b)(4); 50 C.F.R. §402.14(i)). We also provide discretionary conservation recommendations that may be implemented by the action agency (50 C.F.R. §402.14(j)). Finally, we identify the circumstances in which reinitiation of consultation is required (50 C.F.R. §402.16).

“Take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. § 1532). "Harass” is further defined as an act that would “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (NMFSPD 02-110-19).

5 Description of the Proposed Action

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies.

The Federal Action

Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the purpose of EPA's proposed action is to provide pest control that "will not generally cause unreasonable adverse effects on the environment (40 CFR)." Under FIFRA, before a pesticide product may be sold or distributed in the U.S. it must be registered with a label identifying approved uses by EPA's Office of Pesticide Programs (OPP). Once registered, a pesticide may not legally be used unless the use is consistent with directions on its approved label(s) (http:www.epa.gov/pesticides/regulating/registering/index.htm). EPA authorization of pesticide uses are categorized as FIFRA sections 3 (new product registrations), 4 (re-registrations and special review), 18 (emergency use), or 24(c) Special Local Needs (SLN).

The proposed action for this consultation is EPA's registrations of all pesticides containing 1,3-dichloropropene (1,3-D) or metolachlor, including registrations for products containing racemic metolachlor and the enantiomerically enriched s-metolachlor.[6] The proposed action includes (1) approved product labels containing 1,3-D or metolachlor, (2) degradates and metabolites of 1,3-D or metolachlor, (3) formulations, including other ingredients within formulations, (4) adjuvants, and (5) tank mixtures. EPA is required to reassess each registered pesticide at least every 15 years (FQPA; Public Law 104-170). Thus the duration of the action considered in this consultation is for 15 years.

EPA's pesticide registration process involves an examination of the ingredients of a pesticide, the site or crop on which it will be used, the amount, frequency and timing of its use, and its storage and disposal practices. Pesticide products may include active ingredients (a.i.s) and other ingredients, such as adjuvants, and surfactants (described in greater detail below). The EPA evaluates the pesticide to ensure that it will not have unreasonable adverse effects on humans, the environment, and non-target species. An unreasonable adverse effect on the environment is defined in FIFRA as, "(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under" section 408 of the United States Federal Food, Drug, and Cosmetic Act (FFDCA) (21 U.S.C. §346a; 7 U.S.C. 136(bb)).

After registering a pesticide, EPA retains discretionary involvement and control over such registration. EPA must periodically review the registration to ensure compliance with FIFRA and other federal laws (7 U.S.C. §136d). A pesticide registration can be canceled whenever "a pesticide or its labeling or other material does not comply with the provisions of FIFRA or, when

[6] EPA's registrations are for separate actions that we have combined in one Opinion. We considered the effects of each of EPA's actions separately and independently. For convenience, we will refer to one action.

used in accordance with widespread and commonly recognized practice, generally causes unreasonable adverse effects on the environment" (7 U.S.C. §136d(b)).

EPA, NMFS, and FWS agreed on December 12, 2007 that the federal action for EPA's FIFRA registration actions will be defined as the "authorization for use or uses described in labeling of a pesticide product containing a particular pesticide ingredient." In order to insure that EPA's action will not jeopardize listed species or destroy or adversely modify critical habitat, NMFS' analysis encompasses the impacts to listed species of all uses authorized by EPA, regardless of whether those uses have historically occurred. Because uses are authorized by EPA on labels, it is reasonable to assume each of these uses may occur in the future, and therefore potential effects to listed species must be analyzed for all approved uses.

Pesticide Labels. For this consultation, EPA's proposed action encompasses all approved product labels containing 1,3-D and metolachlor, including their degradates, metabolites, and formulations, other ingredients within the formulations, adjuvants, and tank mixtures. The effects of these comprise the stressors of the action. These a.i.'s combined are labeled for a variety of uses including applications to crop and non-crop areas.

Active and Other ingredients. 1,3-D and metolachlor are the a.i.'s that kill or otherwise affect targeted organisms (listed on the label). However, pesticide products that contain these a.i.'s also contain other ingredients (referred to as "inerts" or "other" ingredients on the labels). Inert ingredients are ingredients which EPA defines as not "pesticidally" active. The specific identification of the compounds that make up the inert fraction of a pesticide is not required on the label. However, this does not necessarily imply that inert ingredients are non-toxic, non-flammable, or otherwise non-reactive. EPA authorizes the use of chemical adjuvants to make pesticide products more efficacious. An adjuvant aids the operation or improves the effectiveness of a pesticide. Examples include wetting agents, spreaders, emulsifiers, dispersing agents, solvents, solubilizers, stickers, and surfactants. A surfactant is a substance that reduces surface tension of a system, allowing oil-based and water-based substances to mix more readily. A common group of non-ionic surfactants is the alkylphenol polyethoxylates (APEs), which may be used in pesticides or pesticide tank mixes, and also used in many common household products. Nonylphenol (NP), one of the APEs, has been linked to endocrine-disruption effects in aquatic animals.

Formulations. Pesticide products come in a variety of solid and liquid formulations. Examples of formulation types include dusts, dry flowables, emulsifiable concentrates, granulars, solutions, soluble powders, ultra-low volume concentrates, water-soluble bags, powders, and baits. The formulation type can have implications for product efficacy and exposure to humans and other non-target organisms.

Tank Mix. A tank mix is a combination by the user of two or more pesticide formulations as well as any adjuvants or surfactants added to the same tank prior to application. Typically, formulations are combined to reduce the number of spray operations or to obtain better pest control then if the individual products were applied alone. The compatibility section of a label may advise on tank mixes known to be incompatible or provide specific mixing instructions for use with compatible mixes. Labels may also recommend specific tank mixes. Pursuant to FIFRA, EPA has the discretion to prohibit tank mixtures. Applicators are permitted to include any combination of pesticides in a tank mix as long as each pesticide in the mixture is permitted for use on the application site and the label does not explicitly prohibit the mix.

Pesticide Registration. In 2006, EPA commenced a new program called registration review to reevaluate all pesticides on a regular cycle. EPA is required to review each pesticide at least every 15 years to make sure that as the ability to assess risks to human health and the environment evolves and as policies and practices change, all pesticide products in the marketplace can still be used safely. Registration review includes Sections 3 and 24(c) labels. The label on a pesticide package or container is legally enforceable. The label provides information about how to handle and safely use the pesticide product and avoid harm to human health and the environment. Using a pesticide in a manner that is inconsistent with the use directions on the label is a violation of FIFRA and can result in enforcement actions to correct the violations; EPA's enforcement authorities are set forth in FIFRA §13 and §14. Pesticide registration is the process through which EPA evaluates product labels; EPA examines the ingredients of a pesticide; the site or crop on which it is to be used; the amount, frequency and timing of its use; and storage and disposal practices. Pesticide products (also referred to as "formulated products") may include active ingredients (a.i.s) and other ingredients, such as adjuvants and surfactants. The eligibility for continued registration may be contingent on label modifications to mitigate risk and can include phase-out and cancellation of uses and pesticide products. Registrants can submit applications for the registration of new products and new uses following re-evaluation of an active ingredient. Several types of products are registered, including the pure (or nearly pure) active ingredient, often referred to as technical grade active ingredient (TGAI), technical, or technical product. The technical product is generally used in manufacturing and testing, and not applied directly to crops or other use sites. Products that are applied to crops or other use sites (e.g., rights of way, landscaping), either on their own or in conjunction with other products or surfactants in tank mixes are called end-use products (EUPs).Sometimes companies will also register the pesticide in a manufacturing formulation, intended for sale to another registrant who then includes it into a separately registered EUP. Manufacturing formulations are not intended for application directly to use sites. The EPA may also cancel product registrations. Section 6(b) of FIFRA authorizes EPA to take the initiative to cancel a pesticide registration when existing risks related to the use of the pesticide are unacceptable. EPA's procedures for non-voluntary cancellation are available at https://www.epa.gov/pesticides. EPA typically allows the use of canceled products, and products that do not reflect registration review label mitigation requirements, until those products have been exhausted. EPA's action includes all authorizations for use of pesticide products including products containing the two a.i.s for the duration of the proposed action.

Duration of the Proposed Action. EPA is required to reassess registered pesticide active ingredients at least every 15 years. Given EPA's timeframe for pesticide registration reviews, NMFS' evaluates effects to listed species that may result from the proposed 15-year action including any effects that may continue beyond the end of the 15 years.

Monitoring and Reporting. The current Federal Action does not include any specific provision for monitoring. However, Section 6(a)(2) of the Federal Insecticide, Fungicide and Rodenticide Act requires pesticide product registrants to report adverse effects information, such as incident data involving fish and wildlife to EPA (40 CFR part 159, https://www.ecfr.gov/ Title 40).

The following description of 1,3-D and metolachlor registrations (the action) represents information acquired from EPA and Applicants.

5.1 1,3-D

1,3-D is a soil fumigant used to kill insects, fungi, nematodes, and weeds. Product labels describe allowable application methods, application rates, and where pesticides can legally be applied (use sites). Product labels allow for the application of 1,3-D to sites characterized as cropland. These products primarily authorize soil treatments to control nematodes and manage certain soil-borne diseases prior to planting. 1,3-D is applied through drip irrigation or various soil injection methods that require covering the applied product with soil and/or tarping material. 1,3-D product labels do not generally provide crop specific application rates; rather application rates for various use sites are listed by crop categories (
Table 9); vegetable crops, field crops, fruit and nut crops, and nursery crops). Maximum single and annual application rates for general crop categories range currently authorized range between 296 and 580 lbs a.i./acre. The label restrictions summarized here do not incorporate the changes proposed in EPA's 1,3-Dichloropropene (1,3-D) Proposed Interim Registration Review Decision (Docket Number EPA-HQ-OPP-2013-0154). See chapter 18 for information on how the interim registration review decision was incorporated into the Opinion.

Table 9. Summary of FIFRA section 3 uses authorized for 1,3-D products in the United States.

Use Site	Maximum Single Application Rate (lbs a.i./A)	Maximum Annual Application Rate (lbs a.i./A)	Section 3 label example
Vegetable Crops	580.29	580.29	Telone C-15 Registration 11220-20
Field Crops	580.29	580.29	Telone C-15 Registration 11220-20

Use Site	Maximum Single Application Rate (lbs a.i./A)	Maximum Annual Application Rate (lbs a.i./A)	Section 3 label example
Fruit and Nut Crops	580.29	580.29	Telone C-15 Registration 11220-20
Nursery Crops	580.29	580.29	Telone C-15 Registration 11220-20
Mint[a]	295.5	295.5	Telone II Registration 95290-1

[a]To suppress *Verticillium* wilt

There are currently active registrations for 22 end use products that contain 1,3-D as an active ingredient. Additionally, there are five FIFRA 24(c) - SLN labels that authorize geographically-specific use of 1,3-D in states where listed Pacific salmonids reside (

Table 10). SNL CA-120006 allows for two applications of 1,3-D to California field-grown nursery stock with a minimum retreatment interval of 14 days. While section 3 labels limit the maximum rate in potato to 255.6 lbs a.i./A (vegetable crops), ID-070015 allows for two applications of 1,3-D at rates up to 354.6 lbs/A in Idaho. Additionally, Idaho, Oregon, and Washington, all allow for the use of 1,3-D as an herbicide to all crop lands to control certain weeds (SLN ID-90001, OR-940038, WA-940038). Approximately 82% of the 1,3-D products currently available for use also include chloropicrin (Table 11). Chloropicrin is a broad-spectrum fumigant that can be used as an antimicrobial, fungicide, herbicide, insecticide, and nematocide (EPA 2008). Four end use products include 1,3-D as the only active ingredient (EPA registrations: 11220-1, 95290-1, 95290-3, and 95290-6).

Table 10. Summary of 1,3-D Special Local Needs (SLN) use authorized within the states of California, Idaho, Oregon, and Washington.

Use Site and SLN label #	Method	Maximum Single Application Rate (lbs a.i./A)	Maximum Annual Application Rate (lbs a.i./A)	Number of Applications	Minimum Re-treatment Interval (days)
Idaho potato – USDA Potato Cyst Nematode Eradication Program ID-070015[a]	Soil injection	354.6	709.2	2	45
Unspecified cropland in Idaho – certain weed control ID-090001 [a]	Soil injection	246.25	394	2	7

Use Site and SLN label #	Method	Maximum Single Application Rate (lbs a.i./A)	Maximum Annual Application Rate (lbs a.i./A)	Number of Applications	Minimum Re-treatment Interval (days)
Unspecified cropland in Oregon – certain weed control OR-940038[a]	Soil injection	394	541.75	2	7
Unspecified cropland in Washington – certain weed control WA-940038[a]	Soil injection	246.25	394	2	7

[a] Also subject to restrictions of Telone II label: registration number 62719-32 (now 95290-1)

Table 11. Currently registered formulated products containing 1,3-D and at least one other active ingredient.

Registration number	Product Name	A.I. %	Active Ingredient
95290-5	In-Line	60.8% 33.3%	1,3-dichloropropene Chloropicrin
8536-21	Pic-Clor 15	82.9% 14.9%	1,3-dichloropropene Chloropicrin
8536-22	Pic-Clor 30	68.3% 29.8%	1,3-dichloropropene Chloropicrin
8536-42	Pic-Clor 40 EC	55.6% 37.8%	1,3-dichloropropene Chloropicrin
8536-8	Pic-Clor 60	39.0% 59.6%	1,3-dichloropropene Chloropicrin
8536-43	Pic-Clor 60 EC	56.6% 37.1%	1,3-dichloropropene Chloropicrin
11220-20	Telone C-15	82.9% 14.9%	1,3-dichloropropene Chloropicrin
95290-2	Telone C-35	63.4% 34.7%	1,3-dichloropropene Chloropicrin
11220-21	Tri-form 30	68.3% 29.8%	1,3-dichloropropene Chloropicrin
11220-22	Tri-form 35	63.4% 34.8%	1,3-dichloropropene Chloropicrin
11220-37	Tri-form 40	58.5% 39.9%	1,3-dichloropropene Chloropicrin
11220-34	Tri-form 40 EC	55.6% 37.8%	1,3-dichloropropene Chloropicrin
11220-33	Tri-form 60 EC	37.1% 56.7%	1,3-dichloropropene Chloropicrin

Registration number	Product Name	A.I. %	Active Ingredient
11220-38	Tri-form 70 EC	27.8% 66.3%	1,3-dichloropropene Chloropicrin
11220-35	Tri-form 80 EC	18.5% 75.8%	1,3-dichloropropene Chloropicrin
11220-15	Tri-form 60	39.0% 59.6%	1,3-dichloropropene Chloropicrin
11220-39	Tri-form 70	29.2% 69.8%	1,3-dichloropropene Chloropicrin
11220-36	Tri-form 80	19.5% 79.8%	1,3-dichloropropene Chloropicrin

5.2 Metolachlor

Metolachlor (racemic metolachlor and s-metolachlor) is a broad-spectrum herbicide that controls plants by inhibiting seedling shoot and meristematic growth. Metolachlor products can be applied pre-plant, pre-emergence, or early post-crop emergence to control seedling grasses or certain broadleaf weeds in a wide range of crops. Maximum single application rates range from 0.64 to 3.75 lbs a.i./A (Table 12). Labels allow up to two applications per crop cycle, and multiple crop cycles per year, with maximum annual application rates up to 5.97 lbs a.i./A/year in certain crops. Metolachlor products are formulated as emusifiable concentrates, flowable concentrates, soluble concentrates, granules, and ready to use mixtures. Metolachlor products can be applied through a variety of ground applications methods including broadcast sprays, banded applications, soil incorporation methods, and co-application with dry bulk granular fertilizer. Metolachor can also be applied using aircraft and chemigation equipment (EPA 2019).

There are approximately 100 end use metolachlor products with active registrations. A majority of metolachlor products contain multiple active ingredients. While many contain two or three active ingredients, some products contain up to four pesticides (Table 13). The products that contain a single active ingredient routinely recommend tank mixtures with other herbicides and fertilizers. The label restrictions summarized here do not incorporate the changes proposed in EPA's Metolachlor/S-metolachlor Proposed Interim Registration Review Decision (Docket Number EPA-HQ-OPP-2014-0772). See chapter 18 for information on how the interim registration review decision was incorporated into the Opinion.

Table 12. Summary of metolachlor use authorized within the states of California, Idaho, Oregon, and Washington.

Use Site	Application Method[a]	Maximum Single Application Rate (lbs a.i./A)[b]	Maximum Annual Application Rate (lbs a.i./A)	Maximum Number of Applications	Minimum Re-treatment Interval (days)	Source
Beans and other pod crops	G, A, C	2.0	2.93	NS[c]	NS	Registration 19713-549
Corn	G, A, C	2.68	3.87	NS	NS	EPA 2
California Cotton	A, C	1.60	3.98	NS	NS	EPA 2019
Horseradish	G, A, C	1.3	NS	NS	1 per crop cycle	Registration 1381-207
Potato	G, A, C	2.75	3.61	NS	NS	Registration 19713-549
Pumpkin	G	1.3	NS	NS	NS	Registration 1381-207
Rhubarb	G, A, C	1.3	NS	NS	1 per crop cycle	Registration 89167-42
Safflower	G, A, C	2.0	NS	NS	NS	Registration 89167-42
Sorghum	G, A	1.68	1.67 - NS	NS	NS	EPA 2019

Use Site	Application Method[a]	Maximum Single Application Rate (lbs a.i./A)[b]	Maximum Annual Application Rate (lbs a.i./A)	Maximum Number of Applications	Minimum Re-treatment Interval (days)	Source
Soybean[d]	G, A, C	2.75	2.75	NS	NS	EPA 2019
Sugarbeets	G, A, C	1.60	2.48	NS	60	Registration 100-818
Sunflower	G, A, C	1.91	NS	NS	NS	Registration 89167-42
Tomato	G	2.0	5.97 - NS	NS	NS	EPA 2019
Sod farms	G, A, C	2.48	4.00	2	NS	EPA 2019
Commercial/residential	G	3.75	3.75	NS	NS	Registration 070506-344
Nursery and landscape plantings	G, A, C	3.75	3.75	NS	NS	Registration 070506-344
California - Pepper	G	1.60	1.60	NA	NS	SLN CA-010022 Registration 100-816
California - Seeded and transplanted tomato	G	1.59	1.59	1	NS	SLN CA-030004 Registration 100-816
California - Swiss chard	G	1.27	1.27	1	NS	SLN CA-060019 Registration 100-816
California - Spinach	G	0.95	0.95	1	NS	SLN CA-080006 Registration 100-816

Use Site	Application Method[a]	Maximum Single Application Rate (lbs a.i./A)[b]	Maximum Annual Application Rate (lbs a.i./A)	Maximum Number of Applications	Minimum Re-treatment Interval (days)	Source
California - Dry bulb onion	G	1.27	2.54	NS	21	SLN CA-080017 Registration 100-816
California - Celery	G	1.27	1.905	NS	NS	SLN CA-080019 Registration 100-816
California - Subgroup 1-B (beet, carrot, turnip, etc.) and 1-C (artichoke, ginger, yam, etc.)	G	1.27	1.27	1	NS	SLN CA-100004 Registration 100-816
Idaho - Carrot, collard, radish, beet, kale, mustard, parsnip, rutabaga, turnip	G	0.64	0.64	1	NS	SLN ID-150006 Registration 100-816
Idaho - Pepper	G	1.60	1.60	1	NS	SLN ID-170006 Registration 100-816
Idaho - Dry bulb onion	G	1.27	2.54	NS	21	SLN ID-990016 Registration 100-816
Oregon - Alfalfa for seed	G	3.20	3.20	1	NS	SLN OR-040007 Registration 100-816
Oregon – Seed crops including radish, spinach, beets, and Swiss chard	G	1.27	1.27	1	NS	SLN OR-040010 Registration 100-816

Use Site	Application Method[a]	Maximum Single Application Rate (lbs a.i./A)[b]	Maximum Annual Application Rate (lbs a.i./A)	Maximum Number of Applications	Minimum Re-treatment Interval (days)	Source
Oregon – Transplanted bell pepper	G	1.60	1.60	1	NS	SLN OR-070004 Registration 100-816
Oregon – blueberry, blackberry, and raspberry	G	1.91	1.91	1	NS	SLN OR-110005 Registration 100-816
Oregon – Sweet potato	G	1.27	NS	NS	NS	SLN OR-160006 Registration 100-816
Oregon - Strawberry	G	0.95	1.95	NS	NS	SLN OR-180010 Registration 100-816

[a]Application Methods: C (chemigation), G (ground spray), A (aerial spray)
[b]Rates conveyed by EPA to NMFS in review of preliminary draft materials (August 12, 2020)
[c]NS (Not Specified)
[d]Not allowed in some California counties

Table 13. Currently registered formulated products containing metolachlor and at least one other active ingredient.

Registration number	Product Name	A.I. %	Active Ingredient
100-1282	Halex GT Herbicide	20.50%	S-metolachlor
		20.50%	Glyphosate
		2.05%	Mesotrione
100-1466	Acuron Herbicide	23.40%	S-metolachlor
		10.93%	Atrazine
		2.60%	Mesotrione
		0.65%	Bicyclopyrone
100-1623	A21472 Plus VaporGrip Technology	17.7%	Diglycolamin salt of dicamba
		24.0%	S-metolachlor
100-1660	A22089	31.0%	S-metolachlor
		3.1%	Mesotrione
91234-48	A308.09	7.55%	Sulfentrazone
		68.25%	S-metolachlor
91234-185	A335.05	58.2%	S-metolachlor
		13.8%	Metribuzin
91234-183	A335.07	46.4%	S-metolachlor
		10.2%	Sodium salt of fomesafen
91234-123	A335.08	36.8%	S-metolachlor
		3.68%	Mesotrione
1381-208	Agrisolutions Charger Max ATZ Lite	28.1%	Atrazine
		0.6%	Atrazine related compounds
		35.8%	S-metolachlor
279-3442	F7583-3 Herbicide	7.55%	Sulfentrazone
		24.20%	S-metolachlor
89167-41	AX ATZ S-MET HERBICIDE	33.0%	Atrazine
		0.7%	Atrazine related compounds
		26.1	S-metolachlor

Registration number	Product Name	A.I. %	Active Ingredient
89167-57	AX SULF-SMET Herbicide	7.55% 68.25%	Sulfentrazone S-metolachlor
100-1568	Acuron Flexi	0.87% 3.47% 31.24%	Bicyclopyrone Mesotrione S-metolachlor
100-817	Bicep II Magnum Herbicide	33.0% 0.7% 26.1%	Atrazine Atrazine related compounds S-metolachlor
100-827	Bicep Lite II Magnum Herbicide	28.1% 0.6% 35.8%	Atrazine Atrazine related compounds S-metolachlor
100-886	Bicep Magnum	32.0% 1.7% 26.1%	Atrazine Atrazine related compounds S-metolachlor
100-1162	Boundary 6.5EC Herbicide	58.2% 13.8%	S-metolachlor Metribuzin
87373-24	A308.06	7.55% 68.25%	Sulfentrazone S-metolachlor
352-624	Dupont Cinch ATZ Herbicide	33.0% 0.7% 26.1%	Atrazine Atrazine related compounds S-metolachlor
70506-338	Coyote Herbicide	36.8% 3.68%	S-metolachlor Mesotrione
1381-199	Charger Max ATZ	33.0% 0.7% 26.1%	Atrazine Atrazine related compounds S-metolachlor
352-623	DuPont Cinch ATZ Lite	28.1% 0.6% 35.8%	Atrazine Atrazine related compounds S-metolachlor
100-1161	Expert Herbicide	22.5% 0.4%	Atrazine Atrazine related compounds

Registration number	Product Name	A.I. %	Active Ingredient
		18.65 10.8%	S-metolachlor Glyphosate
100-1414	Lexar-622 Herbicide	19.00% 18.61% 0.39% 2.44%	S-metolachlor Atrazine Atrazine related compounds Mesotrione
100-1442	Lumax EZ Herbicide	27.1% 9.94% 0.21% 2.71%	S-metolachlor Atrazine Atrazine related compounds Mesotrione
100-1410	Zemax Selective Herbicide	36.80% 3.68%	S-metolachlor Mesotrione
5905-603	HM-1507 Herbicide	45.85% 10.04%	S-metolachlor Fomesafen
34704-1065	Intimidator	36.29% 8.05% 7.16%	S-metolachlor Metribuzin Fomesafen
70506-344	Intermoc Herbicide	27.30% 11.65%	S-metolachlor Glufosinate-ammonium
89168-79	Liberty M & M	36.80% 3.68%	S-metolachlor Mesotrione
89168-81	Liberty MAM	19.00% 18.61% 0.31% 2.44%	S-metolachlor Atrazine Atrazine related compounds Mesotrione
89168-87	Liberty PFO	46.4% 10.2%	S-metolachlor Sodium salt of fomesafen
89168-82	Liberty S-MOC ATZ	33.0% 0.5% 26.1%	Atrazine Atrazine related compounds S-metolachlor

Registration number	Product Name	A.I. %	Active Ingredient
89168-86	Liberty X-METCHLORBUZIN	44.59%	S-metolachlor
		10.94%	Metribuzin
89168-89	Liberty X-Sulfent - SMOC	5.67%	Sulfentrazone
		51.20%	S-metolachlor
34704-1070	LPI S-Metolachlor + Atrazine	33.0%	Atrazine
		0.7%	Atrazine related compounds
		26.1%	S-metolachlor
34704-1067	Matador-S	37.08%	S-metolachlor
		8.23%	Metribuzin
		1.83%	Imazethapyr
70506-335	Moccasin MTZ Herbicide	38.94%	S-metolachlor
		12.98%	Metribuzin
100-1268	Prefix Herbicide	46.4%	S-metolachlor
		10.2%	Sodium salt of fomesafen
100-1618	Sequence CS	18.2%	Glyphosate
		24.2%	S-metolachlor
100-1185	Sequence Herbicide	21.8%	Glyphosate
		29.0%	S-metolachlor
92647-7	Tigris Sulfen Elite	7.55%	Sulfentrazone
		68.25%	S-metolachlor
34704-1127	Tribal	36.25%	S-metolachlor
		6.85%	Metribuzin
		3.87	Sulfentrazone
19713-547	Drexel Trizmet II	33.1%	Atrazine
		0.6%	Atrazine related compounds
		26.1%	Metolachlor
19713-663	Drexel Trimet Lite	17.0%	Atrazine
		0.3%	Atrazine related compounds
		13.2%	Metolachlor
19713-677	Up-front Herbicide	46.4%	Metolachlor
		10.2%	Fomesafen

Registration number	Product Name	A.I. %	Active Ingredient
19713-686	Drexel Trizar Herbicide	19.00% 18.61% 0.34%	Metolachlor Atrazine Atrazine related compounds
19713-688	Trizmax Herbicide	29.40% 11.00% 2.94%	Metolachlor Atrazine Mesotrione
19713-694	Mes-O-Sate Herbicide	20.50% 20.50% 2.05%	Metolachlor Atrazine Atrazine related compounds
19713-704	Drexel Me-Too-Lachlor MTZ	58.2% 13.8%	Metolachlor Metribuzine
34704-1054	Matador	43.72% 6.14% 1.38%	Metolachlor Metribuzin Imazethapyr

6 ACTION AREA

Action area means all areas affected directly or indirectly by the Federal action and not just the immediate area involved in the action (50 C.F.R. §402.02). For an ESA consultation on EPA's nationwide authorization of pesticides, the action area would encompass all areas directly or indirectly affected by the use of these a.i.'s throughout the entire U.S. and its territories, and would encompass all ESA-listed species and designated critical habitat under NMFS jurisdiction.

However, in this instance, as a result of the 2002 order in Washington Toxics Coalition v. EPA, EPA initiated consultation on its authorization of 37 pesticide a.i.s regarding their effects on listed Pacific salmonids under NMFS' jurisdiction and associated designated critical habitat in the states of California, Idaho, Oregon, and Washington. Given the geographic scope of the areas in which EPA is authorizing the use of these a.i.s., and anticipated chemical transport following application, the action area for purposes of this Opinion consists of the entire range and most life history stages of listed salmon and steelhead and their designated critical habitat in California, Idaho, Oregon, and Washington. The action area encompasses all freshwater, estuarine, marsh, swamps, nearshore, and offshore marine surface waters of California, Oregon, and Washington. The action area also includes freshwater surface waters in Idaho (Figure 13).

NMFS' analysis focuses only on the effects of EPA's action on listed Pacific salmonids in the above-mentioned states. It includes the effects of these pesticides on the recently listed Lower Columbia River coho salmon, Puget Sound steelhead, and Oregon Coast coho salmon. The Lower Columbia River coho salmon was listed as endangered in 2005. The Puget Sound steelhead and the Oregon Coast coho salmon were listed as threatened in 2007 and 2008, respectively. This Opinion also analyzes the effects of EPA's proposed action on recently proposed designated critical habitats for Puget Sound steelhead and Lower Columbia River coho salmon (January 14, 2013, 50 CFR Part 226).

EPA's consultation with NMFS remains incomplete until it analyzes the effects of its authorization of pesticide product labels with these two compounds for all remaining threatened and endangered species under NMFS' jurisdiction. EPA must insure its action does not jeopardize the continued existence or result in the destruction or adverse modification of critical habitat for other listed species and designated critical habitat under NMFS' jurisdiction throughout the U.S. and its territories.

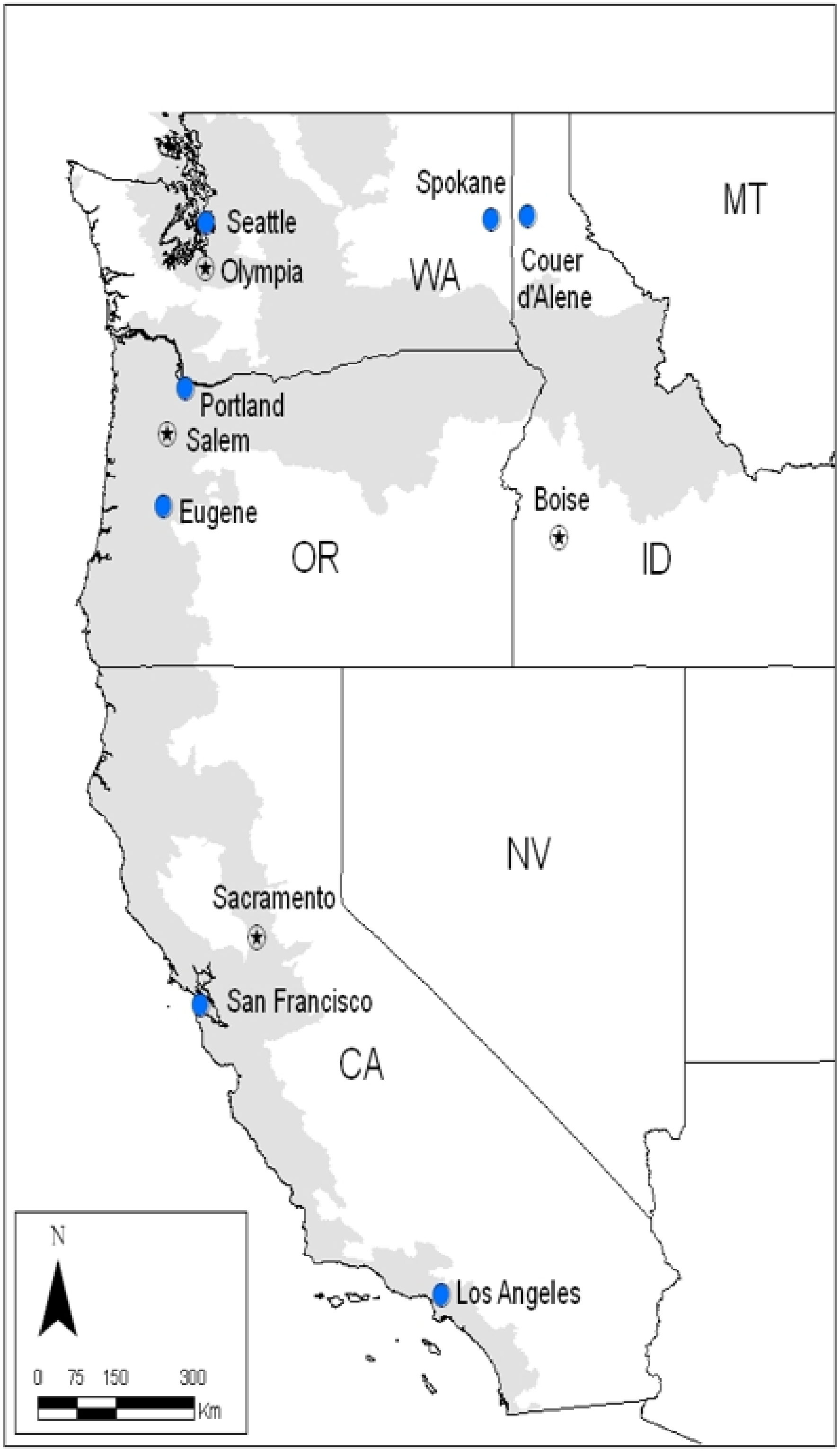

Figure 13. Map showing extent of inland action area with the range of all ESU and DPS boundaries for ESA listed salmonids highlighted in gray.

7 EPA SPECIES AND CRITICAL HABITAT EFFECT DETERMINATIONS

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). A ‘No Effect’ (NE) determination would be the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat.

NMFS uses two criteria to identify the ESA-listed species and critical habitats that are not likely to be adversely affected by the proposed action, as well as the effects of activities that are consequences of the Federal agency’s proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If we conclude that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or critical habitat is not likely to be adversely affected by those activities.

The second criterion is the probability of a response given exposure. ESA-listed species or designated critical habitat that co-occur with a stressor of the action but are not likely to respond to the stressor are also not likely to be adversely affected by the proposed action. We applied these criteria to the ESA-species and designated critical habitats and we summarize our results below.

The probability of an effect on a species or designated critical habitat is a function of exposure intensity and susceptibility of a species to a stressor’s effects (i.e., probability of response). An action warrants a "may affect, not likely to be adversely affected" finding when its effects are wholly beneficial, insignificant or discountable. Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect.

Discountable effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is very unlikely to occur.

'Likely to adversely affect' (LAA) is the appropriate conclusion when any effects of the action are not: discountable, insignificant, or wholly beneficial (not NLAA) and, therefore, adverse effects are possible to listed species or designated critical habitat as a result of the proposed action. If incidental take is anticipated (e.g. individuals may be harmed or harassed) as a result of the proposed action or the conservation value of a physical and biological feature may be diminished, an LAA determination should be made.

This section identifies the ESA-listed salmonid species and designated critical habitats for which the EPA has made the following effects determinations for this action (approval/registration of 1,3-D and metolachlor labelled uses and use sites) in its biological evaluations: no effect, may affect but not likely to adversely affect, or likely to be adversely affected.

EPA made NE and NLAA determinations in BEs for 1,3-D in 2004 and metolachlor in 2006. However, for both compounds, label information and approved use sites have changed in the interim. While EPA and registrants did provide new labels to NMFS for this Opinion, EPA indicated they will not otherwise be providing updates to their 2004 and 2006 BE's. Additionally, two species of salmon were listed as threatened after those BEs were developed. These are the Lower Columbia River Coho, and the Puget Sound Steelhead. Therefore, all of the species listed in Table 15, (regardless of EPA's earlier effect determinations) will be carried forward in this Biological Opinion for further analysis of effects of the action, the potential for jeopardy to the species, or destruction or adverse modification of critical habitat for these two compounds using the analyses described in Chapter 4. NMFS's determinations on effects to listed species and critical habitats listed in Table 15 will be presented in Chapters 12 and 15 of this Opinion.

On April 19, 2004 EPA finalized the biological evaluation for 1,3-D. The 2004 biological evaluation concluded that "the use of 1,3-Dichloropropene may affect but is not likely to adversely affect 11 ESUs when used according to labeled application directions and will have no effect on 15 ESUs in this assessment" (see **Table 1**).

Table 14. Summary of EPA 2004 conclusions on specific ESUs of listed Pacific salmon and steelhead for 1,3-Dichloropropene; adapted from EPA's biological evaluation of 1,3-D (Table 27). EPA did not make effects determinations to designated critical habitat.

Species	ESU	Finding (2004)

Chinook Salmon	California Coastal	No Effect
Chinook Salmon	Central Valley spring-run	No Effect
Chinook Salmon	Lower Columbia	May Affect, NLAA
Chinook Salmon	Puget Sound	May Affect, NLAA
Chinook Salmon	Sacramento River winter-run	May Affect, NLAA
Chinook Salmon	Snake River fall-run	May Affect, NLAA
Chinook Salmon	Snake River spring/summer-run	May Affect, NLAA
Chinook Salmon	Upper Columbia spring-run	May Affect, NLAA
Chinook Salmon	Upper Willamette	May Affect, NLAA
Chum Salmon	Columbia River	May Affect, NLAA
Chum Salmon	Hood Canal summer-run	No Effect
Coho Salmon	Central California	No Effect
Coho Salmon	Oregon Coast	No Effect
Coho Salmon	Southern Oregon/Northern California Coast	No Effect
Sockeye Salmon	Ozette Lake	No Effect
Sockeye Salmon	Snake River	No Effect
Steelhead	Central California Coast	No Effect
Steelhead	Central Valley, California	No Effect
Steelhead	Lower Columbia River	No Effect
Steelhead	Middle Columbia River	May Affect, NLAA
Steelhead	Northern California	No Effect
Steelhead	Snake River Basin	May Affect, NLAA
Steelhead	South-Central California	No Effect
Steelhead	Southern California	No Effect
Steelhead	Upper Columbia River	May Affect, NLAA
Steelhead	Upper Willamette River	No Effect

On June 19, 2006 EPA finalized the biological evaluation for metolachlor covering 26 listed salmonid species per Washington Toxics Coalition v. EPA, No. C-01-132 (W.D. Wash. July 2,

2002) Court Order. The 2006 assessment reached the following conclusions regarding metolachlor use and the 26 ESUs of listed salmonids in California and the Pacific Northwest:

6. Metolachlor is expected to have no direct effect on the listed salmonids.

7. Metolachlor is expected to have no appreciable effect on designated critical habitat for the listed salmonids.

8. Metolachlor is expected to have no effect on the listed salmonid prey.

9. Metolachlor is not likely to adversely affect listed salmonids through effects on aquatic plants.

10. Metolachlor is not likely to adversely affect listed salmonids through effects on riparian vegetation.

Table 15. Listed Species Status and Designated Critical Habitat within the action area.

Species	ESA Status	Critical Habitat Designated?
Chum Salmon, Columbia River	Threatened	Yes
Chum Salmon, Hood Canal summer-run	Threatened	Yes
Chinook Salmon, California Coastal	Threatened	Yes
Chinook Salmon, Central Valley spring-run	Threatened	Yes
Chinook Salmon, Lower Columbia River	Threatened	Yes
Chinook Salmon, Puget Sound	Threatened	Yes
Chinook Salmon, Sacramento River winter-run	Endangered	Yes
Chinook Salmon, Snake River fall-run	Threatened	Yes
Chinook Salmon, Snake River spring/summer run	Threatened	Yes
Chinook Salmon, Upper Columbia River spring-run	Endangered	Yes
Chinook Salmon, Upper Willamette River	Threatened	Yes
Coho Salmon, Central California Coast	Endangered	Yes
Coho Salmon, Lower Columbia River	Threatened	Yes
Coho Salmon, Oregon Coast	Threatened	Yes
Coho Salmon, South Oregon and North Calif. Coast	Threatened	Yes
Sockeye Salmon, Ozette Lake	Threatened	Yes

Sockeye Salmon, Snake River	Endangered	Yes
Steelhead, California Central Valley	Threatened	Yes
Steelhead, Central California coast	Threatened	Yes
Steelhead, Lower Columbia River	Threatened	Yes
Steelhead, Middle Columbia River	Threatened	Yes
Steelhead, Northern California	Threatened	Yes
Steelhead, Puget Sound	Threatened	Yes
Steelhead, Snake River Basin	Threatened	Yes
Steelhead, South Central California Coast	Threatened	Yes
Steelhead, Southern California	Endangered	Yes
Steelhead, Upper Columbia River	Endangered	Yes
Steelhead, Upper Willamette River	Threatened	Yes
Total species and designated critical habitats	**28 Species**	**28 Designated Critical Habitats**

8 STATUS OF SPECIES AND CRITICAL HABITAT LIKELY TO BE ADVERSELY AFFECTED

8.1 Introduction

The purpose of this section is to characterize the condition and status of the 28 species[7] that are likely to be adversely affected by the action, and to describe the status, conservation role and function of their respective critical habitats.

The status of species includes the existing level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution," which is part of the jeopardy determination as described in 50 C.F.R. §402.02.

This section also examines the condition of critical habitat throughout the designated area (such as various watersheds and coastal and marine environments that make up the designated area),

[7] We use the word "species" as it has been defined in section 3 of the ESA, which include "species, subspecies, and any distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature (16 U.S.C 1533)." Pacific salmon other than steelhead that have been listed as endangered or threatened were listed as "evolutionarily significant units" (ESU), which NMFS uses to identify distinct population segments of Pacific salmon. Any ESU or DPS is a "species" for the purposes of the ESA.

and discusses the condition and current function of designated critical habitat, including the essential physical and biological features that contribute to that conservation value of the critical habitat.

The following species and critical habitat designations may occur in the action area (Table 16). More detailed information on the status of these species and critical habitat are found in a number of published documents including recent recovery plans, status reviews, stock assessment reports, and technical memorandums. Many are available on the Internet at http://www.nmfs.noaa.gov/pr/species/.

Table 16. Listed Species and Critical Habitat in the Action Area.

Common Name (Distinct Population Segment (DPS) or Evolutionarily Significant Unit (ESU))	Scientific Name	Status
Chum salmon , Columbia River ESU	Oncorhynchus keta	THREATENED
Chum salmon, Hood Canal summer-run ESU		THREATENED
Chinook salmon, California coastal ESU	Oncorhynchus tshawytscha	THREATENED
Chinook salmon, Central Valley spring-run ESU		THREATENED
Chinook salmon, Lower Columbia River ESU		THREATENED
Chinook salmon, Puget Sound ESU		THREATENED
Chinook salmon, Sacramento River winter-run ESU		ENDANGERED
Chinook salmon, Snake River fall-run ESU		THREATENED
Chinook salmon, Snake River spring/summer run ESU		THREATENED
Chinook salmon, Upper Columbia River spring-run ESU		ENDANGERED
Chinook salmon, Upper Willamette River ESU		THREATENED
Coho salmon, Central California coast ESU	Oncorhynchus kisutch	ENDANGERED
Coho salmon, Lower Columbia River ESU		THREATENED
Coho salmon, Oregon coast ESU		THREATENED
Coho salmon, S. Oregon and N. Calif coasts ESU		THREATENED
Sockeye, Ozette Lake ESU	Oncorhynchus nerka	THREATENED
Sockeye, Snake River ESU		ENDANGERED
Steelhead, California Central Valley DPS	Oncorhynchus mykiss	THREATENED
Steelhead, Central California coast DPS		THREATENED
Steelhead, Lower Columbia River DPS		THREATENED
Steelhead, Middle Columbia River DPS		THREATENED
Steelhead, Northern California DPS		THREATENED
Steelhead, Puget Sound DPS		THREATENED
Steelhead, Snake River Basin DPS		THREATENED
Steelhead, South-Central California coast DPS		THREATENED
Steelhead, Southern California DPS		ENDANGERED
Steelhead, Upper Columbia River DPS		THREATENED
Steelhead, Upper Willamette River DPS		THREATENED

In assessing the status of the listed species NMFS made use of the viable salmonid population (VSP) concept and its four criteria. A VSP is an independent population (a population of which extinction probability is not substantially affected by exchanges of individuals with other populations) with a negligible risk of extinction, over a 100-year period, when threats from random catastrophic events, local environmental variation, demographic variation, and genetic diversity changes are taken into account (McElhany et al. 2000b). The four factors defining a viable population are a population's: (1) spatial structure, their distribution and utilization of their range; (2) abundance; (3) annual growth rate, including trends and variability of annual growth rates; and (4) diversity (McElhany et al. 2000b).

A population's tendency to increase in abundance and its variation in annual population growth and distribution defines a viable population (McElhany et al. 2000b; Morris and Doak 2002). A negative long-term trend in average annual population growth rate will eventually result in extinction. Further, a weak positive long-term growth rate will increase the risk of extinction as it maintains a small population at low abundances over a longer time frame. A large variation in the growth rates also increases the likelihood of extinction (Lande 1993; Morris and Doak 2002). Thus, in our status reviews of each listed species, we provide information on population abundance and annual growth rate of extant populations.

The action area for this consultation contains designated critical habitat for all 28 listed Pacific Salmon listed in Table 16. Critical habitat is defined as the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features that are essential to the conservation of the species, and which may require special management considerations or protection. Critical habitat can also include specific areas outside the geographical area occupied by the species at the time it is listed that are determined by the Secretary to be essential for the conservation of the species (ESA of 1973, as amended, section 3(5)(A)).

The primary purpose in evaluating the status of critical habitat is to identify for each Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS) the function of the critical habitat to support the intended conservation role for each species. Such information is important for an adverse modification analysis as it establishes the context for evaluating whether the proposed action results in negative changes in the function and role of the critical habitat for species conservation. NMFS bases its critical habitat analysis on the areas of the critical habitat that are affected by the proposed action and the area's physical or biological features that are essential to the conservation of a given species, and not on how individuals of the species will respond to changes in habitat quantity and quality.

In evaluating the status of designated critical habitat, we consider the current quantity, quality, and distribution of the PBFs that are essential for the conservation of the species. NMFS has identified PBFs of critical habitat for each life stage (*e.g.,* migration, spawning, rearing, and estuary) common for a number of species. To fully understand the conservation role of these habitats, specific physical and biological habitat features (*e.g.,* water temperature, water quality, forage, natural cover, etc.) were identified for each life stage.

Besides potential toxicity, water free of contaminants is important as contaminants can disrupt normal behavior necessary for successful migration, spawning, and juvenile rearing. Sufficient forage is necessary for juveniles to maintain growth that reduces freshwater predation mortality, increases overwintering success, initiates smoltification, and increases ocean survival. Natural cover such as submerged and overhanging large wood and aquatic vegetation provides shelter from predators, substrates for aquatic and terrestrial invertebrates (salmonid prey), shades freshwater to prevent increase in water temperature, and creates important side channels. A description of the past, ongoing, and continuing activities that threaten the functional condition of PBFs and their attributes are described in the *Environmental Baseline* section of this Biological Opinion (Opinion).

The information from the Status of the Species section may be used as a "risk modifier" in the Integration and Synthesis section (Chapters 13 and 16). Factors which have the potential to "modify" the risk of the action jeopardizing the species are those which are able to interact with the effects of the action. While many of the factors described in this section have the potential to modify the risk, and were thus considered, three of the factors within the status of the species were consistently found to have a high potential to modify the risk. Those three factors are: 1) trends in abundance, spatial distribution, and productivity; 2) listing status; and 3) achievement of recovery goals. We therefore developed three key questions to guide our synthesis of the information within the Status of the Species section:

1. Are abundance, spatial distribution, and productivity trends increasing, decreasing or stable?

2. Is the species listed as threatened or endangered?

3. Have recovery goals been met or are they on a sustained positive trajectory toward recovery?

Each status section concludes with a table providing a brief response to each of these questions.

Within the Integration and Synthesis section we characterize the overall magnitude of influence of the species status as either “low” or “high”. This characterization includes directionality (i.e. positive influence which equates to less risk or negative influence which equates to more risk) as well as confidence. The magnitude, directionality, and confidence of the influence are determined primarily by answers provided to the three key questions outlined above. We acknowledge that the magnitude, and directionality of these three factors varies on a species-by-species basis (for example, the significance of the attainment of recovery goals are relative to the specifics of the recovery goals themselves). We further acknowledge that the quantitative data (e.g. estimates of population growth rates) are incomplete without considering the more qualitative data often provided in recovery plans, status reports and listing documents. Therefore, we characterized magnitude and directionality with the following guidelines: 1) If the listing status of the species is “endangered”, the magnitude is high and the directionality is negative; 2) If the listing status is “threatened” and both of the other two factors indicates stability and/or recovery and/or uncertainty, the magnitude is low and the directionality is negative; 3) if the listing status is “threatened” and the other two factors indicate population decline and failure to meet recovery goals, the magnitude is high and the directionality is negative. It is conceivable directionality could also be positive. For example, if the listing status is “threatened” and the population’s growth rate, abundance, and spatial distribution has been consistently increasing between status reports, the direction could be positive. This is the case of threatened Hood Canal summer-run chum, where the population’s growth rate and abundance has been increasing in recent years.

The overall confidence in the magnitude and directionality is then characterized as either “low” or “high”. Confidence is determined by assessing the amount of evidence provided, as well as by further considering the species specific implications of the three factors. It is important to note that the key-question framework (described above) is a tool to help guide our risk assessors in making transparent and consistent determinations. However, the ultimate consideration of increased or decreased risk attributable to the status of the species is not restricted to the consideration of the key questions alone. All information relevant to the status of the species is considered in the risk assessment.

With but a few exceptions (discussed below) ESA listed salmon and steelhead are doing poorly throughout their Washington, Idaho, Oregon and California range. In most of Washington State, according to the state’s biennial report on salmon (stateofsalmon.wa.gov), ESA listed salmon are below recovery goals (see Table 17). While some species such as Snake River fall-run Chinook and Hood Canal summer-run chum are demonstrating large successes and continue upward trends towards recovery, others species, such as the Puget Sound Chinook and the upper Columbia River spring-run Chinook continue to diminish.

In Idaho, with the exception of the Snake River fall-run Chinook, species are not making progress or are showing only slight signs of progress toward recovery goals. For example, in 2018, only thirteen wild sockeye returned to Idaho, the recovery goal is 2,500.

Oregon salmon species include Oregon Coast Coho. The 2017 adult returns reached only 8.5 percent of the abundance goal. In 2016, the lower Columbia River coho salmon spawner abundance increased from 2015, but was still the fourth lowest observed in the past 15 years of monitoring (ODFW 2016). Lower Columbia River Chinook returns are far below abundance goals and in recent years have shown no progress toward improving in numbers. Upper Willamette River Chinook and steelhead abundance has remained steady in recent years but far below recovery targets.

California returns of all listed salmon continue to decline (Table 18). For example, in total 237,000 salmon and steelhead returned to monitored California rivers to spawn in 2016/2017. This amounts to a 30 percent reduction from the 2015/2016 returns.

Table 17. Washington State ESA-listed salmon progress toward recovery.

Below Goal (ESA listed salmon in Washington)			Near Goal
Getting Worse	Not Making Progress	Showing Signs of Progress	Approaching Goal
Upper Columbia River Spring Chinook	Upper Columbia River Steelhead	Mid-Columbia River Steelhead	Hood Canal Summer Chum
Puget Sound Chinook	Lower Columbia River Chum	Lake Ozette Sockeye	Snake River Fall Chinook
	Lower Columbia River Coho	Lower Columbia River Steelhead	
	Lower Columbia River Fall Chinook	Snake River Steelhead	
	Lower Columbia River Spring Chinook	Puget Sound Steelhead	
	Snake River Spring and Summer Chinook		

Table 18. Total Salmon and steelhead returning to California rivers 2013 – 2017.

Monitoring year	Total Salmon and Steelhead Abundance
2016/2017	237,000
2015/2016	335,000
2014/2015	520,000

2013/2014	680,000

The following narratives summarize the biology and ecology of threatened and endangered species that are likely to be adversely affected by EPA proposed action. The summaries include a description of the timing and duration of each life stage (e.g. adult river entry, spawning, egg incubation, freshwater rearing, smolt outmigration, and ocean migration). We also highlight information related to the viability of populations and the physical or biological features essential for the conservation of the species of designated critical habitats. These summaries provide a foundation for NMFS' evaluation of the effects of the proposed action on these listed species.

8.2 Chum salmon, Columbia River ESU

Table 19. Chum salmon, Columbia River ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus keta	Chum Salmon	Columbia River ESU	Threatened	2016	70 FR 37160	78 FR 41911	70 FR 52630

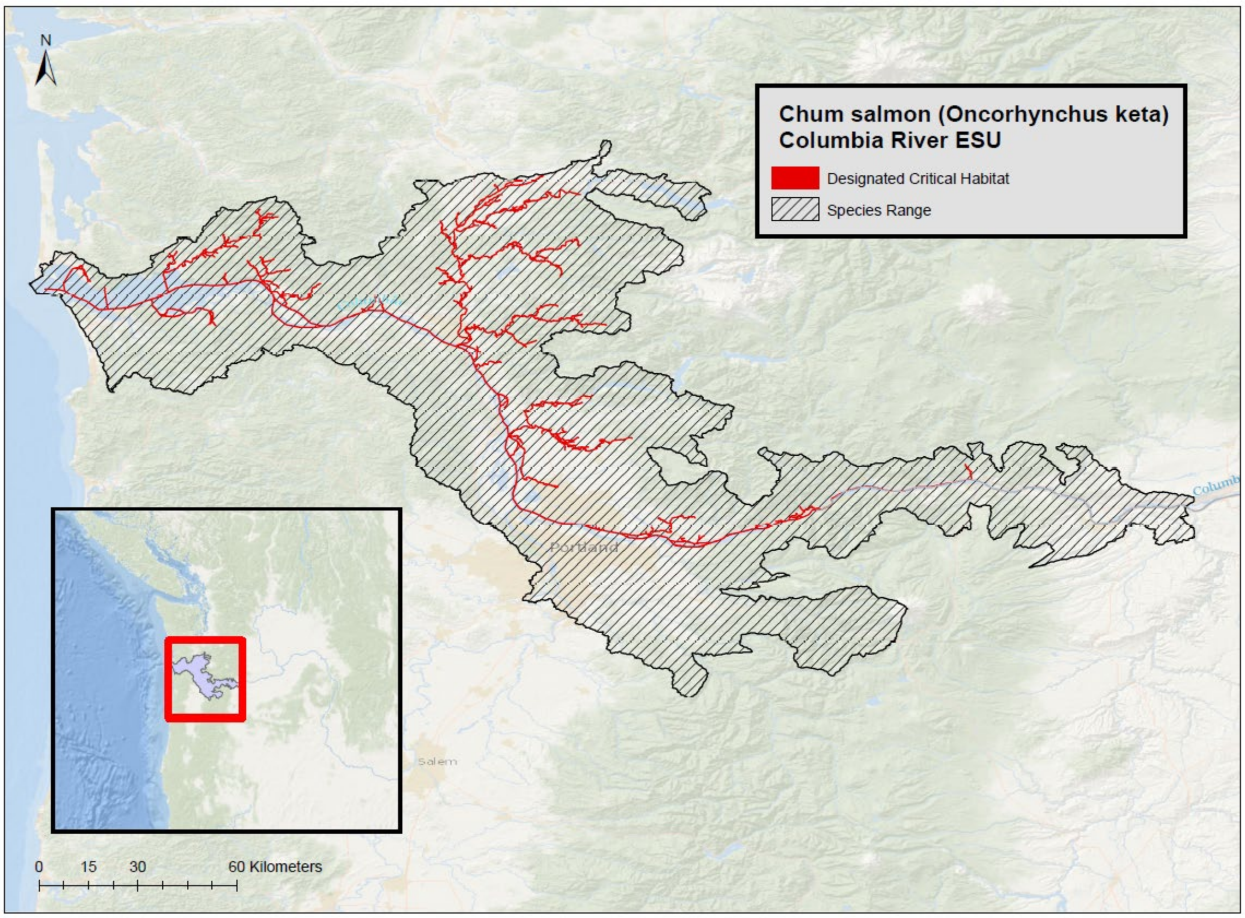

Figure 14. Chum salmon, Columbia River ESU range and designated critical habitat

Species Description. Chum salmon are an anadromous (i.e., adults migrate from marine to freshwater streams and rivers to spawn) and semelparous (i.e., they spawn once and then die) fish species. Adult chum salmon are typically between eight and fifteen pounds, but they can get as large as 45 pounds and 3.6 feet long. Males have enormous canine-like fangs and a striking calico pattern body color (front two-thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) during spawning. Females are less flamboyantly colored and lack the extreme dentition of the males. Ocean stage chum salmon are metallic greenish-blue along the back with black speckles. Chum salmon have the widest natural geographic and spawning distribution of the Pacific salmonids. Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east around the rim of the North Pacific Ocean to Monterey Bay, California. Historically, chum salmon were distributed throughout the coastal regions of western Canada and the U.S. At present, major spawning populations occur as far south as Tillamook Bay on the northern Oregon coast. On March 25, 1999, NMFS listed the Hood Canal Summer-run ESU and the Columbia River ESU of chum salmon as threatened (64 FR 14508). NMFS reaffirmed the status of these two ESUs as threatened on June 28, 2005 (70 FR 37160).

Status. The majority of the populations within the Columbia River chum salmon ESU are at high to very high risk, with very low abundances (NWFSC 2015b). These populations are at risk of extirpation due to demographic stochasticity and Allee effects. One population, Grays River, is at low risk, with spawner abundances in the thousands and demonstrating a recent positive trend. The Washougal River and Lower Gorge populations maintain moderate numbers of spawners and appear to be relatively stable. The life history of chum salmon is such that ocean conditions have a strong influence on the survival of emigrating juveniles. The potential prospect of poor ocean conditions for the near future may put further pressure on the Columbia River chum salmon ESU (NWFSC 2015b). Freshwater habitat conditions may be negatively influencing spawning and early rearing success in some basins, and contributing to the overall low productivity of the ESU. Columbia River chum salmon were historically abundant and subject to substantial harvest until the 1950s (Johnson et al. 1997). There is no directed harvest of this ESU and the incidental harvest rate has been below one percent for the last five years (NWFSC 2015b). Land development, especially in the low gradient reaches that chum salmon prefer, will continue to be a threat to most chum salmon populations due to projected increases in the population of the greater Vancouver-Portland area and the Lower Columbia River overall (Metro 2015). The Columbia River chum salmon ESU remains at a moderate to high risk of extinction (NWFSC 2015b).

Life history. Most chum salmon mature and return to their birth stream to spawn between three and five years of age, with 60 to 90 percent of the fish maturing at four years of age. Age at maturity appears to follow a latitudinal trend (i.e., greater in the northern portion of the species' range). Chum salmon typically spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to 100 km from the sea. Juveniles out-migrate to seawater almost immediately after emerging from the gravel covered redds ((Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, Coho salmon, and most types of Chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

Chum salmon spend two to five years in feeding areas in the northeast Pacific Ocean, which is a greater proportion of their life history compared to other Pacific salmonids. Chum salmon distribute throughout the North Pacific Ocean and Bering Sea, although North American chum salmon (as opposed to chum salmon originating in Asia), rarely occur west of 175 E longitude (Johnson et al. 1997). North American chum salmon migrate north along the coast in a narrow band that broadens in southeastern Alaska, although some data suggest that Puget Sound chum, including Hood Canal summer-run chum, may not make extended coastal migrations into northern British Columbian and Alaskan waters, but instead may travel directly offshore into the north Pacific Ocean (Johnson et al. 1997).

Table 20. Temporal distribution of Chum salmon, Columbia River ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Spawning</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Population Dynamics

Abundance / Productivity. Chum populations in the Columbia River historically reached hundreds of thousands to a million adults each year (NMFS 2017b). In the past 50 years, the average has been a few thousand a year. The majority of populations in the Columbia River chum ESU remain at high to very high risk, with very low abundances (NWFSC 2015b). Ford (2011b) concluded that 14 out of 17 of chum populations in this ESU were either extirpated or nearly extirpated. The very low persistence probabilities or possible extirpations of most chum salmon populations are due to low abundance, productivity, spatial structure, and diversity. Only one population (Grays River) is at low risk, with spawner abundances in the thousands, and demonstrating a recent positive trend. Two other populations (Washougal River and Lower Gorge) maintain moderate numbers of spawners and appear to be relatively stable (NWFSC 2015b).

Genetic Diversity. There are currently four hatchery programs in the Lower Columbia River releasing juvenile chum salmon: Grays River Hatchery, Big Creek Hatchery, Lewis River Hatchery, and Washougal Hatchery (NMFS 2017b). Total annual production from these hatcheries has not exceeded 500,000 fish. All of the hatchery programs in this ESU use integrated stocks developed to supplement natural production. Other populations in this ESU persist at very low abundances and the genetic diversity available would be very low (NWFSC 2015b). Although, hatchery production of Columbia River chum salmon has been limited and hatchery effects on diversity are thought to have been relatively small, diversity has been greatly reduced at the ESU level because of presumed extirpations and low abundance in the remaining populations (fewer than 100 spawners per year for most populations) (LCFRB 2010a; NMFS 2013a).

Distribution. The Columbia River chum salmon ESU includes all natural-origin chum salmon in the Columbia River and its tributaries in Washington and Oregon. The ESU consists of three populations: Grays River, Hardy Creek and Hamilton Creek in Washington State. Chum salmon from four artificial propagation programs also contribute to this ESU.

Designated Critical Habitat. NMFS designated critical habitat for the Columbia River chum salmon ESU in 2005 (70 FR 52630). Sixteen of the 19 subbasins reviewed in NMFS' assessment of critical habitat for the CR chum salmon ESU were rated as having a high conservation value. The remaining three subbasins were given a medium conservation value. Washington's federal lands were rated as having high conservation value to the species. PBFs considered essential for the conservation of the Columbia River ESU of Chum salmon are shown in Table 21.

Table 21 Primary Biological Features of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, Sacramento River winter-run Chinook salmon, and Central California Coast coho salmon – see Table 46) and corresponding species life history events.

Primary Biological Features Site Type	Primary Biological Features Site Attribute	Species Life History Event
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

Limited information exists on the quality of essential habitat characteristics for CR chum salmon. However, the migration PBF has been significantly impacted by dams obstructing adult migration and access to historic spawning locations. Water quality and cover for estuary and rearing PBFs have decreased in quality to the extent that the PBFs are not likely to maintain their intended function to conserve the species.

Recovery Goals. The ESU recovery strategy for Columbia River chum salmon focuses on improving tributary and estuarine habitat conditions, reducing or mitigating hydropower impacts, and reestablishing chum salmon populations where they may have been extirpated (NMFS

2013a). The goal of the strategy is to increase the abundance, productivity, diversity, and spatial structure of chum salmon populations such that the Coast and Cascade chum salmon strata are restored to a high probability of persistence, and the persistence probability of the two Gorge populations improves. For details on Columbia River chum salmon ESU recovery goals, including complete down-listing/delisting criteria, see the NMFS 2013 recovery plan (NMFS 2013a).

Table 22. Summary of status; Chum salmon, Columbia River ESU

Criteria	Description
Abundance / productivity trends	Most populations have very low abundances and productivity, low genetic diversity, high risk of extinction
Listing status	Threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs (water quality and cover) are degraded; Migration PBFs significantly impacted by dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; All 19 watersheds of high or medium conservation value

8.3 Chum salmon, Hood Canal summer-run ESU

Table 23. Chum salmon, Hood Canal summer-run ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus keta	Chum salmon	Hood Canal summer-run	Threatened	2011	70 FR 37160	2005	70 FR 52630

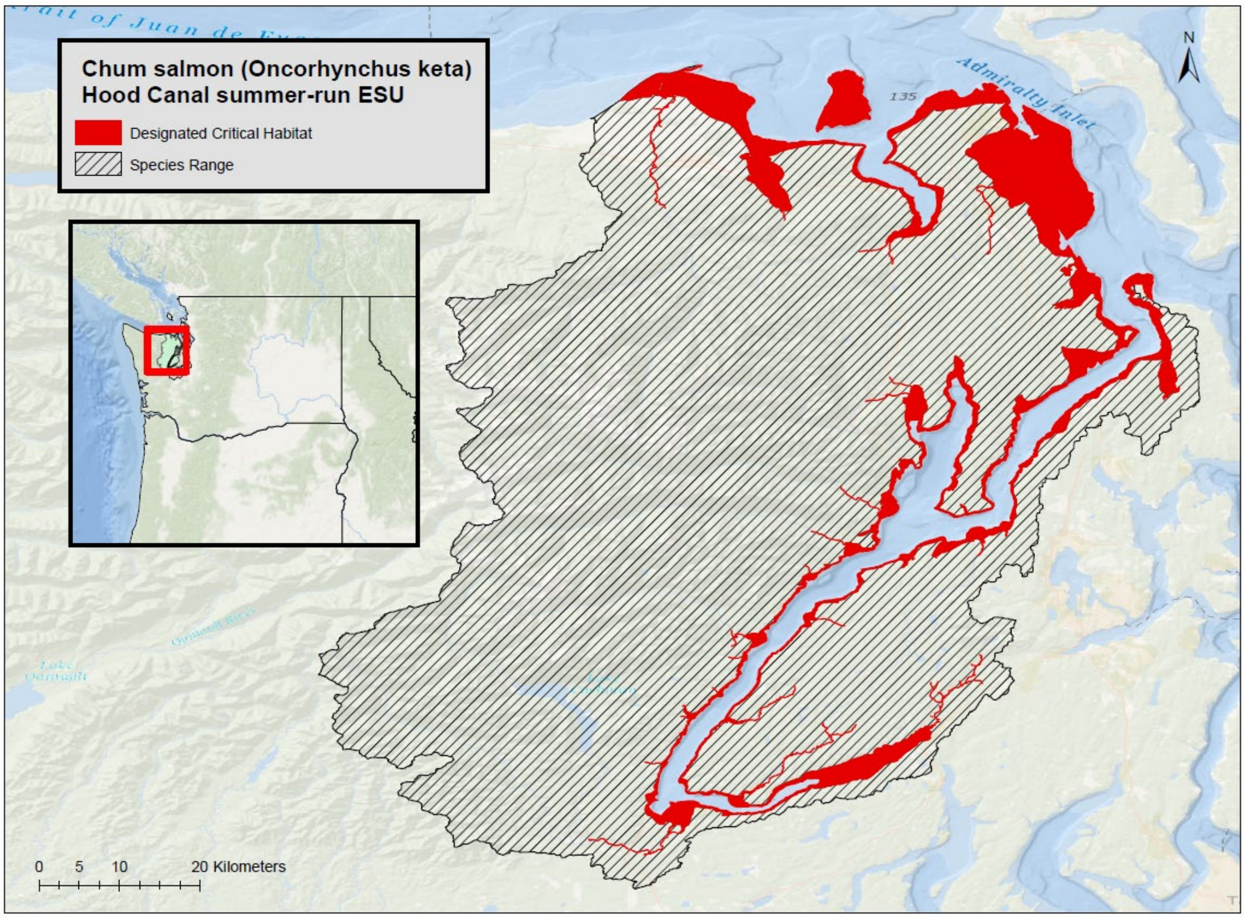

Figure 15. Chum salmon, Hood Canal summer-run ESU range and designated critical habitat

Species Description. Chum salmon are an anadromous (i.e., adults migrate from marine to freshwater streams and rivers to spawn) and semelparous (i.e., they spawn once and then die) fish species. Adult chum salmon are typically between eight and fifteen pounds, but they can get as large as 45 pounds and 3.6 feet long. Males have enormous canine-like fangs and a striking calico pattern body color (front two-thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) during spawning. Females are less flamboyantly colored and lack the extreme dentition of the males. Ocean stage chum salmon are metallic greenish-blue along the back with black speckles. Chum salmon have the widest natural geographic and spawning distribution of the Pacific salmonids. Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east around the rim of the North Pacific Ocean to Monterey Bay, California. Historically, chum salmon were distributed throughout the coastal regions of western Canada and the U.S. At present, major spawning populations occur as far south as Tillamook Bay on the northern Oregon coast. On March 25, 1999, NMFS listed the Hood Canal Summer-run ESU and the Columbia River ESU of chum salmon as threatened (64 FR 14508). NMFS reaffirmed the status of these two ESUs as threatened on June 28, 2005 (70 FR 37160).

Status. The two most recent status reviews (2011 and 2015) indicate some positive signs for the Hood Canal summer-run chum salmon ESU. Diversity has increased from the low levels seen in the 1990s due to both the reintroduction of spawning aggregates and the more uniform relative abundance between populations; considered a good sign for viability in terms of spatial structure and diversity (Ford 2011b). Spawning distribution within most streams was also extended further upstream with increased abundance. At present, spatial structure and diversity viability parameters for each population nearly meet the viability criteria (NWFSC 2015b). Spawning abundance has remained relatively high compared to the low levels observed in the early 1990's (Ford 2011b). Natural-origin spawner abundance has shown an increasing trend since 1999, and spawning abundance targets in both populations were met in some years (NWFSC 2015b). Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon populations, the ESU still does not meet all of the recovery criteria for population viability at this time (NWFSC 2015b). Overall, the Hood Canal Summer-run chum salmon ESU remains at a moderate risk of extinction.

Life history. Most chum salmon mature and return to their birth stream to spawn between three and five years of age, with 60 to 90 percent of the fish maturing at four years of age. Age at maturity appears to follow a latitudinal trend (i.e., greater in the northern portion of the species' range). Chum salmon typically spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to 100 km from the sea. Juveniles out-migrate to seawater almost immediately after emerging from the gravel covered redds ((Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, Coho salmon, and most types of Chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

Chum salmon spend two to five years in feeding areas in the northeast Pacific Ocean, which is a greater proportion of their life history compared to other Pacific salmonids. Chum salmon distribute throughout the North Pacific Ocean and Bering Sea, although North American chum salmon (as opposed to chum salmon originating in Asia), rarely occur west of 175 E longitude (Johnson et al. 1997). North American chum salmon migrate north along the coast in a narrow band that broadens in southeastern Alaska, although some data suggest that Puget Sound chum, including Hood Canal summer-run chum, may not make extended coastal migrations into northern British Columbian and Alaskan waters, but instead may travel directly offshore into the north Pacific Ocean (Johnson et al. 1997).

Table 24. Temporal distribution of Chum salmon, Hood Canal summer-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Population Dynamics

Abundance / Productivity. Of the sixteen populations that comprise the Hood Canal Summer-run chum ESU, seven are considered “functionally extinct” (Skokomish, Finch Creek, Anderson Creek, Dewatto, Tahuya, Big Beef Creek and Chimicum). The remaining nine populations are well distributed throughout the ESU range except for the eastern side of Hood Canal (Johnson et al. 1997). Two independent major population groups have been identified for this ESU: (1) spawning aggregations from rivers and creeks draining into the Strait of Juan de Fuca, and (2) spawning aggregations within Hood Canal proper (Sands 2009). NMFS examined average escapements (geometric means) for five-year intervals and estimated trends over the intervals for all natural spawners and for natural-origin only spawners. For both populations, abundance was relatively high in the 1970s, lowest for the period 1985-1999, and high again for the most recent 10 years (NWFSC 2015b). The overall trend in spawning abundance is generally stable for the Hood Canal population (all natural spawners and natural-origin only spawners) and for the Strait of Juan de Fuca population (all natural spawners). Only the Strait of Juan de Fuca population’s natural-origin only spawners show a significant positive trend. NMFS determined the abundance trends that appear to be positive occured during a short time span between 1995-2009, and again recently from 2011 - 2015 is the Juan de Fuca population (NWFSC 2015b). Productivity rates, which were quite low during the five-year period from 2005-2009 (Ford 2011b), increased from 2011-2015 and were greater than replacement rates from 2014-2015 for both major population groups (NWFSC 2015b). However, productivity of individual spawning aggregates still shows only two of eight aggregates have viable performance. While overall population abundance goals are being met, sub-population abundance goals for Hood Canal summer-run chum have not been met for six of the eight surviving sub-populations, and the species has not achieved spatial structure goals.

Genetic Diversity. There were likely at least two ecological diversity groups within the Strait of Juan de Fuca population and at least four ecological diversity groups within the Hood Canal population. With the possible exception of the Dungeness River aggregation within the Strait of Juan de Fuca population, Hood Canal ESU summer chum spawning groups exist today that represent each of the ecological diversity groups within the two populations (NMFS 2017a). NMFS measured spatial distribution of the Hood Canal chum salmon ESU using the Shannon diversity index (NWFSC 2015b). Higher diversity values indicate a more uniform distribution of the population among spawning sites, which provides greater robustness to the population. Diversity values were generally lower in the 1990s for both independent populations within the ESU, indicating that most of the abundance occurred at a few spawning sites. Although the overall linear trend in diversity appears to be negative, the last five-year interval shows the highest average value for both populations within the Hood Canal ESU. This results in part from the addition of one reintroduced spawning aggregation in the Strait of Juan de Fuca population and two reintroduced spawning aggregations in the Hood Canal population (NMFS 2017a).

Distribution. The Hood Canal summer-run chum salmon ESU includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington. This ESU also includes three artificial propagation programs: Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery (five other Hood Canal summer chum hatchery programs were terminated between 2005 and 2010 and are no longer part of the ESU).

Designated Critical Habitat. NMFS designated critical habitat for Hood Canal Summer-run chum salmon in 2005 (70 FR 52630). There are 12 watersheds within the range of this ESU. Three watersheds received a medium rating and nine received a high rating of conservation value to the ESU (NMFS 2005a). Five nearshore marine areas also received a rating of high conservation value. Habitat areas for the Hood Canal Summer-run chum salmon include 88 mi (142 km) of stream and 402 mi (647 km) of nearshore marine areas. PBFs considered essential for the conservation of the Hood Canal ESU of Chum salmon are shown in Table 21:

The spawning PBF is degraded by excessive fine sediment in the gravel, and the rearing PBF is degraded by loss of access to sloughs in the estuary and nearshore areas and excessive predation. Low river flows in several rivers also adversely affect most PBFs. In the estuarine areas, both migration and rearing PBFs of juveniles are impaired by loss of functional floodplain areas necessary for growth and development of juvenile chum salmon. These degraded conditions likely maintain low population abundances across the ESU.

Recovery Goals. The recovery strategy for Hood Canal Summer-run chum salmon focuses on habitat protection and restoration throughout the geographic range of the ESU, including both freshwater habitat and nearshore marine areas within a one-mile radius of the watersheds' estuaries (NMFS 2007). The recovery plan includes an ongoing harvest management program to reduce exploitation rates, a hatchery supplementation program, and the reintroduction of naturally spawning summer chum aggregations to several streams where they were historically present. The Hood Canal plan gives first priority to protecting the functioning habitat and major production areas of the ESU's eight extant stocks, keeping in mind the biological and habitat needs of different life-history stages, and second priority to restoration of degraded areas, where recovery of natural processes appears to be feasible (HCCC 2005). For details on Hood Canal Summer-run chum salmon ESU recovery goals, including complete down-listing/delisting criteria, see the Hood Canal Coordinating Council 2005 recovery plan (HCCC 2005) and the NMFS 2007 supplement to this recovery plan (NMFS 2007). Both independent populations (Strait of Juan de Fuca, Hood Canal) must have enough fish returning to meet abundance goals, distributed across the ESU to meet spatial structure goals in order to be considered recovered and removed from ESA listing.

Table 25. Summary of status; Chum salmon, Hood Canal summer-run ESU

Criteria	**Description**
Abundance / productivity trends	stable to increasing abundance trend, increasing population productivity
Listing status	threatened
Attainment of recovery goals	some criteria met
Condition of PBFs	Spawning and rearing PBFs are degraded; Migration and rearing PBFs are impaired by loss of floodplain habitat necessary for juvenile growth and development; Elevated temperatures and environmental mixtures anticipated in freshwater habitats ; All 12 watersheds of high or medium conservation value

8.4 Chinook salmon, California coastal ESU

Table 26. Chinook salmon, California coastal ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook salmon	California Coastal	Threatened	2016	70 FR 37160	2016	70 FR 52488

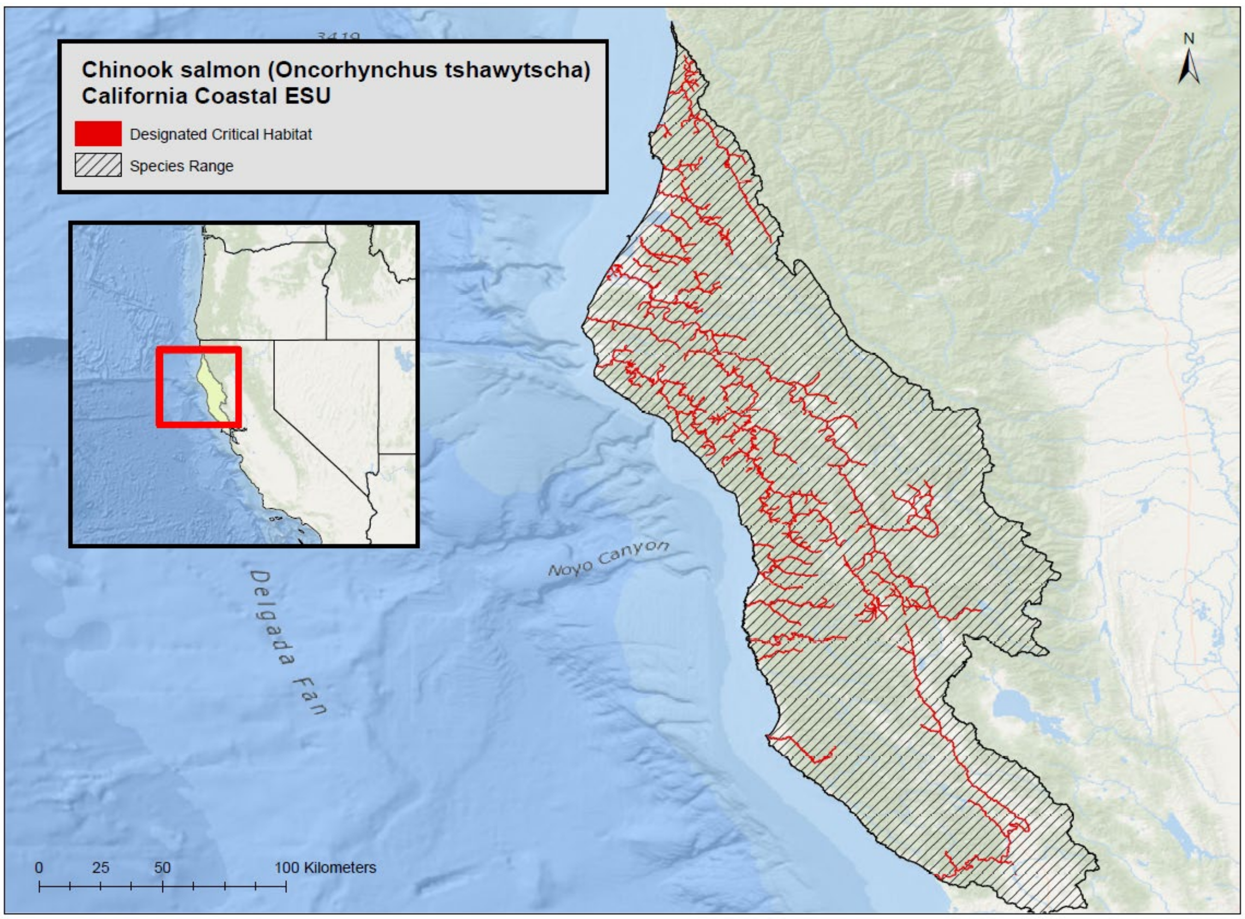

Figure 16. Chinook salmon, California coastal ESU range and designated critical habitat

Species Description. Chinook salmon, also referred to as king salmon in California, are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002a). On September 16, 1999, NMFS listed the California coastal ESU of Chinook salmon as a “threatened” species (FR 64 50394). On June 28, 2005, NMFS confirmed the listing of CC Chinook salmon as threatened under the ESA and also added seven artificially propagated populations from the following hatcheries or programs to the listing. The California Coastal (CC) Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River (Humboldt County, CA.) to the Russian River (Sonoma County, CA) (70 FR 37160).

Status. The ESU was historically comprised of 38 populations which included 32 fall-run populations and 6 spring-run populations across four Diversity Strata (Spence et al. 2008b). All six of the spring-run populations were classified as functionally independent, but are considered extinct (Williams et al. 2011). Good et al. (2005a) cited continued evidence of low population sizes relative to historical abundance, mixed trends in the few available time series of abundance indices available, and low abundance and extirpation of populations in the southern part of the ESU. In addition, the apparent loss of the spring-run life history type throughout the entire ESU as a significant diversity concern. The 2016 recovery plan determined that the four threats of greatest concern to the ESU are channel modification, roads and railroads, logging and wood harvesting, and both water diversion and impoundments and severe weather patterns.

Life history. California coastal Chinook salmon are a fall-run, ocean-type fish. Although a spring-run (river-type) component existed historically, it is now considered extinct (Bjorkstedt et al. 2005). The different populations vary in run timing depending on latitude and hydrological differences between watersheds. Entry of California coastal Chinook salmon into the Russian River depends on increased flow from fall storms, usually in November to January. Juveniles of this ESU migrate downstream from April through June and may reside in the estuary for an extended period before entering the ocean.

The length of time required for embryo incubation and emergence from the gravel is dependent on water temperature. For maximum embryo survival, water temperatures reportedly must be between 41°F and 55.4°F and oxygen saturation levels must be close to maximum. Under those conditions, embryos hatch in 40 to 60 days and remain in the gravel as alevins (the life stage between hatching and egg sack absorption) for another 4 to 6 weeks before emerging as fry. Juveniles may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the- year in the winter or spring months within eight months of hatching.

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982b; MacFarlane and Norton 2002; Sommer et al. 2001). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 27. Temporal distribution of Chinook salmon, California coastal ESU

<table>
<tr><td>Life History phase</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Spawning</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Population Dynamics

Abundance. Comparison of historical and current abundance information indicates that independent populations of Chinook salmon are depressed in many basins (Bennet 2005; Good et al. 2005b; NMFS 2008); only the Russian River currently has a run of any significance (Bjorkstedt et al. 2005). The 2000 to 2007 median observed (at Mirabel Dam) Russian River Chinook salmon run size is 2,991 with a maximum of 6,103 (2003) and a minimum of 1,125 (2008) adults (Cook 2008; Sonoma County Water Agency (SCWA) 2008).

Productivity / Population Growth Rate. The available data, a mixture of short-term (6-year or less) population estimates or expanded redd estimates and longer-term partial population estimates and spawner/red indexes, provide no indication that any of the independent populations (likely to persist in isolation) are approaching viability targets. Overall, there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review (Williams et al. 2011).

Genetic Diversity. At the ESU level, the loss of the spring-run life history type represents a significant loss of diversity within the ESU, as has been noted in previous status reviews (Good et al. 2005b; Williams et al. 2011). Concern remains about the extremely low numbers of Chinook salmon in most populations of the North-Central Coast and Central Coast strata, which diminishes connectivity across the ESU. However, the fact that Chinook salmon have regularly been reported in the Ten Mile, Noyo, Big, Navarro, and Garcia rivers represents a significant improvement in our understanding of the status of these populations in watersheds where they were thought to have been extirpated. These observations suggest that spatial gaps between extant populations are not as extensive as previously believed.

Distribution. The California Coastal Chinook ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River to the Russian River, California (64 FR 50394; September 16, 1999). Seven artificial propagation programs are considered to be part of the ESU: The Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and

Mad River Hatchery fall-run Chinook hatchery programs. These artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (NMFS 2005a).

Designated Critical Habitat. NMFS designated critical habitat for the California coastal Chinook salmon on September 2, 2005 (70 FR 52488). It includes multiple CALWATER hydrological units north from Redwood Creek and south to Russian River. The total area of critical habitat includes 1,500 miles of stream habitat and about 25 square miles of estuarine habitat, mostly within Humboldt Bay. PBFs considered essential for the conservation of the California coastal ESU of Chinook salmon are shown in Table 21:

There are 45 occupied CALWATER Hydrologic Subarea watersheds within the freshwater and estuarine range of this ESU. Eight watersheds received a low rating, 10 received a medium rating, and 27 received a high rating of conservation value to the ESU (70 FR 52488). Two estuarine habitat areas used for rearing and migration (Humboldt Bay and the Eel River Estuary) also received a high conservation value rating. Critical habitat in this ESU consists of limited quantity and quality summer and winter rearing habitat, as well as marginal spawning habitat. Compared to historical conditions, there are fewer pools, limited cover, and reduced habitat complexity. The current condition of PBFs of the California coastal Chinook salmon critical habitat indicates that PBFs are not currently functioning or are degraded; their conditions are likely to maintain a low population abundance across the ESU.

Recovery Goals. Recovery goals, objectives and criteria for the Central Valley spring-run Chinook are fully outlined in the 2016 Recovery Plan. Recovery plan objectives are to: 1. Reduce the present or threatened destruction, modification, or curtailment of habitat or range; 2. Ameliorate utilization for commercial, recreational, scientific, or educational purposes; 3. Abate disease and predation; 4. Establish the adequacy of existing regulatory mechanisms for protecting CC Chinook salmon now and into the future (i.e., post-delisting); 5. Address other natural or manmade factors affecting the continued existence of CC Chinook salmon; and 6. Ensure the status of CC Chinook salmon is at a low risk of extinction based on abundance, growth rate, spatial structure and diversity.

Table 28. Summary of status; Chinook salmon, California coastal ESU

Criteria	Description
Abundance / productivity trends	At considerable risk from population fragmentation and reduced spatial diversity. Comparisons to historical abundance is depressed in many basin. Only one population has had consistent run exceeding 1,000 spawning fish.
Listing status	threatened
Attainment of recovery goals	some criteria met
Condition of PBFs	Spawning PBFs are degraded by timber harvest; Rearing and migration PBFs impacted by dams and invasive species; Estuarine PBFs degraded by water quality and saltwater

	mixing; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 45 watersheds, 27 are of high and 10 are of medium conservation value.

8.5 Chinook salmon, Central Valley spring-run ESU

Table 29. Chinook salmon, Central Valley spring-run ESU; overview table

Species	Common Name	Distinct Population Segments (DPS)	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook Salmon	Central Valley Spring-run	Threatened	2016	1999 64 FR 50394 2014 79 FR 20802	2014	2005 70 FR 52488

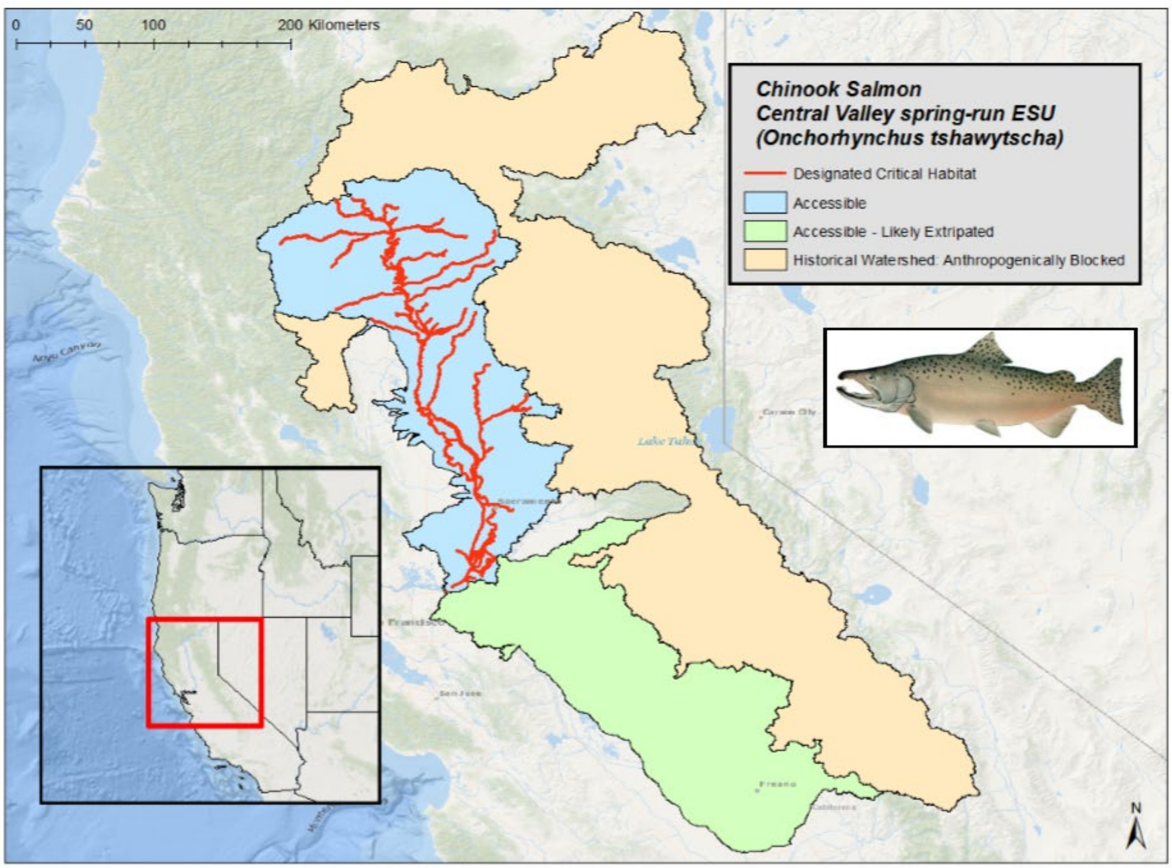

Figure 17. Chinook salmon, Central Valley spring-run ESU range and designated critical habitat

Species Description. Chinook salmon, also referred to as king salmon in California, are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002a). On September 16, 1999, NMFS listed the Central Valley ESU of spring-run Chinook salmon as a “threatened” species (FR 64 50394). Historically, spring-run Chinook salmon occurred in the headwaters of all major river systems in the Central Valley where natural barriers to migration were absent. The only known streams that currently support self-sustaining populations of non-hybridized spring-run Chinook salmon in the Central Valley are Mill, Deer and Butte creeks. Each of these populations is small and isolated (NMFS 2014b).

Status. Although spring-run Chinook salmon were probably the most abundant salmonid in the Central Valley, this ESU has suffered the most severe declines of any of the four Chinook salmon runs in the Sacramento River Basin (Fisher 1994). The ESU is currently limited to independent populations in Mill, Deer, and Butte creeks, persistent and presumably dependent populations in the Feather and Yuba rivers and in Big Chico, Antelope, and Battle creeks, and a few ephemeral or dependent populations in the Northwestern California region (e.g., Beegum, Clear, and Thomes creeks). The Central Valley spring-run Chinook salmon ESU is currently faced with three primary threats: (1) loss of most historic spawning habitat; (2) degradation of the remaining habitat; and (3) genetic introgression with the Feather River fish hatchery spring-run Chinook salmon strays. The potential effects of climate change are likely to adversely affect spring-run Chinook salmon and their recovery (NMFS 2014b).

Life history. Adult Central Valley spring-run Chinook salmon leave the ocean to begin their upstream migration in late January and early February, and enter the Sacramento River between March and September, primarily in May and June (Moyle 2002a; Yoshiyama et al. 1998). Spring-run Chinook salmon generally enter rivers as sexually immature fish and must hold in freshwater for up to several months before spawning. While maturing, adults hold in deep pools with cold water. Spawning normally occurs between mid- August and early October, peaking in September (Moyle 2002a).

The length of time required for embryo incubation and emergence from the gravel is dependent on water temperature. For maximum embryo survival, water temperatures reportedly must be between 41°F and 55.4°F and oxygen saturation levels must be close to maximum. Under those conditions, embryos hatch in 40 to 60 days and remain in the gravel as alevins (the life stage between hatching and egg sack absorption) for another 4 to 6 weeks before emerging as fry. Spring-run fry emerge from the gravel from November to March (Moyle 2002a). Juveniles may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the- year in the winter or spring months within eight months of hatching.

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982b; MacFarlane and Norton 2002; Sommer et al. 2001). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 30. Temporal distribution of Chinook salmon, Central Valley spring-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. The Central Valley as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s. The only known streams that currently support self-sustaining populations of nonhybridized spring-run Chinook salmon in the Central Valley are Mill, Deer and Butte creeks. Abundance and trend estimates for these streams as well as streams supporting dependent populations are provided in Table 31 (NMFS 2014b).

Table 31. Viability metrics for Central Valley spring-run ESU Chinook salmon populations.

Population	N	$\hat{S}$	10-year trend (95% CI)	Recent Decline (%)
Antelope Creek	8.0	2.7	-0.375 (-0.706, -0.045)	87.8
Battle Creek	1836	61	0.176 (0.033, 0.319)	9.0
Big Chico Creek	0.0	0.0	-0.358 (-0.880, 0.165)	60.7
Butte Creek	20169	6723	0.353 (-0.061, 0.768)	15.7
Clear Creek	822	27	0.010 (-0.311, 0.330)	63.3
Cottonwood Creek	4	1.3	-0.343 (-0.672, -0.013)	87.5
Deer Creek	2272	757.3	-0.089 (-0.337, 0.159)	83.8
Feather River Fish Hatchery	10808	3602.7	0.082 (-0.015, 0.179)	17.1
Mill Creek	2091.	697.0	-0.049 (-0.183, 0.086)	58.0
Sacramento River[a]	-	-	-	-
Yuba River	6515	2170.7	0.67 (-0.138, 0.272)	9.0

N: Total population size (N) is estimated as the sum of estimated run sizes over the most recent three years for Core 1 populations (bold) and Core 2 populations.
Ŝ: The mean population size (Ŝ) is the average of the estimated run sizes for the most recent 3 years (2012 to 2014).
Population growth/decline rate (10 year trend) is estimated from the slope of log-transformed estimated run size.
The catastrophic metric (recent decline) is the largest year-to-year decline in total population size (N) over the most recent 10 such ratios.
[a] Beginning in 2009, estimates of spawning escapement of Upper Sacramento River spring chinook were no longer monitored.

Productivity / Population Growth Rate. Cohort replacement rates (CRR) are indications of whether a cohort is replacing itself in the next generation. The majority of Central Valley (CV) spring-run Chinook salmon are found to return as three-year olds, therefore looking at returns every three years is used as an estimate of the CRR. In the past the CRR has fluctuated between just over 1.0 to just under 0.5, and in the recent years with high returns (2012 and 2013), CRR jumped to 3.84 and 8.68 respectively. CRR for 2014 was 1.85, and the CRR for 2015 with very low returns was a record low of 0.14. Low returns in 2015 were further decreased due to high temperatures and most of the CV spring-run Chinook salmon tributaries experienced some pre-spawn mortality. Butte Creek experienced the highest prespawn mortality in 2015, resulting in a carcass survey CRR of only 0.02.

Genetic Diversity. Threats to the genetic integrity of spring-run Chinook salmon was identified as a serious concern to the species when it was listed in 1999 (FR 64 50394; Myers et al. 1998a). Three main factors compromised the genetic integrity of spring-run Chinook salmon: (1) the lack of reproductive isolation following dam construction throughout the Central Valley resulting in introgression with fall-run Chinook salmon in the wild; (2) within basin and inter-basin mixing between spring and fall broodstock for artificial propagation, resulting in introgression in hatcheries; and (3) releasing hatchery-produced juvenile Chinook salmon in the San Francisco estuary, which contributes to the straying of returning adults throughout the Central Valley (NMFS 2014b).

Distribution. The Central Valley Technical Recovery Team delineated 18 or 19 historic independent populations of CV spring-run Chinook salmon, and a number of smaller dependent populations, that are distributed among four diversity groups (southern Cascades, northern Sierra, southern Sierra, and Coast Range) (Lindley et al. 2004). Of these independent populations, only three are extant (Mill, Deer, and Butte creeks) and they represent only the northern Sierra Nevada diversity group. Of the dependent populations, CV spring-run Chinook salmon are found in Battle, Clear, Cottonwood, Antelope, Big Chico, and Yuba creeks, as well as the Sacramento and Feather rivers and a number of tributaries of the San Joaquin River including Mokelumne, Stanislaus, and Tuolumne rivers. The 2005 listing determination concluded that the Feather River Fish Hatchery spring-run Chinook salmon production should be included in the Central Valley spring-run Chinook salmon ESU (79 FR 20802; NMFS 2016a).

Designated Critical Habitat NMFS published a final rule designating critical habitat for Central Valley spring-run Chinook on September 2, 2005 (70 FR 52488). The designated critical habitat includes 1,853 km (1,158 mi) of streams and 655 km2 (254 km2) of estuarine habitat. PBFs considered essential for the conservation of the Central Valley spring-run ESU of Chinook salmon are shown in Table 21.

The current condition of PBFs of the CV Spring-run Chinook salmon critical habitat indicates that PBFs are not currently functioning or are degraded; their conditions are likely to maintain a low population abundance across the ESU. Spawning and rearing PBFs are degraded by high water temperature caused by the loss of access to historic spawning areas in the upper watersheds which maintained cool and clean water throughout the summer. The rearing PBF is degraded by floodplain habitat being disconnected from the mainstem of larger rivers throughout the Sacramento River watershed, thereby reducing effective foraging. Migration PBF is degraded by lack of natural cover along the migration corridors. Juvenile migration is obstructed by water diversions along Sacramento River and by two large state and federal water-export facilities in the Sacramento-San Joaquin Delta.

Recovery Goals. Recovery goals, objectives and criteria for the Central Valley spring-run Chinook are fully outlined in the 2014 Recovery Plan (NMFS 2014b). The ESU delisting criteria for the spring-run Chinook are: 1) One population in the Northwestern California Diversity Group at low risk of extinction; 2) Two populations in the Basalt and Porous Lava Diversity Group at low risk of extinction; 3) Four populations in the Northern Sierra Diversity Group at low risk of extinction; 4) Two populations in the Southern Sierra Diversity Group at low risk of extinction; and 5) Maintain multiple populations at moderate risk of extinction.

Table 32. Summary of status; Chinook salmon, Central Valley spring-run ESU

Criteria	Description
Abundance / productivity trends	Stable to declining trends, low abundances, low genetic diversity, fragmented populations
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by elevated temperatures, lost access to historic spawning sites, and loss of floodplain habitat; Migration PBFs degraded by loss of cover and water diversions; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 38 watersheds, 28 are of high and 3 are of medium conservation value

8.6 Chinook salmon, Lower Columbia River ESU

Table 33. Chinook salmon, Lower Columbia River ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook Salmon	Lower Columbia River ESU	Threatened	2016	70 FR 37160	2013	70 FR 52630

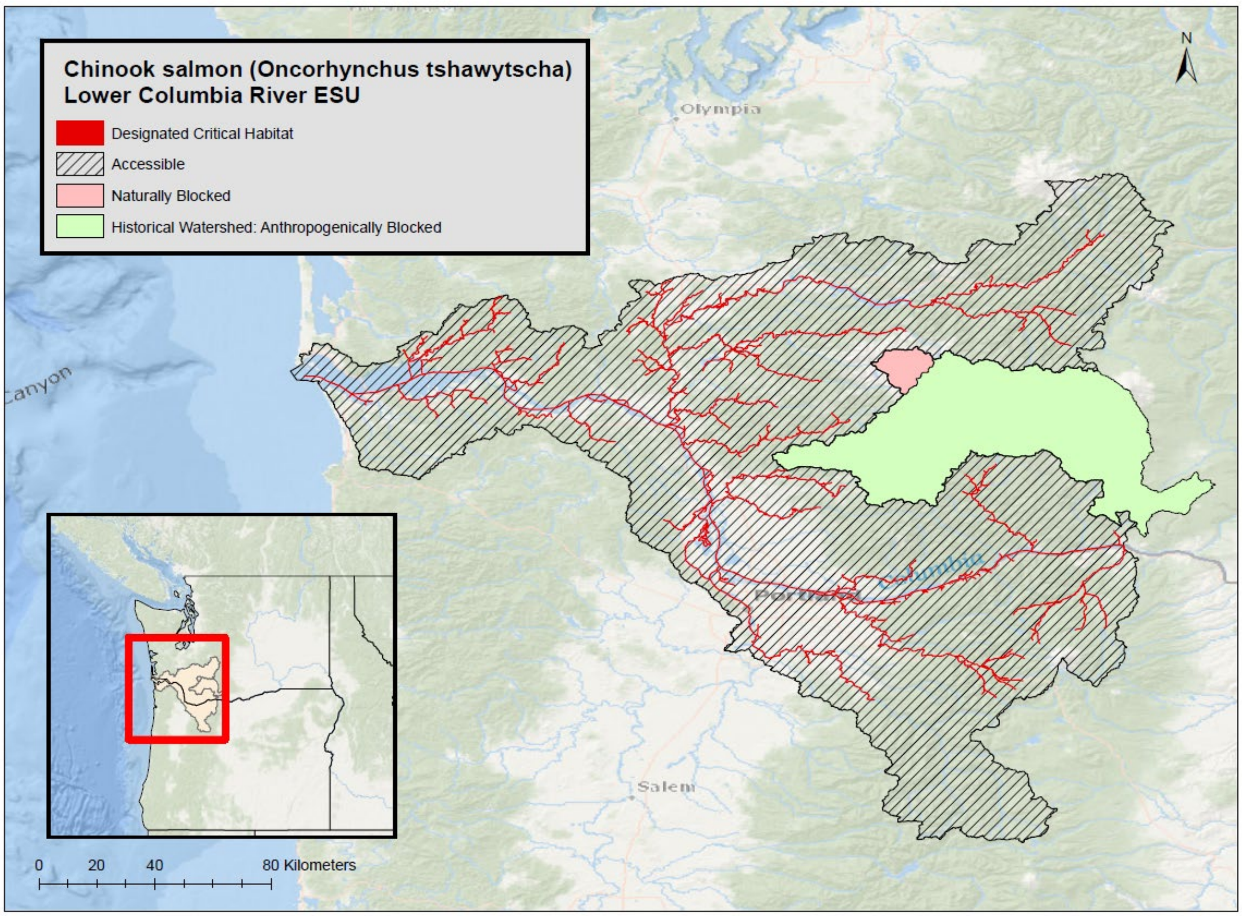

Figure 18. Chinook salmon, Lower Columbia River ESU range and designated critical habitat

Species Description. Chinook salmon, also referred to as king salmon in California, are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002a). On March 24, 1999, NMFS listed the Lower

Columbia River ESU of Chinook salmon as a "threatened" species (64 FR 14308). The listing was revisited and confirmed as "threatened" in 2005 (70 FR 37160). The Lower Columbia River Chinook salmon ESU includes all naturally-spawned populations of fall-run and spring-run Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Oregon and Washington, east of the Hood River and the White Salmon River and any such fish originating from the Willamette River and its tributaries below Willamette Falls. Twenty artificial propagation programs are included in the ESU (70 FR 37160).

Status. Populations of Lower Columbia River Chinook salmon have declined substantially from historical levels. Out of the 32 populations that make up this ESU, only the two late-fall runs (the North Fork Lewis and Sandy) are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years and some are extirpated or nearly so. Five of the six strata fall significantly short of the recovery plan criteria for viability. Low abundance, poor productivity, losses of spatial structure, and reduced diversity all contribute to the very low persistence probability for most Lower Columbia River Chinook salmon populations. Hatchery contribution to naturally-spawning fish remains high for a number of populations, and it is likely that many returning unmarked adults are the progeny of hatchery origin parents, especially where large hatchery programs operate. Continued land development and habitat degradation in combination with the potential effects of climate change will present a continuing strong negative influence into the foreseeable future.

Life history. Lower Columbia River Chinook salmon display three run types including early fall-runs, late fall-runs, and spring-runs. Presently, the fall-run is the predominant life history type. Spring-run Chinook salmon were numerous historically. Fall-run Chinook salmon enter fresh water typically in August through October. Early fall-run spawn within a few weeks in large river mainstems. The late fall-run enters in immature conditions, has a delayed entry to spawning grounds, and resides in the river for a longer time between river entry and spawning. Spring-run Chinook salmon enter fresh water in March through June to spawn in upstream tributaries in August and September.

Offspring of fall-run spawning may migrate as fry to the ocean soon after yolk absorption (*i.e.*, ocean-type), at 30–45 mm in length (Healey 1991). In the Lower Columbia River system, however, the majority of fall-run Chinook salmon fry migrate either at 60-150 days post-hatching in the late summer or autumn of their first year. Offspring of fall-run spawning may also include a third group of yearling juveniles that remain in fresh water for their entire first year before emigrating. The spring-run Chinook salmon migrates to the sea as yearlings (stream-type) typically in spring. However, the natural timing of Lower Columbia River (LCR) spring-run Chinook salmon emigration is obscured by hatchery releases (Myers et al. 2006). Once at sea, the ocean-type LCR Chinook salmon tend to migrate along the coast, while stream-type LCR Chinook salmon appear to move far off the coast into the central North Pacific Ocean

(Healey 1991; Myers et al. 2006). Adults return to tributaries in the lower Columbia River predominantly as three- and four-year-olds for fall-run fish and four- and five-year-olds for spring-run fish.

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982b; MacFarlane and Norton 2002; Sommer et al. 2001). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 34. Temporal distribution of Chinook salmon, Lower Columbia River ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td colspan="10">Present</td></tr>
<tr><td>Spawning</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td colspan="5">Present</td></tr>
<tr><td>Emergence (alevin to fry phases</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Populations of Lower Columbia River Chinook salmon have declined substantially from historical levels. Many of the ESU's populations are believed to have very low abundance of natural-origin spawners (100 fish or fewer), which increases genetic and demographic risks. Other populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners (Table 35).

Table 35. Lower Columbia River Chinook salmon population structure, abundances, and hatchery contributions (Good et al. 2005; Myers et al. 2006).

Run	Population	Historical Abundance	Mean* Number of Spawners	Hatchery Abundance Contributions
F-R	Grays River (WA)	2,477	99	38%
	Elochoman River (WA)	Unknown	676	68%
	Mill, Abernathy, and German Creeks (WA)	Unknown	734	47%
	Youngs Bay (OR)	Unknown	Unknown	Unknown
	Big Creek (OR)	Unknown	Unknown	Unknown
	Clatskanie River (OR)	Unknown	50	Unknown
	Scappoose Creek (OR)	Unknown	Unknown	Unknown
F-R	Lower Cowlitz River (WA)	53,956	1,562	62%
	Upper Cowlitz River (WA)	Unknown	5,682	Unknown

Run	Population	Historical Abundance	Mean* Number of Spawners	Hatchery Abundance Contributions
	Coweeman River (WA)	4,971	274	0%
	Toutle River (WA)	25,392	Unknown	Unknown
	Salmon Creek and Lewis River (WA)	47,591	256	0%
	Washougal River (WA)	7,518	3,254	58%
	Kalama River (WA)	22,455	2,931	67%
	Clackamas River (OR)	Unknown	40	Unknown
	Sandy River (OR)	Unknown	183	Unknown
LF-R	Lewis R-North Fork (WA)	Unknown	7,841	13%
	Sandy River (OR)	Unknown	504	3%
S-R	Upper Cowlitz River (WA)	Unknown	Unknown	Unknown
	Tilton River (WA)	Unknown	Unknown	Unknown
	Cispus River (WA)	Unknown	1,787*	Unknown
	Toutle River (WA)	2,901	Unknown	Unknown
	Kalama River (WA)	4,178	98	Unknown
	Lewis River (WA)	Unknown	347	Unknown
	Sandy River (OR)	Unknown	3,085	3%
F-R	Upper Columbia Gorge (WA)	2,363	136	13%
	Big White Salmon R (WA)	Unknown	334	21%
	Lower Columbia Gorge (OR)	Unknown	Unknown	Unknown
	Hood River (OR)	Unknown	18	Unknown
S-R	Big White Salmon R (WA)	Unknown	334	21%
	Hood River (OR)	Unknown	18	Unknown

**Arithmetic mean*
Recent 5-year spawner abundance (up to 2001) and historic abundance over more than 20 years is given as a geometric mean, and include hatchery origin Chinook salmon.
F-R is fall run, LF-R is late fall run, and S-R is spring run Chinook salmon.

Productivity / Population Growth Rate. Trend indicators for most populations are negative. The majority of populations for which data are available have a long-term trend of <1; indicating the population is in decline (Bennet 2005; Good et al. 2005b). Only the late-fall run population in Lewis River has an abundance and population trend that may be considered viable (McElhany et al. 2007a). The Sandy River is the only stream system supporting a natural production of spring-run Chinook salmon of any amount. However, the population is at risk from low abundance and negative to low population growth rates (McElhany et al. 2007a).

Genetic Diversity. The genetic diversity of all populations (except the late fall-run Chinook salmon) has been eroded by large hatchery influences and periodically by low effective population sizes. The near loss of the spring-run life history type remains an important concern for maintaining diversity within the ESU.

Distribution. The basin wide spatial structure has remained generally intact. However, the loss of about 35 percent of historic habitat has affected distribution within several Columbia River subbasins. Currently, only one population appears self-sustaining (Good et al. 2005b).

Designated Critical Habitat. NMFS designated critical habitat for LCR Chinook salmon on September 2, 2005 (70 FR 52630). It includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Hood Rivers as well as specific stream reaches in a number of tributary subbasins. PBFs considered essential for the conservation of Chinook salmon, Lower Columbia River ESU are shown in Table 21.

Timber harvest, agriculture, and urbanization have degraded spawning and rearing PBFs by reducing floodplain connectivity and water quality, and by removing natural cover in several rivers. Hydropower development projects have reduced the timing and magnitude of water flows, thereby altering the water quantity needed to form and maintain physical habitat conditions and support juvenile growth and mobility. Adult and juvenile migration PBFs are affected by several dams along the migration route.

Recovery Goals. NMFS has developed the following delisting criteria for the Lower Columbia River Chinook salmon ESU. For a complete description of the ESU recovery goals, including complete down-listing/delisting criteria, see the 2013 recovery plan.

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition. High probability of stratum persistence is defined as:
    a. At least two populations in the stratum have at least a 95 percent probability of persistence over a 100-year time frame (i.e., two populations with a score of 3.0 or higher based on the Technical Recovery Team's (TRT) scoring system).
    b. Other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (i.e., the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system). (See Section 2.6 for a brief discussion of the TRT's scoring system.)
    c. Populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.

    A probability of persistence consistent with historical condition refers to the concept that strata that historically were small or had complex population structures may not have met Criteria A through C, above, but could still be considered sufficiently viable if they provide a contribution to overall ESU viability similar to their historical contribution.

2. The threats criteria described in Section 3.2.2 have been met.

Table 36. Summary of status; Chinook salmon, Lower Columbia River ESU

Criteria	Description

Abundance / productivity trends	Trends for most populations are declining. Only one population is self-sustaining. The near loss of the spring-run life history remains an important concern for maintaining genetic diversity.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover; Migration PBFs impacted by dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of occupied watersheds, 31 are of high and 13 are of medium conservation value.

8.7 Chinook salmon, Puget Sound ESU

Table 37. Chinook salmon, Puget Sound ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook salmon	Puget Sound ESU	Threatened	2011	70 FR 37160	2007	70 FR 52630

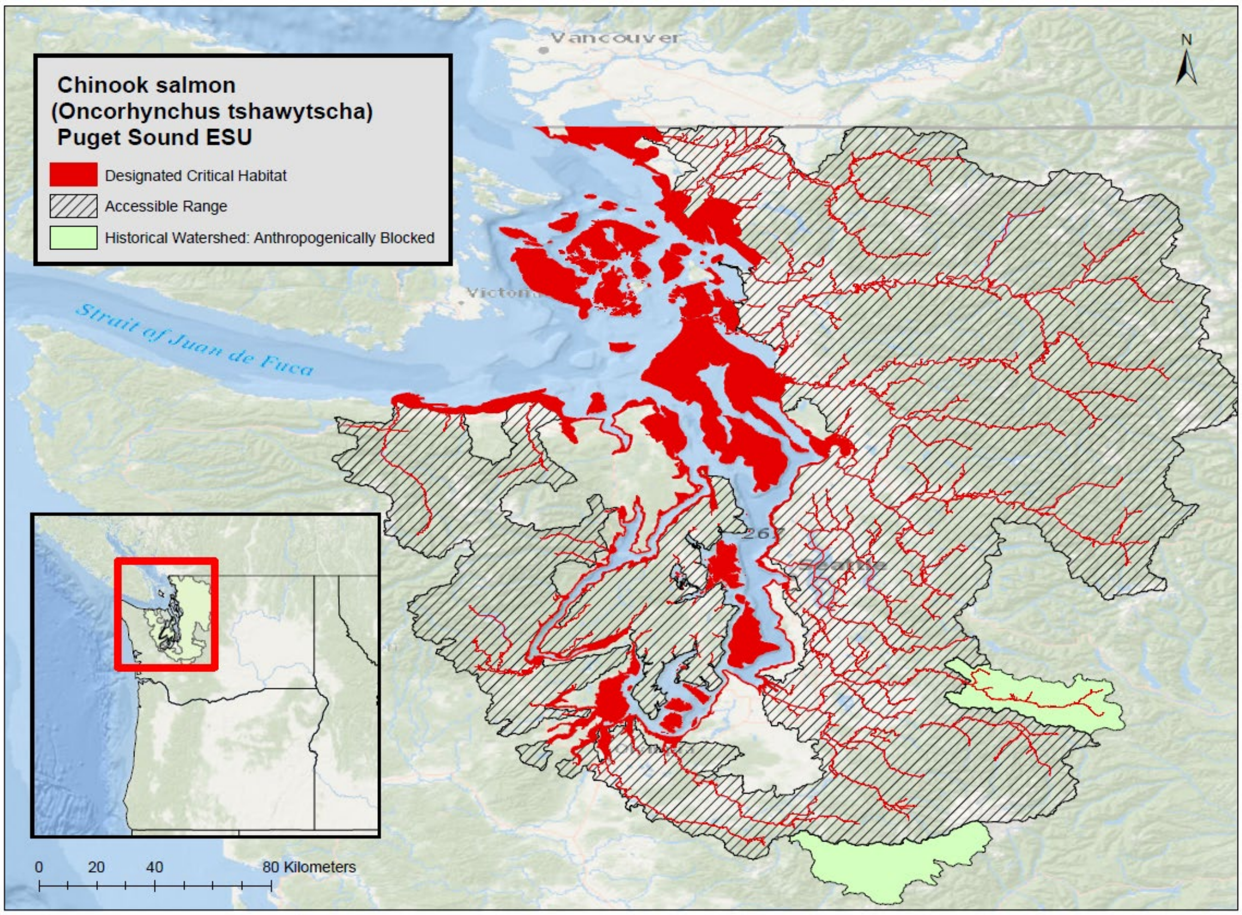

Figure 19. Chinook salmon, Puget Sound ESU range and designated critical habitat

Species Description Chinook salmon, also referred to as king salmon in California, are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002a). On March 24, 1999, NMFS listed the Puget Sound ESU of Chinook salmon as a “threatened” species (64 FR 14308). The listing was revisited and confirmed as “threatened” in 2005 (70 FR 37160). The Puget Sound ESU includes naturally spawned Chinook salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Twenty-six artificial propagation programs are included as part of the ESU.

Status All Puget Sound Chinook salmon populations are well below escapement abundance levels identified as required for recovery to low extinction risk in the recovery plan. In addition, most populations are consistently below the productivity goals identified in the recovery plan as necessary for recovery. Although trends vary for individual populations across the ESU, most populations have declined in total natural origin recruit abundance since the last status review; and natural origin recruit escapement trends since 1995 are mostly stable. A few populations have reached goals but not consistently during the past 10 years (2018 Washington State of the Salmon Report). While some have met their high productivity goals, but never their low (minimum) productivity goals, none of the Puget Sound populations of Chinook salmon could be considered exceeding their abundance recovery goals. Several of the risk factors identified in the previous status review (Good et al. 2005b) are still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Although this ESU’s total abundance is greatly reduced from historic levels, recent abundance levels do not indicate that the ESU is at immediate risk of extinction. This ESU remains relatively well distributed over 22 populations in 5 geographic areas across the Puget Sound. Although current trends are concerning, the available information indicates that this ESU remains at moderate risk of extinction.

Life history Puget Sound Chinook salmon populations exhibit both early-returning (August) and late-returning (mid-September and October) Chinook salmon spawners (Healey 1991). Juvenile Chinook salmon within the Puget Sound generally exhibit an “ocean-type” life history. However, substantial variation occurs with regard to juvenile residence time in freshwater and estuarine environments. Hayman (Hayman et al. 1996) described three juvenile life histories for Chinook salmon with varying freshwater and estuarine residency times in the Skagit River system in northern Puget Sound. In this system, 20 percent to 60 percent of sub-yearling migrants rear for several months in freshwater habitats while the remaining fry migrate to rear in the Skagit River estuary and delta (Beamer et al. 2005). Juveniles in tributaries to Lake Washington exhibit both a stream rearing and a lake rearing strategy. Lake rearing fry are found in highest densities in nearshore shallow (<1 m) habitat adjacent to the opening of tributaries or at the mouth of tributaries where they empty into the lake (Tabor et al. 2006). Puget Sound Chinook salmon also has several estuarine rearing juvenile life history types that are highly dependent on estuarine areas for rearing (Beamer et al. 2005). In the estuaries, fry use tidal marshes and connected tidal channels including dikes and ditches developed to protect and drain agricultural land. During their first ocean year, immature Chinook salmon use nearshore areas of Puget Sound during all seasons and can be found long distances from their natal river systems (Brennan et al. 2004).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1981; MacFarlane and Norton 2002; Sommer et al. 2001a). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 38. Temporal distribution of Chinook salmon, Puget Sound ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
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<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="6">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td colspan="6">Present</td></tr>
<tr><td>Emergence (alevin to fry phase)</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Estimates of the historic abundance range from 1,700 to 51,000 potential Puget Sound Chinook salmon spawners per population. During the period from 1996 to 2001, the geometric mean of natural spawners in populations of Puget Sound Chinook salmon ranged from 222 to just over 9,489 fish. Thus, the historical estimates of spawner capacity are several orders of magnitude higher than spawner abundances currently observed throughout the ESU (Good et al. 2005b).

Table 39. Puget Sound Chinook salmon preliminary population structure, abundances, and hatchery contributions (Good et al. 2005).

Independent Populations	Historical Abundance	Mean Number of Spawners	Hatchery Abundance Contributions
Nooksack-North Fork	26,000	1,538	91%
Nooksack-South Fork	13,000	338	40%
Lower Skagit	22,000	2,527	0.2%
Upper Skagit	35,000	9,489	2%
Upper Cascade	1,700	274	0.3%
Lower Sauk	7,800	601	0%
Upper Sauk	4,200	324	0%
Suiattle	830	365	0%
Stillaguamish-North Fork	24,000	1,154	40%
Stillaguamish-South Fork	20,000	270	Unknown
Skykomish	51,000	4,262	40%
Snoqualmie	33,000	2,067	16%
Sammamish	Unknown	Unknown	Unknown
Cedar	Unknown	327	Unknown
Duwamish/Green			
Green	Unknown	8,884	83%

Independent Populations	Historical Abundance	Mean Number of Spawners	Hatchery Abundance Contributions
White	Unknown	844	Unknown
Puyallup	33,000	1,653	Unknown
Nisqually	18,000	1,195	Unknown
Skokomish	Unknown	1,392	Unknown
Mid Hood Canal Rivers			
Dosewallips	4,700	48	Unknown
Duckabush	Unknown	43	Unknown
Hamma Hamma	Unknown	196	Unknown
Mid Hood Canal	Unknown	311	Unknown
Dungeness	8,100	222	Unknown
Elwha	Unknown	688	Unknown

Productivity / Population Growth Rate. While natural origin recruit escapements have remained fairly constant during the most recent review period (1985-2009), total natural origin recruit abundance and productivity have continued to decline. Median recruits per spawner for the last five-year period (brood years 2002-2006) is the lowest over any of the five year intervals. However, results vary across populations in the ESU with some populations showing stronger trends than others. Long-term trends in abundance and median population growth rates for naturally spawning populations indicate that approximately half of the populations are declining and the other half are increasing in abundance over the length of available time series. However, the median overall long-term trend in abundance is close to 1 for most populations that have a lambda exceeding 1, indicating that most of these populations are barely replacing themselves.

Genetic Diversity / Spatial Distribution The Northwest Fisheries Science Center estimated the diversity index for five year time intervals over the 25 year time span of the available data. In general, a higher diversity value indicates a healthier distribution of salmon among the streams and rivers in the ESU. Current estimates of diversity show a decline over the past 25 years, indicating a decline of salmon in some areas and increases in others. Salmon returns to the Whidbey Region increased in abundance while returns to other regions declined. In aggregate, the diversity of the ESU as a whole has been declining over the last 25 years.

Designated Critical Habitat

Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). It includes 1,683 km of stream channels, 41 square km of lakes, and 3,512 km of nearshore marine habitat. PBFs considered essential for the conservation of Chinook salmon, Puget Sound ESU are shown in Table 21.

Forestry practices have heavily impacted migration, spawning, and rearing PBFs in the upper watersheds of most river systems within critical habitat designated for the Puget Sound Chinook salmon. Degraded PBFs include reduced conditions of substrate supporting spawning, incubation and larval development caused by siltation of gravel; and degraded rearing habitat by removal of cover and reduction in channel complexity. Urbanization and agriculture in the lower alluvial valleys of mid- to southern Puget Sound and the Strait of Juan de Fuca have reduced channel function and connectivity, reduced available floodplain habitat, and affected water quality. Thus, these areas have degraded spawning, rearing, and migration PBFs. Hydroelectric development and flood control also obstruct Puget Sound Chinook salmon migration in several basins. The most functional PBFs are found in northwest Puget Sound: the Skagit River basin, parts of the Stillaguamish River basin, and the Snohomish River basin where federal land overlaps with critical habitat designated for the Puget Sound Chinook salmon. However, estuary PBFs are degraded in these areas by reduction in the water quality from contaminants, altered salinity conditions, lack of natural cover, and modification and lack of access to tidal marshes and their channels.

Recovery Goals. The ESU-wide delisting and recovery criteria (PSTRT, 2002) provide flexibility in meeting the requirements of the Endangered Species Act, and preserve options for Puget Sound Chinook in the future. The recommendations by the TRT describe the biological characteristics that would constitute a viable ESU for Puget Sound Chinook. The ESU would have a high likelihood of persistence if:

1. All populations improve in status and at least some achieve a low risk status.
2. At least 2-4 viable Chinook populations are present in each of the 5 regions.
3. Each region has one or more viable populations from each major diversity group that was historically present within that region.
4. Freshwater tributary habitats in Puget Sound are providing sufficient function for ESU persistence. Ecological functioning occurs even in those habitats that do not currently support any of the 22 identified Chinook populations, since they affect nearshore processes and may provide future habitat options.
5. The production of Chinook salmon in Puget Sound tributaries is consistent with ESU recovery objectives, and contributes to the health of the overall ecosystem in the region.
6. None of the 22 remaining Chinook populations go extinct, and the direct and indirect effects of habitat, harvest and hatchery management actions are consistent with ESU recovery.

Table 40. Summary of status; Chinook salmon, Puget Sound ESU

Criteria	Description
Abundance / productivity trends	Abundance is several orders of magnitude below historic levels. Approximately half the populations are declining and half are increasing in abundance. Most of the populations that are increasing have lambda of close to 1 (barely replacing themselves).
Listing status	threatened
Attainment of recovery goals	criteria not yet met

Condition of PBFs	Spawning, rearing and migration PBFs are degraded by forestry, agriculture, urbanization, and loss of habitat; Estuarine PBFs degraded by water quality, altered salinity, and lack of natural cover; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 61 watersheds, 40 are of high and 9 are of medium conservation value.

8.8 Chinook salmon, Sacramento River winter-run ESU

Table 41. Chinook salmon, Sacramento winter-run ESU; overview table

Species	Common Name	Distinct Population Segments (DPS)	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook Salmon	Sacramento River winter-run	Endangered	2011	1990 54 FR 32085 1994 59 FR 440	2014	1993 58 FR 33212

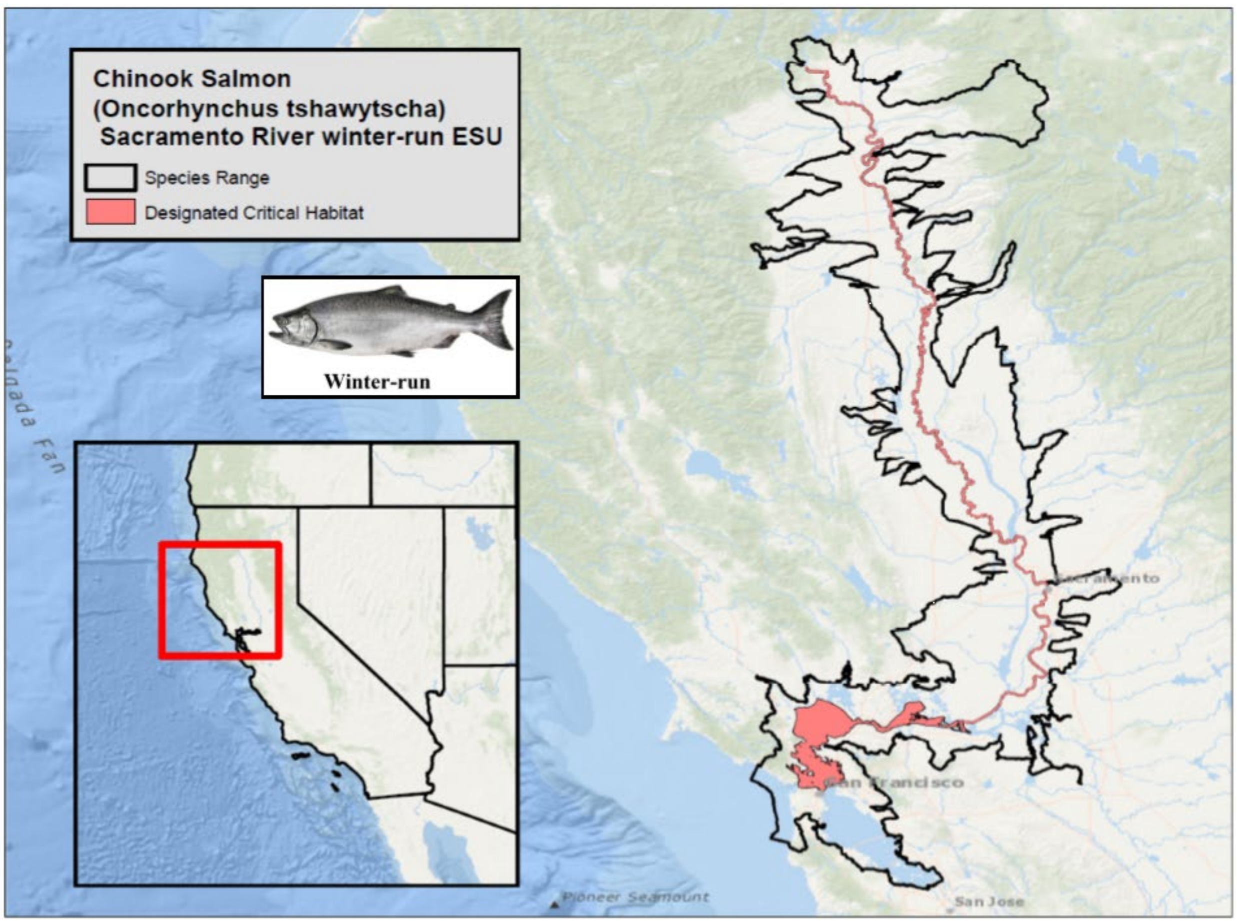

Figure 20. Chinook salmon, Sacramento winter-run ESU range and designated critical habitat

Species Description. Chinook salmon, also referred to as king salmon in California, are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002a). On January 4, 1994, NMFS listed the Sacramento River winter-run ESU of Chinook salmon as Endangered (59 FR 440). The Sacramento River winter-run Chinook salmon ESU includes winter-run Chinook salmon spawning naturally in the Sacramento River and its tributaries, as well as winter-run Chinook salmon that are part of the conservation hatchery program at the Livingston Stone National Fish Hatchery (LSNFH). Winter-run Chinook salmon originally spawned in the upper Sacramento River system (Little Sacramento, Pit, McCloud and Fall rivers) and in Battle Creek (Yoshiyama et al. 1998; Yoshiyama et al. 2001). Currently, winter-run Chinook salmon spawning habitat is likely limited to the reach of the Sacramento River extending from Keswick Dam downstream to the Red Bluff Diversion Dam.

Status. The Sacramento River winter-run Chinook salmon ESU is composed of just one small population that is currently under severe stress caused by one of California's worst droughts on record. Over the last 10 years of available data (2003-2013), the abundance of spawning winter-run Chinook adults ranged from a low of 738 in 2011 to a high of 17,197 in 2007, with an average of 6,298. The population subsists in large part due to agency-managed cold water releases from Shasta Reservoir during the summer and artificial propagation from Livingston Stone National Fish Hatchery's winter-run Chinook salmon conservation program. Winter-run Chinook salmon are dependent on sufficient cold water storage in Shasta Reservoir, and it has long been recognized that a prolonged drought could have devastating impacts, possibly leading to the species' extinction. The probability of extended droughts is increasing as the effects of climate change continue(NMFS 2014b). In addition to the drought, another important threat to winter-run Chinook salmon is a lack of suitable rearing habitat in the Sacramento River and Delta to allow for sufficient juvenile growth and survival(NMFS 2016e).

Life history. Winter-run Chinook salmon are unique because they spawn during summer months when air temperatures usually approach their yearly maximum. As a result, winter-run Chinook salmon require stream reaches with cold water sources that will protect embryos and juveniles from the warm ambient conditions in summer. Adult winter-run Chinook salmon immigration and holding (upstream spawning migration) through the Delta and into the lower Sacramento River occurs from December through July, with a peak during the period extending from January through April (Fish and Service 1995). Winter-run Chinook salmon are sexually immature when upstream migration begins, and they must hold for several months in suitable habitat prior to spawning. Spawning occurs between late-April and mid-August, with a peak in June and July as reported by California Department of Fish and Wildlife (CDFW) annual escapement surveys (2000-2006).

Winter-run Chinook salmon embryo incubation in the Sacramento River can extend into October (Vogel et al. 1988). Winter-run Chinook salmon fry rearing in the upper Sacramento River exhibit peak abundance during September, with fry and juvenile emigration past Red Bluff Diversion Dam (RBDD) primarily occurring from July through November (Poytress and Carrillo 2010; Poytress and Carrillo 2011; Poytress and Carrillo 2012). Emigration of winter-run Chinook salmon juveniles past Knights Landing, located approximately 155.5 river miles downstream of the RBDD, reportedly occurs between November and March, peaking in December, with some emigration continuing through May in some years (Snider and Titus 2000).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982a; MacFarlane and Norton 2002). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 42. Temporal distribution of Chinook salmon, Sacramento winter-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="6">Present</td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td></td><td colspan="6">Present</td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases</td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td colspan="5">Present</td></tr>
</table>

Population Dynamics

Abundance. Over the last 10 years of available data (2003-2013), the abundance of spawning winter-run Chinook adults ranged from a low of 738 in 2011 to a high of 17,197 in 2007, with an average of 6,298 (*Figure 21*).

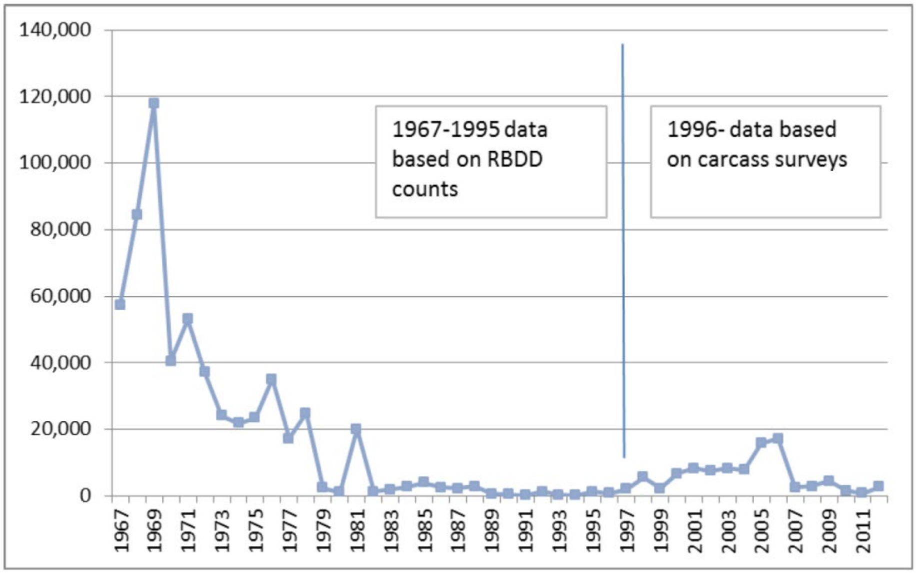

Figure 21. Estimated Sacramento River winter-run Chinook salmon run size (1967-2012)

Productivity / Population Growth Rate. The population declined from an escapement of near 100,000 in the late 1960s to fewer than 200 in the early 1990s (Good et al. 2005a). More recent population estimates of 8,218 (2004), 15,730 (2005), and 17,153 (2006) show a three-year average of 13,700 returning winter-run Chinook salmon (CDFW Website 2007). However, the run size decreased to 2,542 in 2007 and 2,850 in 2008. Monitoring data indicated that approximately 5.6 percent of winter-run Chinook salmon eggs spawned in the Sacramento River in 2014 survived to the fry life stage (three to nearly 10 times lower than in previous years). The ongoing drought has made 2015 another challenging year for winter-run Chinook salmon (NMFS 2016e).

Genetic Diversity. The rising proportion of hatchery fish among returning adults threatens to increase the risk of extinction. Lindley et al. (2007) recommend that in order to maintain a low risk of genetic introgression with hatchery fish, no more than five percent of the naturally-spawning population should be composed of hatchery fish. Since 2001, hatchery origin winter-run Chinook salmon have made up more than five percent of the run, and in 2005 the contribution of hatchery fish exceeded 18 percent (Lindley et al. 2007).

Distribution. The range of winter-run Chinook salmon has been greatly reduced by Keswick and Shasta dams on the Sacramento River and by hydroelectric development on Battle Creek. Currently, winter-run Chinook salmon spawning is limited to the main-stem Sacramento River between Keswick Dam (River Mile [RM] 302) and the RBDD (RM 243) where the naturally-spawning population is artificially maintained by cool water releases from the dams. Within the Sacramento River, the spatial distribution of spawners is largely governed by water year type and the ability of the Central Valley Project to manage water temperatures (NMFS 2014b).

Designated Critical Habitat. NMFS designated critical habitat for the Sacramento winter-run Chinook on June 16, 1993 (58 FR 33212). It includes: the Sacramento River from Keswick Dam, Shasta County (river mile 302) to Chipps Island (river mile 0) at the westward margin of the Sacramento-San Joaquin Delta, and other specified estuarine waters**.** Physical and biological features that are essential for the conservation of Sacramento winter-run Chinook salmon, based on the best available information, include (1) access from the Pacific Ocean to appropriate spawning areas in the upper Sacramento River; (2) the availability of clean gravel for spawning substrate; (3) adequate river flows for successful spawning, incubation of eggs, fry development and emergence, and downstream transport of juveniles; (4) water temperatures between 42.5 and 57.5 °F (5.8 and 14.1 degrees Celsius (°C)) for successful spawning, egg incubation, and fry development; (5) habitat and adequate prey free of contaminants; (6) riparian habitat that provides for successful juvenile development and survival; and (7) access of juveniles downstream from the spawning grounds to San Francisco Bay and the Pacific Ocean (58 FR 33212).

The current condition of PBFs for the Sacramento River Winter-run Chinook salmon indicates that they are not currently functioning or are degraded. Their conditions are likely to maintain low population abundances across the ESU. Spawning and rearing PBFs are especially degraded by high water temperature caused by the loss of access to historic spawning areas in the upper watersheds where water maintains lower temperatures. The rearing PBF is further degraded by floodplain habitat disconnected from the mainstems of larger rivers throughout the Sacramento River watershed. The migration PBF is also degraded by the lack of natural cover along the migration corridors. Rearing and migration PBFs are further affected by pollutants entering the surface waters and riverine sediments as contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Juvenile migration is obstructed by water diversions along Sacramento River and by two large state and federal water-export facilities in the Sacramento-San Joaquin Delta.

Recovery Goals. Recovery goals, objectives and criteria for the Sacramento River winter-run Chinook are fully outlined in the 2014 Recovery Plan (NMFS 2014b). In order to achieve the downlisting criteria, the species would need to be composed of two populations – one viable and one at moderate extinction risk. Having a second population would improve the species' viability, particularly through increased spatial structure and abundance, but further improvement would be needed to reach the goal of recovery. To delist winter-run Chinook salmon, three viable populations are needed. Thus, the downlisting criteria represent an initial key step along the path to recovering winter-run Chinook salmon.

Table 43. Summary of status; Chinook salmon, Sacramento winter-run ESU

Criteria	**Description**

Abundance / productivity trends	Only one small population, declining population trend hatchery-supported propagation, low genetic diversity
Listing status	Endangered
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by elevated temperatures and loss of habitat; Migration PBFs degraded by lack of natural cover and water diversions; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; The entire Sacramento river and delta are considered of high conservation value

8.9 Chinook salmon, Snake River fall-run

Table 44. Chinook salmon, Snake River fall-run ESU; overview table

Species	Common Name	Distinct Population Segments (DPS)	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook Salmon	Snake River fall-run	Threatened	2011	2005 70 FR 37160 2014 79 FR 20802	Proposed 2015	1993 58 FR 68543

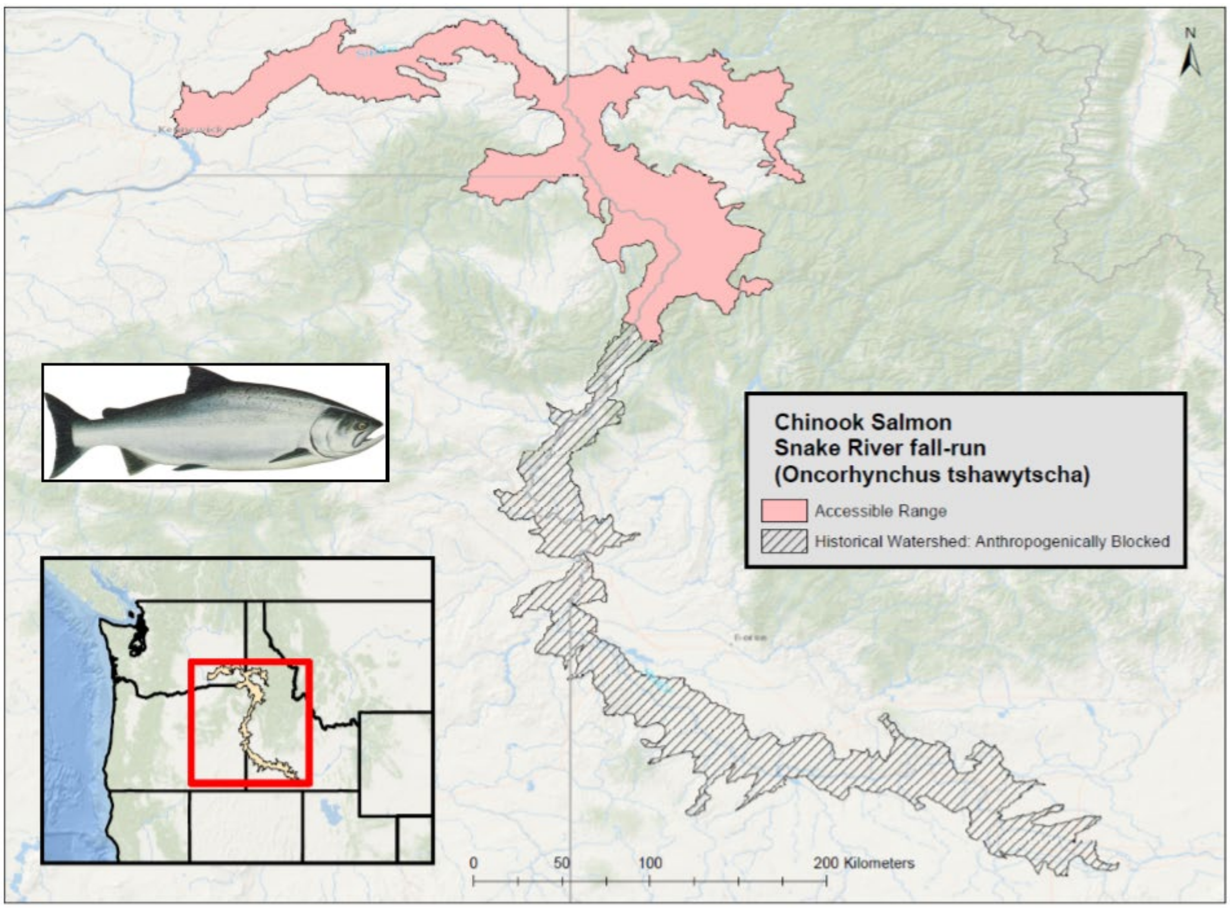

Figure 22. Chinook salmon, Snake River fall-run ESU range and designated critical habitat

Species Description. Chinook salmon are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002b). NMFS first listed Snake River fall Chinook salmon as a threatened species under the ESA on April 22, 1992 (57 FR 14658). NMFS reaffirmed the listing status in June 28, 2005 (70 FR 37160), and reaffirmed the status again in its 2014 (79 FR 20802). Snake River fall Chinook salmon historically spawned throughout the 600-mile reach of the mainstem Snake River from its mouth upstream to Shoshone Falls, a 212-foot high natural barrier near Twin Falls, Idaho (RM 614.7). The listed ESU currently includes all natural-origin fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam (the lowest of three impassable dams that form the Hells Canyon Complex) and from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins. The listed ESU also includes fall-run Chinook salmon from four artificial propagation programs (NMFS 2011; NMFS 2015).

Status. As late as the late 1800s, approximately 408,500 to 536,180 fall Chinook salmon are believed to have returned annually to the Snake River. The run began to decline in the late 1800s and then continued to decline through the early and mid-1900s as a result of overfishing and other human activities, including the construction of major dams. Snake River fall Chinook salmon abundance has increased significantly since ESA listing in the 1990s. The overall current risk rating for the Lower Mainstem Snake River fall Chinook salmon population is viable (recovery plan). Nevertheless, while the number of natural-origin fall Chinook salmon has been high, substantial uncertainty remains about the status of the species' productivity and diversity. Threats posed by straying out-of-ESU hatchery fish have declined due to improved management. Still, large reaches of historical habitat remain blocked and inundated, and the mainstem Snake and Columbia River hydropower system, while less of a constraint than in the past, continues to cause juvenile and adult losses. The number of hatchery-origin fall Chinook salmon on the spawning grounds continues to threaten natural-origin fish productivity and genetic diversity. Further, the combined and relative effects of the different threats across the life cycle ─ including threats from climate change ─ remain poorly understood (NMFS 2011; NMFS 2015).

Life history. Snake River fall-run Chinook return to the Columbia River in August and September, pass Bonneville Dam from mid-August to the end of September, and enter the Snake River between early September and mid-October (DART 2013). Once they reach the Snake River, fall Chinook salmon generally travel to one of five major spawning areas and spawn from late October through early December (Connor et al. 2014).

Upon emergence from the gravel, most young fall Chinook salmon move to shoreline riverine habitat (recovery plan). Some fall Chinook salmon smolts sustain active migration after passing Lower Granite Dam and enter the ocean as subyearlings, whereas some delay seaward migration and enter the ocean as yearlings (Connor et al. 2005; McMichael et al. 2008; NMFS 2015). Snake River fall Chinook salmon can be present in the estuary as juveniles in winter, as fry from

March to May, and as fingerlings throughout the summer and fall (Fresh et al. 2005; Roegner et al. 2012; Teel et al. 2014).

Once in the Northern California Current, dispersal patterns differ for yearlings and subyearlings. Subyearlings migrate more slowly, are found closer to shore in shallower water, and do not disperse as far north as yearlings (Fisher et al. 2014; Sharma and Quinn 2012; Trudel et al. 2009; Tucker et al. 2011). Snake River basin fall Chinook salmon spend one to four years in the Pacific Ocean, depending on gender and age at the time of ocean entry (Connor et al. 2005).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982a; MacFarlane and Norton 2002). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 45. Temporal distribution of Chinook salmon, Snake River fall-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
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<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Incubation (eggs)</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Emergence (alevin to fry phases</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. The naturally spawning fall Chinook salmon in the lower Snake River have included both returns originating from naturally spawning parents and from returning hatchery releases. The geometric mean natural-origin adult abundance for the most recent 10 years of annual spawner escapement estimates (2005-2014) is 6,418, with a standard error of 0.19 (NMFS 2015)

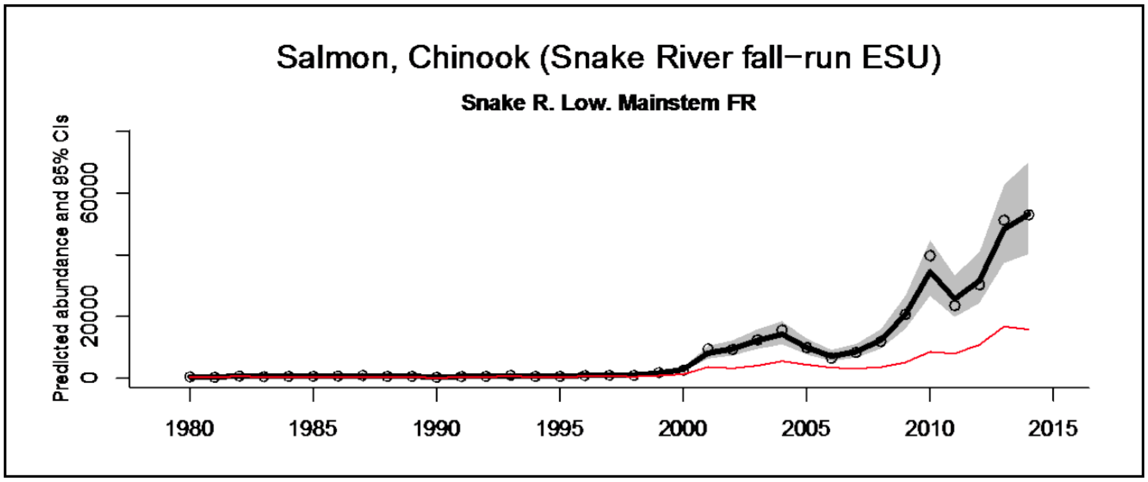

Figure 23. Smoothed trend in estimated total (thick black line) and natural (thin red line) population spawning abundance. Points show the annual spawning abundance estimates (from 2015 draft recovery plan).

Productivity / Population Growth Rate. The current estimate of productivity for this population (1990-2009 brood years) is 1.53 with a standard error of 0.18. This estimate of productivity, however, may be problematic for two reasons: (1) the increasingly small number of years that actually contribute to the productivity estimate means that there is increasing statistical uncertainty surrounding that estimate, and (2) the years contributing to the estimate are now far in the past and may not accurately reflect the true productivity of the current population (NMFS 2015)

Genetic Diversity. Genetic samples from the aggregate population in recent years indicate that composite genetic diversity is being maintained and that the Snake River Fall Chinook hatchery stock is similar to the natural component of the population, an indication that the actions taken to reduce the potential introgression of out-of-basin hatchery strays has been effective. Overall, the current genetic diversity of the population represents a change from historical conditions and, applying the Interior Columbia Technical Recovery Team (ICTRT) guidelines, the rating for this metric is moderate risk (NMFS 2015).

Distribution. The extant Lower Snake River Fall Chinook salmon population consists of a spatially complex set of five historical major spawning areas (Cooney et al. 2007), each of which consists of a set of relatively discrete spawning patches of varying size. The primary Major spawning area (MaSA) in the extant Lower Mainstem Snake River population is the 96-km Upper Mainstem Snake River Reach, extending upriver from the confluence of the Salmon River to the Hells Canyon Dam site, where the canyon walls narrow and strongly confine the river bed. A second mainstem Snake River MaSA, the Lower Mainstem Snake River Reach, extends 69 km downstream from the Salmon River confluence to the upper end of the contemporary Lower Granite Dam pool. The lower mainstem reaches of two major tributaries to the mainstem Snake River, the Grande Ronde and the Clearwater Rivers, were also identified by the ICTRT as

MaSAs. Both of these river systems currently support fall Chinook salmon spawning in the lower reaches. In addition, there is some historical evidence for production of late spawning Chinook salmon in spatially isolated reaches in upriver tributaries to each of these systems (NMFS 2015).

Designated Critical Habitat. NMFS designated critical habitat for SR Fall-run Chinook salmon on December 28, 1993 (58 FR 68543). PBFs considered essential for the conservation of Chinook salmon, Snake River fall-run ESU are shown in Table 46.

Table 46. Essential features of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONC coho salmon, and corresponding species life history events.

Essential Features Site	Essential Features Site Attribute	Species Life History Event
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/parr/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

The major degraded PBFs within critical habitat designated for SR Fall-run Chinook salmon include: (1) safe passage for juvenile migration which is reduced by the presence of the Snake and Columbia River hydropower system within the lower mainstem; (2) rearing habitat water quality altered by influx of contaminants and changing seasonal temperature regimes caused by water flow management; and (3) spawning/rearing habitat PBF attributes (spawning areas with gravel, water quality, cover/shelter, riparian vegetation, and space to support egg incubation and larval growth and development) that are reduced in quantity (80 percent loss) and quality due to the mainstem lower Snake River hydropower system.

Water quality impairments in the designated critical habitat are common within the range of this ESU. Pollutants such as petroleum products, pesticides, fertilizers, and sediment in the form of turbidity enter the surface waters and riverine sediments from the headwaters of the Snake, Salmon, and Clearwater Rivers to the Columbia River estuary; traveling along with contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in the salmon tissue. This species also requires migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Recovery Goals. Recovery goals, objectives and criteria for the Snake River fall-run Chinook are fully outlined in the 2015 Recovery Plan (NMFS 2015). ESA recovery goals should support conservation of natural fish and the ecosystems upon which they depend. Thus, the ESA recovery goal for Snake River fall Chinook salmon is that: the ecosystems upon which Snake River fall Chinook salmon depend are conserved such that the ESU is self-sustaining in the wild and no longer needs ESA protection.

Table 47. Summary of status; Chinook salmon, Snake River fall-run ESU

Criteria	Description
Abundance / productivity trends	Stable to increasing abundance trend, moderate extinction risk. Productivity of naturally spawned populations uncertain. Large proportion of hatchery-reared fish.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning, rearing and migration PBFs are degraded by loss of habitat, impaired stream flows, barriers to fish passage, and poor water quality; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; The entire river corridor is considered of high conservation value

8.10 Chinook salmon, Snake River spring/summer-run ESU

Table 48. Chinook salmon, Snake River spring/summer-run ESU; overview table

Species	Common Name	Distinct Population Segments (DPS)	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook Salmon	Snake River Spring and Summer run	Threatened	2011	2005 70 FR 37160 2014 79 FR 20802	2017	1999 64 FR 57399

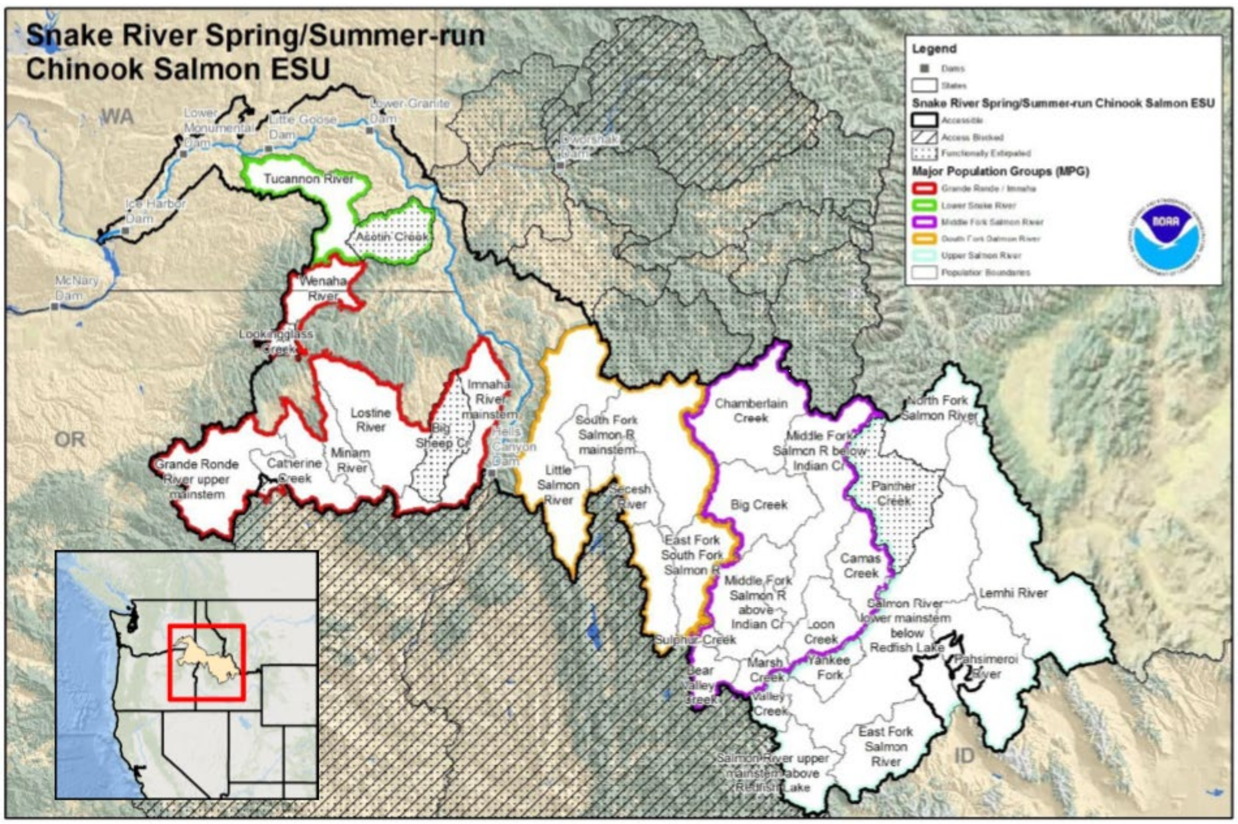

Figure 24. Chinook salmon, Snake River spring/summer-run ESU range and designated critical habitat

Species Description. Chinook salmon are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002b). Snake River spring/summer-run Chinook salmon ESU was listed as a threatened species under the ESA on April 22, 1992 (57 FR 14658). NMFS reaffirmed the listing on June 28, 2005 (70 FR 37160) and made minor technical corrections to the listing on April 14, 2014 (79 FR 20802). The Snake River spring/summer Chinook salmon ESU includes all naturally spawned populations of spring/summer Chinook salmon in the mainstem Snake River and the Tucannon River, Grand Ronde River, Imnaha River, and Salmon River subbasins as well as spring/summer Chinook salmon from 11 artificial propagation programs (NMFS 2016c).

Status. The historical run of Chinook in the Snake River likely exceeded one million fish annually in the late 1800s, by the 1950s the run had declined to near 100,000 adults per year. The adult counts fluctuated throughout the 1980s but then declined further, reaching a low of 2,200 fish in 1995. Currently, the majority of extant spring/summer Chinook salmon populations in the Snake River spring/summer Chinook salmon ESU remain at high overall risk of extinction, with a low probability of persistence within 100 years. Factors cited in the 1991 status review as contributing to the species' decline since the late 1800s include overfishing, irrigation diversions, logging, mining, grazing, obstacles to migration, hydropower development, and questionable management practices and decisions (Matthews and Waples 1991). In addition, new threats ─ such as those posed by toxic contamination, increased predation by non-native species, and effects due to climate change ─ are emerging (NMFS 2016a).

Life history. Adult spring-run Chinook salmon destined for the Snake River return to the Columbia River from the ocean in early spring and pass Bonneville Dam beginning in early March and ending May 31st. Snake River summer-run Chinook salmon return to the Columbia River from June through July. Adults from both runs hold in deep pools in the mainstem Columbia and Snake Rivers and the lower ends of the spawning tributaries until late summer, when they migrate into the higher elevation spawning reaches. Generally, Snake River spring-run Chinook salmon spawn in mid- through late August. Snake River summer-run Chinook salmon spawn approximately one month later than spring-run fish and tend to spawn lower in the tributary drainages, although their spawning areas often overlap with those of spring-run spawners

The eggs that Snake River spring and summer Chinook salmon deposit in late summer and early fall incubate over the following winter, and hatch in late winter and early spring. Juveniles rear through the summer, overwinter, and typically migrate to sea in the spring of their second year of life, although some juveniles may spend an additional year in fresh water. Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer-rearing or overwintering areas. Most yearling fish are thought to spend relatively little time in the estuary compared to sub-yearling ocean-type fish however there is considerable variation in residence times in different habitats and in the timing of estuarine and ocean entry among individual fish (Holsman et al. 2012; McElhany et al. 2000a).

Snake River spring/summer-run Chinook salmon range over a large area in the northeast Pacific Ocean, including coastal areas off Washington, British Columbia, and southeast Alaska, the continental shelf off central British Columbia, and the Gulf of Alaska (NMFS 2016c). Most of the fish spend two or three years in the ocean before returning to tributary spawning grounds primarily as 4- and 5-year-old fish. A small fraction of the fish spend only one year in the ocean and return as 3-year-old "jacks," heavily predominated by males (Good et al. 2005a).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982a; MacFarlane and Norton 2002). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 49. Temporal distribution of Chinook salmon, Snake River spring/summer-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td><td></td></tr>
<tr><td>Emergence (alevin to fry phases</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance / Productivity

Lower Snake River Major Population Group (MPG): Abundance and productivity remain the major concern for the Tucannon River population. Natural spawning abundance (10-year geometric mean) has increased but remains well below the minimum abundance threshold for the single extant population in this MPG. Poor natural productivity continues to be a major concern.

Grande Ronde/Imnaha MPG: The Wenaha River, Lostine/Wallowa River and Minam River populations showed substantial increases in natural abundance relative to the previous ICTRT review, although each remains below their respective minimum abundance thresholds. The Catherine Creek and Upper Grande Ronde populations each remain in a critically depressed state. Geometric mean productivity estimates remain relatively low for all populations in the MPG.

South Fork Salmon River MPG: Natural spawning abundance (10-year geometric mean) estimates increased for the three populations with available data series. Productivity estimates for these populations are generally higher than estimates for populations in other MPGs within the

ESU. Viability ratings based on the combined estimates of abundance and productivity remain at high risk, although the survival/capacity gaps relative to moderate and low risk viability curves are smaller than for other ESU populations.

Middle Fork Salmon River MPG: Natural-origin abundance and productivity remains extremely low for populations within this MPG. As in the previous ICTRT assessment, abundance and productivity estimates for Bear Valley Creek and Chamberlain Creek (limited data series) are the closest to meeting viability minimums among populations in the MPG.

Upper Salmon River MPG: Abundance and productivity estimates for most populations within this MPG remain at very low levels relative to viability objectives. The Upper Salmon Mainstem has the highest relative abundance and productivity combination of populations within the MPG.

Genetic Diversity / Spatial Structure

Lower Snake River MPG: The integrated spatial structure/diversity risk rating for the Lower Snake River MPG is moderate.

Grande Ronde/Imnaha MPG: The Upper Grande Ronde population is rated at high risk for spatial structure and diversity while the remaining populations are rated at moderate.

South Fork Salmon River MPG: Spatial structure/diversity risks are currently rated moderate for the South Fork Mainstem population (relatively high proportion of hatchery spawners) and low for the Secesh River and East Fork South Fork populations.

Middle Fork Salmon River MPG: Spatial structure/diversity risk ratings for Middle Fork Salmon River MPG populations are generally moderate. This primarily is driven by moderate ratings for genetic structure assigned by the ICTRT because of uncertainty arising from the lack of direct genetic samples from within the component populations.

Upper Salmon River MPG: Spatial structure/diversity risk ratings vary considerably across the Upper Salmon River MPG. Four of the eight populations are rated at low or moderate risk for overall spatial structure and diversity and could achieve viable status with improvements in average abundance/productivity. The high spatial structure/diversity risk rating for the Lemhi population is driven by a substantial loss of access to tributary spawning/rearing habitats and the associated reduction in life-history diversity. High risk ratings for Pahsimeroi River, East Fork Salmon River, and Yankee Fork Salmon River are driven by a combination of habitat loss and diversity concerns related to low natural abundance combined with chronically high proportions of hatchery spawners in natural areas.

Distribution. The Snake River spring/summer Chinook salmon ESU includes all naturally spawned populations of spring/summer Chinook salmon in the mainstem Snake River and the

Tucannon River, Grand Ronde River, Imnaha River, and Salmon River subbasins. The ESU is broken into five major population groups (MPG). Together, the MPGs contain 28 extant independent naturally spawning populations, three functionally extirpated populations, and one extirpated population. The Upper Salmon River MPG contains eight extant populations and one extirpated population. The Middle Fork Salmon River MPG contains nine extant populations. The South Fork Salmon River MPG contains four extant populations. The Grande Ronde/Imnaha Rivers MPG contains six extant populations, with two functionally extirpated populations. The Lower Snake River MPG contains one extant population and one functionally extirpated population. The South Fork and Middle Fork Salmon Rivers currently support most of the natural spring/summer Chinook salmon production in the Snake River drainage (NMFS 2016c).

Designated Critical Habitat. Critical habitat for Snake River spring/summer Chinook salmon was designated on December 28, 1993 (58 FR 68543) and revised slightly on October 25, 1999 (64 FR 57399). PBFs considered essential for the conservation of Chinook salmon, Snake River spring/summer-run ESU are shown in Table 46.

Spawning and juvenile rearing PBFs are regionally degraded by changes in flow quantity, water quality, and loss of cover. Juvenile and adult migrations are obstructed by reduced access that has resulted from altered flow regimes from hydroelectric dams. According to the ICBTRT, the Panther Creek population was extirpated because of legacy and modern mining-related pollutants creating a chemical barrier to fish passage (Chapman and Julius 2005).

Presence of cool water that is relatively free of contaminants is particularly important for the spring/summer run life history as adults hold over the summer and juveniles may rear for a whole year in the river. Water quality impairments are common in the range of the critical habitat designated for this ESU. Pollutants such as petroleum products, pesticides, fertilizers, and sediment in the form of turbidity enter the surface waters and riverine bottom substrate from the headwaters of the Snake, Salmon, and Clearwater Rivers to the Columbia River estuary as contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in the salmon tissue. This species also requires migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Recovery Goals. Recovery goals, scenarios and criteria for the Snake River spring and summer-run Chinook salmon are fully outlined in the recovery plan issued in 2017 (NMFS 2017). The status levels targeted for populations within an ESU or DPS are referred to collectively as the "recovery scenario" for the ESU or DPS. NMFS has incorporated the viability criteria into viable recovery scenarios for each Snake River spring/summer Chinook salmon and steelhead MPG.

The criteria should be met for an MPG to be considered Viable, or low (5 percent or less) risk of extinction, and thus contribute to the larger objective of ESU or DPS viability. These criteria are:

- At least one-half the populations historically present (minimum of two populations) should meet viability criteria (5 percent or less risk of extinction over 100 years).
- At least one population should be highly viable (less than 1 percent risk of extinction).
- Viable populations within an MPG should include some populations classified as "Very Large'" or "Large," and "Intermediate" reflecting proportions historically present.
- All major life history strategies historically present should be represented among the populations that meet viability criteria.
- Remaining populations within an MPG should be maintained (25 percent or less risk of extinction) with sufficient abundance, productivity, spatial structure, and diversity to provide for ecological functions and to preserve options for ESU or DPS recovery.
- For MPGs with only one population, this population must be highly viable (less than 1 percent risk of extinction).

Table 50. Summary of status; Chinook salmon, Snake River spring/summer-run ESU

Criteria	**Description**
Abundance / productivity trends	Low abundances, high risk of extinction. Poor natural productivity with unknown rates. Several Salmon River populations have higher abundances, but still well below recovery criteria. Moderate genetic diversity.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning, rearing and migration PBFs are degraded by loss of habitat, altered stream flows, barriers to fish passage, dams, loss of cover, and poor water quality; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; The entire river corridor is considered of high conservation value

8.11 Chinook salmon, Upper Columbia River spring-run ESU

Table 51. Chinook salmon, Upper Columbia River spring-run ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook salmon	Upper Columbia River spring-run ESU	Endangered	2016	70 FR 37160	2007	70 FR 52630

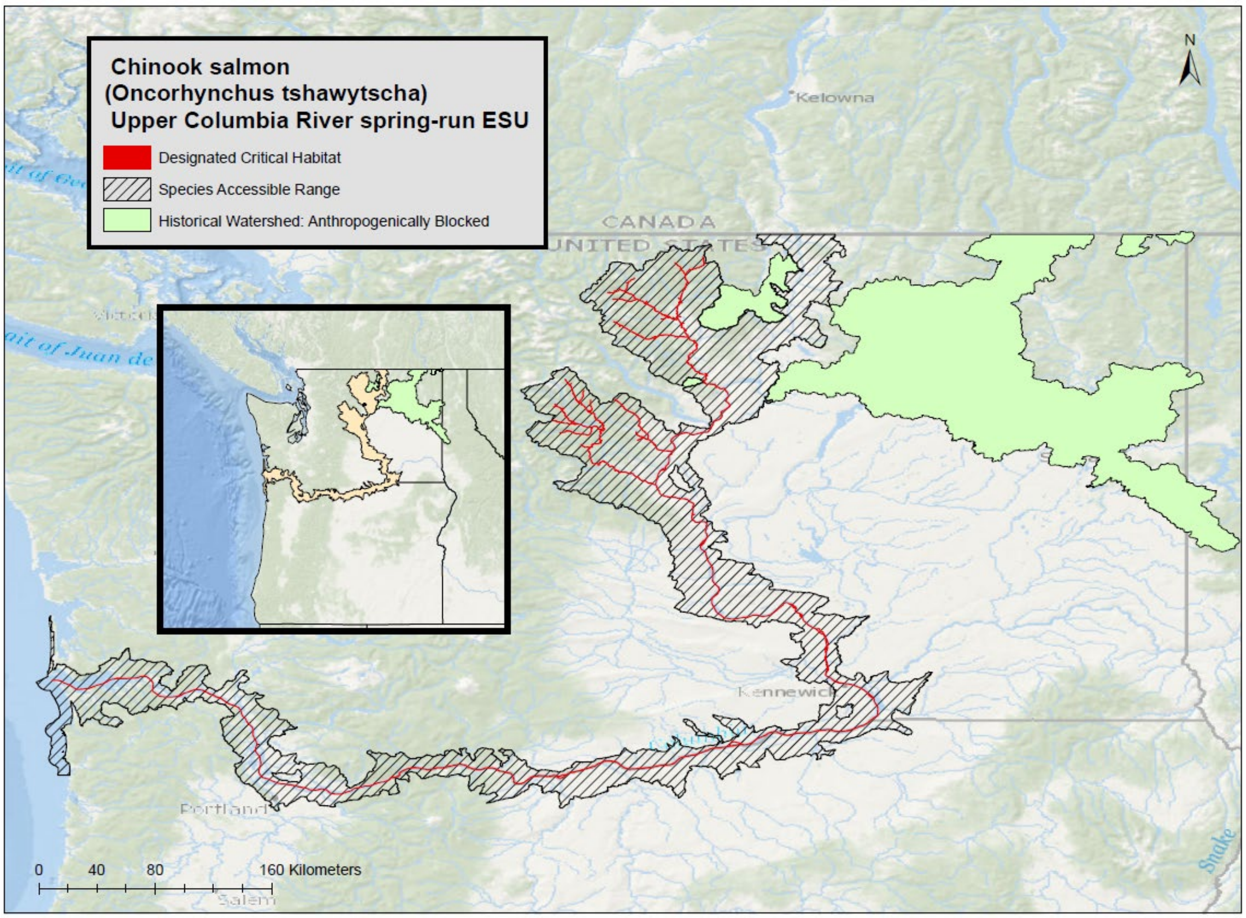

Figure 25. Chinook salmon, Upper Columbia River spring-run ESU range and designated critical habitat

Species Description. Chinook salmon are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002b). Upper

Columbia River spring-run Chinook salmon ESU was listed as an endangered species under the ESA on March 24, 1999 (64 FR 14308). NMFS reaffirmed the listing on June 28, 2005 (70 FR 37160). The Snake River spring/summer Chinook salmon ESU includes all naturally spawned populations of spring/summer Chinook salmon in the mainstem Snake River and the Tucannon River, Grand Ronde River, Imnaha River, and Salmon River subbasins as well as spring/summer Chinook salmon from 11 artificial propagation programs (NMFS 2016c). This ESU includes naturally spawned spring-run Chinook salmon originating from Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River subbasin). Also, spring-run Chinook salmon from six artificial propagation programs.

Status. The Upper Columbia spring Chinook ESU includes three extant populations (Wenatchee, Entiat, and Methow), as well as one extinct population in the Okanogan subbasin (ICBTRT 2003). All three populations continued to be rated at low risk for spatial structure but at high risk for diversity criteria. Large-scale supplementation efforts in the Methow and Wenatchee Rivers are ongoing, intended to counter short-term demographic risks given current average survival levels and the associated year-to-year variability. Under the current recovery plan, habitat protection and restoration actions are being implemented that are directed at key limiting factors. Although the status of the ESU has improved relative to measures available at the time of listing, all three populations remain at high risk (NWFSC 2015).

Life history. Adult Spring Chinook in the Upper Columbia Basin begin returning from the ocean in the early spring, with the run into the Columbia River peaking in mid-May. Spring Chinook enter the Upper Columbia tributaries from April through July. After migration, they hold in freshwater tributaries until spawning occurs in the late summer, peaking in mid to late August. Juvenile spring Chinook spend a year in freshwater before migrating to salt water in the spring of their second year of life. Most Upper Columbia spring Chinook return as adults after two or three years in the ocean. Some precocious males, or jacks, return after one winter at sea. A few other males mature sexually in freshwater without migrating to the sea. However, four and five year old fish that have spent two and three years at sea, respectively, dominate the run. Fecundity ranges from 4,200 to 5,900 eggs, depending on the age and size of the female.

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982a; MacFarlane and Norton 2002). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 52. Temporal distribution of Chinook salmon, Upper Columbia River spring-run ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td colspan="7">Present</td><td></td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. For all populations, average abundance over the recent 10-year period is below the average abundance thresholds that the ICTRT identifies as a minimum for low risk (ICTRT 2008a; ICTRT 2008b; ICTRT 2008c). The geometric mean spawning escapements from 1997 to 2001 were 273 for the Wenatchee population, 65 for the Entiat population, and 282 for the Methow population. These numbers represent only 8 percent to 15 percent of the minimum abundance thresholds. The five-year geometric mean remained low as of 2003.

Productivity / Population Growth Rate. Based on 1980-2004 returns, the lambda for this ESU is estimated at 0.93 (meaning the population is not replacing itself) (Fisher and Hinrichsen 2006). The long-term trend for abundance and lambda for individual populations indicate a decline for all three populations (Good et al. 2005b). Short-term lambda values indicate an increasing trend for the Methow population, but not for the Wenatchee and Entiat populations (ICTRT 2008a; ICTRT 2008b; ICTRT 2008c).

Genetic Diversity. The ICTRT characterizes the diversity risk to all Upper Columbia River (UCR) Spring-run Chinook populations as “high”. The high risk is a result of reduced genetic diversity from homogenization of populations that occurred under the Grand Coulee Fish Maintenance Project in 1939-1943.

Distribution. Spring Chinook currently spawn and rear in the upper main Wenatchee River upstream from the mouth of the Chiwawa River, overlapping with summer Chinook in that area (Peven et al. 1994). The primary spawning areas of spring Chinook in the Wenatchee subbasin include Nason Creek and the Chiwawa, Little Wenatchee, and White rivers. (Hamstreet and Carie 2003) described the current spawning distribution for spring Chinook in the Entiat subbasin as the Entiat River (river mile 16.2 to 28.9) and the Mad River (river mile 32 1.5-5.0). Spring Chinook of the Methow population currently spawn in the mainstem Methow River and the Twisp, Chewuch, and 5 Lost drainages (Humling and Snow 2005; Scribner et al. 1993). A few also spawn in Gold, Wolf, 6 and Early Winters creeks.

Designated Critical Habitat. NMFS designated critical habitat for Upper Columbia River Spring-run Chinook salmon on September 2, 2005 (70 FR 52630). It includes all Columbia River estuarine areas and river reaches proceeding upstream to Chief Joseph Dam and several tributary subbasins. PBFs considered essential for the conservation of Chinook salmon, Upper Columbia River spring-run ESU are shown in Table 21.

Spawning and rearing PBFs are somewhat degraded in tributary systems by urbanization in lower reaches, grazing in the middle reaches, and irrigation and diversion in the major upper drainages. These activities have resulted in excess erosion of fine sediment and silt that smother spawning gravel; reduction in flow quantity necessary for successful incubation, formation of physical rearing conditions, and juvenile mobility. Moreover siltation further affects critical habitat by reducing water quality through contaminated agricultural runoff; and removing natural cover. Adult and juvenile migration PBFs are heavily degraded by Columbia River Federal dam projects and a number of mid-Columbia River Public Utility District dam projects also obstruct the migration corridor.

Recovery Goals. Recovery goals, objectives and detailed criteria for the Central Valley spring-run Chinook are fully outlined in the 2016 Recovery Plan. The general recovery objectives are:

- Increase the abundance of naturally produced spring Chinook spawners within each population in the Upper Columbia ESU to levels considered viable.
- Productivity 21 Increase the productivity (spawner:spawner ratios and smolts/redds) of naturally produced spring Chinook within each population to levels that result in low risk of extinction.
- Restore the distribution of naturally produced spring Chinook to previously occupied areas (where practical) and allow natural patterns of genetic and phenotypic diversity to be expressed.

Table 53. Summary of status; Chinook salmon, Upper Columbia River spring-run ESU

Criteria	Description
Abundance / productivity trends	All populations have low abundance and the long-term trend in growth rate of the ESU is declining (the population is not replacing itself).
Listing status	Endangered
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by urbanization and irrigation water diversions; Migration PBFs degraded by numerous dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of occupied watersheds, 26 are of high and 5 are of medium conservation value

8.12 Chinook salmon, Upper Willamette River ESU

Table 54. Chinook salmon, Upper Willamette River ESU; overview table

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus tshawytscha	Chinook salmon	Upper Willamette River ESU	Threatened	2016	70 FR 37160	2011	70 FR 52630

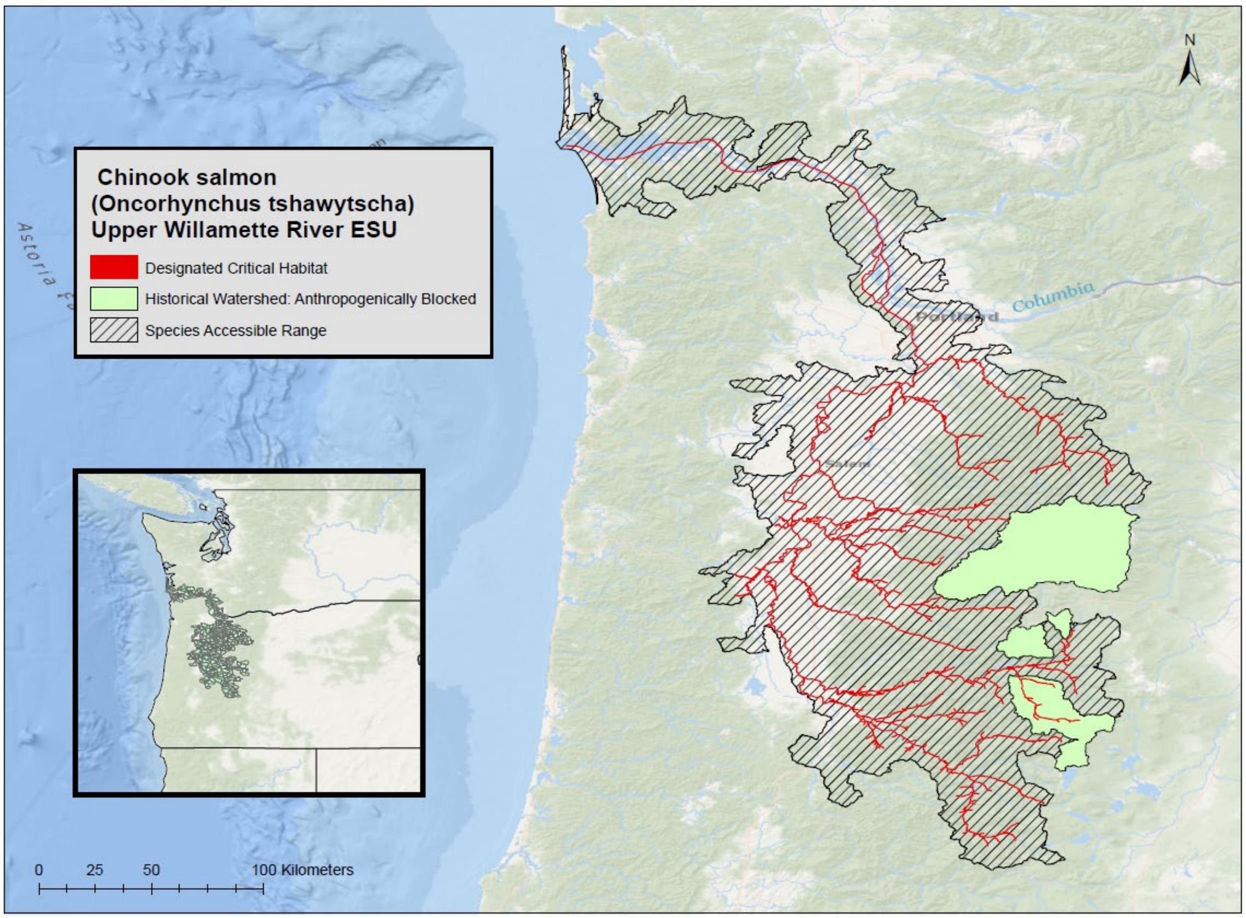

Figure 26. Chinook salmon, Upper Willamette River ESU range and designated critical habitat

Species Description. Chinook salmon are the largest of the Pacific salmon. Spawning adults are olive to dark maroon in color, without conspicuous streaking or blotches on the sides. Spawning males are darker than females, and have a hooked jaw and slightly humped back. They can be distinguished from other spawning salmon by the color pattern, particularly the spotting on the back and tail, and by the dark, solid black gums of the lower jaw (Moyle 2002b). Upper Willamette River Chinook salmon ESU was listed as an endangered species under the ESA on

March 24, 1999 (64 FR 14308). NMFS reaffirmed the listing on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned spring-run Chinook salmon originating from the Clackamas River and from the Willamette River and its tributaries above Willamette Falls. Also, spring-run Chinook salmon from six artificial propagation programs.

Status. The Upper Willamette River Chinook ESU is considered to be extremely depressed, likely numbering less than 10,000 fish compared to a historical abundance estimate of 300,000 (Myers et al. 2003). There are seven demographically independent populations of spring-run Chinook salmon in the Upper Willamette River (UWR) Chinook salmon ESU: Clackamas, Molalla, North Santiam, South Santiam, Calapooia, McKenzie, and the Middle Fork Willamette (Myers et al. 2006). Currently, significant natural production occurs in only the Clackamas and McKenzie populations (McElhany et al. 2007a). Juvenile spring Chinook produced by hatchery programs are released throughout many of the subbasins and adult Chinook returns to the ESU are typically 80-90 percent hatchery origin fish. Access to historical spawning and rearing areas is restricted by large dams in the four historically most productive tributaries, and in the absence of effective passage programs will continue to be confined to more lowland reaches where land development, water temperatures, and water quality may be limiting. Pre-spawning mortality levels are generally high in the lower tributary reaches where water temperatures and fish densities are generally the highest.

Life history. Upper Willamette River Chinook salmon exhibit an earlier time of entry into the Columbia River than other spring-run Chinook salmon ESUs (Myers et al. 1998b). Adults appear in the lower Willamette River in February, but the majority of the run ascends Willamette Falls in April and May, with a peak in mid- to late May. However, present-day salmon ascend the Willamette Falls via a fish ladder. Consequently, the migration of spring Chinook salmon over Willamette Falls extends into July and August (overlapping with the beginning of the introduced fall-run of Chinook salmon).

The adults hold in deep pools over summer and spawn in late fall or early winter when winter storms augment river flows. Fry may emerge from February to March and sometimes as late as June (Myers et al. 2006). Juvenile migration varies with three distinct juvenile emigration "runs": fry migration in late winter and early spring; sub-yearling (0 yr +) migration in fall to early winter; and yearlings (1 yr +) migrating in late winter to spring. Sub-yearlings and yearlings rear in the mainstem Willamette River where they also use floodplain wetlands in the lower Willamette River during the winter-spring floodplain inundation period.

Juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (Healey et al. 1991). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982a; MacFarlane and Norton 2002). Upon reaching the ocean, juvenile Chinook salmon feed voraciously on larval and juvenile fishes, plankton, and terrestrial insects (Healey et al. 1991; MacFarlane and Norton 2002). Chinook salmon grow rapidly in the ocean environment, with growth rates dependent on water temperatures and food availability.

Table 55. Temporal distribution of Chinook salmon, Upper Willamette River ESU

Life History phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Entering Fresh Water (adults/jacks)					Present							
Spawning								Present				
Incubation (eggs)									Present			
Emergence (alevin to fry phases)	Present										Present	
Rearing and migration (juveniles)	Present											

Population Dynamics

Abundance. The UWR Chinook ESU is considered to be extremely depressed, likely numbering less than 10,000 fish compared to a historical abundance estimate of 300,000 (Myers et al. 2003). Currently, significant natural production occurs in only the Clackamas and McKenzie populations (McElhany et al. 2007a).

Table 56. Upper Willamette River Chinook salmon independent populations core (C) and genetic legacy (G) populations and hatchery contributions (Good et al. 2005).

Functionally Independent Populations	Historical Abundance	Most Recent Spawner Abundance	Hatchery Abundance Contributions
Clackamas River (C)	Unknown	2,910	64%
Molalla River	Unknown	52 redds	>93%
North Santiam River (C)	Unknown	~ 7.1 rpm	>95%
South Santiam River	Unknown	982 redds	>84%
Calapooia River	Unknown	16 redds	100%
McKenzie River (C,G)	Unknown	~2,470	26%
Middle Fork Willamette River (C)	Unknown	235 redds	>39%
Total	>70,000	~9,700	Mostly hatchery

Productivity / Population Growth Rate The spring Chinook salmon in the McKenzie River is the only remaining self-sustaining naturally reproducing independent population. The other natural-origin populations in this ESU have very low current abundances, and long- and short-term population trends are negative.

Genetic Diversity Access of fall-run Chinook salmon to the upper Willamette River and the mixing of hatchery stocks within the ESU have threatened the genetic integrity and diversity of the species. Much of the genetic diversity that existed between populations has been homogenized (Myers et al. 2006).

Distribution Radio-tagging results from 2014 suggest that few fish strayed into west-side tributaries (no detections) and relatively fewer fish were unaccounted for between Willamette Falls and the tributaries, 12.9 percent of clipped fish and 5.3 percent of unclipped fish (Jepson et al. 2015). In contrast to most of the other populations in this ESU, McKenzie River Chinook salmon have access to much of their historical spawning habitat, although access to historically high quality habitat above Cougar Dam (South Fork McKenzie River) is still limited by poor downstream juvenile passage. Similarly, natural-origin returns to the Clackamas River have remained flat, despite adults having access to much of their historical spawning habitat. Although returning adults have access to most of the Calapooia and Molalla basin, habitat conditions are such that the productivity of these systems is very low. Natural-origin spawners in the Middle Fork Willamette River in the last 10 years consisted solely of adults returning to Fall Creek. While these fish contribute to the Demographically Independent Populations (DIP) and ESU, at best the contribution will be minor. Finally, improvements were noted in the North and South Santiam DIPs. The increase in abundance in both DIPs was in contrast to the other DIPs and the counts at Willamette Falls. While spring-run Chinook salmon in the South Santiam DIP have access to some of their historical spawning habitat, natural origin spawners in the North Santiam are still confined to below Detroit Dam and subject to relatively high prespawning mortality rates (NWFSC 2015).

Designated Critical Habitat NMFS designated critical habitat for this species on September 2, 2005 (70 FR 52630). Designated critical habitat includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Willamette River as well as specific stream reaches in a number of subbasins. PBFs considered essential for the conservation of Chinook salmon, Upper Willamette River ESU are shown in Table 21.

The current condition of PBFs of the UWR Chinook salmon critical habitat indicates that migration and rearing PBFs are not currently functioning or are degraded. These conditions impact their ability to serve their intended role for species conservation. The migration PBF is degraded by dams altering migration timing and water management altering the water quantity necessary for mobility and survival. Migration, rearing, and estuary PBFs are also degraded by loss of riparian vegetation and instream cover. Pollutants such as petroleum products, fertilizers, pesticides, and fine sediment enter the stream through runoff, point source discharge, drift during application, and non-point discharge where agricultural and urban development occurs. Degraded water quality in the lower Willamette River where important floodplain rearing habitat is present affects the ability of this habitat to sustain its role to conserve the species.

Recovery Goals. Recovery goals, objectives and detailed criteria for the Upper Willamette River Chinook are fully outlined in the 2011 Recovery Plan. The 2011 recovery plan outlines five potential scenario options for meeting the viability criteria for recovery. Of the five scenarios, scenario 1 reportedly represented the most balanced approach given limitations in some populations. The approach in this Plan to achieve ESU delisting of UWR Chinook salmon is to recover the McKenzie (core and genetic legacy population) and the Clackamas populations to an extinction risk status of very low risk (beyond minimal viability thresholds), to recover the North Santiam and Middle Fork Willamette populations (core populations) to an extinction risk status of low risk, to recover the South Santiam population to moderate risk, and improve the status of the remaining populations from very high risk to high risk.

Table 57. Summary of status; Chinook salmon, Upper Willamette River ESU

Criteria	**Description**
Abundance / productivity trends	Only one of seven remaining naturally reproducing independent populations. Unknown historical abundance. Declining trends with a high hatchery-produced fraction.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Migration, rearing, and estuary PBFs are degraded by dams, water management, loss of riparian vegetation, and quality of floodplain habitat; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 59 assessed watersheds, 22 are of high and 18 are of medium conservation value

8.13 Coho salmon, Central California Coast ESU

Table 58. Coho salmon, central California coast ESU; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus kisutch	**Coho salmon**	**Central California Coast**	**Endangered**	2016	70 FR 37160	2012	64 FR 24049

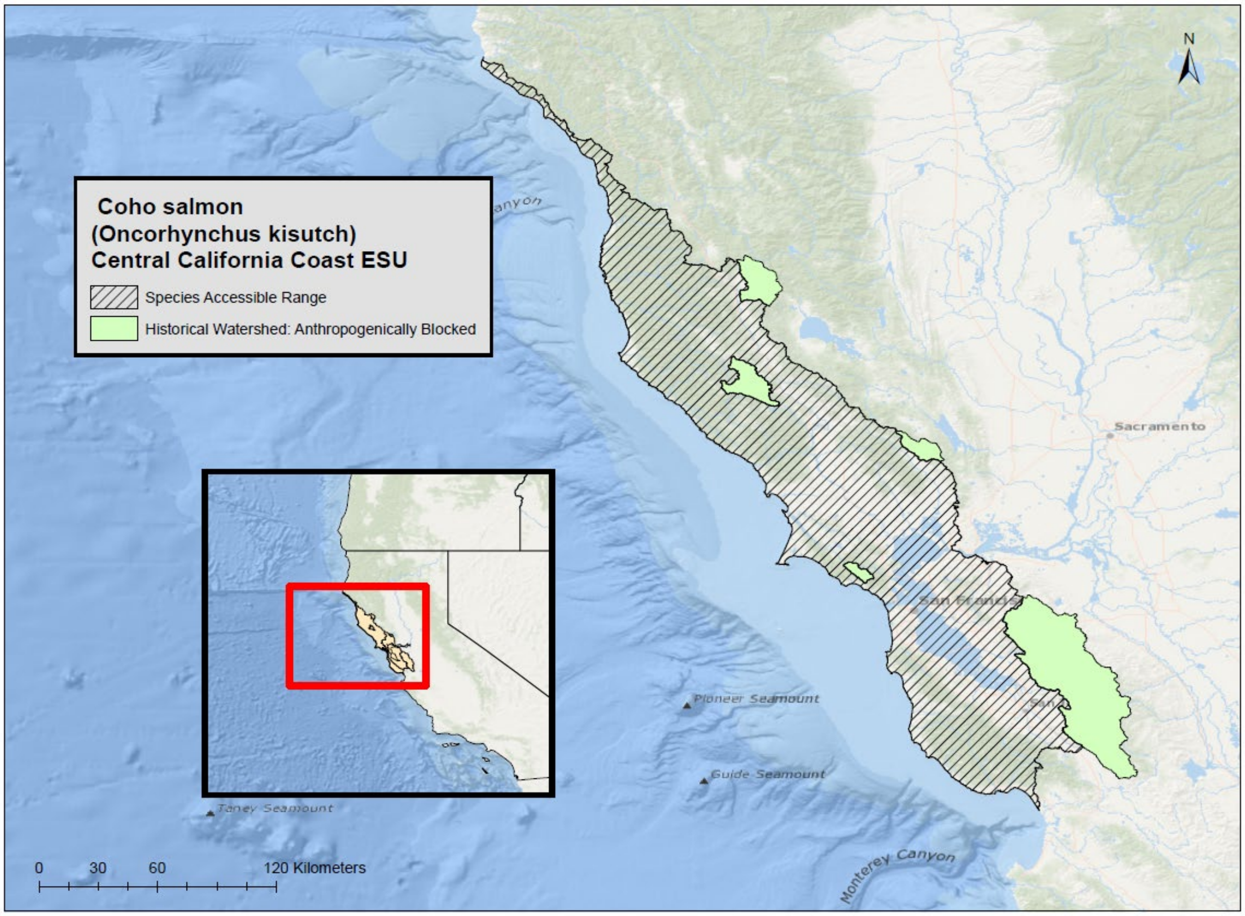

Figure 27. Coho salmon, central California coast ESU range

Species Description Coho salmon are an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn). Adult coho salmon are typically about two feet long and eight pounds. Coho have backs that are metallic blue or green, silver sides, and light bellies; spawners are dark with reddish sides; and when coho salmon are in the ocean, they have small black spots on the back and upper portion of the tail. Central California coast coho salmon ESU was listed as threatened under the ESA on October 31, 1996 (64 FR 56138). NMFS re-classified the ESU as endangered on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned coho salmon originating from rivers south of Punta Gorda, California to and including Aptos Creek, as well as such coho salmon originating from tributaries to San Francisco Bay. Also, coho salmon from three artificial propagation programs.

Status The low survival of juveniles in freshwater, in combination with poor ocean conditions, has led to the precipitous declines of Central California Coast (CCC) coho salmon populations. Most independent CCC coho salmon populations remain at critically low levels, with those in the southern Santa Cruz Mountains strata likely extirpated. Data suggests some populations show a slight positive trend in annual escapement, but the improvement is not statistically significant. Overall, all CCC coho salmon populations remain, at best, a slight fraction of their recovery target levels, and, aside from the Santa Cruz Mountains strata, the continued extirpation of dependent populations continues to threaten the ESU’s future survival and recovery. The evaluation of current habitat conditions and ongoing and future threats led to the conclusion that summer and winter rearing survival are very low due to impaired instream habitats. These impairments were due to a lack of complexity formed by instream wood, high sediment loads, lack of refugia habitats during winter, low summer flows and high instream temperatures. Additionally, populations throughout the ESU, but particularly at the southern end of the range, are likely to be significantly impacted by climate change in the future (NMFS 2012).

Life history Central California Coast coho salmon typically enter freshwater from November through January, and spawn into February or early March (Moyle 2002a). The upstream migration towards spawning areas coincides with large increases in stream flow (Hassler 1987). Coho salmon often are not able to enter freshwater until heavy rains have caused breaching of sand bars that form at the mouths of many coastal California streams. Spawning occurs in streams with direct flow to the ocean, or in large river tributaries (Moyle 2002b). Female coho salmon choose a site to spawn at the head of a riffle, just downstream of a pool where water flow changes from slow to turbulent, and where medium to small size gravel is abundant (Moyle 2002b).

Eggs incubate in redds from November through April, and hatch into “alevins” after a period of 35-50 days (Shapovalov and Taft 1954b). The period of incubation is inversely related to water temperature. Alevins remain in the gravel for two to ten weeks then emerge into the water column as young juveniles, known as “fry”. Juveniles, or fry, form schools in shallow water along the undercut banks of the stream to avoid predation. The juveniles feed heavily during this time, and as they grow they set up individual territories. Juveniles are voracious feeders, ingesting any organism that moves or drifts over their holding area. The juvenile’s diet is mainly aquatic insect larvae and terrestrial insects, but small fish are taken when available (Moyle 2002a).

After one year in freshwater juvenile coho salmon undergo physiological transformation into “smolts” for outmigration to the ocean. Smolts may spend time residing in the estuarine habitat prior to ocean entry, to allow for the transition to the saline environment. After entering the ocean, the immature salmon initially remain in the nearshore waters close to their natal stream. They gradually move northward, generally staying over the continental shelf (Brown et al. 1994). After approximately two years at sea, adult coho salmon move slowly homeward. Adults begin their freshwater migration upstream after heavy fall or winter rains breach the sandbars at the mouths of coastal streams (Sandercock 1991) and/or flows are sufficient to reach upstream spawning areas.

Table 59. Temporal distribution of Coho salmon, central California coast ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Spawning</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Limited information exists on the abundance of coho salmon within the CCC coho salmon ESU. About 200,000 to 500,000 coho salmon were produced statewide in the 1940s (Good et al. 2005b). This escapement declined to about 99,000 by the 1960s with approximately 56,000 (56 percent) originating from streams within the CCC coho salmon ESU. The estimated number of coho salmon produced within the ESU in 2011 was between 2,000 and 3,000 wild adults (Gallagher et al. 2010).

Productivity / Population Growth Rate. Within the Lost Coast – Navarro Point stratum, current population sizes range from 4 percent to 12 percent of proposed recovery targets, with two populations (Albion River and Big River, respectively) at or below their high-risk depensation thresholds. Most independent populations show positive but non-significant population trends. Dependent populations within the stratum have declined significantly since 2011. Similar results were obtained immediately south within the Navarro Point – Gualala Point stratum, where two of the three largest independent populations, the Navarro and Garcia rivers, have averaged 257 and 46 adult returns, respectively, during the past six years (both populations are at or below their high-risk depensation threshold). Data from the three dependent populations within the stratum (Brush, Greenwood and Elk creeks) suggest little to no adult coho salmon escapement since 2011. In the Russian River and Lagunitas Creek watersheds, which are the two largest within the Central Coast strata, recent coho salmon population trends suggest limited improvement, although both populations remain well below recovery targets. Likewise, most dependent populations within the strata remain at very low levels, although excess broodstock adults from the Russian River and Olema Creek were recently stocked into Salmon Creek and the subsequent capture of juvenile fish indicates successful reproduction occurred. Finally, recent sampling within Pescadero Creek and San Lorenzo River, the only two independent populations within the Santa Cruz Mountains strata, suggest coho salmon have likely been extirpated within both basins. A bright spot appears to be the recent improvement in abundance and spatial distribution noted within the strata's dependent populations; Scott Creek experienced the largest coho salmon run in a decade during 2014/15, and researchers recently detected juvenile coho salmon within four dependent watersheds where they were previously thought to be extirpated (San Vincente, Waddell, Soquel and Laguna creeks

Genetic Diversity. Hatchery raised smolt have been released infrequently but occasionally in large numbers in rivers throughout the ESU (Bjorkstedt et al. 2005). Releases have included transfer of stocks within California and between California and other Pacific states as well as smolt raised from eggs collected from native stocks. However, genetic studies show little homogenization of populations, *i.e.,* transfer of stocks between basins have had little effect on the geographic genetic structure of CCC coho salmon (Sonoma County Water Agency (SCWA) 2002). The CCC coho salmon likely has considerable diversity in local adaptations given that the ESU spans a large latitudinal diversity in geology and ecoregions, and include both coastal and inland river basins.

Distribution. The TRT identified 11 "functionally independent", one "potentially independent" and 64 "dependent" populations in the CCC coho salmon ESU (Bjorkstedt *et al.,* 2005 with modifications described in Spence *et al.* 2008). The 75 populations were grouped into five Diversity Strata. ESU spatial structure has been substantially modified due to lack of viable source populations and loss of dependent populations. One of the two historically independent populations in the Santa Cruz mountains (*i.e.,* South of the Golden Gate Bridge) is extirpated (Good et al. 2005b; Spence et al. 2008a). Coho salmon are considered effectively extirpated from the San Francisco Bay (NMFS 2001; Spence et al. 2008a). The Russian River is of particular importance for preventing the extinction and contributing to the recovery of CCC coho salmon (NOAA 2013). The Russian River population, once the largest and most dominant source population in the ESU, is now at high risk of extinction because of low abundance and failed productivity (Spence et al. 2008a). The Lost Coast to Navarro Point to the north contains the majority of coho salmon remaining in the ESU.

Designated Critical Habitat. Critical habitat for the CCC coho salmon ESU was designated on May 5, 1999 (64 FR 24049). It encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Punta Gorda and the San Lorenzo River (inclusive) in California. Critical habitat for this species also includes two streams entering San Francisco Bay: Arroyo Corte Madera Del Presidio and Corte Madera Creek. PBFs considered essential for the conservation of Coho salmon, central California coast ESU are:

- Within the range of both ESUs, the species' life cycle can be separated into 5 essential habitat types:
    1. Juvenile summer and winter rearing areas;

2. juvenile migration corridors;
3. areas for growth and development to adulthood;
4. adult migration corridors; and
5. spawning areas.

- Essential features of coho critical habitat include adequate
  1. substrate,
  2. water quality,
  3. water quantity,
  4. water temperature,
  5. water velocity,
  6. cover/shelter,
  7. food,
  8. riparian vegetation,
  9. space, and
  10. safe passage conditions.

NMFS (2008) evaluated the condition of each habitat attribute in terms of its current condition relative to its role and function in the conservation of the species. The assessment of habitat for this species showed a distinct trend of increasing degradation in quality and quantity of all PBFs as the habitat progresses south through the species range, with the area from the Lost Coast to the Navarro Point supporting most of the more favorable habitats and the Santa Cruz Mountains supporting the least. However, all populations are generally degraded regarding spawning and incubation substrate, and juvenile rearing habitat. Elevated water temperatures occur in many streams across the entire ESU.

Recovery Goals See the 2012 Recovery Plan for complete down listing/delisting criteria for each of the following recovery goals (NMFS 2012):

1. Prevent extinction by protecting existing populations and their habitats;

2. Maintain current distribution of coho salmon and restore their distribution to previously occupied areas essential to their recovery;

3. Increase abundance of coho salmon to viable population levels, including the expression of all life history forms and strategies;

4. Conserve existing genetic diversity and provide opportunities for interchange of genetic material between and within meta populations;

5. Maintain and restore suitable freshwater and estuarine habitat conditions and characteristics for all life history stages so viable populations can be sustained naturally;

6. Ensure all factors that led to the listing of the species have been ameliorated; and

7. Develop and maintain a program of monitoring, research, and evaluation that advances understanding of the complex array of factors associated with coho salmon survival and recovery and which allows for adaptively managing our approach to recovery over time.

Table 60. Summary of status; Coho salmon, central California coast ESU

Criteria	**Description**
Abundance / productivity trends	Stable population trend, low abundances, fragmented populations, supported by hatchery propagation.
Listing status	Endangered
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Degradation in quality and quantity of PBFs, especially in southern end of range; Rearing PBFs degraded by loss of suitable incubation substrate and loss of habitat; Elevated temperatures anticipated in freshwater habitats; Environmental mixtures anticipated in freshwater habitats may impact PBFs

8.14 Coho salmon, Lower Columbia River ESU

Table 61. Coho salmon, lower Columbia River ESU; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus kisutch	**Coho salmon**	**Lower Columbia River**	**Threatened**	2016	70 FR 37160	2013	81 FR 9251

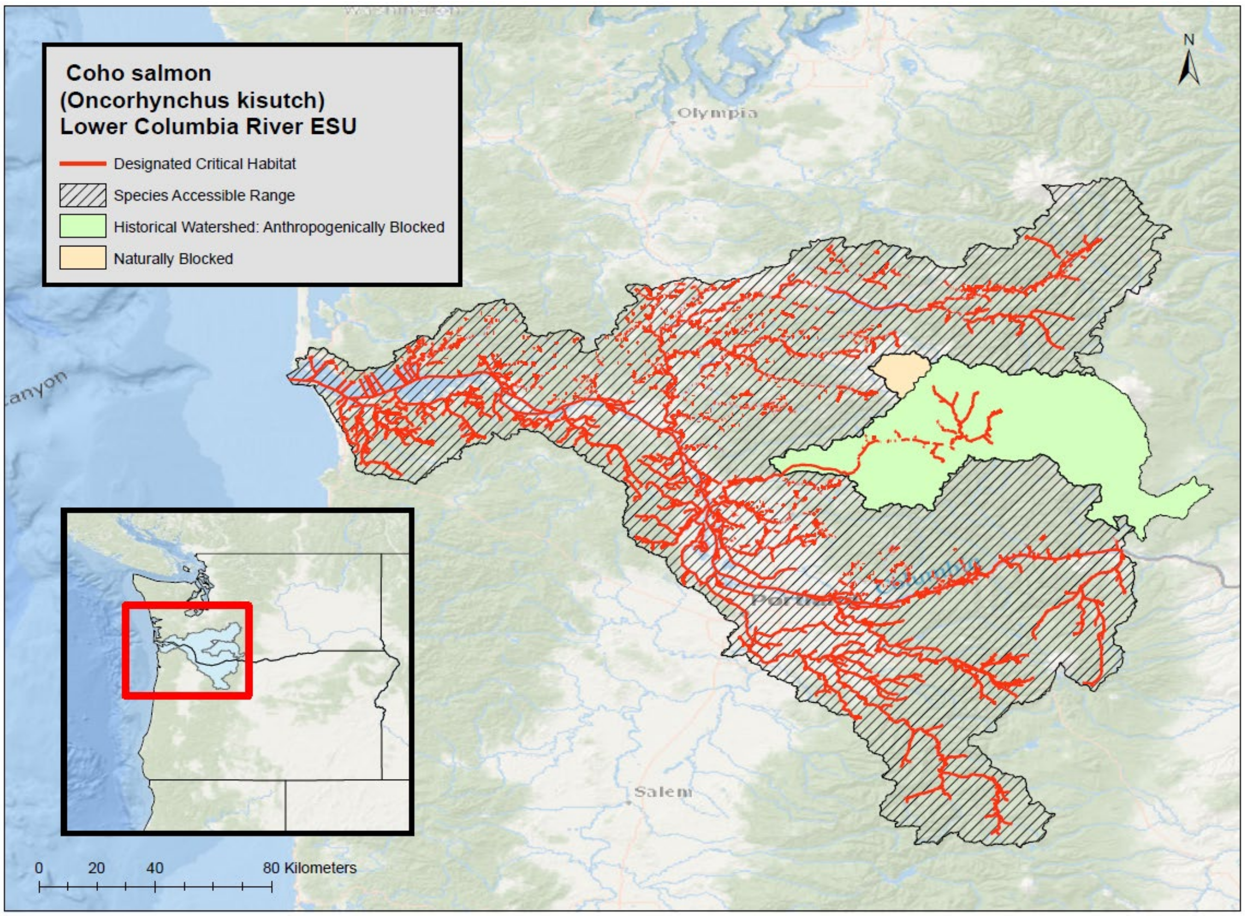

Figure 28. Coho salmon, lower Columbia River ESU range and designated critical habitat

Species Description Coho salmon are an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn). Adult coho salmon are typically about two feet long and eight pounds. Coho have backs that are metallic blue or green, silver sides, and light bellies; spawners are dark with reddish sides; and when coho salmon are in the ocean, they have small black spots on the back and upper portion of the tail. Lower Columbia River coho salmon ESU was listed as threatened under the ESA on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood Rivers (inclusive) and any such fish originating from the Willamette River and its tributaries below Willamette Falls. Also, coho salmon from 21 artificial propagation programs.

Status Recovery efforts have likely improved the status of a number of coho salmon demographically independent populations (DIPs), abundances are still at low levels and the majority of the DIPs remain at moderate or high risk. For the lower Columbia River region, land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years. Regardless, this ESU is still considered to be at moderate risk (NWFSC 2015a).

Life history Lower Columbia River coho salmon are typically categorized into early- and late-returning stocks. Early-returning (Type S) adult coho salmon enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho salmon pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some occurs as late as March (LCFRB 2010b).

Coho salmon typically spawn in small to medium, low- to-moderate elevation streams from valley bottoms to stream headwaters. Coho salmon construct redds in gravel and small cobble substrate in pool tailouts, riffles, and glides, with sufficient flow depth for spawning activity (NMFS 2013b). Eggs incubate over late fall and winter for about 45 to 140 days, depending on water temperature, with longer incubation in colder water. Fry may thus emerge from early spring to early summer (ODFW 2010). Juveniles typically rear in freshwater for more than a year. After emergence, coho salmon fry move to shallow, low-velocity rearing areas, primarily along the stream edges and inside channels. Juvenile coho salmon favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side-channel rearing areas are particularly critical for overwinter survival, which is a key regulator of freshwater productivity (LCFRB 2010b).

Most juvenile coho salmon migrate seaward as smolts in April to June, typically during their second year. Salmon that have stream-type life histories, such as coho, typically do not linger for extended periods in the Columbia River estuary, but the estuary is a critical habitat used for feeding during the physiological adjustment to salt water. Juvenile coho salmon are present in the Columbia River estuary from March to August. Columbia River coho salmon typically range throughout the nearshore ocean over the continental shelf off of the Oregon and Washington coasts. Early-returning (Type S) coho salmon are typically found in ocean waters south of the Columbia River mouth. Late-returning (Type N) coho salmon are typically found in ocean waters north of the Columbia River mouth. Most coho salmon sexually mature at age three, except for a small percentage of males (called “jacks”) who return to natal waters at age two, after only 5 to 7 months in the ocean (LCFRB 2010b).

Table 62. Temporal distribution of Coho salmon, lower Columbia River ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Spawning</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Although poor data quality prevents precise quantification, most populations are believed to have very low abundance of natural-origin spawners (50 fish or fewer, compared to historical abundances of thousands or tens of thousands).

Productivity / Population Growth Rate. Both the long- and short-term trend, and lambda for the natural origin (late-run) portion of the Clackamas River coho salmon are negative but with large confidence intervals (Good et al. 2005b). The short-term trend for the Sandy River population is close to 1, indicating a relatively stable population during the years 1990 to 2002 (Good et al. 2005b). The long-term trend (1977 to 2002) for this same population shows that the population has been decreasing (trend=0.54); there is a 43 percent probability that the median population growth rate (lambda) was less than one. More recent spawning surveys indicate short-term increases in natural production in the Clatskanie, Scappoose, and Mill/Abernathy/Germany populations (Ford 2011a; ODFW 2010).

Genetic Diversity. The spatial structure of some populations is constrained by migration barriers (such as tributary dams) and development in lowland areas. Low abundance, past stock transfers, other legacy hatchery effects, and ongoing hatchery straying may have reduced genetic diversity within and among coho salmon populations (LCFRB 2010a, ODFW 2010). It is likely that hatchery effects have also decreased population productivity.

Distribution. The Lower Columbia River coho salmon ESU historically consisted of a total of 24 independent populations (see Table 6-2). Because NMFS had not yet listed the ESU in 2003 when the WLC TRT designated core and genetic legacy populations for other ESUs, there are no such designations for Lower Columbia River coho salmon. However, the Clackamas and Sandy subbasins contain the only populations in the ESU that have clear records of continuous natural spawning (McElhany et al. 2007b).

Designated Critical Habitat. Critical habitat for the lower Columbia River coho salmon ESU was designated on February 24, 2016 (81 FR 9252). PBFs considered essential for the conservation of Coho salmon, lower Columbia River ESU are shown in Table 21.

Reduced complexity, connectivity, quantity, and quality of habitat used for spawning, rearing, foraging, and migrating continues to be a concern for all four lower Columbia River listed species. Loss of habitat from conversion to agricultural or urbanized uses continues to be a particular concern throughout the lower Columbia River region, especially the loss of habitat complexity in the lower tributary/mainstem Columbia River interface, and concomitant changes in water temperature (LCFRB 2010b; NMFS 2013b; ODFW 2010). Toxic contamination through the production, use, and disposal of numerous chemicals from multiple sources including industrial, agricultural, medical and pharmaceutical, and common household uses that enter the Columbia River in wastewater treatment plant effluent, stormwater runoff, and nonpoint source pollution is a growing concern (Morace 2012).

Recovery Goals NMFS has developed the following delisting criteria for the Lower Columbia River coho salmon ESU:

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition. High probability of stratum persistence is defined as:
    a. At least two populations in the stratum have at least a 95 percent probability of persistence over a 100-year time frame (i.e., two populations with a score of 3.0 or higher based on the TRT's scoring system).
    b. Other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (i.e., the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system). (See Section 2.6 for a brief discussion of the TRT's scoring system.)
    c. Populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
    d. A probability of persistence consistent with historical condition refers to the concept that strata that historically were small or had complex population structures may not have met Criteria A through C, above, but could still be considered sufficiently viable if they provide a contribution to overall ESU viability similar to their historical contribution.
2. The threats criteria described in Section 3.2.2 of the 2013 recovery plan have been met.

Table 63. Summary of status; Coho salmon, lower Columbia River ESU

Criteria	Description
Abundance / productivity trends	90 percent reduction in abundance of all independent populations. Two of 25 populations have significant natural production. Long and short term lambda projections remain

	negative. Diversity of populations remain in the high risk category.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover; Migration PBFs impacted by dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats

8.15 Coho salmon, Oregon Coast ESU

Table 64. Coho salmon, Oregon coast ESU; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus kisutch	Coho salmon	Oregon Coast	Threatened	2016	76 FR 35755	2016	73 FR 7816

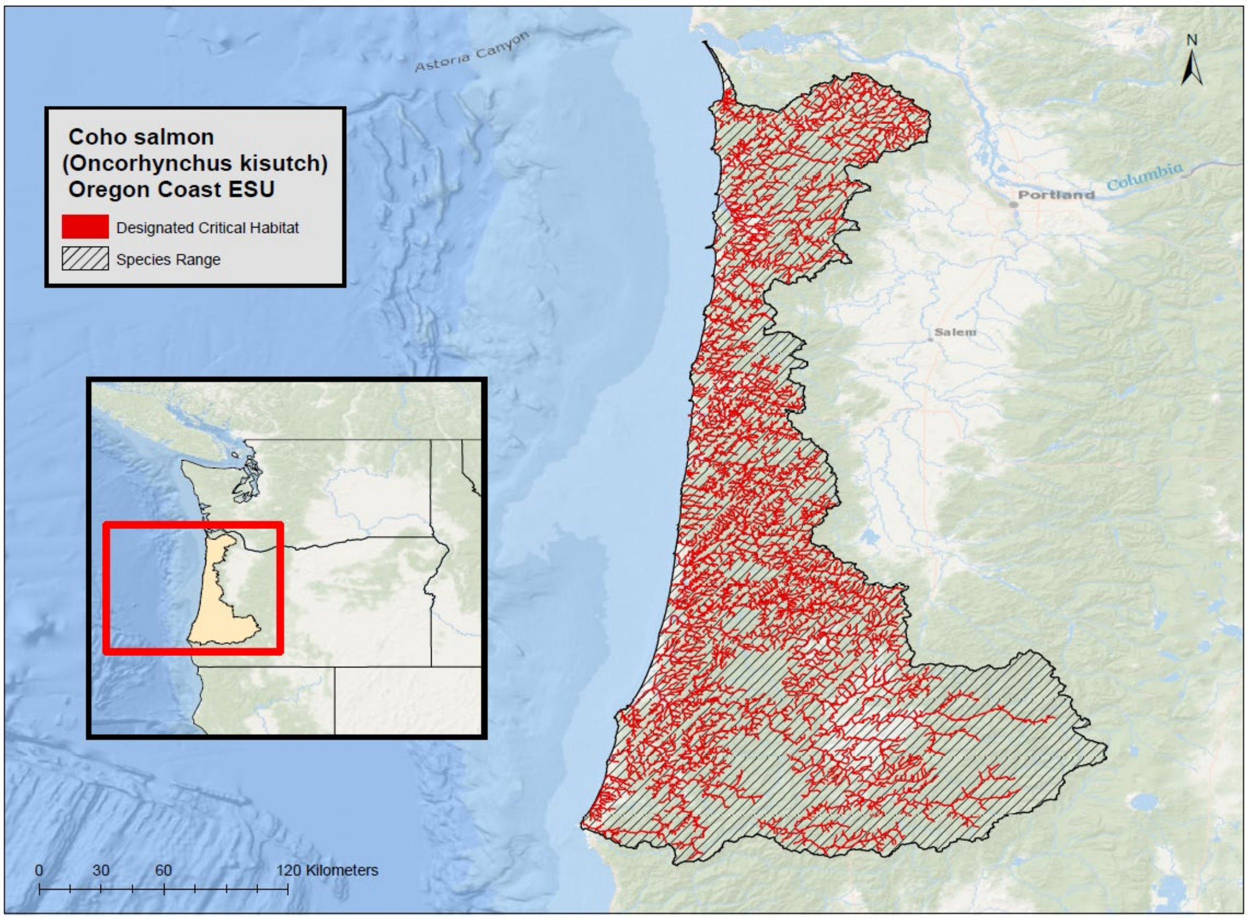

Figure 29. Coho salmon, Oregon coast ESU range and designated critical habitat

Species Description Coho salmon are an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn). Adult coho salmon are typically about two feet long and eight pounds. Coho have backs that are metallic blue or green, silver sides, and light bellies; spawners are dark with reddish sides; and when coho salmon are in the ocean, they have small black spots on the back and upper portion of the tail. Oregon coast coho salmon ESU was listed as threatened under the ESA on August 10, 1998 (63 FR 42587). The listing was revisited and confirmed as threatened on June 20, 2011 (76 FR 35755). This ESU includes naturally spawned coho salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco, and also coho salmon from one artificial propagation program: Cow Creek Hatchery Program.

Status Findings by the NWFSC (2015a) and ODFW (2016) show many positive improvements to Oregon Coast coho salmon in recent years, including positive long-term abundance trends and escapement. Results from the NWFSC recent review show that while Oregon Coast coho salmon spawner abundance varies by time and population, the total abundance of spawners within the ESU has been generally increasing since 1999, with total abundance exceeding 280,000 spawners in three of the last five years. Overall, the NWFSC (2015a) found that increases in Oregon Coast coho salmon ESU scores for persistence and sustainability clearly indicate that the biological status of the ESU is improving, due in large part to management decisions (reduced harvest and hatchery releases). It determined, however, that Oregon Coast coho salmon abundance remains strongly correlated with marine survival rates.

Life history The anadromous life cycle of coho salmon begins in their home stream where they emerge from eggs as 'alevins' (a larval life stage dependent on food stored in a yolk sac). These very small fish require cool, slow moving freshwater streams with quiet areas such as backwater pools, beaver ponds, and side channels (Reeves et al. 1989) to survive and grow through summer and winter seasons. Current production of coho salmon smolts in the Oregon Coast coho salmon ESU is particularly limited by the availability of complex stream habitat that provides the shelter for overwintering juveniles during periods when flows are high, water temperatures are low, and food availability is limited (ODFW 2007).

The Oregon Coast coho salmon follow a yearling-type life history strategy, with most juvenile coho salmon migrating to the ocean as smolts in the spring, typically from as late as March into June. Coho salmon smolts outmigrating from freshwater reaches may feed and grow in lower mainstem and estuarine habitats for a period of days or weeks before entering the nearshore ocean environment. The areas can serve as acclimation areas, allowing coho salmon juveniles to adapt to saltwater. Research shows that substantial numbers of coho fry may also emigrate downstream from natal streams into tidally influenced lower river wetlands and estuarine habitat (Bass 2010; Chapman 1962; Koski 2009).

Oregon Coast coho salmon tend to make relatively short ocean migrations. Coho from this ESU are present in the ocean from northern California to southern British Columbia, and even fish from a given population can be widely dispersed in the coastal ocean, but the bulk of the ocean harvest of coho salmon from this ESU are found off the Oregon coast. The majority of coho salmon adults return to spawn as 3–year-old fish, having spent about 18 months in freshwater and 18 months in salt water (Sandercock 1991). The primary exceptions to this pattern are ''jacks,'' sexually mature males that return to freshwater to spawn after only 5 to 7 months in the ocean.

Table 65. Temporal distribution of Coho salmon, Oregon coast ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
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<tr><td>Spawning</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
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<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Results from the NWFSC recent review show that while Oregon Coast (OC) coho salmon spawner abundance varies by time and population, the total abundance of spawners within the ESU has been generally increasing since 1999, with total abundance exceeding 280,000 spawners in three of the last five years (NWFSC 2015a).

Productivity / Population Growth Rate. Most independent populations in the ESU showed an overall increasing trend in abundance with synchronously high abundances in 2002-2003, 2009-2011, and 2014, and low abundances in 2007, 2009, and 2015. This synchrony suggests the overriding importance of marine survival to recruitment and escapement of Oregon Coast coho salmon (NWFSC 2015a).

Genetic Diversity. While the 2008 biological review team status review concluded that there was low certainty that ESU-level genetic diversity was sufficient for long-term sustainability in the ESU (Wainwright et al. 2008), the recent NWFSC review suggests this is an unlikely outcome. The observed upward trends in abundance and productivity and downward trends in hatchery influence make decreases in genetic or life history diversity or loss of dependent populations in recent years unlikely (NWFSC 2015a).

Distribution. The geographic setting for the Oregon Coast coho salmon ESU includes the Pacific Ocean and the freshwater habitat (rivers, streams, and lakes) along the Oregon Coast from the Necanicum River near Seaside on the north to the Sixes River near Port Orford on the south. The Oregon/Northern California Coasts Technical Recovery Team identified 56 historical populations that function collectively to form the Oregon Coast coho salmon ESU. The team classified 21 of the populations as independent because they occur in basins with sufficient historical habitat to have persisted through several hundred years of normal variations in marine and freshwater conditions (NMFS 2016d).

Designated Critical Habitat. NMFS designated critical habitat for Oregon Coast coho salmon on February 11, 2008 (73 FR 7816). PBFs considered essential for the conservation of Coho salmon, Oregon coast ESU are shown in Table 21.

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

The spawning PBF has been impacted in many watersheds from the inclusion of fine sediment into spawning gravel from timber harvest and forestry related activities, agriculture, and grazing. These activities have also diminished the channels' rearing and overwintering capacity by reducing the amount of large woody debris in stream channels, removing riparian vegetation, disconnecting floodplains from stream channels, and changing the quantity and dynamics of stream flows. The rearing PBF has been degraded by elevated water temperatures in 29 of the 80 HUC 5 watersheds; rearing PBF within the Nehalem, North Umpqua, and the inland watersheds of the Umpqua subbasins have elevated stream temperatures. Water quality is impacted by contaminants from agriculture and urban areas in low lying areas in the Umpqua subbasins, and in coastal watersheds within the Siletz/Yaquina, Siltcoos, and Coos subbasins. Reductions in water quality have been observed in 12 watersheds due to contaminants and excessive nutrition. The migration PBF has been impacted throughout the ESU by culverts and road crossings that restrict passage. As described above the PBFs vary widely throughout the critical habitat area designated for OC coho salmon, with many watersheds heavily impacted with low quality PBFs while habitat in other coho salmon bearing watersheds having sufficient quality for supporting the conservation purpose of designated critical habitat.

Recovery Goals. See the 2016 Recovery Plan for detailed descriptions of the recovery goals and delisting criteria (NMFS 2016d). In the simplest terms, NMFS will remove the Oregon Coast coho salmon from federal protection under the ESA when we determine that:

- The species has achieved a biological status consistent with recovery—the best available information indicates it has sufficient abundance, population growth rate, population spatial structure, and diversity to indicate it has met the biological recovery goals.
- Factors that led to ESA listing have been reduced or eliminated to the point where federal protection under the ESA is no longer needed, and there is reasonable certainty that the relevant regulatory mechanisms are adequate to protect Oregon Coast coho salmon sustainability.

Table 66. Summary of status; Coho salmon, Oregon coast ESU

Criteria	Description
Abundance / productivity trends	Drastic reductions in ESU abundance compared to historical estimates. Highly variable abundances with periods of severe declines followed by a year of increases. Long term trends remain negative due to low abundances in the 1990s.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met

Condition of PBFs	Rearing PBFs are degraded by elevated water temperature; All PBFs degraded by reduced water quality from contaminants and excess nutrients; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 80 assessed watersheds, 45 are of high and 27 are of medium conservation value

8.16 Coho salmon, Southern Oregon/Northern California Coast ESU

Table 67. Coho salmon, Southern Oregon/Northern California ESU ; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus kisutch	Coho salmon	Southern Oregon / Northern California	Threatened	2016	70 FR 37160	2014	64 FR 24049

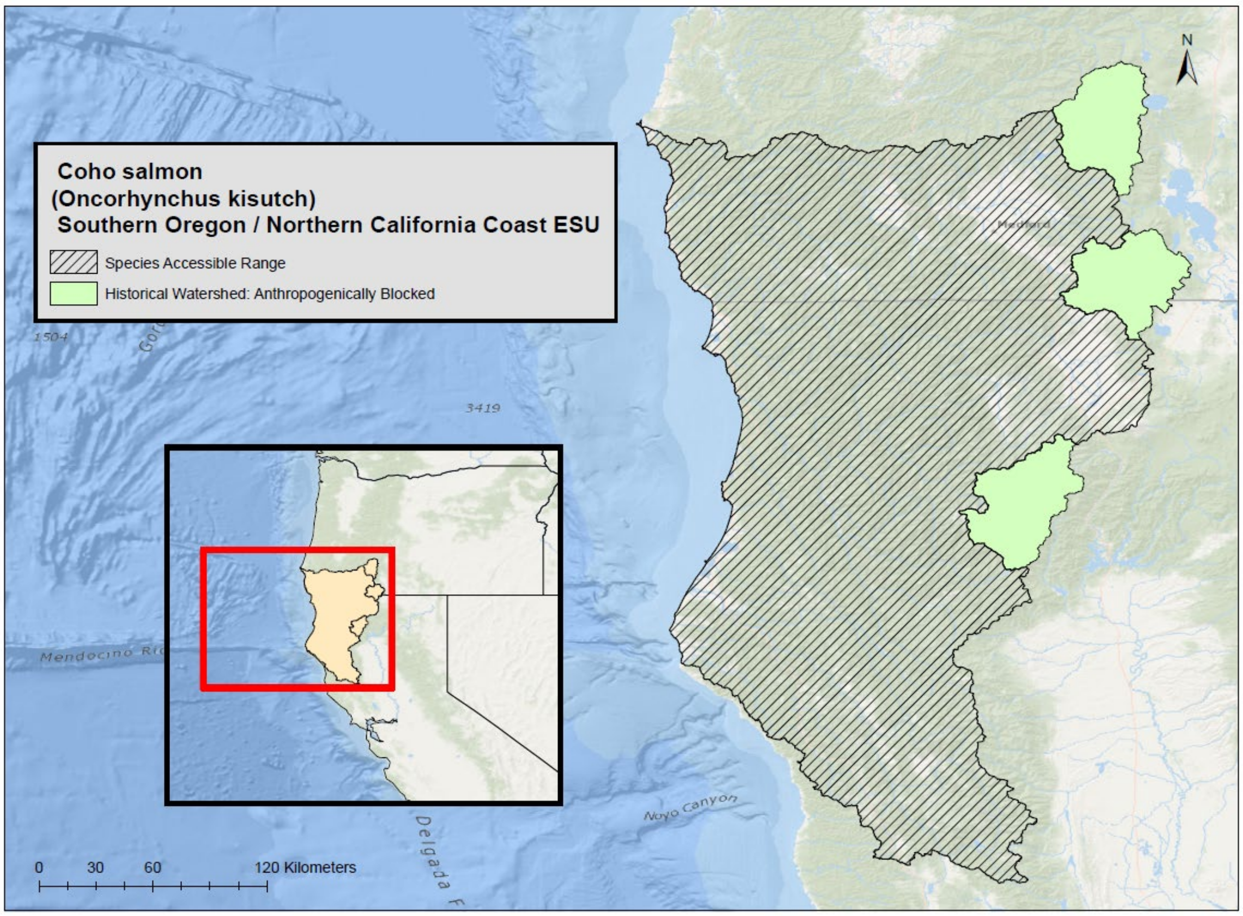

Figure 30. Coho salmon, Southern Oregon/Northern California ESU range and designated critical habitat

Species Description Coho salmon are an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn). Adult coho salmon are typically about two feet long and eight pounds. Coho have backs that are metallic blue or green, silver sides, and light bellies; spawners are dark with reddish sides; and when coho salmon are in the ocean, they have small black spots on the back and upper portion of the tail. Southern Oregon / Northern California Coast (SONCC) coho salmon ESU was listed as threatened under the ESA on May 6, 1997 (62

FR 24588). The listing was revisited and confirmed as threatened on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned coho salmon originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California. Also, coho salmon from three artificial propagation programs.

Status Though population-level estimates of abundance for most independent populations are lacking, the best available data indicate that none of the seven diversity strata appears to support a single viable population as defined by the SONCC coho salmon technical recovery team's viability criteria (low extinction risk; Williams et al. (2008)). Further, 24 out of 31 independent populations are at high risk of extinction and 6 are at moderate risk of extinction. Based on the above discussion of the population viability parameters, and qualitative viability criteria presented in Williams et al. (2008), NMFS concludes that the SONCC coho salmon ESU is currently not viable and is at high risk of extinction. The primary causes of the decline are likely long-standing human-caused conditions (e.g., harvest and habitat degradation), which exacerbated the impacts of adverse environmental conditions (e.g., drought and poor ocean conditions) (60 FR 38011; July 25, 1995).

Life history Coho salmon is an anadromous fish species that generally exhibits a relatively simple 3-year life cycle. Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. The run and spawning times vary between and within populations. Depending on river temperatures, eggs incubate in ''redds'' (gravel nests excavated by spawning females) for 1.5 to 4 months before hatching as ''alevins'' (a larval life stage dependent on food stored in a yolk sac). Once most of the yolk sac is absorbed, the 30 to 35 millimeter fish (then termed "fry") begin emerging from the gravel in search of shallow stream margins for foraging and safety (Council 2004). Coho salmon fry typically transition to the juvenile stage by about mid-June when they are about 50 to 60 mm, and both stages are collectively referred to as "young of the year." Juveniles develop vertical dark bands or "parr marks", and begin partitioning available instream habitat through aggressive agonistic interactions with other juvenile fish (Quinn 2005). Juveniles rear in fresh water for up to 15 months, then migrate to the ocean as ''smolts'' in the spring. Coho salmon typically spend 2 growing seasons in the ocean before returning to their natal stream to spawn as 3 year-olds. Some precocious males, called ''jacks,'' return to spawn after only 6 months at sea (NMFS 2014a).

Table 68. Temporal distribution of Coho salmon, Southern Oregon/Northern California ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Incubation (eggs)</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Population-level estimates of abundance for most independent populations are lacking. The best available data indicate that none of the seven diversity strata appears to support a single viable population (one at low risk of extinction) as defined by in the viability criteria. In fact, most of the 30 independent populations in the ESU are at high risk of extinction for abundance because they are below or likely below their depensation threshold (NMFS 2014a).

Productivity / Population Growth Rate. Available data show that the 95 percent confidence intervals for the slope of the regression line include zero for many populations, indicating that whether the slope is negative or positive cannot be determined. However, there is 95 percent confidence that the slope of the regression line is negative, indicating a decreasing trend, for Mill Creek in the Smith River and Freshwater Creek in Humboldt Bay Tributaries. In contrast, there is 95 percent confidence that the slope of the regression line is positive, indicating an increasing trend, at Gold Ray Dam in the Upper Rogue River(NMFS 2014a).

Genetic Diversity. The primary factors affecting the genetic and life-history diversity of SONCC coho salmon appear to be low population abundance and the influence of hatcheries and out-of-basin introductions. The ESU's current genetic variability and variation in life-history likely contribute significantly to long-term risk of extinction. Given the recent trends in abundance across the ESU, the genetic and life-history diversity of populations is likely very low and is inadequate to contribute to a viable ESU (NMFS 2014a).

Distribution. The SONCC Coho Salmon ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon and Punta Gorda, California, as well as coho salmon produced by three artificial propagation programs: Cole Rivers Hatchery, Trinity River Hatchery, and Iron Gate Hatchery. The ESU is comprised of 40 populations within seven diversity strata. Recent information for SONCC coho salmon indicates that their distribution within the ESU has been reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent. However, extant populations can still be found in all major river basins within the ESU (70 FR 37160; June 28, 2005).

Designated Critical Habitat NMFS designated critical habitat for the SONCC coho salmon on May 5, 1999 (64 FR 24049). PBFs considered essential for the conservation of Coho salmon, Southern Oregon/Northern California ESU are shown in Table 46.

Critical habitat designated for the SONCC coho salmon is generally of good quality in northern coastal streams. Spawning PBF has been degraded throughout the ESU by logging activities that have increased fines in spawning gravel. Rearing PBF has been considerably degraded in many inland watersheds from the loss of riparian vegetation resulting in unsuitably high water temperatures. Rearing and juvenile migration PBFs have been reduced from the disconnection of floodplains and off-channel habitat in low gradient reaches of streams, consequently reducing winter rearing capacity.

Recovery Goals See the 2014 recovery plan for complete down listing/delisting criteria for this ESU (NMFS 2014a).

Table 69. Biological recovery objectives and criteria for SONCC coho salmon. All Biological criteria must be met in a recovered ESU. Taken from (NMFS 2014a).

VSP Parameter	Population Role	Biological Recovery Objective	Biological Recovery Criteria[1]
Abundance	Core	Achieve a low risk of extinction[2]	The geometric mean of wild adults over 12 years meets or exceeds the "low risk threshold" of spawners for each core population[2,3,4]
	Non-Core 1	Achieve a moderate or low risk of extinction[2]	The annual number of wild adults is greater than or equal to four spawners per IP-km for each non-core population[2]
Productivity	Core and Non-Core 1	Population growth rate is not negative	Slope of regression of the geometric mean of wild adults over the time series ≥ zero[4]
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed	Annual within-population juvenile distribution ≥ 80%[4] of habitat[5,6] (outside of a temperature mask[7])
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity	≥ 80% of accessible habitat[4] is occupied in years[8] following spawning of cohorts that experienced high marine survival[9]
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish	Proportion of hatchery-origin adults (pHOS) < 0.05
	Core and Non-Core 1	Achieve life-history diversity	Variation is present in migration timing, age structure, size and behavior. The variation in these parameters[10] is retained.

[1] All applicable criteria must be met for each population in order for the ESU to be viable.
[2] See Table 4-2 for specific spawner abundance requirements needed to meet this objective.
[3] In the Shasta River, Upper Trinity River, and Upper Rogue River populations, IP above some anthropogenic dams was excluded from the spawner target, so the low-risk threshold for these populations is based on the IP downstream of those dams.
[4] Assess for at least 12 years, striving for a coefficient of variation (CV) of 15% or less at the population level (Crawford and Rumsey 2011).
[5] Based on available rearing habitat within the watershed (Wainwright et al. 2008). For purposes of these biological recovery criteria, "available" means accessible. 80% of habitat occupied relates to a truth value of +1.0,(true: juveniles occupy a high proportion of the available rearing habitat within the watershed (p. 56, Wainwright et al. 2008).
[6] The average for each of the three year classes over the 12 year period used for delisting evaluation must each meet this criterion. Strive to detect a 15% change in distribution with 80% certainty (Crawford and Rumsey 2011).
[7] Williams et al. (2008) identified a threshold air temperature, above which juvenile coho salmon generally do not occur, and identified areas with air temperatures over this threshold. These areas are considered to be within the temperature mask.
[8] If young-of-year are sampled, sampling would occur the spring following spawning of the cohorts experiencing high marine survival. If 1+ juveniles are sampled, sampling would occur approximately 1.5 years after spawning of the cohorts experiencing high marine survival, but before outmigration to the estuary and ocean.
[9] High marine survival is defined as 10.2% for wild fish and 8% for hatchery fish; Sharr et al. 2000. If marine survival is not high, then this criterion does not apply.
[10] This variation is documented in the population profiles in Chapters 7 to 46 of this plan.

Table 70. Summary of status; Coho salmon, Southern Oregon/Northern California ESU

Criteria	Description
Abundance / productivity trends	Data on population abundance and trends are limited for this ESU. Trend data are variable throughout the ESU.
Listing status	Threatened

Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning PBFs are degraded by logging; Rearing and migration PBFs degraded by loss of riparian vegetation and loss of floodplain habitat; Elevated temperatures and environmental mixtures anticipated in freshwater habitats

8.17 Sockeye salmon, Ozette Lake ESU

Table 71. Sockeye salmon, Ozette Lake ESU; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus nerka	Sockeye salmon	Ozette Lake	Threatened	2016	70 FR 37160	2009	70 FR 52630

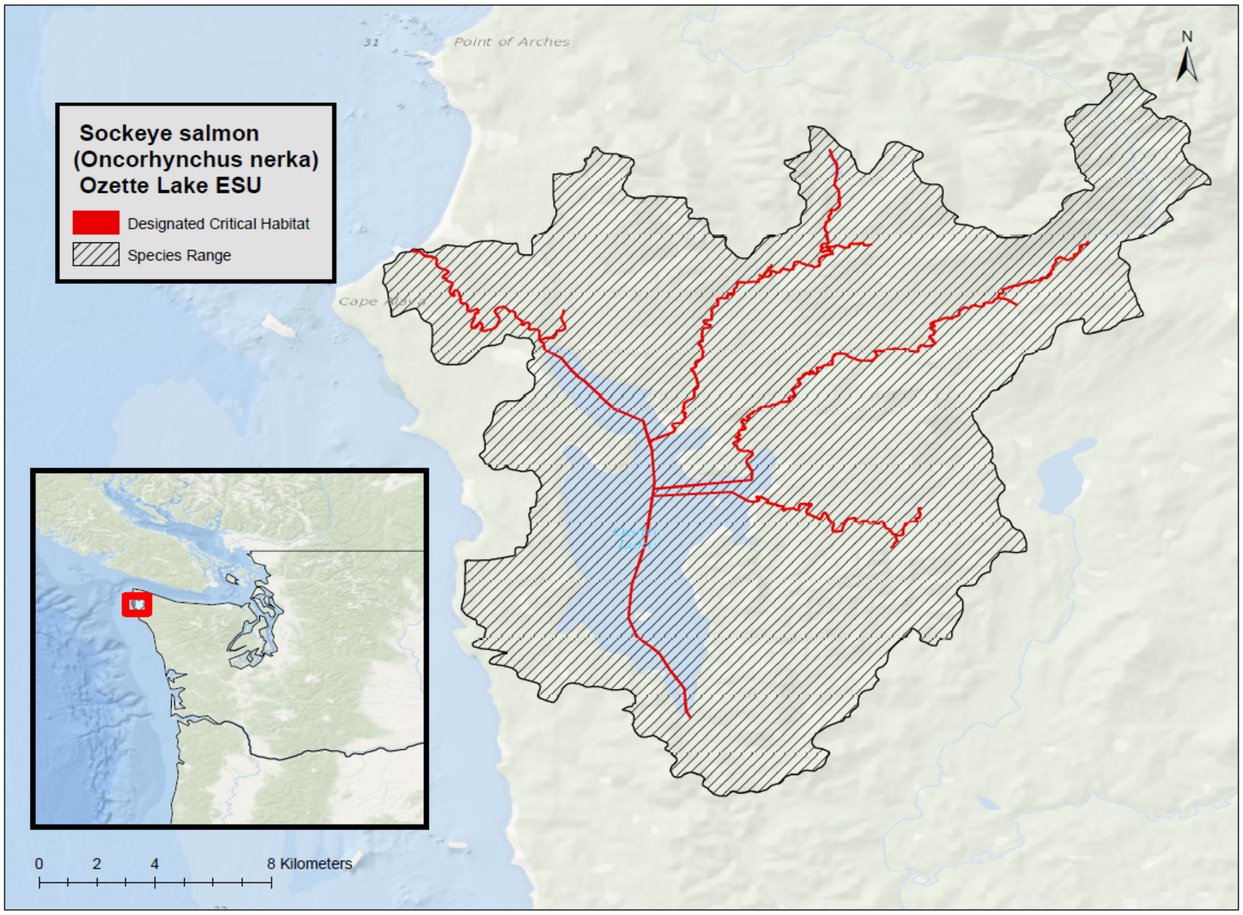

Figure 31. Sockeye salmon, Ozette Lake ESU range and designated critical habitat

Species Description The sockeye salmon is an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn), although some sockeye spend their entire lives (about five years) in freshwater. Adult sockeye salmon are about three feet long and eight pounds. Sockeyes are bluish black with silver sides when they are in the ocean, and they turn bright red with a green head when they are spawning. On March 25, 1999, NMFS listed the Ozette Lake sockeye salmon ESU as threatened (64 FR 14528) and reaffirmed the ESU's status as threatened on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned sockeye salmon originating from the Ozette River and Ozette Lake and its tributaries. Also, sockeye salmon from two artificial propagation programs.

Status NMFS listed the Ozette Lake sockeye salmon ESU because of habitat loss and degradation from the combined effects of logging, road building, predation, invasive plant species, and overharvest. Ozette Lake sockeye salmon have not been commercially harvested since 1982 and only minimally harvested by the Makah Tribe since 1982 (0 to 84 fish per year); there is no known marine fishing of this ESU. Overall abundance is substantially below historical levels, and whether the decrease in abundance is a result of fewer spawning aggregations, lower abundances in each aggregation, or a combination of both factors is unknown. Regardless, this ESU's viability has not improved, and the ESU would likely have a low resilience to additional perturbations. However, recovery potential for the Ozette Lake sockeye salmon ESU is good, particularly because of protections afforded it based on the lake's location within a national park (NMFS 2009d).

Life history Most sockeye salmon exhibit a lake-type life history (i.e., they spawn and rear in or near lakes), though some exhibit a river-type life history. Spawning generally occurs in late summer and fall, but timing can vary greatly among populations. In lakes, sockeye salmon commonly spawn along "beaches" where underground seepage provides fresh oxygenated water. Females spawn in three to five redds (nests) over a couple of days. Incubation period is a function of water temperature and generally lasts 100-200 days (Burgner 1991). Sockeye salmon spawn once, generally in late summer and fall, and then die (semelparity).

Sockeye salmon fry primarily rear in lakes; river-emerged and stream-emerged fry migrate into lakes to rear. In the early fry stage from spring to early summer, juveniles forage exclusively in the warmer littoral (i.e., shoreline) zone where they depend mostly on fly larvae and pupae, copepods, and water fleas. Sub-yearling sockeye salmon move from the littoral habitat to a pelagic (i.e., open water) existence where they feed on larger zooplankton; however, flies may still make up a substantial portion of their diet. From one to three years after emergence, juvenile sockeye salmon generally rear in lakes, though some river-spawned sockeye may migrate to sea in their first year. Juvenile sockeye salmon feeding behaviors change as they transition through life stages after emergence to the time of smoltification. Distribution in lakes and prey preference is a dynamic process that changes daily and yearly depending on many factors including water temperature, prey abundance, presence of predators and competitors, and size of the juvenile. Peak emigration to the ocean occurs in mid-April to early May in southern sockeye populations (lower than 52ºN latitude) and as late as early July in northern populations (62ºN latitude) (Burgner 1991). Adult sockeye salmon return to their natal lakes to spawn after spending one to four years at sea. The diet of adult salmon consists of amphipods, copepods, squid and other fish.

Table 72. Temporal distribution of Sockeye salmon, Ozette Lake ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td>Present</td><td></td><td></td><td colspan="9">Present</td></tr>
<tr><td>Spawning</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. The historical abundance of Ozette Lake sockeye salmon is poorly documented, but may have been as high as 50,000 individuals (Blum 1988). Kemmerich (Kemmerich 1945), reported a decline in the run size since the 1920s weir counts and Makah Fisheries Management (Makah Fisheries Management 2000) concluded a substantial decline in the Tribal catch of Ozette Lake sockeye salmon occurred at the beginning of the 1950s. Whether decrease in abundance compared to historic estimates is a result of fewer spawning aggregations, lower abundances at each aggregation, or both, is unknown (Good et al. 2005b).

The most recent (1996-2006) escapement estimates (run size minus broodstock take) range from a low of 1,404 in 1997 to a high of 6,461 in 2004, with a median of approximately 3,800 sockeye per year (geometric mean: 3,353) (Rawson et al. 2009). No statistical estimation of trends is reported. However, comparing four year averages (to include four brood years in the average since the species primarily spawn as four-year olds) shows an increase during the period 2000 to 2006: For return years 1996 to 1999 the run size averaged 2,460 sockeye salmon, for the years 2000 to 2003 the run size averaged just over 4,420 fish, and for the years 2004 to 2006, the three-year average abundance estimate was 4,167 sockeye (Data from appendix A in (Rawson et al. 2009)). It is estimated that between 35,500 and 121,000 spawners could be normally carried after full recovery (Hard et al. 1992).

Productivity / Population Growth Rate. The Ozette Lake sockeye salmon ESU is composed of one historical population (Currens et al. 2009) with multiple spawning aggregations and two populations from the Umbrella Creek and Big River sockeye hatchery programs. Historically, at least four lake beaches were used for spawning; today only two beach spawning locations, Allen's and Olsen's Beaches, are used. Additionally, spawning occurs in the two tributaries of the hatchery programs (NWFSC 2015b). The historical abundance of Ozette Lake sockeye salmon is poorly documented, but it may have been as high as 50,000 individuals (Blum 1988). Declines began to be reported in the 1920s. For the period from 1977 to 2011 the estimated annual number of natural spawners ranged from 699 to 5,313, well below the 31,250 – 121,000 viable population range proposed in the Lake Ozette sockeye recovery plan (Haggerty et al. 2009). The limited available data indicate that abundance of Lake Ozette sockeye did not change substantially from the 2011 status review (Ford 2011b) to the 2015 review (NWFSC 2015b). Productivity has fluctuated up and down over the last few decades, but overall appears to have remained stable (NWFSC 2015b). The proportion of beach spawners originating from the hatchery is unknown, but straying is likely low.

Genetic Diversity. For the Ozette Lake sockeye salmon ESU, the proportion of beach spawners is likely low; therefore, hatchery-originated fish are not likely to greatly affect the genetics of the naturally-spawned population. However, Ozette Lake sockeye have a relatively low genetic diversity compared to other sockeye salmon populations examined in Washington State (Crewson et al. 2001). Genetic differences do occur among age cohorts. However, because different age groups do not reproduce together, the population may be more vulnerable to significant reductions in population structure due to catastrophic events or unfavorable conditions affecting a single year class. Finally, actions identified in the Ozette Lake Sockeye Salmon Hatchery and Genetics Management Plan are being implemented, but the tributary hatchery reintroduction program will not reduce genetic diversity in the natural beach spawning aggregation because there is very little straying of hatchery-origin fish to beach spawning areas (NOAA 2016a).

Distribution. The Ozette Lake sockeye salmon ESU includes all naturally spawned aggregations of sockeye salmon in Lake Ozette and streams and tributaries flowing into Lake Ozette, Washington. The ESU also includes fish originating from two artificial propagation programs: the Umbrella Creek and Big River sockeye hatchery programs.

Designated Critical Habitat. NMFS designated critical habitat for Ozette Lake sockeye salmon on September 2, 2005 (70 FR 52630). It encompasses areas within the Hoh/Quillayute subbasin, Ozette Lake, and the Ozette Lake watershed. PBFs considered essential for the conservation of Sockeye salmon, Ozette Lake ESU are shown in Table 21.

Spawning habitat has been affected by loss of tributary spawning areas and exposure of much of the available beach spawning habitat due to low water levels in summer. Further, native and non-native vegetation as well as sediment have reduced the quantity and suitability of beaches for spawning. The rearing PBF is degraded by excessive predation and competition with introduced non-native species, and by loss of tributary rearing habitat. Migration habitat may be adversely affected by high water temperatures and low water flows in summer which causes a thermal block to migration (La Riviere 1991).

Recovery Goals Recovery goals, objectives and criteria for Ozette Lake sockeye salmon are fully outlined in the 2009 recovery plan (NMFS 2009c).

Table 73. Summary of proposed Lake Ozette sockeye viability criteria for naturally self-sustaining adults. Taken from (NMFS 2009c)

VSP Parameter	Proposed Criteria
Abundance Planning Range	31,250 – 121,000 spawners, over a number of years
Productivity	Population growth rate stable or increasing
Spatial Structure	Multiple spatially distinct and persistent spawning aggregations across the historical range of the population
Diversity	One or more persistent spawning aggregations from each major genetic and life history group historically present within the population

Table 74. Summary of status; Sockeye salmon, Ozette Lake ESU

Criteria	Description
Abundance / productivity trends	Stable productivity rates, but abundance only 1 percent of historical levels. Low genetic diversity and low resilience to future perturbations.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by excessive predation, invasive species, and loss of habitat; Spawning and migration PBFs are degraded by low water levels, loss of suitable spawning habitat, and low summer water flows; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; The entire watershed is of high conservation value

8.18 Sockeye salmon, Snake River ESU

Table 75. Sockeye salmon, Snake River ESU; overview table

Species	Common Name	ESU	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus nerka	Sockeye salmon	Snake River	Endangered	2016	70 FR 37160	2015	58 FR 68543

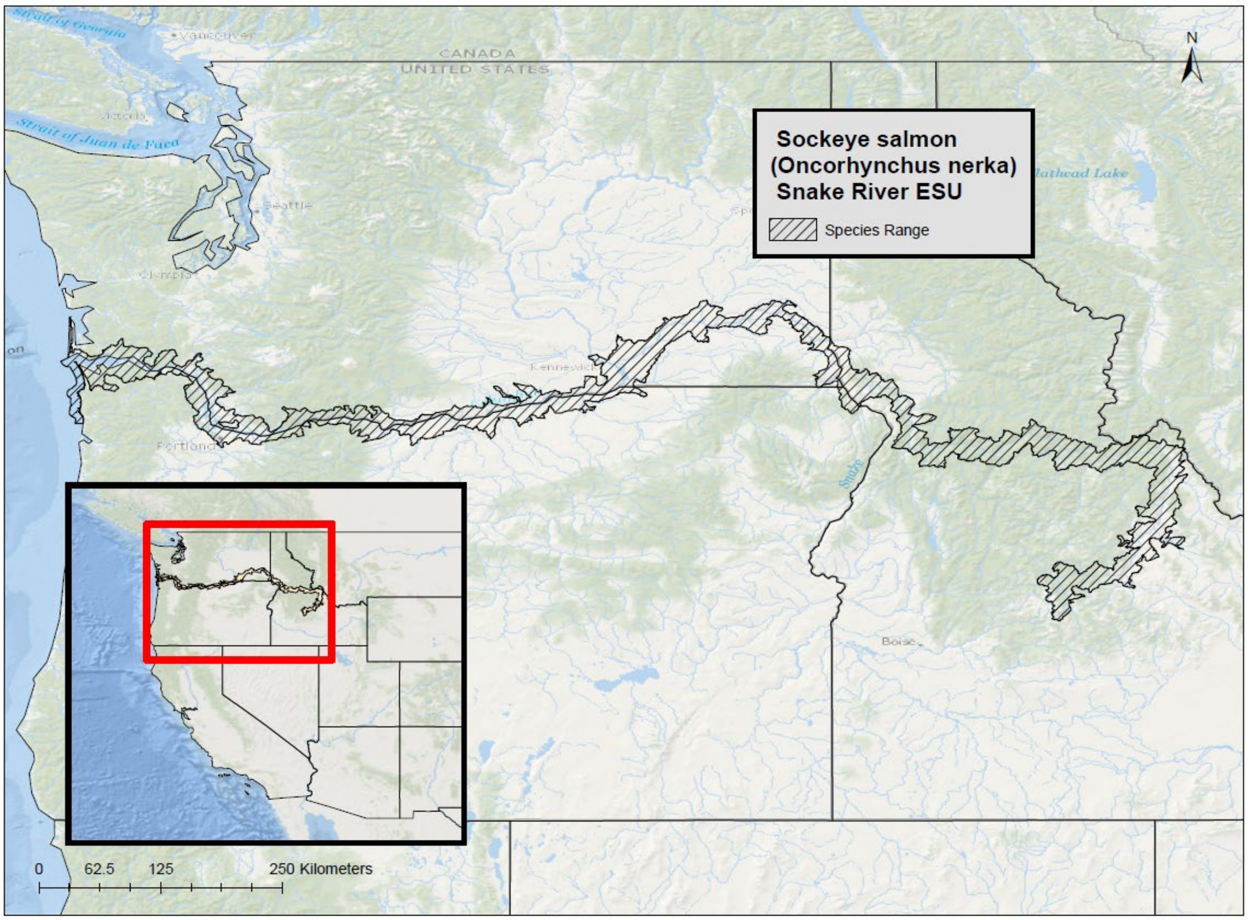

Figure 32. Sockeye salmon, Snake River ESU range and designated critical habitat

Species Description The sockeye salmon is an anadromous species (i.e., adults migrate from marine to freshwater streams and rivers to spawn), although some sockeye spend their entire lives (about five years) in freshwater. Adult sockeye salmon are about three feet long and eight pounds. Sockeyes are bluish black with silver sides when they are in the ocean, and they turn bright red with a green head when they are spawning. On November 20, 1991 NMFS listed the Ozette Lake sockeye salmon ESU as endangered (70 FR 37160) and reaffirmed the ESU's status as endangered on June 28, 2005 (70 FR 37160). This ESU includes naturally spawned anadromous and residual sockeye salmon originating from the Snake River basin, and also sockeye salmon from one artificial propagation program: Redfish Lake Captive Broodstock Program.

Status The Snake River sockeye salmon ESU includes only one population comprised of all anadromous and residual sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive propagation program. Historical evidence indicates that the Snake River sockeye once had a range of life history patterns, with spawning populations present in several of the small lakes in the Sawtooth Basin (NMFS 2011). NMFS listed the Snake River sockeye salmon ESU because of habitat loss and degradation from the combined effects of damming and hydropower development, overexploitation, fisheries management practices, and poor ocean conditions. Recent effects of climate change, such as reduced stream flows and increased water temperatures, are limiting Snake River ESU productivity (NMFS 2016j). Adults produced through the captive propagation program currently support the entire ESU. This ESU is still at extremely high risk across all four basic risk measures (abundance, productivity, spatial structure, and diversity) and would likely have a very low resilience to additional perturbations. Habitat improvement projects have slightly decreased the risk to the species, but habitat concerns and water temperature issues remain. Overall, although the status of the Snake River sockeye salmon ESU appears to be improving, there is no indication that the biological risk category has changed (NWFSC 2015b).

Life history Most sockeye salmon exhibit a lake-type life history (i.e., they spawn and rear in or near lakes), though some exhibit a river-type life history. Spawning generally occurs in late summer and fall, but timing can vary greatly among populations. In lakes, sockeye salmon commonly spawn along “beaches” where underground seepage provides fresh oxygenated water. Females spawn in three to five redds (nests) over a couple of days. Incubation period is a function of water temperature and generally lasts 100-200 days (Burgner 1991). Sockeye salmon spawn once, generally in late summer and fall, and then die (semelparity).

Sockeye salmon fry primarily rear in lakes; river-emerged and stream-emerged fry migrate into lakes to rear. In the early fry stage from spring to early summer, juveniles forage exclusively in the warmer littoral (i.e., shoreline) zone where they depend mostly on fly larvae and pupae, copepods, and water fleas. Sub-yearling sockeye salmon move from the littoral habitat to a pelagic (i.e., open water) existence where they feed on larger zooplankton; however, flies may still make up a substantial portion of their diet. From one to three years after emergence, juvenile sockeye salmon generally rear in lakes, though some river-spawned sockeye may migrate to sea in their first year. Juvenile sockeye salmon feeding behaviors change as they transition through life stages after emergence to the time of smoltification. Distribution in lakes and prey preference is a dynamic process that changes daily and yearly depending on many factors including water temperature, prey abundance, presence of predators and competitors, and size of the juvenile. Peak emigration to the ocean occurs in mid-April to early May in southern sockeye populations (lower than 52ºN latitude) and as late as early July in northern populations (62ºN latitude) (Burgner 1991). Adult sockeye salmon return to their natal lakes to spawn after spending one to four years at sea. The diet of adult salmon consists of amphipods, copepods, squid and other fish.

Table 76. Temporal distribution of Sockeye salmon, Snake River ESU

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="12">Present</td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td></tr>
<tr><td>Incubation (eggs)</td><td>Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">Present</td></tr>
<tr><td>Emergence (alevin to fry phases</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance / Productivity. For the Snake River ESU, the only extant population at the time of listing occurred in Redfish Lake. Adult returns to Redfish Lake during the period 1954 through 1966 ranged from 11 to 4,361 fish (Bjornn et al. 1968). In 1985, 1986, and 1987, 11, 29, and 16 sockeye, respectively, were counted at the Redfish Lake weir. Since 1987, only 18 natural-origin sockeye salmon have returned to the Stanley Basin. The first adult returns from the captive broodstock program returned to the Stanley Basin in 1999. From 1999 through 2005, 345 captive brood adults that had migrated to the ocean returned to the Stanley Basin, and returns increased to over 600 in 2008 and more than 700 returning adults in 2009. Annual adult releases during 2011-2014 averaged over 1,200; almost double the average for the prior five-year period (NWFSC 2015b). The large increases in returning adults in recent years reflect improved downstream and ocean survival as well as increases in juvenile production since the early 1990s. The captive brood program has been successful in providing substantial numbers of hatchery-produced sockeye for use in supplementation efforts. While increased abundance of hatchery-reared Snake River sockeye salmon has reduced the risk of loss, levels of naturally-produced sockeye salmon returns have remained extremely low (Ford 2011b; NWFSC 2015b). Substantial increases in survival rates across life history stages must occur to re-establish sustainable natural production (Hebdon et al. 2004; Keefer et al. 2008).

Genetic Diversity. For the Snake River ESU, the Sawtooth Hatchery is focusing on genetic conservation (NMFS 2016b). An overrepresentation of genes from the anadromous population in Redfish Lake exists, but inbreeding is low, which is a sign of a successful captive broodstock program (Kalinowski et al. 2012).

Distribution. The Snake River sockeye salmon ESU includes only one population comprised of all anadromous and residual sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive propagation program.

Designated Critical Habitat. NMFS designated critical habitat for Snake River sockeye salmon on December 28, 1993 (58 FR 68543). The critical habitat encompasses the waters, waterway bottoms, and adjacent riparian zones of specified lakes and river reaches in the Columbia River that are or were accessible to salmon of this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams). Specific PBFs are shown in Table 46.

Recovery Goals. See the 2015 recovery plan for the Snake River sockeye salmon ESU for complete down-listing/delisting criteria for recovery goals for the species (NMFS 2015). Broadly, recovery plan goals emphasize restoring historical lake populations and improving water quality and quantity in lakes and migration corridors.

Table 77. Summary of status; Sockeye salmon, Snake River ESU

Criteria	**Description**
Abundance / productivity trends	Only one population remaining in Redfish Lake and it is supported by hatchery propagation. Increasing abundance, but well below those needed for sustainable natural production. Low resilience to future perturbations.
Listing status	Endangered
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Rearing and migration PBFs are degraded by impaired water quality from adjacent land uses; Migration PBFs are degraded by multiple dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; All occupied and used areas of the watershed are of high conservation value

8.19 Steelhead, California Central Valley DPS

Table 78. Steelhead, California Central Valley DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	**Steelhead Trout**	**California Central Valley**	**Threatened**	2016	71 FR 834	2014	70 FR 52488

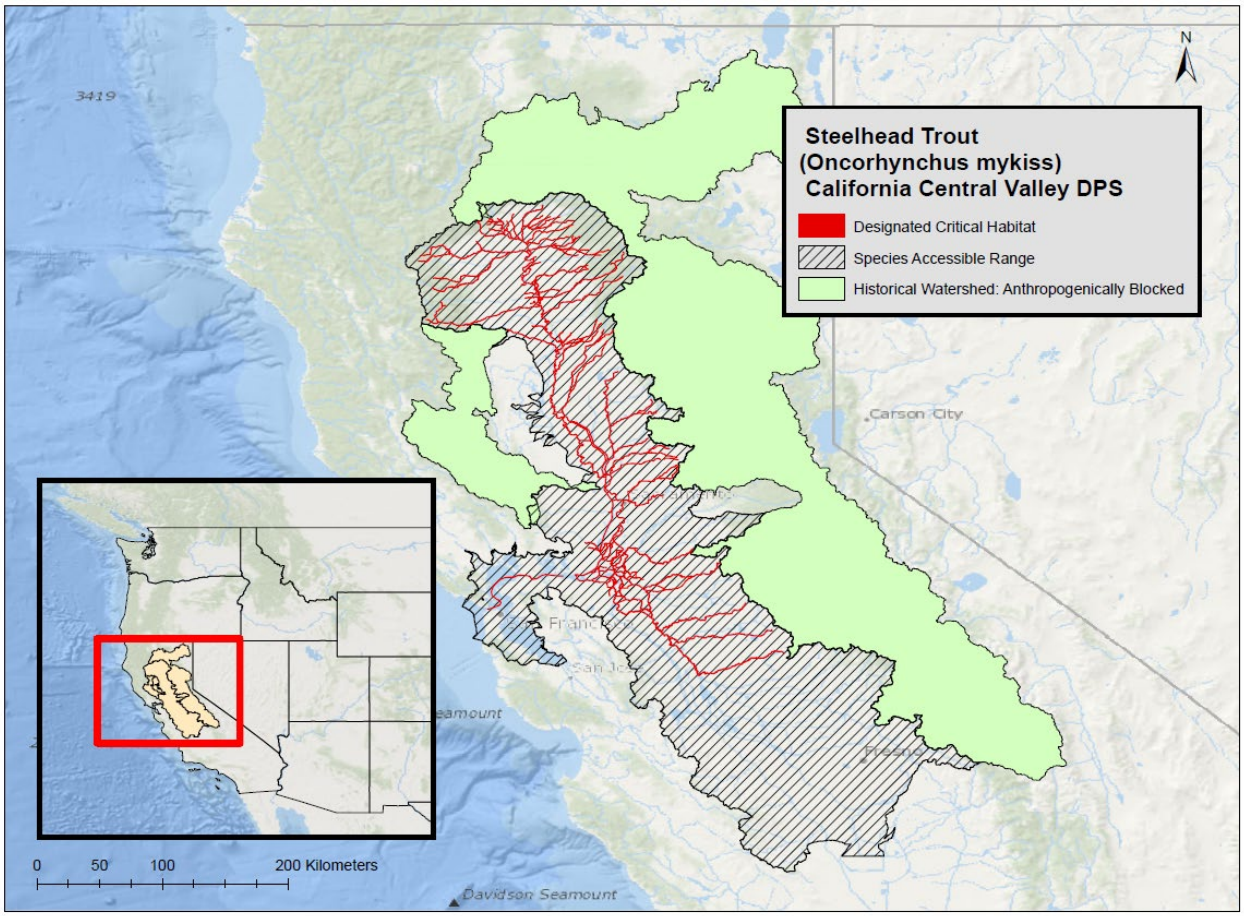

Figure 33. Steelhead, California Central Valley DPS range and designated critical habitat

Species Description. Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On March 19, 1998 NMFS listed the California Central Valley (CCV) DPS of steelhead as threatened (63 FR 13347) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Sacramento and San Joaquin Rivers and their tributaries; excludes such fish originating from San Francisco and San Pablo Bays and their tributaries. This DPS includes steelhead from two artificial propagation programs.

Status. Many watersheds in the Central Valley are experiencing decreased abundance of CCV steelhead. Dam removal and habitat restoration efforts in Clear Creek appear to be benefiting CCV steelhead as recent increases in non-clipped (wild) abundance have been observed. Despite the positive trend in Clear Creek, all other concerns raised in the previous status review remain, including low adult abundances, loss and degradation of a large percentage of the historic spawning and rearing habitat, and domination of smolt production by hatchery fish. Many other planned restoration and reintroduction efforts have yet to be implemented or completed, or are focused on Chinook salmon, and have yet to yield demonstrable improvements in habitat, let alone documented increases in naturally produced steelhead. There are indications that natural production of steelhead continues to decline and is now at a very low level. Their continued low numbers in most hatcheries, domination by hatchery fish, and relatively sparse monitoring makes the continued existence of naturally reproduced steelhead a concern. CCV steelhead is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Life history. Central Valley steelhead spawn downstream of dams on every major tributary within the Sacramento and San Joaquin River systems. The female steelhead selects a site with good intergravel flow, digs a redd with her tail, usually in the coarse gravel of the tail of a pool or in a riffle, and deposits eggs while an attendant male fertilizes them. The preferred water temperature range for steelhead spawning is reported to be 30°F to 52°F (Gallagher 2000). Following deposition of fertilized eggs in the redd, they are covered with loose gravel. The eggs hatch in three to four weeks at 50°F to 59°F, and fry emerge from the gravel four to six weeks later (Shapovalov and Taft 1954). Regardless of life history strategy, for the first year or two of life steelhead are found in cool, clear, fast flowing permanent streams and rivers where riffles predominate over pools, there is ample cover from riparian vegetation or undercut banks, and invertebrate life is diverse and abundant (Moyle 2002b). The smallest fish are most often found in riffles, intermediate size fish in runs, and larger fish in pools.

Steelhead typically migrate to marine waters after spending two years in fresh water. They reside in marine waters for typically two or three years prior to returning to their natal stream to spawn as four- or five-year olds. Unlike Pacific salmon, steelhead are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Moyle 2002b). Currently, Central Valley steelhead are considered "ocean-maturing" (also known as winter) steelhead, although summer steelhead may have been present prior to construction of large dams. Ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. Central Valley steelhead enter fresh water from August through April. They hold until flows are high enough in tributaries to enter for spawning (Moyle 2002b). Steelhead adults typically spawn from December through April, with peaks from January through March in small streams and tributaries where cool, well oxygenated water is available year-round (Hallock et al. 1961b; McEwan 2001).

Table 79. Temporal distribution of Steelhead, California Central Valley DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="5">Present</td><td></td><td colspan="6">Present</td></tr>
<tr><td>Spawning</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Incubation (eggs)</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Historic CCV steelhead run size may have approached one to two million adults annually (McEwan 2001). By the early 1960s, the steelhead run size had declined to about 40,000 adults (McEwan 2001). Over the past 30 years, the naturally spawned steelhead populations in the upper Sacramento River have declined substantially. Hallock *et al.* (1961a) estimated an average of 20,540 adult steelhead in the Sacramento River, upstream of the Feather River, through the 1960s. Steelhead were counted at the Red Bluff Diversion Dam (RBDD) up until 1993. Counts at the dam declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the early 1990s. An estimated total annual run size for the entire Sacramento-San Joaquin system was no more than 10,000 adults during the early 1990s (McEwan and Jackson 1996; McEwan 2001). Based on catch ratios at Chipps Island in the Delta and using some generous assumptions regarding survival, the average number of CCV steelhead females spawning naturally in the entire Central Valley during the years 1980 to 2000 **was estimated at about 3,600 (Good et al. 2005b)**

Productivity / Population Growth Rate. CCV steelhead lack annual monitoring data for calculating trends and lambda. However, the RBDD counts and redd counts up to 1993 and later sporadic data show that the DPS has had a significant long-term downward trend in abundance (NMFS 2009a).

Genetic Diversity / Distribution. The CCV steelhead distribution ranged over a wide variety of environmental conditions and likely contained biologically significant amounts of spatially structured genetic diversity (Lindley et al. 2006). Thus, the loss of populations and reduction in abundances have reduced the large diversity that existed within the DPS. The genetic diversity of the majority of CCV steelhead spawning runs is also compromised by hatchery-origin fish.

Designated Critical Habitat. NMFS designated critical habitat for CCV steelhead on September 2, 2005 (70 FR 52488). PBFs considered essential for the conservation of Steelhead, California Central Valley DPS are shown in Table 21.

Recovery Goals See the 2014 recovery plan for the California Central Valley steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species. The delisting criteria for this DPS are:

- One population in the Northwestern California Diversity Group at low risk of extinction
- Two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction
- Four populations in the Northern Sierra Diversity Group at low risk of extinction
- Two populations in the Southern Sierra Diversity Group at low risk of extinction
- Maintain multiple populations at moderate risk of extinction

The current condition of CCV steelhead critical habitat is degraded, and does not provide the conservation value necessary for species recovery. In addition, the Sacramento-San Joaquin River Delta, as part of CCV steelhead designated critical habitat, provides very little function necessary for juvenile CCV steelhead rearing and physiological transition to salt water.

The spawning PBF is subject to variations in flows and temperatures, particularly over the summer months. Some complex, productive habitats with floodplains remain in the system and flood bypasses (*i.e.*, Yolo and Sutter bypasses). However, the rearing PBF is degraded by the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system and which typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Stream channels commonly have elevated temperatures.

The current conditions of migration corridors are substantially degraded. Both migration and rearing PBFs are affected by dense urbanization and agriculture along the mainstems and in the Delta which contribute to reduced water quality by introducing several contaminants. In the Sacramento River, the migration corridor for both juveniles and adults is obstructed by the RBDD gates which are down from May 15 through September 15. The migration PBF is also obstructed by complex channel configuration making it more difficult for CCV steelhead to migrate successfully to the western Delta and the ocean. In addition, the state and federal government pumps and associated fish facilities change flows in the Delta which impede and obstruct a functioning migration corridor that enhances migration. The estuarine PBF, which is present in the Delta, is affected by contaminants from agricultural and urban runoff and release of wastewater treatment plants effluent.

Table 80. Summary of status; Steelhead, California Central Valley DPS

Criteria	Description
Abundance / productivity trends	Long-term trend of declining abundances and reduced genetic diversity. Populations supplemented by hatchery propagation.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Spawning PBFs are degraded by altered water flows and temperature; Rearing and migration PBFs are degraded by altered riverine habitat, dense urbanization and agriculture, poor water quality, and water diversions; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 67 occupied watersheds, 37 are of high and 18 are of medium conservation value

8.20 Steelhead, Central California Coast DPS

Table 81. Steelhead, Central California Coast DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Central California Coast	Threatened	2011	71 FR 834	2016	70 FR 52488

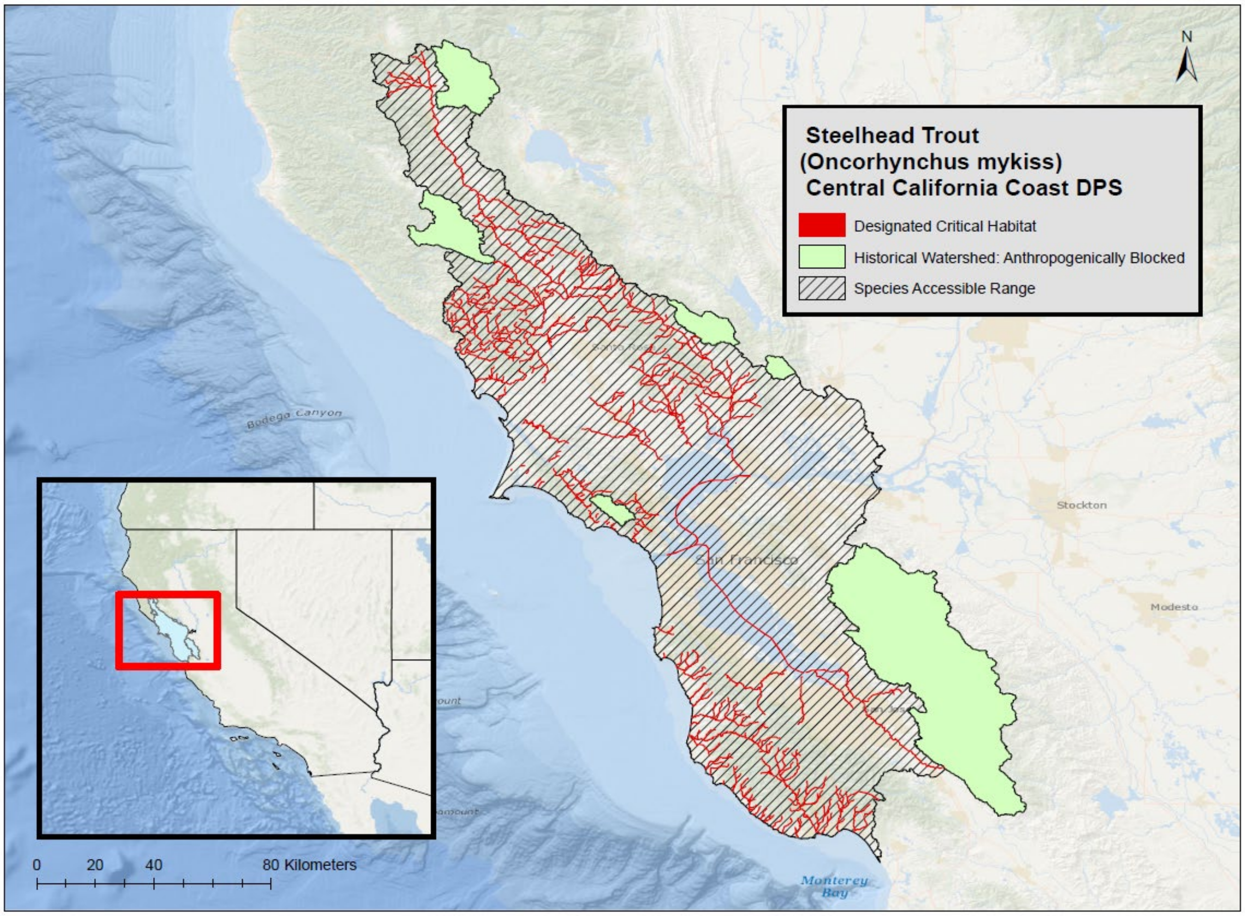

Figure 34. Steelhead, Central California Coast DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On August 18, 1997 NMFS listed the Central California Coast (CCC) DPS of steelhead as threatened (62 FR 43937) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes all naturally spawned populations of steelhead (and their progeny) in streams from the Russian River to Aptos Creek, Santa Cruz County, California (inclusive). It also includes the drainages of San Francisco and San Pablo Bays.

Status The CCC steelhead consisted of nine historic functionally independent populations and 23 potentially independent populations (Bjorkstedt et al. 2005). Of the historic functionally independent populations, at least two are extirpated while most of the remaining are nearly extirpated. Current runs in the basins that originally contained the two largest steelhead populations for CCC steelhead, the San Lorenzo and the Russian Rivers, both have been estimated at less than 15 percent of their abundances just 30 years earlier (Good et al. 2005b). The Russian River is of particular importance for preventing the extinction and contributing to the recovery of CCC steelhead (NOAA 2013). Steelhead access to significant portions of the upper Russian River has also been blocked (Busby et al. 1996; NMFS 2008).

Life history The DPS is entirely composed of winter-run fish, as are those DPSs to the south. Adults return to the Russian River and migrate upstream from December – April, and smolts emigrate between March – May) (Hayes et al. 2004; Shapovalov and Taft 1954a). Most spawning takes place from January through April. While age at smoltification typically ranges for one to four years, recent studies indicate that growth rates in Soquel Creek likely prevent juveniles from undergoing smoltification until age two (Sogard et al. 2009). Survival in fresh water reaches tends to be higher in summer and lower from winter through spring for year classes 0 and 1 (Sogard et al. 2009). Larger individuals also survive more readily than do smaller fish within year classes (Sogard et al. 2009). Greater movement of juveniles in fresh water has been observed in winter and spring versus summer and fall time periods. Smaller individuals are more likely to be observed to exceed 0.3 mm per day, and are highest in winter through spring, potentially due to higher water flow rates and greater food availability (Boughton et al. 2007; Sogard et al. 2009).

Table 82. Temporal distribution of Steelhead, Central California Coast DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
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<tr><td>Incubation (eggs)</td><td colspan="5">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Historically, the entire CCC steelhead DPS may have consisted of an average runs size of 94,000 adults in the early 1960s (Good et al. 2005b). Information on current CCC steelhead populations consists of anecdotal, sporadic surveys that are limited to only smaller portions of watersheds. Presence-absence data indicated that most (82 percent) sampled streams (a subset of all historical steelhead streams) had extant populations of juvenile *O. mykiss* (Adams 2000; Good et al. 2005b).

Productivity / Population Growth Rate. Though the information for individual populations is limited, available information strongly suggests that no population is viable. Long-term population sustainability is extremely low for the southern populations in the Santa Cruz mountains and in the San Francisco Bay (NMFS 2008). Declines in juvenile southern populations are consistent with the more general estimates of declining abundance in the region (Good et al. 2005b). The interior Russian River winter-run steelhead has the largest runs with an estimate of an average of over 1,000 spawners; it may be able to be sustained over the long-term but hatchery management has eroded the population's genetic diversity (Bjorkstedt et al. 2005; NMFS 2008). Data on abundance trends do not exist for the DPS as a whole or for individual watersheds. Thus, it is not possible to calculate long-term trends or lambda.

Genetic Diversity / Distribution. This DPS includes all naturally spawned populations of steelhead (and their progeny) in streams from the Russian River to Aptos Creek, Santa Cruz County, California (inclusive). It also includes the drainages of San Francisco and San Pablo Bays.

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). It includes the Russian River watershed, coastal watersheds in Marin County, streams within the San Francisco Bay, and coastal watersheds in the Santa Cruz Mountains down to Apos Creek. PBFs considered essential for the conservation of Steelhead, Central California Coast DPS are shown in Table 21.

Streams throughout the critical habitat have reduced quality of spawning PBFs; sediment fines in spawning gravel have reduced the ability of the substrate attribute to provide well oxygenated and clean water to eggs and alevins. High proportions of fines in bottom substrate also reduce forage by limiting the production of aquatic stream insects adapted to running water. Elevated water temperatures and impaired water quality have further reduced the quality, quantity and function of the rearing PBF within most streams. These impacts have diminished the ability of designated critical habitat to conserve the CCC steelhead.

Recovery Goals See the 2016 recovery plan for the Central California Coast steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species. Recovery plan objectives are to:

- Reduce the present or threatened destruction, modification, or curtailment of habitat or range;
- Ameliorate utilization for commercial, recreational, scientific, or educational purposes;
- Abate disease and predation;

- Establish the adequacy of existing regulatory mechanisms for protecting CCC steelhead now and into the future (i.e., post-delisting);
- Address other natural or manmade factors affecting the continued existence of CCC steelhead;
- Ensure CCC steelhead status is at a low risk of extinction based on abundance, growth rate, spatial structure and diversity.

Table 83. Summary of status; Steelhead, Central California Coast DPS

Criteria	**Description**
Abundance / productivity trends	5-year population trend uncertain. Population abundance supplemented by hatchery propagation. Populations are likely not viable, and have lost spatial structure.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Spawning and rearing PBFs are degraded by sedimentation and elevated temperature; All PBFs are degraded by loss of habitat, low summer flows, erosion, and contaminants; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 47 occupied watersheds, 19 are of high and 15 are of medium conservation value

8.21 Steelhead, Lower Columbia River DPS

Table 84. Steelhead, Lower Columbia River DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Lower Columbia River	Threatened	2016	71 FR 834	2013	70 FR 52630

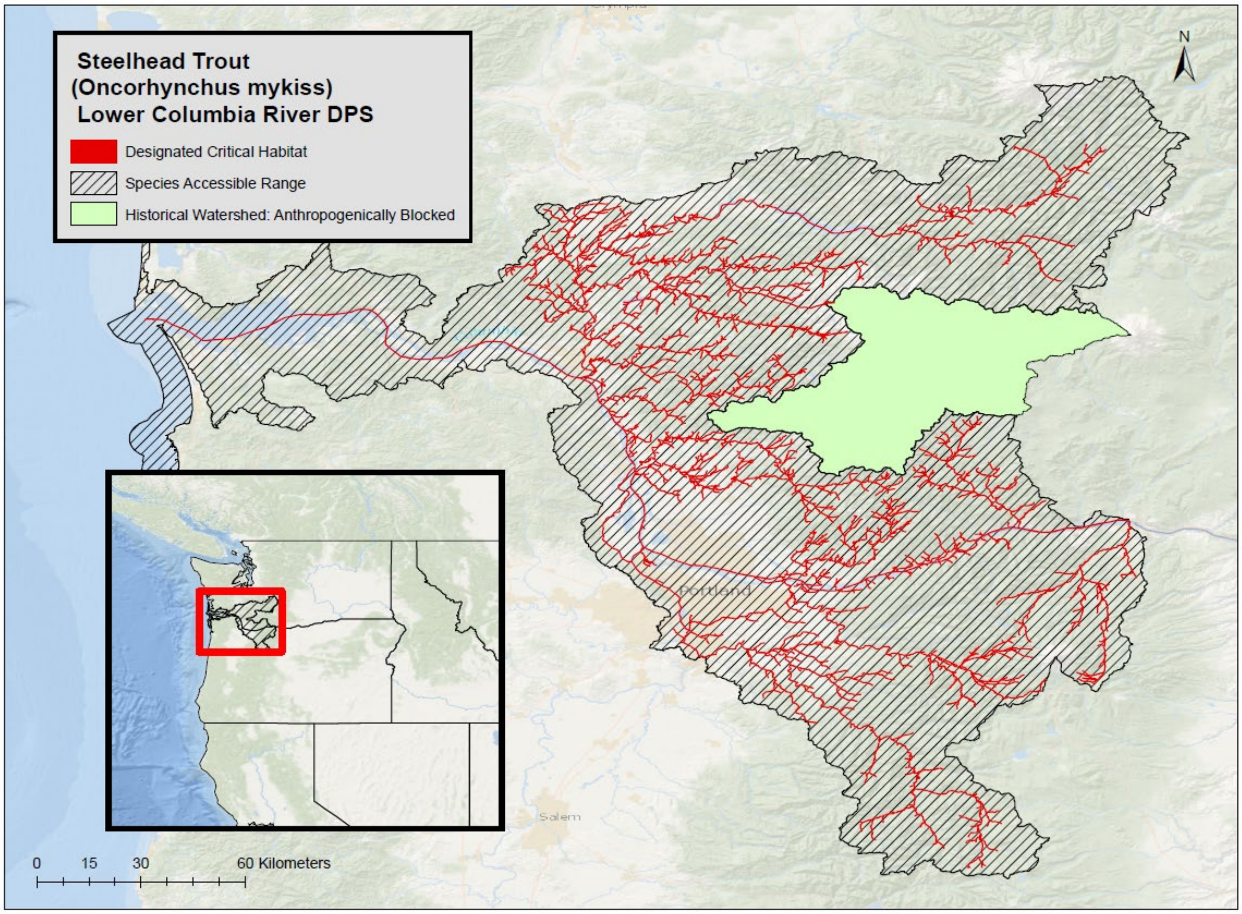

Figure 35. Steelhead, Lower Columbia River DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On March 19, 1998 NMFS listed the Lower Columbia River (LCR) DPS of steelhead as threatened (63 FR 13347) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous *O. mykiss* (steelhead) originating below natural and manmade impassable barriers from rivers between the Cowlitz and Wind Rivers (inclusive) and the Willamette and Hood Rivers (inclusive); excludes such fish originating from the upper Willamette River basin above Willamette Falls. This DPS includes steelhead from seven artificial propagation programs.

Status The LCR steelhead had 17 historically independent winter steelhead populations and 6 independent summer steelhead populations (McElhany et al. 2003; Myers et al. 2006). All historic LCR steelhead populations are considered extant. However, spatial structure within the historically independent populations, especially on the Washington side, has been substantially reduced by the loss of access to the upper portions of some basins due to tributary hydropower development. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances (NWFSC 2015b). Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead DIPs were similarly stable, but at low abundance levels. Habitat degradation continues to be a concern for most populations. Even with modest improvements in the status of several winter-run populations, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability. The DPS therefore continues to be at moderate risk (NWFSC 2015b).

Life history The LCR steelhead DPS includes both summer- and winter-run stocks. Summer-run steelhead return sexually immature to the Columbia River from May to November, and spend several months in fresh water prior to spawning. Winter-run steelhead enter fresh water from November to April, are close to sexual maturation during freshwater entry, and spawn shortly after arrival in their natal streams. Where both races spawn in the same stream, summer-run steelhead tend to spawn at higher elevations than the winter-run. The majority of juvenile LCR steelhead remain for two years in freshwater environments before ocean entry in spring. Both winter- and summer-run adults normally return after two years in the marine environment.

Table 85. Temporal distribution of Steelhead, Lower Columbia River DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
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<tr><td>Emergence (alevin to fry phases</td><td></td><td></td><td></td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. All LCR steelhead populations declined from 1980 to 2000, with sharp declines beginning in 1995. Historical counts in some of the larger tributaries (Cowlitz, Kalama, and Sandy Rivers) suggest the population probably exceeded 20,000 fish. During the 1990s, fish abundance dropped to 1,000 to 2,000 fish. Recent abundance estimates of natural-origin spawners range from completely extirpated for some populations above impassable barriers to over 700 fishes for the Kalama and Sandy winter-run populations. A number of the populations have a substantial fraction of hatchery-origin spawners in spawning areas. Many of the long-and short-term trends in abundance of individual populations are negative.

Productivity / Population Growth Rate. There is a difference in population stability between winter- and summer-run LCR steelhead. The winter-run steelhead in the Cascade region has the highest likelihood of being sustained as it includes a few populations with moderate abundance and positive short-term population growth rates (Good et al. 2005b; McElhany et al. 2007a). The Gorge summer-run steelhead is at the highest risk over the long-term as the Hood River population is at high risk of being lost (McElhany et al. 2007a)

Genetic Diversity / Distribution. This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from rivers between the Cowlitz and Wind Rivers (inclusive) and the Willamette and Hood Rivers (inclusive); excludes such fish originating from the upper Willamette River basin above Willamette Falls. This DPS includes steelhead from seven artificial propagation programs. The WLC TRT identified 23 historical independent populations of Lower Columbia River steelhead: 17 winter-run populations and six summer-run populations, within the Cascade and Gorge ecozones.

Designated Critical Habitat. Critical habitat was designated for the LCR steelhead on September 2, 2005 (70 FR 52488). PBFs considered essential for the conservation of Steelhead, Lower Columbia River DPS are shown in Table 21.

Critical habitat is affected by reduced quality of rearing and juvenile migration PBFs within the lower portion and alluvial valleys of many watersheds; contaminants from agriculture affect both water quality and food production in these reaches of tributaries and in the mainstem Columbia River. Several dams affect adult migration PBF by obstructing the migration corridor. Watersheds which consist of a large proportion of federal lands such as is the case with the Sandy River watershed, have relatively healthy riparian corridors that support attributes of the rearing PBF such as cover, forage, and suitable water quality.

Recovery Goals NMFS therefore has developed the following delisting criteria for the Lower Columbia River steelhead DPS. (NMFS has amended the WLC TRT's criteria to incorporate the concept that each stratum should have a probability of persistence consistent with its historical condition, thus allowing for resolution of questions regarding the Gorge strata):

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition. High probability of stratum persistence is defined as:

a. At least two populations in the stratum have at least a 95 percent probability of persistence over a 100-year time frame (i.e., two populations with a score of 3.0 or higher based on the TRT's scoring system).
b. Other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (i.e., the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system). (See Section 2.6 for a brief discussion of the TRT's scoring system.)
c. Populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
d. A probability of persistence consistent with historical condition refers to the concept that strata that historically were small or had complex population structures may not have met Criteria A through C, above, but could still be considered sufficiently viable if they provide a contribution to overall ESU viability similar to their historical contribution.

2. The threats criteria described in Section 3.2.2 of the recovery plan have been met.

Table 86. Summary of status; Steelhead, Lower Columbia River DPS

Criteria	Description
Abundance / productivity trends	5-year population trend stable. Populations have low genetic diversity and impacted by a loss of available habitat.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by agricultural runoff and lack of available prey; Spawning, rearing and migration PBFs are degraded by timber harvests, dams, and loss of floodplain habitat; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 41 occupied watersheds, 28 are of high and 11 are of medium conservation value

8.22 Steelhead, Middle Columbia River DPS

Table 87. Steelhead, Middle Columbia River DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Middle Columbia River	Threatened	2016	71 FR 834	2009	70 FR 52630

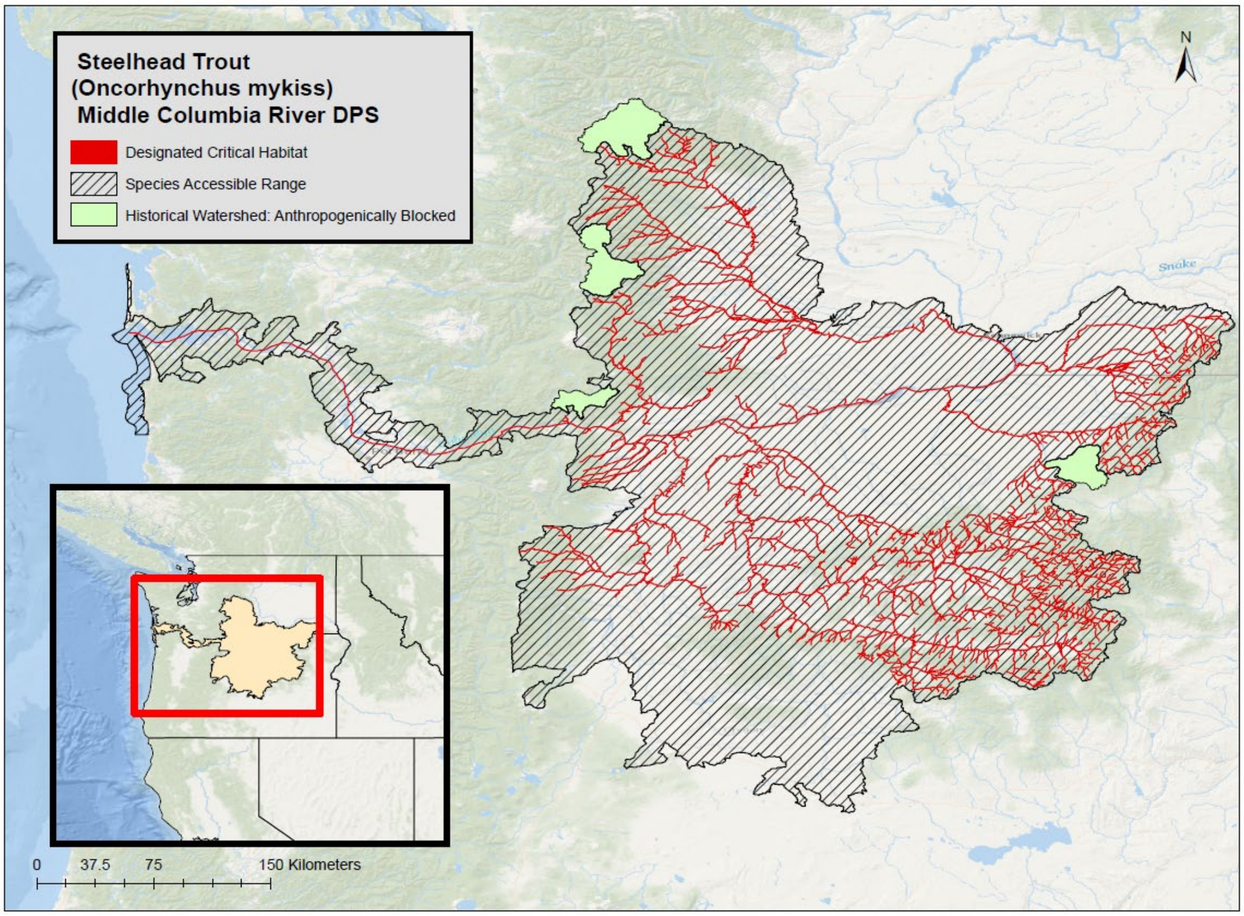

Figure 36. Steelhead, Middle Columbia River DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On March 25, 1999 NMFS listed the Middle Columbia River (MCR) DPS of steelhead as threatened (64 FR 14517) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River; excludes such fish originating from the Snake River basin. This DPS includes steelhead from seven artificial propagation programs.

Status The ICTRT identified 16 extant populations in four major population groups (Cascades Eastern Slopes Tributaries, John Day River, Walla Walla and Umatilla Rivers, and Yakima River) and one unaffiliated independent population (Rock Creek) (ICTRT 2003). There are two extinct populations in the Cascades Eastern Slope major population group: the White Salmon River and the Deschutes Crooked River above the Pelton/Round Butte Dam complex. Present population structure is delineated largely on geographical proximity, topography, distance, ecological similarities or differences. Using criteria for abundance and productivity, the ICTRT modeled a gaps analysis for each of the four MPGs in this DPS under three different ocean conditions and a base hydro condition (most recent 20-year survival rate). The results showed that none of the MPGs would be able to achieve a five percent or less risk of extinction over 100 years without recovery actions. It is important to consider that significant gaps in factors affecting spatial structure and diversity also contribute to the risk of extinction for these fish.

Life history MCR steelhead populations are mostly of the summer-run type. Adult steelhead enter fresh water from June through August. The only exceptions are populations of inland winter-run steelhead which occur in the Klickitat River and Fifteenmile Creek (Busby et al. 1996). The majority of juveniles smolt and outmigrate as two-year olds. Most of the rivers in this region produce about equal or higher numbers of adults having spent one year in the ocean as adults having spent two years. However, summer-run steelhead in Klickitat River have a life cycle more like LCR steelhead whereby the majority of returning adults have spent two years in the ocean (Busby et al. 1996). Adults may hold in the river up to a year before spawning.

Table 88. Temporal distribution of Steelhead, Middle Columbia River DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="12">Present</td></tr>
<tr><td>Spawning</td><td colspan="7">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td colspan="7">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td></td><td colspan="5">Present</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Historic run estimates for the Yakima River imply that annual species abundance may have exceeded 300,000 returning adults (Busby et al. 1996). The five-year average (geometric mean) return of natural MCR steelhead for 1997 to 2001 was up from previous years' basin estimates. Returns to the Yakima River, the Deschutes River, and sections of the John Day

River system were substantially higher compared to 1992 to 1997 (Good et al. 2005b). The five-year average for these basins is 298 and 1,492 fish, respectively (Good et al. 2005b).

Productivity / Population Growth Rate. Good *et al.* (2005b) calculated that the median estimate of long-term trend over 12 indicator data sets was –2.1 percent per year (–6.9 to 2.9), with 11 of the 12 being negative. Long-term annual population growth rates (λ) were also negative (Good et al. 2005b). The median long-term λ was 0.98, assuming that hatchery spawners do not contribute to production, and 0.97 assuming that both hatchery- and natural-origin spawners contribute equally.

Distribution. The MCR steelhead DPS includes all naturally spawned steelhead populations below natural and manmade impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding *O. mykiss* from the Snake River Basin. Steelhead from the Snake River basin (described later in this section) are excluded from this DPS. Seven artificial propagation programs are part of this DPS. They include: the Touchet River Endemic, Yakima River Kelt Reconditioning Program (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River, and the Deschutes River steelhead hatchery programs. These artificially propagated populations are considered no more divergent relative to the local natural populations than would be expected between closely related natural populations within the DPS. According to the ICBTRT (ICTRT 2003), this DPS is composed of 16 populations in four major population groups (Cascade Eastern Slopes Tributaries, John Day River, Walla Walla and Umatilla Rivers, and Yakima River), and one unaffiliated population (Rock Creek).

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). PBFs considered essential for the conservation of Steelhead, Middle Columbia River DPS are shown in Table 21.

The current condition of critical habitat designated for the MCR steelhead is moderately degraded. Critical habitat is affected by reduced quality of juvenile rearing and migration PBFs within many watersheds; contaminants from agriculture affect both water quality and food production in several watersheds and in the mainstem Columbia River. Loss of riparian vegetation to grazing has resulted in high water temperatures in the John Day basin. Reduced quality of the rearing PBFs has diminished its contribution to the conservation value necessary for the recovery of the species. Several dams affect adult migration PBF by obstructing the migration corridor.

Recovery Goals See the 2016 recovery plan for the Middle Columbia River steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species (NMFS 2016).

Table 89. Summary of status; Steelhead, Middle Columbia River DPS

Criteria	**Description**
Abundance / productivity trends	5-year population trend stable to improving, but abundances still low compared to historical numbers.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by water quality, reduced invertebrate prey, and loss of riparian vegetation; Migration PBFs are degraded by several dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 106 assessed watersheds, 73 are of high and 24 are of medium conservation value

8.23 Steelhead, Northern California DPS

Table 90. Steelhead, Northern California DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Northern California	Threatened	2016	71 FR 834	2016	70 FR 52488

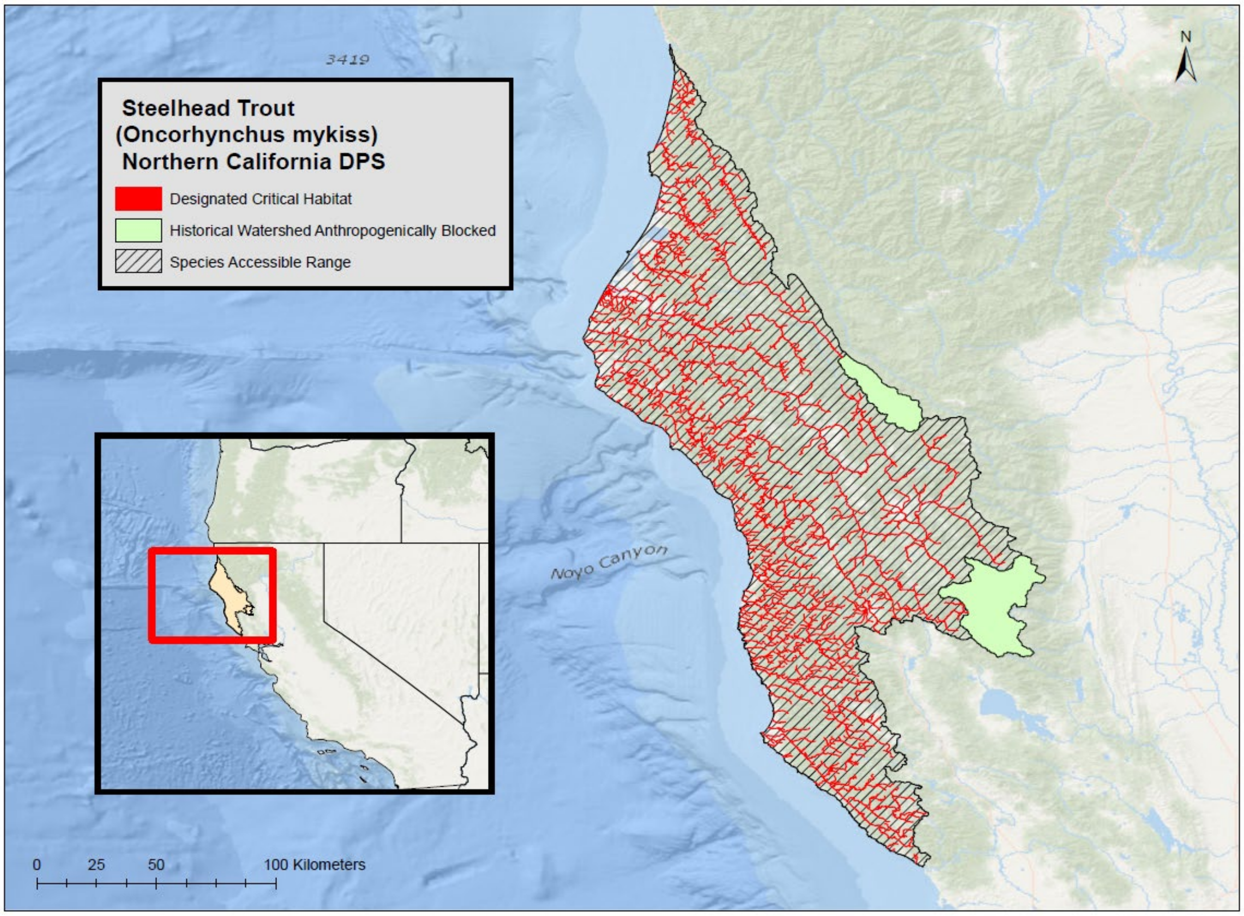

Figure 37. Steelhead, Northern California DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On June 7, 2000 NMFS listed the Northern California (NC) DPS of steelhead as threatened (65 FR 36074) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers in California coastal river basins from Redwood Creek to and including the Gualala River.

Status The available data for winter-run populations— predominantly in the North Coastal, North-Central Coastal, and Central Coastal strata— indicate that all populations are well below viability targets, most being between 5 percent and 13 percent of these goals. For the two Mendocino Coast populations with the longest time series, Pudding Creek and Noyo River, the 13-year trends have been negative and neutral, respectively (Williams et al. 2016). However, the short-term (6-year) trend has been generally positive for all independent populations in the North-Central Coastal and Central Coastal strata, including the Noyo River and Pudding Creek. Data from Van Arsdale Station likewise suggests that, although the long-term trend has been negative, run sizes of natural-origin steelhead have stabilized or are increasing. Thus, we have no strong evidence to indicate conditions for winter-run populations in the DPS have worsened appreciably since the last status review (Williams et al. 2016). Summer-run populations continue to be of significant concern because of how few populations currently exist. The Middle Fork Eel River population has remained remarkably stable for nearly five decades and is closer to its viability target than any other population in the DPS. Although the time series is short, the Van Duzen River appears to be supporting a population numbering in the low hundreds. However, the Redwood Creek and Mattole River populations appear small, and little is known about other populations including the Mad River and other tributaries of the Eel River (i.e., Larabee Creek, North Fork Eel, and South Fork Eel). Most populations for which there are population estimates available remain well below viability targets; however, the short-term increases observed for many populations, despite the occurrence of a prolonged drought in northern California, suggests this DPS is not at immediate risk of extinction.

Life history This DPS includes both winter- and summer –run steelhead. In the Mad and Eel Rivers, immature steelhead may return to fresh water as “half-pounders” after spending only two to four months in the ocean. Generally, a half-pounder will overwinter in fresh water and return to the ocean in the following spring.

Juvenile out-migration appears more closely associated with size than age but generally, throughout their range in California, juveniles spend two years in fresh water (Busby et al. 1996). Smolts range from 14-21 cm in length. Juvenile steelhead may migrate to rear in lagoons throughout the year with a peak in the late spring/early summer and in the late fall/early winter period (Shapovalov and Taft 1954a; Zedonis 1992).

Steelhead spend anywhere from one to five years in salt water, however, two to three years are most common (Busby et al. 1996). Ocean distribution is not well known but coded wire tag recoveries indicate that most NC steelhead migrate north and south along the continental shelf (Barnhart 1986).

Table 91. Temporal distribution of Steelhead, Northern California DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Present</td></tr>
<tr><td>Spawning</td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Present</td></tr>
<tr><td>Incubation (eggs)</td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases</td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Northern California steelhead historic functionally independent populations and their abundances and hatchery contributions are provided in Table 92.

Table 92. Northern California DPS steelhead historic and recent spawner abundance

Population	Historical Abundance	Recent Spawner Abundance	Hatchery Abundance Contributions
Mad River (S)	6,000	162-384	2%
MF Eel River (S)	Unknown	384-1,246	0%
NF Eel River (S)	Unknown	Extirpated	N/A
Mattole River (S)	Unknown	9-30*	Unknown
Redwood Creek (S)	Unknown	6*	Unknown
Van Duzen (W)	10,000	Unknown	Unknown
Mad River (W)	6,000	Unknown	Unknown
SF Eel River (W)	34,000	2743-20,657	Unknown
Mattole River (W)	12,000	Unknown	Unknown
Redwood Creek (W)	10,000	Unknown	Unknown
Humboldt Bay (W)	3,000	Unknown	Unknown
Freshwater Creek (W)		25-32	
Ten Mile River (W)	9,000	Unknown	Unknown
Noyo River (W)	8,000	186-364*	Unknown
Big River (W)	12,000	Unknown	Unknown
Navarro River (W)	16,000	Unknown	Unknown
Garcia River (W)	4,000	Unknown	Unknown
Gualala River (W)	16,000	Unknown	Unknown
Total	198,000	Unknown	

**From Spence et al. (2008). Redwood Creek abundance is the mean count over four generations. Mattole River abundances from surveys conducted between 1996 and 2005. Noyo River abundances from surveys conducted since 2000.*

Population	Historical Abundance	Recent Spawner Abundance	Hatchery Abundance Contributions
Summer –run steelhead is noted with a (S) and winter-run steelhead with a (W)			

Productivity / Population Growth Rate Good *et al.* (2005b) estimated lambda at 0.98 with a 95% confidence interval of 0.93 and 1.04. The result is an overall downward trend in both the long- and short- term. Juvenile data were also recently examined. Both upward and downward trends were apparent (Good et al. 2005b).

Reduction of summer-run steelhead populations has significantly reduced current DPS diversity compared to historic conditions. Of the 10 summer-run steelhead populations, only four are extant. Of these, only the Middle Fork Eel River population is at moderate risk of extinction, the remaining three are at high risk (Spence et al. 2008a). Hatchery influence has likely been limited.

Genetic Diversity / Distribution: Artificial propagation was identified as negatively affecting wild stocks of salmonids through interactions with non-native fish, introductions of disease, genetic changes, competition for space and food resources, straying and mating with native populations, loss of local genetic adaptations, mortality associated with capture for broodstock and palliating the destruction of habitat and concealing problems facing wild stocks.

Designated Critical Habitat NMFS designated critical habitat for NC steelhead on September 2, 2005 (70 FR 52488). PBFs considered essential for the conservation of Steelhead, Northern California DPS are shown in Table 21.

The current condition of critical habitat designated for the NC steelhead is moderately degraded. Nevertheless, it does provide some conservation value necessary for species recovery. Within portions of its range, especially the interior Eel River, rearing PBF quality is affected by elevated temperatures by removal of riparian vegetation. Spawning PBF attributes such as the quality of substrate supporting spawning, incubation, and larval development have been generally degraded throughout designated critical habitat by silt and sediment fines in the spawning gravel. Bridges and culverts further restrict access to tributaries in many watersheds, especially in watersheds with forest road construction, thereby reducing the function of adult migration PBF.

Recovery Goals See the 2016 recovery plan for the Northern California steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species (NMFS 2016b).

Table 93. Summary of status; Steelhead, Northern California DPS

Criteria	Description

Abundance / productivity trends	5-year population trend stable to improving, but abundances still low compared to historical numbers.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by loss of riparian vegetation and elevated temperature; Spawning PBFs are degraded by lack of quality substrate and sedimentation; Migration PBFs are degraded by bridges, culverts, and forest road construction; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 50 assessed watersheds, 27 are of high and 14 are of medium conservation value

8.24 Steelhead, Puget Sound DPS

Table 94. Steelhead, Puget Sound DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Puget Sound	Threatened	2011	72 FR 26722	2019	81 FR 9251

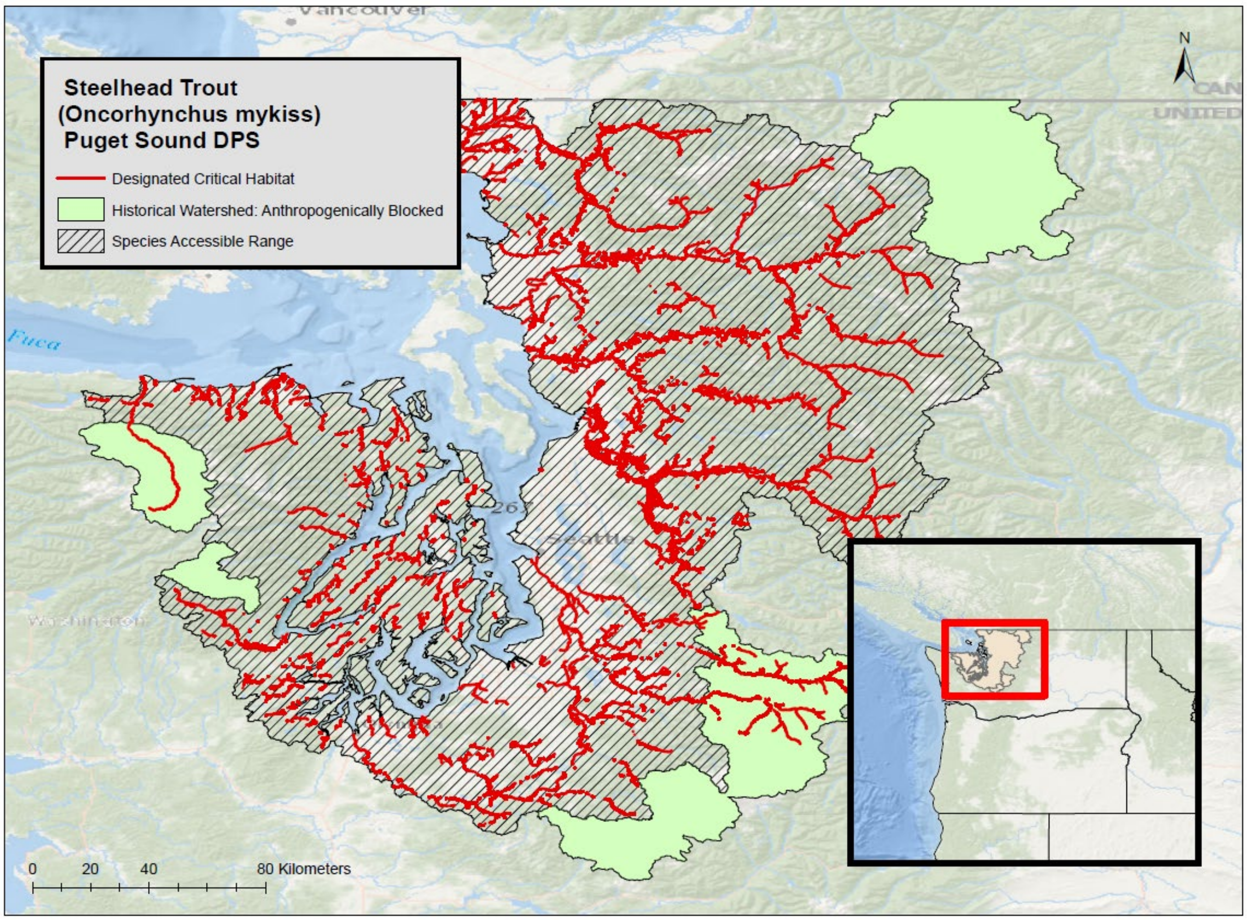

Figure 38. Steelhead, Puget Sound DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On May 11, 2007 NMFS listed the Puget Sound (PS) DPS of steelhead as threatened (72 FR 26722). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Also, steelhead from six artificial propagation programs.

Status For all but a few putative demographically independent populations of steelhead in Puget Sound, estimates of mean population growth rates obtained from observed spawner or redd counts are declining—typically 3 to 10 percent annually. Extinction risk within 100 years for most populations in the DPS is estimated to be moderate to high, especially for draft populations in the putative South Sound and Olympic major population groups. Collectively, these analyses indicate that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future, but are not currently in danger of imminent extinction. The Biological Review Team identified degradation and fragmentation of freshwater habitat, with consequent effects on connectivity, as the primary limiting factors and threats facing the PS steelhead DPS. In the three years since listing, the status of threats has not changed appreciably. The status of the listed PS steelhead DPS has not changed substantially since the 2007 listing. Most populations within the DPS are showing continued downward trends in estimated abundance, a few sharply so. The limited available information indicates that this DPS remains at a moderate risk of extinction.

Life history The Puget Sound steelhead DPS contains both winter-run and summer-run steelhead. Adult winter-run steelhead generally return to Puget Sound tributaries from December to April (NMFS 2005b). Spawning occurs from January to mid-June, with peak spawning occurring from mid-April through May. Prior to spawning, maturing adults hold in pools or in side channels to avoid high winter flows. Less information exists for summer-run steelhead as their smaller run size and higher altitude headwater holding areas have not been conducive for monitoring. Based on information from four streams, adult run time occur from mid-April to October with a higher concentration from July through September (NMFS 2005b).

The majority of juveniles reside in the river system for two years with a minority migrating to the ocean as one or three-year olds. Smoltification and seaward migration occur from April to mid-May. The ocean growth period for Puget Sound steelhead ranges from one to three years in the ocean (Busby et al. 1996). Juveniles or adults may spend considerable time in the protected marine environment of the fjord-like Puget Sound during migration to the high seas.

Table 95. Temporal distribution of Steelhead, Puget Sound DPS

Life History phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Entering Fresh Water (adults/jacks)	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Spawning		Present	Present	Present	Present	Present	Present					
Incubation (eggs)		Present	Present	Present	Present	Present	Present	Present				
Emergence (alevin to fry phases)				Present	Present	Present	Present	Present	Present			
Rearing and migration (juveniles)	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present

Population Dynamics

Abundance. In the 1996 and 2005 status reviews, the Skagit and Snohomish Rivers (North Puget Sound) winter-run steelhead were found to produce the largest escapements ((Busby et al. 1996), (NMFS 2005b)). The two rivers still produce the largest wild escapement with a recent (2005 to 2008) four-year geometric mean of 5,468 for the Skagit River and an average 2,944 steelhead in Snohomish River for the two years 2005 and 2006 (Washington Department of Fish and Wildlife (WDFW) 2009). Lake Washington has the lowest abundances of winter-run steelhead with an escapement of less than 50 fish in each year from 2000 through 2004 (Washington Department of Fish and Wildlife (WDFW) 2008). The stock is now virtually extirpated with only eight and four returning fish in 2007 and 2008, respectively (Washington Department of Fish and Wildlife (WDFW) 2009). No abundance estimates exist for most of the summer-run populations; all appear to be small, most averaging less than 200 spawners annually.

Productivity / Population Growth Rate. Long-term trends (1980 to 2004) for the Puget Sound steelhead natural escapement have declined significantly for most populations, especially in southern Puget Sound, and in some populations in northern Puget Sound (Stillaguamish winter-run), Canal (Skokomish winter-run), and along the Strait of Juan de Fuca (Dungeness winter-run) (NMFS 2005b). Positive trends were observed in the Samish winter-run (northern Puget Sound) and the Hamma Hamma winter-run (Hood Canal) populations. The increasing trend on the Hamma Hamma River may be due to a captive rearing program rather than to natural escapement (NMFS 2005b).

The negative trends in escapement of naturally produced fish resulted from peaks in natural escapement in the early 1980s. Still, the period 1995 through 2004 (short-term) showed strong negative trends for several populations. This is especially evident in southern Puget Sound (Green, Lake Washington, Nisqually, and Puyallup winter-run), Hood Canal (Skokomish winter-run), and the Strait of Juan de Fuca (Dungeness winter-run) (NMFS 2005b). As with the long-term trends, positive trends were evident in short-term natural escapement for the Samish and Hamma Hamma winter-run populations, and also in the Snohomish winter-run populations.

Median population growth rates (λ) using 4-year running sums is less than 1, indicating declining population growth, for nearly all populations in the DPS (NMFS 2005b). However, some of the populations with declining recent population growth show only slight declines, (*e.g.*, Samish and Skagit winter-run in northern Puget Sound, and Quilcene and Tahuya winter-run in Hood Canal).

Genetic Diversity. Only two hatchery stocks genetically represent native local populations (Hamma Hamma and Green River natural winter-run). The remaining programs, which account for the vast preponderance of production, are either out-of-DPS derived stocks or were within-DPS stocks that have diverged substantially from local populations. The WDFW estimated that

31 of the 53 stocks were of native origin and predominantly natural production (Washington Department of Fish and Wildlife (WDFW) 1993).

Distribution NMFS listed Puget Sound steelhead as threatened on May 11, 2007 (72 FR 26722). Fifty-three populations of steelhead have been identified in this DPS, of which 37 are winter-run. Summer-run populations are distributed throughout the DPS but are concentrated in northern Puget Sound and Hood Canal; only the Elwha River and Canyon Creek support summer-run steelhead in the rest of the DPS. The Elwha River run, however, is descended from the introduced Skamania Hatchery summer-run steelhead. Historical summer-run steelhead in the Green River and Elwha River were likely extirpated in the early 1900s.

Designated Critical Habitat. NMFS designated critical habitat for Puget Sound steelhead on February 2, 2016 (81 FR 9251). PBFs considered essential for the conservation of Steelhead, Puget Sound DPS are shown in Table 21.

Recovery Goals. See the 2019 Puget Sound Steelhead DPS recovery plan for recovery goals as well as the delisting criteria for this species (NMFS 2019).

Table 96. Summary of status; Steelhead, Puget Sound DPS

Criteria	**Description**
Abundance / productivity trends	5-year population trend stable, but populations have reduced genetic diversity.
Listing status	Threatened
Attainment of recovery goals	Criteria not yet met
Condition of PBFs	Rearing, migration and spawning PBFs are degraded by forestry, agriculture, urbanization, loss of floodplain habitat, and poor water quality; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Most watersheds are of high or medium conservation value

8.25 Steelhead, Snake River Basin

Table 97. Steelhead, Snake River Basin DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Snake River Basin	Threatened	2016	71 FR 834	2017	70 FR 52630

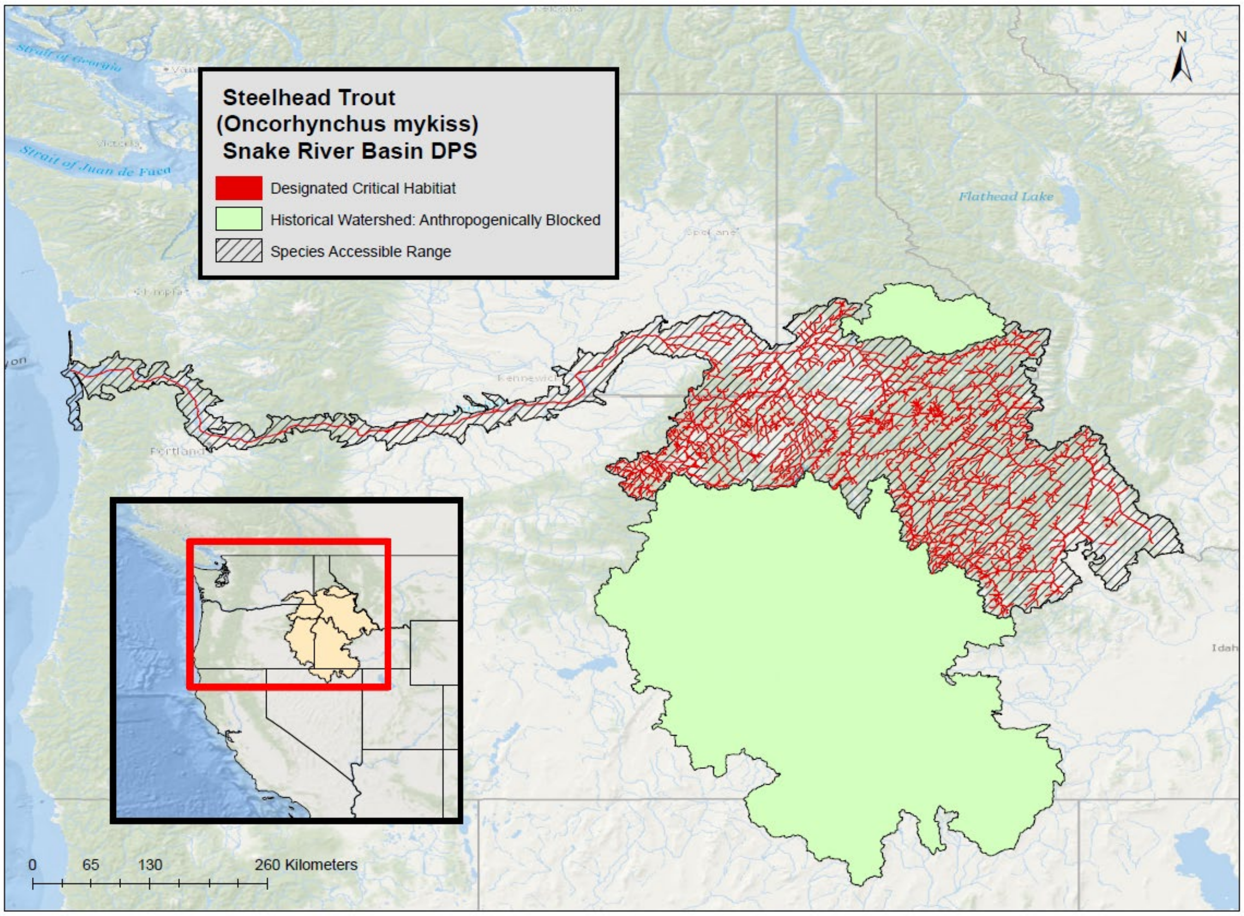

Figure 39. Steelhead, Snake River Basin DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On August 18, 1997 NMFS listed the Snake River Basin DPS of steelhead as threatened (62 FR 43937) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Snake River basin, and also steelhead from six artificial propagation programs.

Status Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan being written by NMFS based on the updated status information available for this review, and the status of many individual populations remains uncertain (NWFSC 2015b). The Grande Ronde MPG is tentatively rated as viable; more specific data on spawning abundance and the relative contribution of hatchery spawners for the Lower Grande Ronde and Wallowa populations would improve future assessments. A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.

Life history SR basin steelhead are generally classified as summer-run fish. They enter the Columbia River from late June to October. After remaining in the river through the winter, SR basin steelhead spawn the following spring (March to May). Managers recognize two life history patterns within this DPS primarily based on ocean age and adult size upon return: A-run or B-run. A-run steelhead are typically smaller, have a shorter freshwater and ocean residence (generally one year in the ocean), and begin their up-river migration earlier in the year. B-run steelhead are larger, spend more time in fresh water and the ocean (generally two years in ocean), and appear to start their upstream migration later in the year. SR basin steelhead usually smolt after two or three years.

Table 98. Temporal distribution of Steelhead, Snake River Basin DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td></td><td></td><td></td><td></td><td colspan="6">Present</td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance / Productivity. There is uncertainty for wild populations given limited data for adult spawners in individual populations. Regarding population growth rate, there are mixed long- and short-term trends in abundance and productivity. Overall, the abundances remain well below interim recovery criteria.

Genetic Diversity. Genetic diversity is affected by the displacement of natural fish by hatchery fish (declining proportion of natural-origin spawners)

Distribution. The ICTRT (ICTRT 2003) identified 23 populations. SR basin steelhead remain spatially well distributed in each of the six major geographic areas in the Snake River basin (Good et al. 2005b). The SR basin steelhead B- run populations remain particularly depressed.

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). PBFs considered essential for the conservation of Steelhead, Snake River Basin DPS are shown in Table 21.

The current condition of critical habitat designated for SR basin steelhead is moderately degraded. Critical habitat is affected by reduced quality of juvenile rearing and migration PBFs within many watersheds; contaminants from agriculture affect both water quality and food production in several watersheds and in the mainstem Columbia River. Loss of riparian vegetation to grazing has resulted in high water temperatures in the John Day basin. These factors have substantially reduced the rearing PBFs contribution to the conservation value necessary for species recovery. Several dams affect adult migration PBF by obstructing the migration corridor.

Recovery Goals See the 2017 ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon and Snake River Basin Steelhead for recovery goals as well as the delisting criteria for this species (NMFS 2017).

Table 99. Summary of status; Steelhead, Snake River Basin DPS

Criteria	Description
Abundance / productivity trends	5-year population trend stable to improving, but still in moderate danger of extinction. Overall abundances are still below thresholds necessary for recovery.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by agricultural runoff, reduced invertebrate prey, loss of riparian vegetation, and elevated temperature; Migration PBFs are degraded by several dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of assessed watersheds, 229 are of high and 41 are of medium conservation value

8.26 Steelhead, South-Central California Coast DPS

Table 100. Steelhead, South-Central California Coast DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	South-Central California Coast	Threatened	2016	71 FR 834	2013	70 FR 52488

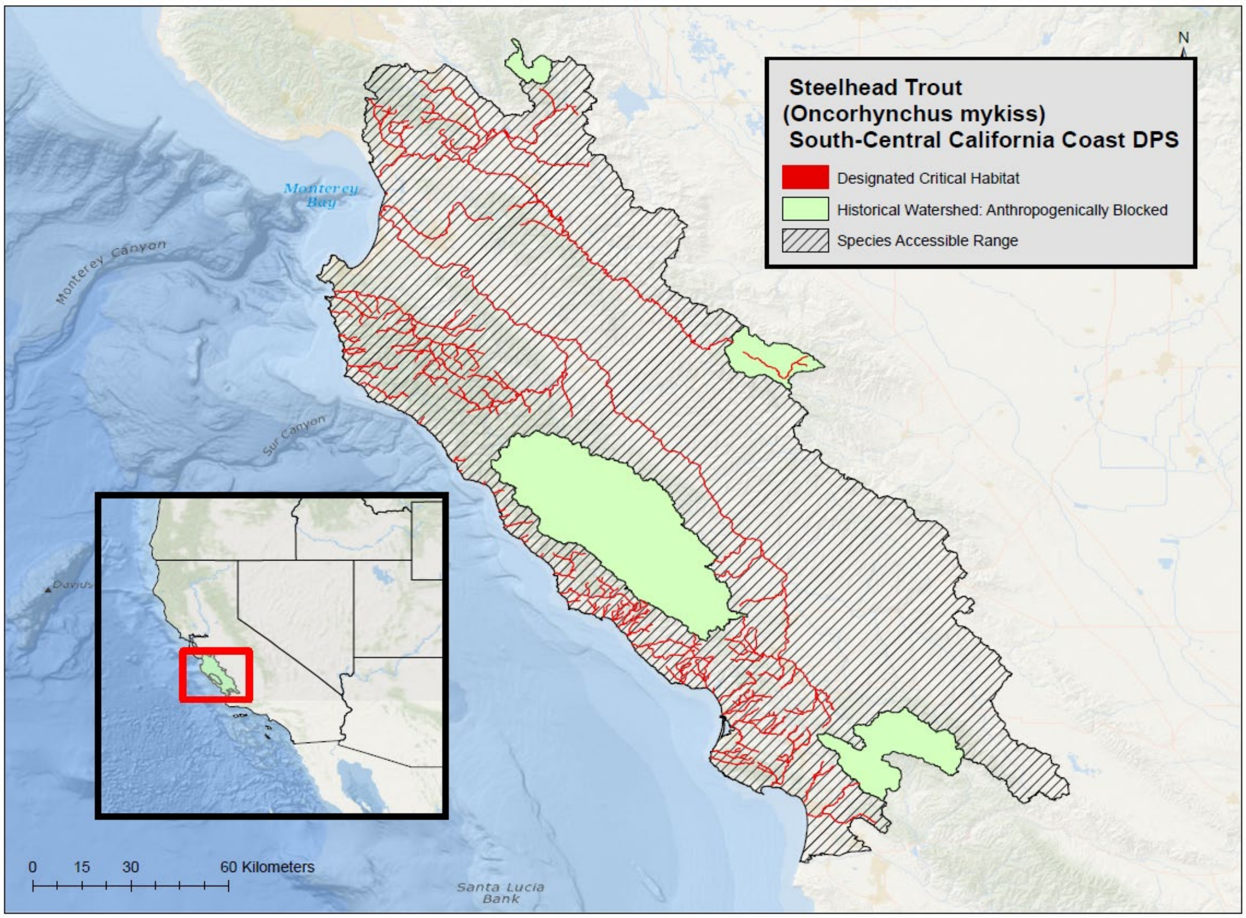

Figure 40. Steelhead, South-Central California Coast DPS range and designated critical habitat

Species Description Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On August 18, 1997 NMFS listed the South-Central California Coast (SCCC) DPS of steelhead as threatened (62 FR 43937) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 5248). This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Pajaro River to (but not including) the Santa Maria River.

Status Following the dramatic rise in South-Central California's human population after World War II and the associated land and water development within coastal drainages (particularly major dams and water diversions), steelhead abundance rapidly declined, leading to the extirpation of populations in many watersheds and leaving only sporadic and remnant populations in the remaining, more highly modified watersheds such as the Salinas River and Arroyo Grande Creek watersheds (Boughton et al. 2007; Good et al. 2005b). As conditions in South-Central California coastal rivers and streams continued to deteriorate, put-and-take trout stocking became more focused on suitable man made reservoirs. Since the listing of the SCCC DPS as threatened in 1997, the California Department of Fish and Wildlife has ceased stocking hatchery reared fish in the anadromous waters of South-Central California (California Department of Fish and Wildlife and U.S. Fish and Wildlife Service 2010). A substantial portion of the upper watersheds, which contain the majority of historical spawning and rearing habitats for anadromous *O. mykiss*, remain intact (though inaccessible to anadromous fish) and protected from intensive development as a result of their inclusion in the Los Padres National Forest (Blakley and Barnette 1985).

Life history Only winter steelhead are found in this DPS. Migration and spawn timing are similar to adjacent steelhead populations. There is limited life history information for steelhead in this DPS.

Table 101. Temporal distribution of Steelhead, South-Central California Coast DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td></td><td colspan="2">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance / Productivity. The data summarized in this status review indicate small (generally <10 fish) but surprisingly persistent annual runs of anadromous O. mykiss are currently being monitored across a limited but diverse set of basins within the range of this DPS, but interrupted in years when the mouth of the coastal estuaries fail to open to the ocean due to low flows (Williams et al. 2011; Williams et al. 2016).

Genetic Diversity / Distribution. South-Central California Coast (SCCC) steelhead include all naturally spawned steelhead populations below natural and manmade impassable barriers in streams from the Pajaro River (inclusive) to, but not including the Santa Maria River, California. No artificially propagated steelhead populations that reside within the historical geographic range of this DPS are included in this designation. The two largest basins overlapping within the range of this DPS include the inland basins of the Pajaro River and the Salinas River.

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52488). PBFs considered essential for the conservation of Steelhead, South-Central California Coast DPS are shown in Table 21.

Migration and rearing PBFs are degraded throughout critical habitat by elevated stream temperatures and contaminants from urban and agricultural areas. Estuarine PBF is impacted by most estuaries being breached, removal of structures, and contaminants.

Recovery Goals. See the 2013 recovery plan for the South-Central California Coast steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species.

Table 102. Summary of status; Steelhead, South-Central California Coast DPS

Criteria	Description
Abundance / productivity trends	5-year population trend declining, depressed abundances.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing and migration PBFs are degraded by elevated temperatures and contaminants from urban and agricultural runoff; Estuarine PBFs are degraded by altered habitat and contaminated runoff; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 29 occupied watersheds, 12 are of high and 11 are of medium conservation value

8.27 Steelhead, Southern California DPS

Table 103. Steelhead, Southern California DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Southern California Coast	Endangered	2016	71 FR 834	2012	70 FR 52488

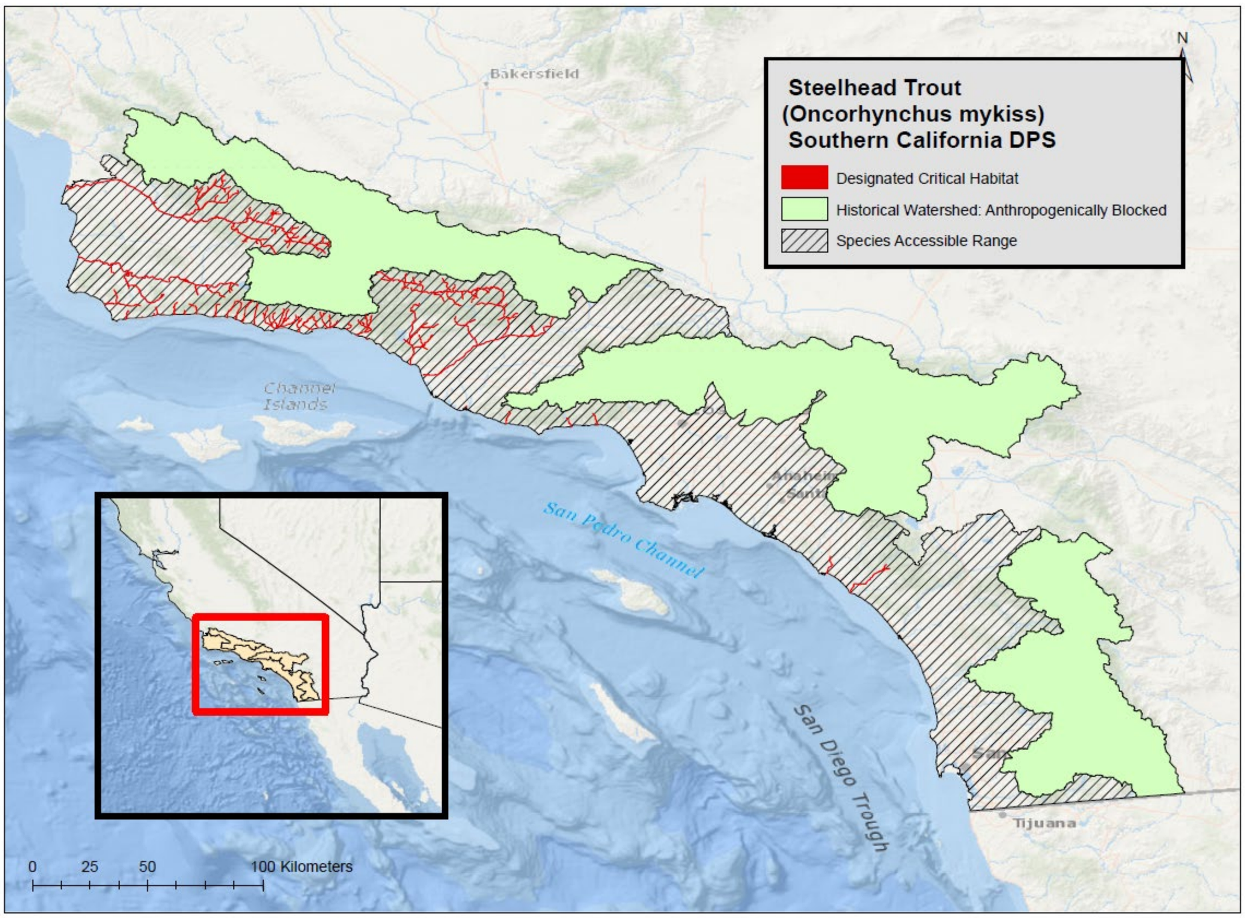

Figure 41. Steelhead, Southern California DPS range and designated critical habitat

Species Description. Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On August 18, 1997 NMFS listed the Southern California (SC) DPS of steelhead as endangered (62 FR 43937) and reaffirmed the DPS's status as endangered on January 5, 2006 (71 FR 5248). This DPS includes naturally spawned anadromous *O. mykiss* (steelhead) originating below natural and manmade impassable barriers from the Santa Maria River to the U.S.-Mexico Border.

Status. There is little new evidence to indicate that the status of the Southern California Coast Steelhead DPS has changed appreciably in either direction since the last status review (Williams et al. 2011). The extended drought and the recent genetic data documenting the high level of introgression and extirpation of native *O. mykiss* stocks in the southern portion of the DPS has elevated the threats level to the already endangered populations; the drought, and the lack of 55 comprehensive monitoring, has also limited the ability to fully assess the status of individual populations and the DPS as whole. The systemic anthropogenic threats identified at the time of the initial listing have remained essentially unchanged over the past 5 years, though there has been significant progress in removing fish passage barriers in a number of the smaller and mid-sized watersheds. Threats to the Southern California Steelhead DPS posed by environmental variability resulting from projected climate change are likely to exacerbate the factors affecting the continued existence of the DPS.

Life history. There is limited life history information for SC steelhead. In general, migration and life history patterns of SC steelhead populations are dependent on rainfall and streamflow (Moore 1980). Steelhead within this DPS can withstand higher temperatures compared to populations to the north. The relatively warm and productive waters of the Ventura River have resulted in more rapid growth of juvenile steelhead compared to the more northerly populations (Moore 1980).

Table 104. Temporal distribution of Steelhead, Southern California DPS

Life History phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Entering Fresh Water (adults/jacks)		Present										
Spawning				Present								
Incubation (eggs)				Present								
Emergence (alevin to fry phases)						Present						
Rearing and migration (juveniles)	Present											

Population Dynamics

Abundance / Productivity. Limited information exists on SC steelhead runs. Based on combined estimates for the Santa Ynez, Ventura, and Santa Clara rivers, and Malibu Creek, an estimated 32,000 to 46,000 adult steelhead occupied this DPS historically. In contrast, less than 500 adults are estimated to occupy the same four waterways presently. The last estimated run size for steelhead in the Ventura River, which has its headwaters in Los Padres National Forest, is 200 adults (Busby et al. 1996).

Genetic Diversity / Distribution. Limited information is available regarding the structural and genetic diversity of the Southern California steelhead.

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). PBFs considered essential for the conservation of Steelhead, Southern California DPS are shown in Table 21.

All PBFs have been affected by degraded water quality by pollutants from densely populated areas and agriculture within the DPS. Elevated water temperatures impact rearing and juvenile migration PBFs in all river basins and estuaries. Rearing and spawning PBFs have also been affected throughout the DPS by management or reduction in water quantity. The spawning PBF has also been affected by the combination of erosive geology and land management activities that have resulted in an excessive amount of fines in the spawning gravel of most rivers.

Recovery Goals. See the 2012 recovery plan for the California Central Valley steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species.

Table 105. Summary of status; Steelhead, Southern California DPS

Criteria	Description
Abundance / productivity trends	5-year population trend uncertain. Population abundance supplemented by hatchery propagation. Populations are at the extreme southern end of the species' range. Large annual variations in abundances, and fragmented distributions.
Listing status	endangered
Attainment of recovery goals	criteria not yet met
Condition of PBFs	All PBFs are degraded by pollutants in urban and agricultural runoff, elevated temperatures, erosion, and low water flows; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 29 freshwater and estuarine watersheds, 21 are of high and 5 are of medium conservation value

8.28 Steelhead, Upper Columbia River DPS

Table 106. Steelhead, Upper Columbia River DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	Upper Columbia River	Endangered	2016	74 FR 42605	2007	70 FR 52630

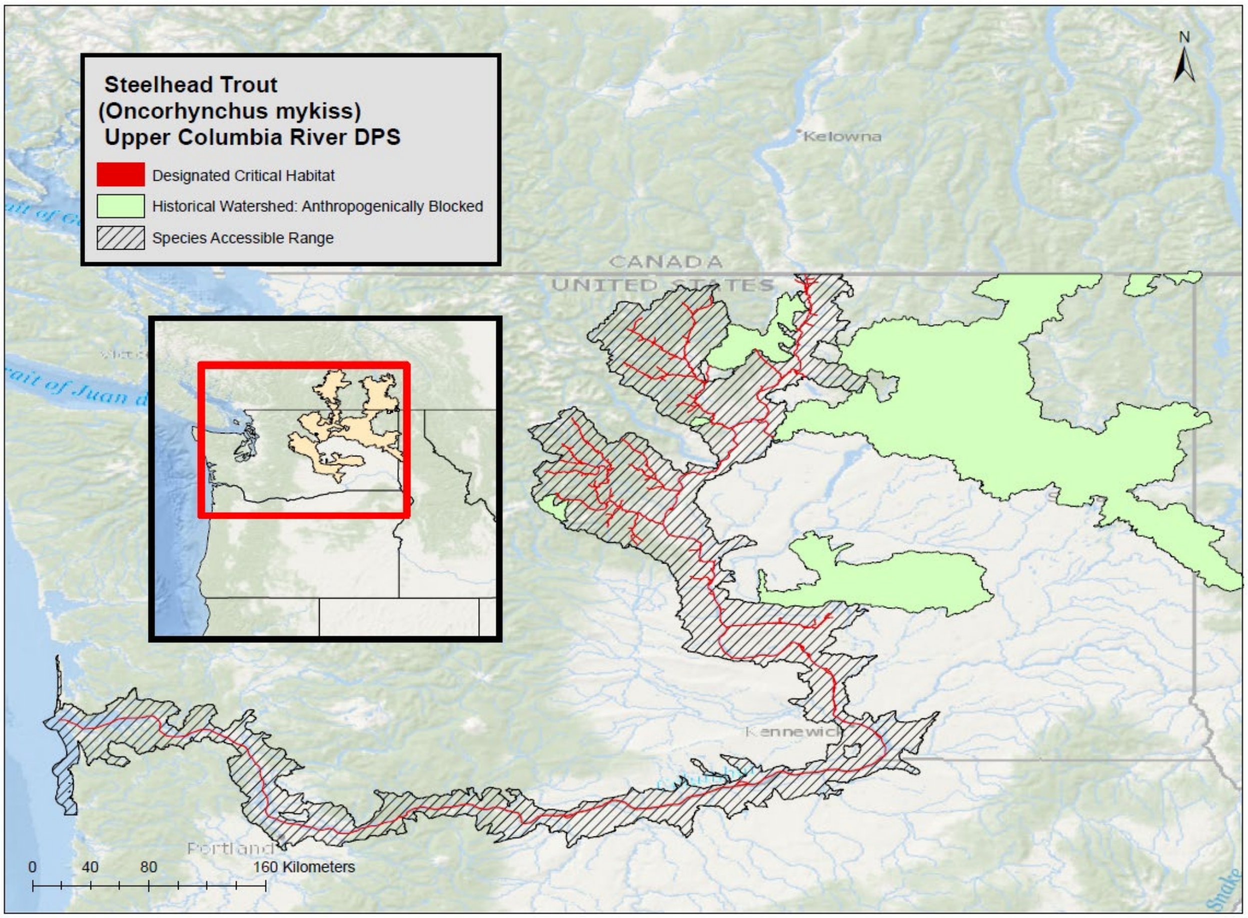

Figure 42. Steelhead, Upper Columbia River DPS range and designated critical habitat

Species Description. Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On August 18, 1997 NMFS listed the Upper Columbia River (UCR) DPS of steelhead as endangered (62 FR 43937) and reaffirmed the DPS's status as endangered on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous *O. mykiss* (steelhead) originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Yakima River to the U.S.-Canada border. Also, steelhead from six artificial propagation programs.

Status. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat and unchanged for the Methow (NWFSC 2015b). However abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations. Short-term patterns in those indicators appear to be largely driven by year-to-year fluctuations in survival rates in areas outside of these watersheds. All three populations continued to be rated at low risk for spatial structure but at high risk for diversity criteria. Although the status of the ESU is improved relative to measures available at the time of listing, all three populations remain at high risk (NWFSC 2015b).

Life history. All UCR steelhead are summer-run steelhead. Adults return in the late summer and early fall, with most migrating relatively quickly to their natal tributaries. A portion of the returning adult steelhead overwinters in mainstem reservoirs, passing over upper-mid-Columbia dams in April and May of the following year. Spawning occurs in the late spring of the year following river entry. Juvenile steelhead spend one to seven years rearing in fresh water before migrating to sea. Smolt outmigrations are predominantly year class two and three (juveniles), although some of the oldest smolts are reported from this DPS at seven years. Most adult steelhead return to fresh water after one or two years at sea.

Table 107. Temporal distribution of Steelhead, Upper Columbia River DPS

<table>
<tr><th>Life History phase</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="12">Present</td></tr>
<tr><td>Spawning</td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td colspan="4">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases</td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. Returns of both hatchery and naturally produced steelhead to the upper Columbia River have increased in recent years. The average 1997 to 2001 return counted through the Priest Rapids fish ladder was approximately 12,900 fish. The average for the previous five years (1992 to 1996) was 7,800 fish. Abundance estimates of returning naturally produced UCR steelhead were based on extrapolations from mainstem dam counts and associated sampling information (Good et al. 2005b). The natural component of the annual steelhead run over Priest Rapids Dam increased from an average of 1,040 (1992-1996), representing about 10 percent of the total adult count, to 2,200 (1997-2001), representing about 17 percent of the adult count during this period of time (ICTRT 2003).

Recent population abundances for the Wenatchee and Entiat aggregate population and the Methow population remain well below the minimum abundance thresholds developed for these populations (ICTRT 2003). A five-year geometric mean (1997 to 2001) of approximately 900 naturally produced steelhead returned to the Wenatchee and Entiat rivers (combined). The abundance is well below the minimum abundance thresholds but it represents an improvement over the past (an increasing trend of 3.4 percent per year).

Productivity / Population Growth Rate. Regarding the population growth rate of natural production, on average, over the last 20 full brood year returns (1980/81 through 1999/2000 brood years), including adult returns through 2004-2005, UCR steelhead populations have not replaced themselves. Overall adult returns are dominated by hatchery fish, and detailed information is lacking on the productivity of the natural population.

Genetic Diversity. All UCR steelhead populations have reduced genetic diversity from homogenization of populations that occurred during the Grand Coulee Fish Maintenance project from 1939-1943, from 1960, and 1981 (Chapman et al. 1994).

Distribution. The UCR steelhead consisted of four historical independent populations: the Wenatchee, Entiat, Methow, and Okanogan. All populations are extant. The UCR steelhead must navigate over several dams to access spawning areas. The construction of Grand Coulee Dam in 1939 blocked access to over 50 percent of the river miles formerly available to UCR steelhead (ICTRT 2003).

Designated Critical Habitat. Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). PBFs considered essential for the conservation of Steelhead, Upper Columbia River DPS are shown in Table 21.

The current condition of critical habitat designated for the UCR steelhead is moderately degraded. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development. Critical habitat is affected by reduced quality of juvenile rearing and migration PBFs within many watersheds; contaminants from agriculture affect both water quality and food production in several watersheds and in the mainstem Columbia River. Several dams affect adult migration PBF by obstructing the migration corridor.

Recovery Goals. See the 2007 recovery plan for the Upper Columbia River steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species.

Table 108. Summary of status; Steelhead, Upper Columbia River DPS

Criteria	Description

Abundance / productivity trends	5-year population trend improving, but low genetic diversity. Abundances still below those necessary for recovery.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by agricultural runoff and lack of available prey; Migration PBFs are degraded by several dams; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of 41 occupied watersheds, 31 are of high and 7 are of medium conservation value

8.29 Steelhead, Upper Willamette River DPS

Table 109. Steelhead, Upper Willamette River DPS; overview table

Species	Common Name	DPS	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Oncorhynchus mykiss	Steelhead Trout	California Central Valley	Threatened	2016	71 FR 834	2011	70 FR 52630

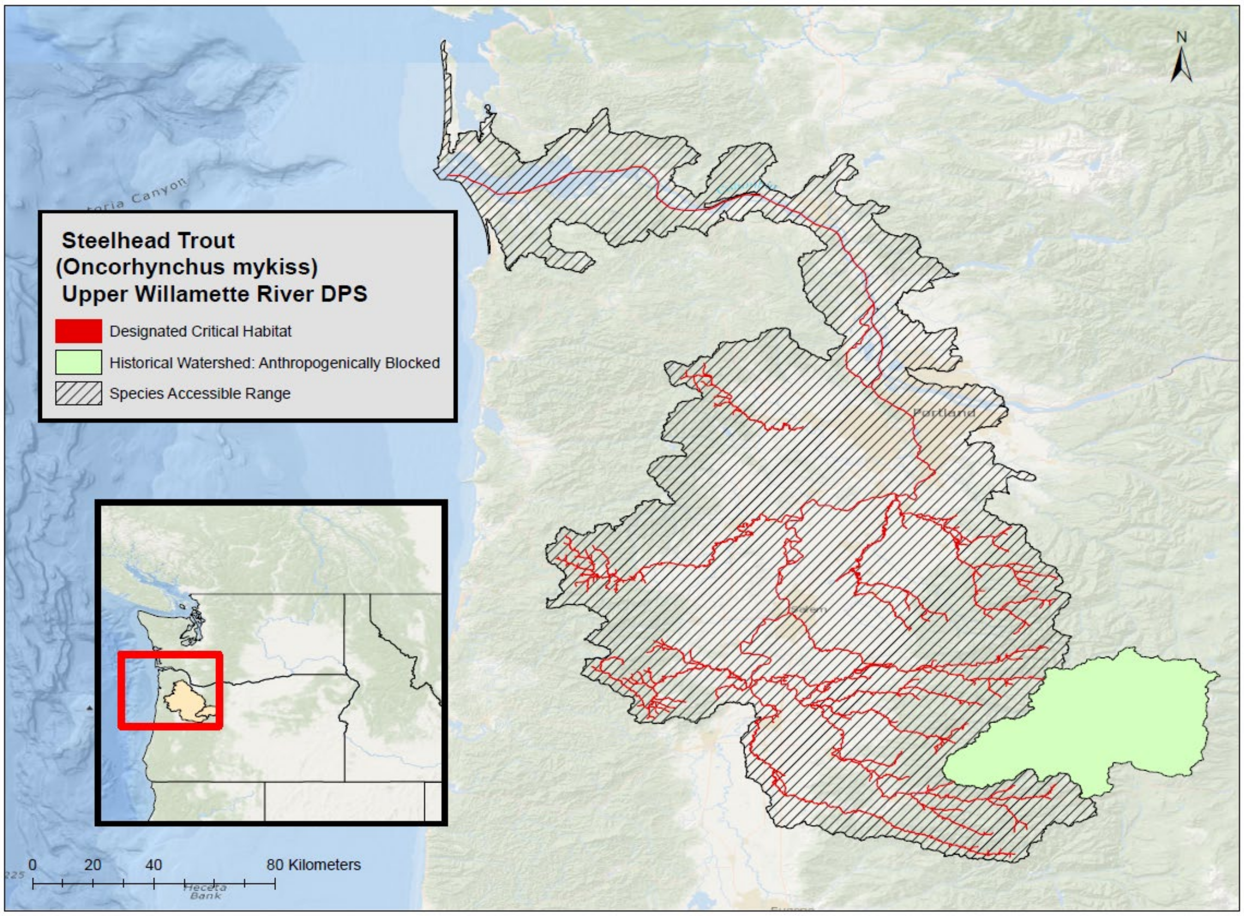

Figure 43. Steelhead, Upper Willamette River DPS range and designated critical habitat

Species Description. Steelhead are dark-olive in color, shading to silvery-white on the underside with a speckled body and a pink-red stripe along their sides. Those migrating to the ocean develop a slimmer profile, becoming silvery in color, and typically growing larger than rainbow trout that remain in fresh water. Steelhead trout grow to 55 pounds (25 kg) in weight and 45 inches (120 cm) in length, though the average size is much smaller. On March 25, 1999 NMFS listed the Upper Willamette River (UWR) DPS of steelhead as threatened (64 FR 14517) and reaffirmed the DPS's status as threatened on January 5, 2006 (71 FR 834). This DPS includes naturally spawned anadromous winter-run *O. mykiss* (steelhead) originating below natural and manmade impassable barriers from the Willamette River and its tributaries upstream of Willamette Falls to and including the Calapooia River.

Status. Four basins on the east side of the Willamette River historically supported independent populations for the UWR steelhead, all of which remain extant. Data reported in McElhaney et al. (2007) indicate that currently the two largest populations within the DPS are the Santiam River populations. Mean spawner abundance in both the North and South Santiam River is about 2,100 native winter-run steelhead. However, about 30 percent of all habitat has been lost due to human activities (McElhany et al. 2007a). The North Santiam population has been substantially affected by the loss of access to the upper North Santiam basin. The South Santiam subbasin has lost habitat behind non-passable dams in the Quartzville Creek watershed. Notwithstanding the lost spawning habitat, the DPS continues to be spatially well distributed, occupying each of the four major subbasins.

Overall, the declines in abundance noted during the previous review (Ford et al. 2011) continued through the period 2010-2015. There is considerable uncertainty in many of the abundance estimates, except for perhaps the tributary dam counts. Radio-tagging studies suggest that a considerable proportion of winter-run steelhead ascending Willamette Falls do not enter the demographically independent populations (DIPs) that constitute this DPS; these fish may be nonnative early winter-run steelhead that appear to have colonized the western tributaries, misidentified summer-run steelhead, or late winter-run steelhead that have colonized tributaries not historically part of the DPS.

Life history. Native steelhead in the Upper Willamette are a late-migrating winter group that enters fresh water in January and February (Howell et al. 1985). UWR steelhead do not ascend to their spawning areas until late March or April, which is late compared to other West Coast winter steelhead. Spawning occurs from April to June 1. The unusual run timing may be an adaptation for ascending the Willamette Falls, which may have facilitated reproductive isolation of the stock. The smolt migration past Willamette Falls also begins in early April and proceeds into early June, peaking in early- to mid-May (Howell et al. 1985). Smolts generally migrate through the Columbia via the Multnomah Channel rather than the mouth of the Willamette River. As with other coastal steelhead, the majority of juveniles smolt and outmigrate after two years; adults return to their natal rivers to spawn after spending two years in the ocean. Repeat spawners are predominantly female and generally account for less than 10 percent of the total run size (Busby et al. 1996).

Table 110. Temporal distribution of Steelhead, Upper Willamette River DPS

<table>
<tr><td>Life History phase</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td></tr>
<tr><td>Entering Fresh Water (adults/jacks)</td><td colspan="6">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Spawning</td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incubation (eggs)</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Emergence (alevin to fry phases)</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Present</td><td></td><td></td><td></td></tr>
<tr><td>Rearing and migration (juveniles)</td><td colspan="12">Present</td></tr>
</table>

Population Dynamics

Abundance. UWR steelhead are moderately depressed from historical levels (McElhany et al. 2007a). Average number of late-fall steelhead passing Willamette Falls decreased during the 1990s to less than 5,000 fish. The number again increased to over 10,000 fish in 2001 and 2002. The geometric and arithmetic mean number of late-run steelhead passing Willamette Falls for the period 1998 to 2001 were 5,819 and 6,795, respectively.

Productivity / Population Growth Rate. Population information for individual basins exist as redds per (river) mile. These redd counts show a declining long-term trend for all populations (Good et al. 2005b). One population, the Calapooia, had a positive short-term trend during the years from 1990 to 2001. McElhany *et al.* (2007a) however, found that the populations had a low risk of extinction. Two of the populations were considered at moderate risk from failed abundances and recruitment levels and two (North and South Santiam Rivers) were considered at low risk given current abundances and recruitment (McElhany et al. 2007a).

Genetic Diversity. The release of non-native summer-run steelhead continues to be a concern. Genetic analysis suggests that there is some level of introgression among native late-winter-run steelhead and summer-run steelhead (Van Doornik et al. 2015).

Distribution. The UWR steelhead DPS includes all naturally spawned winter-run steelhead populations in the Willamette River and its tributaries upstream from Willamette Falls to the Calapooia River (inclusive). The North Santiam and South Santiam rivers are thought to have been major production areas (McElhany et al. 2003) and these populations were designated as “core” and “genetic legacy”. The four “east-side” subbasin populations are part of one stratum, the Cascade Tributaries Stratum, for UWR winter steelhead. There are no hatchery programs supporting this DPS (Myers et al. 2006). The hatchery summer-run steelhead that are produced and released in the subbasins are from an out-of-basin stock and not considered part of the DPS. Accessibility to historical spawning habitat is still limited, especially in the North Santiam River. Much of the accessible habitat in the Molalla, Calapooia, and lower reaches of North and South Santiam rivers is degraded and under continued development pressure. Although habitat restoration efforts are underway, the time scale for restoring functional habitat is considerable (NWFSC 2015b).

Designated Critical Habitat. NMFS designated critical habitat for this species on September 2, 2005 (70 FR 52488). PBFs considered essential for the conservation of Steelhead, Upper Willamette River DPS are shown in Table 21.

The current condition of critical habitat designated for the UWR steelhead is degraded, and provides a reduced conservation value necessary for species recovery. Critical habitat is affected by reduced quality of juvenile rearing and migration PBFs within many watersheds; contaminants from agriculture affect both water quality and food production in several watersheds and in the mainstem Columbia River. Several dams affect adult migration PBF by obstructing the migration corridor.

Recovery Goals See the 2011 recovery plan for the Upper Willamette River steelhead DPS for complete down-listing/delisting criteria for recovery goals for the species.

Table 111. Summary of status; Steelhead, Upper Willamette River DPS

Criteria	**Description**
Abundance / productivity trends	5-year population trend declining, large fluctuations in abundances.
Listing status	threatened
Attainment of recovery goals	criteria not yet met
Condition of PBFs	Rearing PBFs are degraded by agricultural runoff and lack of available prey; Migration PBFs are degraded by dams and elevated temperatures; Elevated temperatures and environmental mixtures anticipated in freshwater habitats; Of assessed watersheds, 14 are of high and 6 are of medium conservation value

9 Environmental Baseline

9.1 Introduction

The environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The key purpose of the environmental baseline is to describe the natural and anthropogenic factors influencing the status and condition of ESA-listed species and designated critical habitat in the action area. Since this is a consultation on a program with a large geographic scope, this environmental baseline focuses more generally on the status and trends of the aquatic ecosystems on the U.S. west coast and the consequences of that status for listed resources.

Activities that negatively impact water quality also threaten aquatic species. The deterioration of water quality is a contributing factor that has led to the reduction in populations of some ESA-listed aquatic species under NMFS jurisdiction. Declines in populations of these species leave them vulnerable to a multitude of threats. Due to the cumulative effects of reduced abundance, low or highly variable growth capacity, and the loss of essential habitat, these species are less resilient to additional disturbances. In larger populations, stressors that affect only a limited number of individuals could once be tolerated by the species without resulting in population level impacts; in smaller populations, the same stressors are more likely to reduce the likelihood of survival. In addition, populations that have ongoing stressors already present in the environment are less likely to be resilient to additional stressors resulting from the action. It is with this understanding of the Environmental Baseline that we will consider the effects of the proposed action on endangered and threatened species and their designated critical habitat. The action area for this consultation covers a very large number of individual watersheds and an even larger number of specific water bodies (e.g., lakes, rivers, streams, estuaries). It is, therefore, not practicable to describe the environmental baseline and assess risk for each particular area. Accordingly, this Opinion approaches the environmental baseline on a region-by-region basis, describing the activities, conditions and stressors which adversely affect ESA-listed species and designated critical habitat. These include natural threats (e.g., parasites and disease, predation and competition, wildland fires), water quality, hydromodification projects, land use changes, dredging, mining, artificial propagation, non-native species, fisheries, vessel traffic, and climate changes. For each of these threats we start with a general overview of the problem, followed by a more focused analysis at the regional level for the species listed above, as appropriate and where such data are available.

Our summary of the environmental baseline complements the information provided in the Status of Species and Critical Habitats Likely to Be Adversely Affected section (Chapter 7), and provides background necessary to evaluate and interpret information presented in the Effects of the Action and Cumulative Effects sections (Chapters 10, 12, 15).

The quality of the biophysical components within aquatic ecosystems is affected by natural events as well as human activities conducted within and around coastal waters, estuarine and riparian zones, as well as those conducted more remotely in the upland portion of the watershed. Industrial activities can result in discharge of pollutants, changes in water temperature and levels of dissolved oxygen, and the addition of nutrients. In addition, forestry and agricultural practices can result in erosion, run-off of fertilizers, herbicides, insecticides or other chemicals, nutrient enrichment and alteration of water flow.

The information from the environmental baseline is treated as a “risk modifier” in the Integration and Synthesis section (Chapters 13, 16). Factors which have the potential to “modify” the risk are those which are able to interact with the effects of the action. For example, elevated temperatures have been demonstrated to increase the toxicity of organophosphate pesticides in fish (Mayer and Ellersieck 1986; Mayer and Ellersieck 1988; Osterauer and Köhler 2008) and certain mixtures of cholinesterase inhibiting pesticide increase the toxicity to juvenile coho salmon (Laetz et al. 2014). While many of the factors described in this section have the potential to modify the action, and were thus considered, two of the factors present in the environmental baseline were consistently found to have a high potential to modify the risk. The two factors are: 1) elevated freshwater temperatures, and 2) pesticide environmental mixtures. Elevated temperatures may increase risk to species because adverse toxicological responses are heightened with increases in temperature. Pesticide environmental mixtures may increase risk because of additive or synergistic effects. Current methodologies for calculating mixture toxicity indicate that additivity is the appropriate initial assumption (Cedergreen and Streibig 2005) unless available data suggest antagonism (less than additive toxicity) or synergism (greater than additive toxicity) is more appropriate. We found no published data showing antagonism or synergism in mixtures containing metolachlor or telone. Therefore, additive toxicity is the default assumption in this Opinion. We therefore developed two key questions to guide our synthesis of the information within the environmental baseline section:

1. Are freshwater temperatures elevated?

2. Are pesticide mixtures present, or anticipated based on current land use?

We used the best available information to answer these two questions for each of our species. To assess elevated temperature, we evaluated the most recent Total Maximum Daily Load (TMDL) 303(d) listings to calculate the total river-kilometers of recorded temperature exceedance within each species range (e.g. Table 6). Species recovery plans, status updates, and listing documents also contributed species specific information regarding documented temperature exceedances. To assess pesticide environmental mixtures we examined land use categories within each species range by performing an overlap analysis with the most recent National Land Cover Database (NLCD) information (e.g. ***Table 2***). We found the United States Geological Survey’s (USGS) most recent National Water-Quality Assessment (NAWQA) report (Ryberg et al. 2014) corroborated previous reports findings of trends between concentration and land use for pesticides with both agricultural and urban applications. As such, we used land use categories such as “cultivated crops”, “pasture/hay”, and “developed land” as proxies for areas with an increased potential for environmental mixtures. Additional sources of information used to characterize the occurrence of pesticide environmental mixtures within specie habitats include:

species recovery plans, status updates, listing documents, pesticide monitoring data, incident data, existing pesticide consultations, and pesticide usage information.

Within the Integration and Synthesis section (Chapters 13 and 16) we characterize the overall magnitude of influence of the environmental baseline as either “low” or “high”. This characterization includes directionality (i.e. positive influence which equates to less risk or negative influence which equates to more risk) as well as confidence. The magnitude, directionality, and confidence of the influence are supported by answers provided to the two questions outlined above. We acknowledge that the magnitude, and directionality of these two factors varies on a species-by-species basis, for example the same proportion of habitat with elevated temperatures may affect two species in different ways. We further acknowledge that the quantitative data (e.g. 303(d), NLCD) is incomplete without considering the qualitative data often provided in recovery plans, status reports and listing documents. Therefore, we characterized magnitude and directionality with the following guidelines:

- If answers to one or both key questions are in the affirmative, and, if the extent of one or both factors are considered to be of sufficient concern for that species, then the magnitude is large and the directionality is negative;

- If both key questions are answered in the negative, and, if other baseline factors for that species (e.g. prey availability) indicate a positive baseline, then the magnitude will be small and the directionality will be positive;

- If answers to both key questions are in the negative, and, if other baseline factors for that species (e.g. prey availability) indicate a negative baseline, then the magnitude will be small and the directionality will be negative.

The three guidelines above are not exhaustive of all possible combinations of the factors examined in the baseline, rather they outline only those combinations which were encountered in this Opinion. We characterize the overall confidence in the magnitude and directionality as either “low” or “high”. Confidence is determined by assessing the amount of evidence provided, as well as by further considering the species-specific implications of the two factors. It is important to note that the key-question framework (described above) is a tool to help guide our risk assessors in making transparent and consistent determinations. However, the ultimate consideration of increased or decreased risk attributable to the environmental baseline is not restricted to the consideration of the key questions alone. All information relevant to the environmental baseline within the action area is considered in the risk assessment.

The environmental baseline that follows is organized into three general sections: 1) a general overview of baseline factors relevant to all west coast salmonids; 2) baseline factors specific to the Pacific Northwest region, and 3) baseline factors specific to the California region.

9.2 General Baseline Factors

9.2.1 Coastal Condition Assessment

The West coastal region includes rocky coasts, estuaries, bays, sub-estuaries and city harbors. In total the west coast contains 2,200 square miles of estuaries, over 60% of which is part of three major estuarine systems: the San Francisco Estuary, Columbia River Estuary, and Puget Sound (USEPA 2015). The coastal counties of the West Coast are home to 19% of the U.S. population, and 63% of the total population of the West Coast states. The population in these coastal counties has nearly doubled since 1970 and is currently estimated to be around 40 million people (USEPA 2015).

Figure 44 shows a summary of findings from the Environmental Protection Agency's (EPA) National Coastal Condition Assessment Report for the Northeast Region (USEPA 2015). A total of 134 sites were sampled to assess approximately 2,200 square miles of West Coast coastal waters. Biological quality is rated as good in 71% of the West coast region based on the benthic index. Poor biological conditions occur in 3% of the coastal area. About 21% of the region reported missing results. Based on the water quality index, 64% of the West Coast is in good condition, 26% is rated fair, and 2% is rated poor.

Based on the sediment quality index, 31% of the West Coast area sampled is in good condition, 23% is in fair condition, and 27% is in poor condition (19% were reported "missing"). Compared to ecological risk-based thresholds for fish tissue contamination, 5% of the West coast is rated as good, 29% is rated fair, and 44% is rated poor. The contaminants that most often exceed the thresholds for a "poor" rating in the assessed areas of the West Coast are selenium, mercury, arsenic, and, in a small proportion of the area, total polychlorinated biphenyls (PCBs).

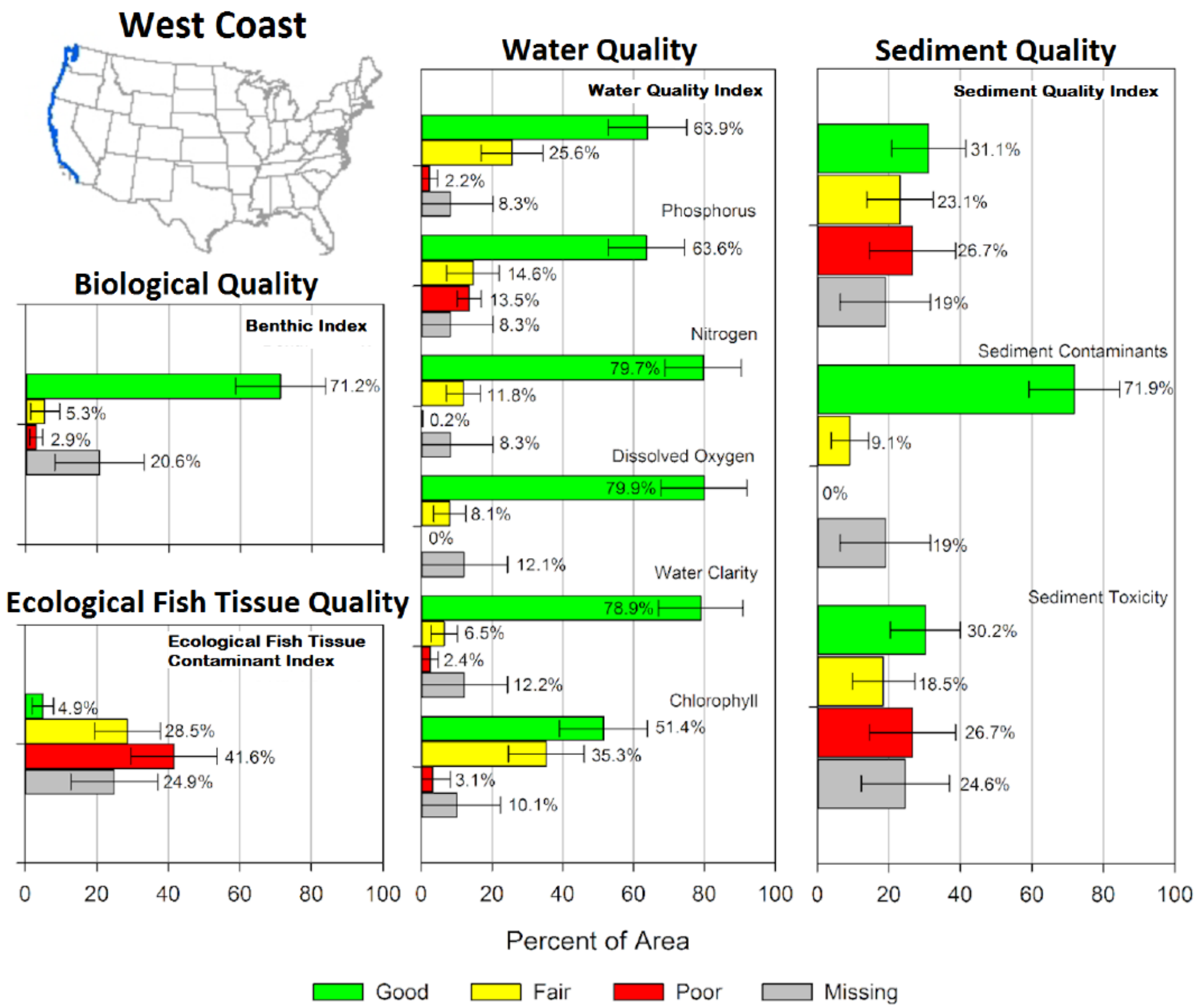

Figure 44. National Coastal Condition Assessment 2010 Report findings for the West Coast Region. Bars show the percentage of coastal area within a condition class for a given indicator (n = 134 sites sampled). Error bars represent 95% confidence levels (USEPA 2015).

9.2.2 Parasites and/or Disease

Most young fish are highly susceptible to disease during the first two months of life. The cumulative mortality in young animals can reach 90 to 95%. Although fish disease organisms occur naturally in the water, native fish have co-evolved with them. Fish can carry these diseases at less than lethal levels (Foott et al. 2003; Kier Associates 1991; Walker and Foott 1993). However, disease outbreaks may occur when water quality is diminished and fish are stressed from crowding and diminished flows (Guillen 2003; Spence et al. 1996). Young coho salmon or other salmonid species may become stressed and lose their resistance in higher temperatures (Spence et al. 1996). Consequently, diseased fish become more susceptible to predation and are less able to perform essential functions, such as feeding, swimming, and defending territories

(McCullough 1999). Examples of parasites and disease for salmonids include whirling disease, infectious hematopoietic necrosis (IHN), sea-lice (e.g. *Lepeophtheirus salmonis*, various *Caligus* species *Henneguya salminicola*, or Ich (*Ichthyopthirius multifiliis)* and Columnaris *(Flavobacterium columnare*)).

Whirling disease is a parasitic infection caused by the microscopic parasite *Myxobolus cerebrali*. Infected fish continually swim in circular motions and eventually expire from exhaustion. The disease occurs in the wild and in hatcheries and results in losses to fry and fingerling salmonids, especially rainbow trout. The disease is transmitted by infected fish, fish parts and birds.

IHN is a viral disease in many wild and farmed salmonid stocks in the Pacific Northwest. This disease affects rainbow/steelhead trout, cutthroat trout (*Salmo clarki*), brown trout (*Salmo trutta*), Atlantic salmon (*Salmo salar*), and Pacific salmon including Chinook, sockeye, chum, and coho salmon. The virus is triggered by low water temperatures and is shed in the feces, urine, sexual fluids, and external mucus of salmonids. Transmission is mainly from fish to fish, primarily by direct contact and through the water.

Sea lice is a marine ectoparasite found in coastal waters that can also cause deadly infestations of farm-grown salmon and may affect wild salmon. *Henneguya salminicola*, a protozoan parasite, is commonly found in the flesh of salmonids, particularly in British Columbia. The fish responds by walling off the parasitic infection into a number of cysts that contain milky fluid. This fluid is an accumulation of a large number of parasites. Fish with the longest freshwater residence time as juveniles have the most noticeable infection. The order of prevalence for infection is coho followed by sockeye, Chinook, chum, and pink salmon. The *Henneguya* infestation does not appear to cause disease in the host salmon – even heavily infected fish tend to return to spawn successfully.

Additionally, ich (a protozoan) and Columnaris (a bacterium) are two common fish diseases that were implicated in the massive kill of adult salmon in the Lower Klamath River in September 2002 (CDFG 2003; Guillen 2003).

9.2.3 Predation

Salmonids are exposed to high rates of natural predation, during freshwater rearing and migration stages, as well as during ocean migration. Salmon along the U.S. west coast are prey for marine mammals, birds, sharks, and other fishes. Concentrations of juvenile salmon in the coastal zone experience high rates of predation. In the Pacific Northwest, the increasing size of tern, seal, and sea lion populations may have reduced the survival of some salmon ESUs/DPSs. Threatened Puget Sound Chinook adults are preferred prey of endangered Southern Resident Killer Whales (Orcas).

9.2.3.1 Marine Mammal Predation

Marine mammals are known to attack and eat salmonids. Harbor seals (Phoca vitulina), California sea lions (Zalophus californianus), and killer whales (Orcinus orca) prey on juvenile or adult salmon. As indicated above, southern resident killer whales have a strong preference for Chinook salmon (up to 78% of identified prey) during late spring to fall (Ford and Ellis 2006; Hanson et al. 2005; Hard et al. 1992). Generally, harbor seals do not feed on salmonids as frequently as California sea lions (Pearcy 1997). California sea lions from the Ballard Locks in Seattle, Washington have been estimated to consume about 40% of the steelhead runs since 1985/1986 (Gustafson et al. 1997). In the Columbia River, salmonids may contribute substantially to sea lion diet at specific times and locations (Pearcy 1997). Spring Chinook salmon and steelhead are subject to pinniped predation when they return to the estuary as adults (NMFS 2006). Adult Chinook salmon in the Columbia River immediately downstream of Bonneville Dam have also experienced increased predation by California sea lions. In recent years, sea lion predation of adult Lower Columbia River winter steelhead in the Bonneville tailrace has increased. This prompted ongoing actions to reduce predation effects. They include the exclusion, hazing, and in some cases, lethal take of marine mammals near Bonneville Dam (NMFS 2008d).

9.2.3.2 Avian Predation

Large numbers of fry and juveniles are eaten by birds such as mergansers (*Mergus* spp.), common murre (*Uria aalage*), gulls (*Larus* spp.), and belted kingfishers (*Megaceryle alcyon*). Avian predators of adult salmonids include bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) (Pearcy 1997). Caspian terns (*Sterna caspia*) and cormorants (*Phalacrocorax* spp.) also take significant numbers of juvenile or adult salmon. Stream-type juveniles, especially yearling smolts from spring-run populations, are vulnerable to bird predation in the estuary. This vulnerability is due to salmonid use of the deeper, less turbid water over the channel, which is located near habitat preferred by piscivorous birds (Binelli et al. 2005). Recent research shows that subyearlings from the LCR Chinook salmon ESU are also subject to tern predation. This may be due to the long estuarine residence time of the LCR Chinook salmon (Ryan et al. 2006). Caspian terns and cormorants may be responsible for the mortality of up to 6% of the outmigrating stream-type juveniles in the Columbia River basin (Collis 2007; Roby et al. 2006).

Antolos et al. (2005) quantified predation on juvenile salmonids by Caspian terns nesting on Crescent Island in the mid-Columbia reach. Between 1,000 and 1,300 adult terns were associated with the colony during 2000 and 2001, respectively. These birds consumed about 465,000 juvenile salmonids in the first and approximately 679,000 salmonids in the second year. However, caspian tern predation in the estuary was reduced from 13,790,000 smolts to 8,201,000 smolts after relocation of the colony from Rice to East Sand Island in 1999. Based on PIT-tag recoveries at the colony, these were primarily steelhead for Upper Columbia River stocks. Less than 0.1% of the in-river migrating yearling Chinook salmon from the Snake River and less than 1% of the yearling Chinook salmon from the Upper Columbia were consumed. PIT-tagged coho smolts (originating above Bonneville Dam) were second only to steelhead in predation rates at the East Sand Island colony in 2007 (Roby et al. 2008). There are few quantitative data on avian predation rates on Snake River sockeye salmon.

9.2.3.3 Fish Predation

Pikeminnows (Ptychocheilus oregonensis) are significant predators of yearling juvenile migrants (Friesen and Ward 1999). Chinook salmon were 29% of the prey of northern pikeminnows in lower Columbia reservoirs, 49% in the lower Snake River, and 64% downstream of Bonneville Dam. Sockeye smolts comprise a very small fraction of the overall number of migrating smolts (Ferguson 2006) in any given year. The significance of fish predation on juvenile chum is unknown. There is little direct evidence that piscivorous fish in the Columbia River consume juvenile sockeye salmon. The ongoing Northern Pikeminnow Management Program has reduced predation-related juvenile salmonid mortality since 1990. Benefits of recent northern pikeminnow management activities to chum salmon are unknown. However, it may be comparable to those for other salmon species with a sub-yearling juvenile life history (Friesen and Ward 1999).

The primary fish predators in estuaries are probably adult salmonids or juvenile salmonids which emigrate at older and larger sizes than others. They include cutthroat trout (O. clarki) or steelhead smolts preying on chum or pink salmon smolts. Outside estuaries, many large non-salmonid populations reside just offshore and may consume large numbers of smolts. These fishes include Pacific hake (*Merluccius productus*), Pacific mackerel (*Scomber japonicus*), lingcod (*Ophiodon elongates*), spiny dogfish (*Squalus acanthias*), various rock fish, and lamprey (Beamish and Neville 1995; Beamish et al. 1992; Pearcy 1992).

9.2.4 Wildland Fire

Wildland fires that are allowed to burn naturally in riparian or upland areas may benefit or harm aquatic species, depending on the degree of departure from natural fire regimes. Although most fires are small in size, large size fires increase the chances of adverse effects on aquatic species. Large fires that burn near the shores of streams and rivers can have biologically significant short-term effects. They include increased water temperatures, ash, nutrients, pH, sediment, toxic chemicals, and loss of large woody debris (Buchwalter et al. 2004; Rinne 2004). Nevertheless, fire is also one of the dominant habitat-forming processes in mountain streams (Bisson et al. 2003). As a result, many large fires burning near streams can result in fish kills with the survivors actively moving downstream to avoid poor water quality conditions (Greswell 1999; Rinne 2004). The patchy, mosaic pattern burned by fires provides a refuge for those fish and invertebrates that leave a burning area or simply spares some fish that were in a different location at the time of the fire (USFS 2000). Small fires or fires that burn entirely in upland areas also cause ash to enter rivers and increase smoke in the atmosphere, contributing to ammonia concentrations in rivers as the smoke adsorbs into the water (Greswell 1999).

The presence of ash also has indirect effects on aquatic species depending on the amount of ash entry into the water. All ESA-listed salmonids rely on macroinvertebrates as a food source for at least a portion of their life histories. When small amounts of ash enter the water, there are usually no noticeable changes to the macroinvertebrate community or the water quality (Bowman and Minshall 2000). When significant amounts of ash are deposited into rivers, the macroinvertebrate community density and composition may be moderately to drastically reduced for a full year with long-term effects lasting 10 years or more (Buchwalter et al. 2003; Buchwalter et al. 2004; Minshall et al. 2001). Larger fires can also indirectly affect fish by altering water quality. Ash and smoke contribute to elevated ammonium, nitrate, phosphorus, potassium, and pH, which can remain elevated for up to four months after forest fires (Buchwalter et al. 2003).

9.2.5 Climate Variability and Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, and changes in precipitation patterns, all of which are likely to impact ESA resources. The National Oceanic and Atmospheric Association's (NOAA) climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://www.climate.gov).

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered.

A set of four scenarios was developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. The scenarios are referred to as representative concentration pathways (RCPs), which capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100 (IPCC 2014a). The RCP scenarios drive climate model projections for temperature, precipitation, sea level, and other variables: RCP2.6 is a stringent mitigation scenario; RCP2.5 and RCP6.0 are intermediate scenarios; and RCP8.5 is a scenario with no mitigation or reduction in the use of fossil fuels. The IPCC future global climate predictions (2014 and 2018) and national and regional climate predictions included in the Fourth National Climate Assessment for U.S. states and territories (2018) use the RCP scenarios.

The increase of global mean surface temperature change by 2100 is projected to be 0.3 to 1.7°C under RCP2.6, 1.1 to 2.6°C under RCP 4.5, 1.4 to 3.1°C under RCP6.0, and 2.6 to 4.8°C under RCP8.5 with the Arctic region warming more rapidly than the global mean under all scenarios (IPCC 2014a). The Paris Agreement aims to limit the future rise in global average temperature to 2°C, but the observed acceleration in carbon emissions over the last 15 to 20 years, even with a lower trend in 2016, has been consistent with higher future scenarios such as RCP8.5 (Hayhoe et al. 2018).

The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0°C from 1901 through 2016 (Hayhoe et al. 2018). The IPCC Special Report on the Impacts of Global Warming (2018) (IPCC 2018) noted that human-induced warming reached temperatures between 0.8 and 1.2°C above pre-industrial levels in 2017, likely increasing between 0.1 and 0.3°C per decade. Warming greater than the global average has already been experienced in many regions and seasons, with most land regions experiencing greater warming than over the ocean (Allen et al. 2018). Annual average temperatures have increased by 1.8°C across the contiguous U.S. since the beginning of the 20th century with Alaska warming faster than any other state and twice as fast as the global average since the mid-20th century (Jay et al. 2018). Global warming has led to more frequent heat waves in most land regions and an increase in the frequency and duration of marine heatwaves (Allen et al. 2018). Average global warming up to 1.5°C as compared to pre-industrial levels is expected to lead to regional changes in extreme temperatures, and increases in the frequency and intensity of precipitation and drought (Allen et al. 2018).

Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure [(MacLeod et al. 2005); (Robinson et al. 2005); (Kintisch 2006); (Learmonth et al. 2006); (McMahon and Hays 2006); (Evans and Bjørge 2013); (IPCC 2014a)]. Though predicting the precise consequences of climate change on highly mobile marine species is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring.

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species including marine mammals, sea turtles, and fish. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012). (Hazen et al. 2012) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. They predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses.

These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snowpack, increases winter flows, and advances the timing of spring melt (Mote 2016; Mote et al. 2014). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Mote et al. 2014; Tague et al. 2013).

Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Abatzoglou et al. 2014). Precipitation is more likely to occur during October through March and less during summer months. More winter precipitation will be rain than snow (ISAB 2007) (Mote et al. 2013; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5-5.3 degree increases in Columbia Basin streams and a peak temperature of 26 degrees Celsius in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Isaak et al. 2012; Mantua and Hamlet 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Crozier et al. 2008; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Raymondi et al. 2013; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Raymondi et al. 2013; Wainwright and Weitkamp 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (Lawson et al. 2004; McMahon and Hartman 1989). In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7 degrees Celsius by the end of the century (IPCC 2014b). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Reeder et al. 2013; Tillmann and Siemann 2011).

9.2.6 Oceanographic Factors

As atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC 2014b). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al. 2012; Feely et al. 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012; Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, likely reaching predicted increases of 10-32 inches by 2081-2100 (IPCC 2014b). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Reeder et al. 2013; Tillmann and Siemann 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Reeder et al. 2013; Tillmann and Siemann 2011).

Oceanographic features of the action area may influence prey availability and habitat for Pacific salmonids. These features comprise climate regimes which may suffer regime shifts due to climate changes or other unknown influences. The action area includes important spawning and rearing grounds and physical or biological features essential to the conservation of listed Pacific salmonids - *i.e.*, water quality, prey, and passage conditions. These Pacific oceanographic conditions, climatic variability, and climate change may affect salmonids in the action area.

There is evidence that Pacific salmon abundance may have fluctuated for centuries as a consequence of dynamic oceanographic conditions (Beamish and Bouillon 1993; Beamish et al. 2009; Finney et al. 2002). Sediment cores reconstructed for 2,200-year records have shown that Northeastern Pacific fish stocks have historically been regulated by these climate regimes (Finney et al. 2002). The long-term pattern of the Aleutian Low pressure system has corresponded to the trends in salmon catch, to copepod production, and to other climate indices, indicating that climate and the marine environment may play an important role in salmon production. Pacific salmon abundance and corresponding worldwide catches tend to be large during naturally-occurring periods of strong Aleutian low pressure causing stormier winters and upwelling, positive Pacific Decadal Oscillation (PDO), and an above average Pacific circulation index (Beamish et al. 2009). A trend of an increasing Aleutian Low pressure indicates high pink and chum salmon production and low production of coho and Chinook salmon (Beamish et al. 2009). The abundance and distribution of salmon and zooplankton also relate to shifts in North Pacific atmosphere and ocean climate (Francis and Hare 1994).

Over the past century, regime shifts have occurred as a result of the North Pacific's natural climate regime. Reversals in the prevailing polarity of the PDO occurred around 1925, 1947, 1977, and 1989 (Hare and Mantua. 2000; Mantua et al. 1997). The reversals in 1947 and 1977 correspond to dramatic shifts in salmon production regimes in the North Pacific Ocean (Mantua et al. 1997). During the pre-1977 climate regime, the productivity of salmon populations from the Snake River exceeded expectations (residuals were positive) when values of the PDO were negative (Levin 2003). During the post-1977 regime when ocean productivity was generally lower (residuals were negative), the PDO was negative (Levin 2003).

A smaller, less pervasive regime shift occurred in 1989 (Hare and Mantua. 2000). Beamish *et al.* (2000) analyzed this shift and found a decrease in marine survival of coho salmon in Puget Sound and off the coast of California to Washington. Trends in coho salmon survival were linked over the southern area of their distribution in the Northeast Pacific to a common climatic event. The Aleutian Low Pressure Index and the April flows from the Fraser River also changed abruptly about this time (Beamish et al. 2000).

Poor environmental conditions for salmon survival and growth may be more prevalent with projected warming increases and ocean acidification. Increasing climate temperatures can influence smolt development which is limited by time and temperature (McCormick et al. 2009).

Food availability and water temperature may affect proper maturation and smoltification and feeding behavior (Mangel 1994). Climate change may also have profound effects on seawater entry and marine performance of anadromous fish, including increased salinity intrusion in estuaries due to higher sea levels, as well as a projected decrease of seawater pH (Orr et al. 2005). There is evidence that Chinook salmon survival in the Pacific during climate anomalies and El Nino events changes as a result of a shift from predation- to competition-based mortality in response to declines in predator and prey abundances and increases in pink salmon abundance (Ruggerone and Goetz 2004). If climate change leads to an overall decrease in the availability of food, then returning fish will likely be smaller (Mangel 1994). Finally, future climatic warming could lead to alterations of river temperature regimes, which could further reduce available fish habitat (Yates et al. 2008).

We expect changing weather and oceanographic conditions may affect prey availability, temperature and water flow in habitat conditions, and growth for all 28 ESUs/DPSs. Consequently, we expect the long-term survival and reproductive success for listed salmonids to be negatively affected by global climate change.

9.2.7 Pesticides

9.2.7.1 Monitoring Data – General Overview

The following discussion is a general overview of monitoring information. Details specific to each region are provided in 9.3.4 and 9.4.4 below. The USGS NAWQA program assessed trends in pesticide concentration at 59 sites across the U.S. for three overlapping periods: 1992-2001, 1997-2006, and 2001-2010. Trends in reported agriculture use intensity were assessed for the same periods at 57 sites (Ryberg et al. 2014). The report found widespread agreement between trends in concentration and use for agricultural pesticides. Additionally, the report found that trends between concentration and use for pesticides with both agricultural and urban use could be explained by taking into consideration concentration trends in urban streams (Ryberg et al. 2014).

Pesticide concentrations were detected at concentrations which exceeded aquatic-life benchmarks in many rivers and streams throughout the 20-year sampling period (Stone et al. 2014). In a more recent decade sampled (2002 – 2011), 61% of streams and rivers which drain agricultural watersheds contained pesticides at concentrations which exceeded thresholds. In Addition, 46% of mixed-land and 90% of urban streams were found to have pesticides in exceedance of aquatic-life benchmarks. According to (Stone et al. 2014) a number of important pesticides were not included in the sampling protocol and thus the potential for adverse effect is likely greater than is suggested by the percent of streams with exceedances.

When pesticides are released into the environment, they frequently end up as contaminants in aquatic environments. Depending on their physical properties some are rapidly transformed via chemical, photochemical, and biologically mediated reactions into other compounds, known as degradates. These degradates may become as prevalent as the parent pesticides depending on their rate of formation and their relative persistence.

Another dimension of pesticides and their degradates in the aquatic environment is their simultaneous occurrence as mixtures (Gilliom et al. 2006). Mixtures result from the use of different pesticides for multiple purposes within a watershed or groundwater recharge area. Pesticides generally occur more often in natural waterbodies as mixtures than as individual compounds.

Mixtures of pesticides were detected more often in streams than in ground water and at relatively similar frequencies in streams draining areas of agricultural, urban, and mixed land use. More than 90% of the time, water from streams in these developed land use settings had detections of two or more pesticides or degradates. About 70% and 20% of the time, streams had five or more and 10 or more pesticides or degradates, respectively (Gilliom et al. 2006). Fish exposed to multiple pesticides at once may also experience additive and synergistic effects. If the effects on a biological endpoint from concurrent exposure to multiple pesticides can be predicted by adding the potency of the pesticides involved, the effects are said to be additive. If, however, the response to a mixture leads to a greater than expected effect on the endpoint, and the pesticides within the mixture enhance the toxicity of one another, the effects are characterized as synergistic. These effects are of particular concern when the pesticides share a mode of action. NAWQA analysis of all detections indicates that more than 6,000 unique mixtures of 5 pesticides were detected in agricultural streams (Gilliom et al. 2006). The number of unique mixtures varied with land use.

During the years 2012-2014 the USEPA and USGS conducted an assessment of targeted-chemical composition and cumulative biochemical activity of water samples collected from streams across the United States. Eight of the 10 most-frequently detected anthropogenic organics were pesticides with frequencies ranging 66-84% of all sites (Bradley et al. 2017).

Pollution originating from a discrete location such as a pipe discharge or wastewater treatment outfall is known as a point source. Point sources of pollution require a National Pollutant Discharge Elimination System (NPDES) permit. These permits are issued for aquaculture, concentrated animal feeding operations, industrial wastewater treatment plants, biosolids (sewer/sludge), pre-treatment and stormwater overflows. The Environmental Protection Agency (EPA) administers the NPDES permit program and states certify that NPDES permit holders comply with state water quality standards. Nonpoint source discharges do not originate from discrete points; thus, nonpoint sources are difficult to identify, quantify, and are not regulated. Examples of nonpoint source pollution include, but are not limited to, urban runoff from impervious surfaces, areas of fertilizer and pesticide application, sedimentation, and manure.

According to EPA's database of NPDES permits, about 243 NPDES individual permits are co-located with listed Pacific salmonids in California. Collectively, the total number of EPA-recorded NPDES permits in Idaho, Oregon, and Washington that are co-located with listed Pacific salmonids is 1,978.

On November 27, 2006, EPA issued a final rule which exempted pesticides from the NPDES permit process, provided that application was approved under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The NPDES permits, then, do not include any point source application of pesticides to waterways in accordance with FIFRA labels. On January 7, 2009, the Sixth Circuit Court of Appeals vacated this rule (National Cotton Council v. EPA, 553 F.3d 927 (6th Cir. 2009)). The result of the vacatur, according to the Sixth Circuit, is that "discharges of pesticide pollutants are subject to the NPDES permitting program" under the CWA. In response, EPA has developed a Pesticide General Permit through the NPDES permitting program to regulate such discharges.

9.2.7.2 Baseline Pesticide Consultations

NMFS has consulted with EPA on the registration of several 33 pesticides. NMFS (NMFS 2008b) determined that current use of chlorpyrifos, diazinon, and malathion is likely to jeopardize the continued existence of 27 listed salmonid ESUs/DPSs.[10] NMFS (NMFS 2009b) further determined that current use of carbaryl and carbofuran is likely to jeopardize the continued existence of 22 ESUs/DPSs; and the current use of methomyl is likely to jeopardize the continued existence of 18 ESUs/DPSs of listed salmonids. NMFS also published conclusions regarding the registration of 12 different a.i.s (NMFS 2010b). NMFS concluded that pesticide products containing azinphos methyl, disulfoton, fenamiphos, methamidophos, or methyl parathion are not likely to jeopardize the continuing existence of any listed Pacific Salmon or destroy or adversely modify designated critical habitat. NMFS also concluded that the effects of products containing bensulide, dimethoate, ethoprop, methidathion, naled, phorate, or phosmet are likely to jeopardize the continued existence of some listed Pacific Salmonids and to destroy or adversely modify designated habitat of some listed salmonids. NMFS issued a biological Opinion on the effects of four herbicides and two fungicides (NMFS 2011b). NMFS concluded that products containing 2,4-D are likely to jeopardize the existence of all listed salmonids, and adversely modify or destroy the critical habitat of some ESU / DPSs. Products containing chlorothalonil or diuron were also likely to adversely modify or destroy critical habitat, but not likely to jeopardize listed salmonids. NMFS also concluded that products containing captan, linuron, or triclopyr BEE do not jeopardize the continued existence of any ESUs/DPSs of listed Pacific salmonids or adversely modify designated critical habitat. NMFS still found, however, that an incidental take statement was necessary for each of these chemicals to reduce harm to

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[10] The Fourth Circuit Court of Appeals remanded this Opinion on February 21, 2013. The Opinion was remanded to address the issues raised by the Court. Those issues are addressed in this Opinion.

individuals. In 2012, NMFS completed two additional Opinions covering four more pesticides. In May, 2012 NMFS issued an Opinion on oryzalin, pendimethalin, and trifluralin concluding each of these chemicals are likely to jeopardize the continued existence of some listed Pacific salmonids, and adversely modify designated critical habitat of some listed salmonids (NMFS 2012b). In July 2012, NMFS issued an Opinion on thiobencarb, an herbicide authorized for use only on rice. California is the only state within the range of listed Pacific salmonids that has approved the use of thiobencarb and is the only state among the action area states that grows rice. The thiobencarb Opinion focused on three listed Pacific salmon ESUs/DPSs in California's Central Valley where rice is grown. NMFS concluded EPAs registration of thiobencarb would harm listed species, but not jeopardize the continued existence of these three species and would not adversely modify their designated critical habitat. In 2013, NMFS issued an Opinion on the effects of three pesticides: diflubenzuron, fenbutatin oxide, and propargite. NMFS concluded that products containing diflubenzuron, fenbutatin oxide, and propargite are likely to jeopardize the existence of many listed salmonids, and adversely modify or destroy the critical habitat of many ESU / DPSs. All of NMFS previous Opinions on pesticides can be found at https://www.fisheries.noaa.gov/national/consultations/pesticide-consultations.

9.2.7.3 Pesticide Usage

As described in the introduction, the environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The key purpose of the environmental baseline is to describe the natural and anthropogenic factors influencing the status and condition of ESA-listed species and designated critical habitat in the action area. The information from the environmental baseline is treated as a "risk modifier" in the Integration and Synthesis section. Factors which have the potential to "modify" the risk are those which are able to interact with the effects of the action. While many of the factors described in this section have the potential to impact listed salmon and their designated critical habitat, and were thus considered, two of the factors presented in the environmental baseline were consistently found to have a high potential to modify the risk. The two factors are: 1) elevated freshwater temperatures, and 2) pesticide environmental mixtures. Elevated temperatures may increase risk to species because adverse toxicological responses are heightened with increases in temperature. Pesticide environmental mixtures may increase risk because of additive or synergistic effects. Current methodologies for calculating mixture toxicity indicate that additivity is the appropriate initial assumption (Cedergreen and Streibig 2005) unless available data suggest antagonism (less than additive toxicity) or synergism (greater than additive toxicity) is more appropriate. We found no published data showing antagonism or synergism in mixtures containing metolachlor or telone. Therefore, additive toxicity is the default assumption in this Opinion.

To assess pesticide environmental mixtures we examined land use categories within each species range by performing an overlap analysis with the National Land Cover Database (NLCD) information (NLCD, 2011) (e.g. ***Table 2***). We found the United States Geological Survey's (USGS) most recent National Water-Quality Assessment (NAWQA) report (Ryberg et al. 2014) corroborated previous reports findings of trends between concentration and land use for pesticides with both agricultural and urban applications. As such, we used land use categories such as "cultivated crops", "pasture/hay", and "developed land" as proxies for areas with an increased potential for environmental mixtures. Additional sources of information available to characterize the occurrence of pesticide environmental mixtures include: species recovery plans, status updates, listing documents, pesticide monitoring data, pesticide usage information, and incident data. We also consider existing consultations on pesticide use within the species range. However, note that of the more than 1200 active ingredients authorized for use in pesticide products in the United States, only 34 have been the subject of section 7 consultation with listed Pacific salmonids.

The following section (in addition to the state-specific sections later in this chapter) describes the general sources of pesticide usage information which were considered in the environmental baseline. Note that pesticide usage information is just one of numerous types of information qualitatively considered when evaluating pesticide environmental mixtures within species habitats.

The term "use" describes the authorized parameters (e.g. application rate, frequency, crop type, etc.) of pesticide application as described on the FIFRA label. EPA authorizes the FIFRA label that describes when, where, and how pesticide products can legally be applied. Therefore, the label defines the Federal action and is the subject of the analysis in the "Effects of the Action" portion of this Biological Opinion.

A related concept is that of "usage" which describes parameters (e.g. rate, frequency, percent treated) related to the ways in which a particular pesticide has been applied in the past. In short, use describes how pesticides are authorized to be applied whereas usage describes how pesticides have been applied in the past. Both use and usage can change over time. While use of metolachlor and telone defines the action being evaluated in this Opinion, the usage of all pesticides and other stressors that occur in the action area from past and present actions are also evaluated in the environmental baseline section. Ultimately, the conclusions regarding the species and designated critical habitat are derived through an integration of the information presented in the Status, Environmental Baseline, Effects of the Action, and Cumulative Effects sections of the Biological Opinion.

EPA has provided NMFS with national and state use and usage summaries for both metolachlor and telone which cover the years 2013-2017. The use information (i.e., registered use sites and application rates) comes from approved product labels and summarizes the maximum permitted usage. The usage information within these reports comes from both direct pesticide usage reporting (e.g., California Department of Pesticide Regulation) as well as usage estimates from proprietary surveys (e.g., the AgroTrak Study from Kynetec USA, Inc). This and other pesticide usage information is considered as part of the environmental baseline i.e. "past and present impacts of all Federal, State, or private actions" as described in 50 CFR 402.02. Summaries of the usage information available for Pacific Northwest and California Regions are provided below. The complete reports as compiled and provided by EPA are provided in Attachment 1. Note that the consideration of pesticide usage in the environmental baseline is not limited to metolachlor and telone, rather the environmental baseline considers the usage of all pesticides within the species range. The metolachlor and telone specific usage information are thus provided in this section as an example of the type of information available.

9.2.8 Reports of Ecological Incidents

Section 6(a)(2) of the Federal Insecticide, Fungicide and Rodenticide Act requires pesticide product registrants to report adverse effects information, such as incident data involving fish and wildlife. Criteria require reporting of large-scale incidents. For example, pesticide registrants are required to report the following (40 CFR part 159):

- Fish – Affecting 1,000 or more individuals of a schooling species or 50 or more individuals of a non-schooling species.
- Birds – Affecting 200 or more individuals of a flocking species, or 50 or more individuals of a songbird species, or 5 or more individuals of a predatory species.
- Mammals, reptiles, amphibians – Affecting 50 or more individuals of a relatively common or herding species or 5 or more individuals of a rare or solitary species.

The number of documented incidents is believed to be a very small fraction of total incidents caused by pesticides for a variety of reasons. Incident reports for non-target organisms typically provide information only on mortality events and plant damage. Sub-lethal effects in organisms such as abnormal behavior, reduced growth and/or impaired reproduction are rarely reported, except for phytotoxic effects in terrestrial plants. An absence of reports does not necessarily equate to an absence of incidents given the nature of the incident reporting.

Information on the potential effects of pesticides on non-target plants and animals is compiled in the Ecological Incident Information System (EIIS). The EIIS is a database containing adverse effect (typically mortality) reports on non-target organisms where such effects have been associated with the use of pesticides. Other Ecological Incident databases used are the Incident Data System (IDS), Aggregated Incident Database, and Avian Information Monitoring System (AIMS).

Each incident record indicates whether the incident occurred due to a misuse, registered use, or whether it is undetermined. Each incident is additionally classified with a certainty of the association with the identified active ingredient and are classified as: "highly probable," "probable," "possible," and "unlikely."

Incidents Involving 1,3-Dichloropropene

The following summary of ecological incidents was provided in EPA's 2013 Problem Formulation document for 1,3-Dichloropropene. Note that not all of the incidents described in the summary occurred within the Action Area relevant to this consultation. Four additional incidents were reported between the publication of the Problem Formulation and the 2019 Draft Risk Assessment for 1,3-D. Details of the four additional incidents were not provided.

From EPA's Problem Formulation: EIIS returned eight terrestrial plant incidents in Washington, California, Idaho, Florida, Mississippi, and South Carolina attributed to 1,3-D use with "possible" to "highly probable" certainty (USEPA, 2007b). Most of the incidents resulted from registered uses of products co- formulated with 1,3-D and chloropicrin; however, a few resulted from use of 1,3-D only. Incident #I007358-001 occurred in January 1998 when apple trees were planted on a field previously treated with 1,3-D and chloropicrin. Some trees didn't leaf out fully, were sick, or died. Incident #I012366-064 occurred in March 2001 when a registered use of 1,3,-D and chloropicrin damaged 52 acres of watermelons. Incident #I013636-048 occurred in April 2001 when 80 acres of grape fields were fumigated with 1,3-D. Roughly half of the crop died as a result of 1,3-D phytotoxicity and a settlement was reached. Incident #I014702-075 occurred in June 2002 when a registered use of 1,3-D damaged 20 acres of potatoes, resulting in poor yield and crop quality. Incident #I014702-076 occurred in September 2003 when a registered use of 1,3-D and chloropicrin damaged 91 acres of watermelon seedlings. Incident #s I014871-001 and I016962-028 occurred in July 2003 and May 2005, respectively, when golf courses treated with 1,3-D experienced significant burn shortly after application. Incident #I017958-012 occurred in August 2006 when 1,3-D applied to peach seedlings several months before killed the entire crop. In addition to the terrestrial plant incident, EIIS reports one aquatic incident (#I016738-016) when 1,3-D and chloropicrin applied to strawberry fields via irrigation accidently spilled into a nearby creek, resulting in 1000 fish killed. Residues taken from the fish confirmed the exposure. As of 30 April, 2012, AIMS identified no ecological incidents involving 1,3-D. Registrants reported 5 minor plant incidents and 1 minor wildlife incident with 1,3-D between 2000 and 2012. Unless additional information on these aggregated incidents becomes available, they will be assumed to be representative of registered uses of 1,3-D in the risk assessment.

Incidents Involving Metolachlor

The following summary of ecological incidents was provided in EPA's 2014 Problem Formulation document for Metolachlor. Note that not all of the incidents described in the summary occurred within the Action Area relevant to this consultation. EPA conducted a search of available databases again in 2019 as part of the Draft Risk Assessment. The 2019 search indicated a total of 623 ecological incidents associated with the use of S-metolachlor and metolachlor.

From EPA's Problem Formulation: A preliminary review on June 27, 2014 of the Ecological Incident Information System (EIIS, version 2.1.1), which is maintained by the Agency's Office of Pesticide Programs, and the Avian Monitoring Information System (AIMS), which is maintained by the American Bird Conservancy, indicates a total of 269 reported ecological incidents associated with the use of metolachlor and 206 reported ecological incidents associated with the use of S-metolachlor. This total excludes incidents classified as 'unlikely' or 'unrelated' and only includes those incidents with certainty categories of 'possible', 'probable', and 'highly probable' (for EIIS) and 'possible', 'probable', 'likely', 'highly likely' and 'certain' (for AIMS). Incidents classified as 'unlikely' the result of or 'unrelated' to metolachlor or S-metolachlor will not be included in this Problem Formulation or the ecological risk assessment conducted for Registration Review.

All of the metolachlor incidents, excluding those classified as 'unlikely' or 'unrelated', occurred between 1984 and 2014. Thirteen of the metolachlor incidents reported in the EIIS database involved aquatic animals, 2 involved terrestrial animals, and 254 involved plants. The certainty categories regarding the likelihood that the use of metolachlor caused the 269 incidents were probable (99 incidents), possible (167 incidents), and highly probable (3 incidents). One hundred and sixty-seven of the incidents were considered registered uses at the time of the incident, 17 involved misuses, and the legality of use was undetermined in 85 incidents. The reported incidents for metolachlor involved 265 uses that are currently registered [agriculture area, corn, nut, peanut, potato, soybean, turf, and wheat], and 4 in which the use site was not specified.

Incidents are reported separately for S-metolachlor, but the number and type of reports are similar. There were a total of 206 reported incidents for S-metolachlor. Twenty-nine involved terrestrial animals and 177 involved plants. Of the 29 incidents that involved terrestrial animals, only 1 was a bird incident also reported in AIMS (EIIS: 1015105). The certainty categories regarding the likelihood that the use of S-metolachlor caused the 206 incidents were probable (74 incidents) and possible (132 incidents). One hundred and forty-two of the incidents were considered registered uses at the time of the incident, 7 involved misuses, and the legality of use was undetermined in 57 incidents. Based on the data, it appears that most of the reports are undesired effects treatment site, when applied in accordance with a registered use. The most commonly reported crops damaged were corn, cotton, and soybean.

In addition to the incidents recorded in EIIS and AIMS, additional incidents have been reported to the Agency in aggregated incident reports. Pesticide registrants report certain types of incidents to the Agency as aggregate counts of incidents occurring per product per quarter.

Ecological incidents reported in aggregate reports include those categorized as ‘minor fish and wildlife’ (W-B), ‘minor plant’ (P-B), and ‘other non-target’ (ONT) incidents. ‘Other non-target’ incidents include reports of adverse effects to insects and other terrestrial invertebrates. For metolachlor, registrants have reported 5 minor fish and wildlife incidents, 44 minor plant incidents, and 0 other non-target incidents. For S-metolachlor, registrants have reported 4 minor fish and wildlife incidents, 672 minor plant incidents, and 0 other non-target incidents. Unless additional information on these aggregated incidents becomes available, they will be assumed to be representative of registered uses of metolachlor and S-metolachlor in the risk assessment.

In the risk assessment, the incidents will be further evaluated to determine if the reported incidents represent current patterns of use for metolachlor and S-metolachlor. Examples of additional considerations are mitigation (e.g., reduced application rates), product cancellations, and changes in use patterns that have occurred since the date of the reported incident(s).

9.2.9 Water Temperature

Elevated temperature is considered a pollutant in most states with approved Water Quality Standards under the federal Clean Water Act (CWA) of 1972. Under the authority of the CWA, states periodically prepare a list of all surface waters in the state for which beneficial uses are impaired by pollutants including drinking, recreation, aquatic habitat, and industrial uses. This process is in accordance with section 303(d) of the CWA. Estuaries, lakes, and streams listed under 303(d) are those that are considered impaired or threatened by pollution. They are water quality limited, do not meet state surface water quality standards, and are not expected to improve within the next two years.

Each state has unique 303(d) listing criteria and processes. Generally, a water body is listed separately for each standard it exceeds, so it may appear on the list more than once. If a water body is not on the 303(d) list, it is not necessarily contaminant-free; rather it may not have been tested. Therefore, the 303(d) list is a minimum list for each state regarding polluted water bodies by parameter.

After states develop their lists of impaired waters, they are required to prioritize and submit their lists to EPA for review and approval. Each state establishes a priority ranking for such waters, considering the severity of the pollution and the uses to be made of such waters. States are expected to identify high priority waters targeted for TMDL development within two years of the 303(d) listing process.

Temperature is significant for the health of aquatic life. Water temperatures affect the distribution, health, and survival of native cold-blooded salmonids in the Pacific Northwest and elsewhere. These fish will experience adverse health effects when exposed to temperatures outside their optimal range. For listed Pacific salmonids, water temperature tolerance varies between species and life stages. Optimal temperatures for rearing salmonids range from 10ºC to 16ºC. In general, the increased exposure to stressful water temperatures and the reduction of suitable habitat caused by drought conditions reduce the abundance of salmon. Warm temperatures can reduce fecundity, reduce egg survival, retard growth of fry and smolts, reduce rearing densities, increase susceptibility to disease, decrease the ability of young salmon and trout to compete with other species for food, and to avoid predation (McCullough 1999; Spence et al. 1996). Migrating adult salmonids and upstream migration can be delayed by excessively warm stream temperatures. Excessive stream temperatures may also negatively affect incubating and rearing salmonids (Gregory and Bisson 1997).

Sublethal temperatures (above 24ºC) could be detrimental to salmon by increasing susceptibility to disease (Colgrove and Wood 1966) or elevating metabolic demand (Brett 1995). Substantial research demonstrates that many fish diseases become more virulent at temperatures over 15.6ºC (McCullough 1999). Due to the sensitivity of salmonids to temperature, states have established lower temperature thresholds for salmonid habitat as part of their water quality standards.

9.2.10 Baseline Habitat Condition

As noted in the status of the species section, the riparian zones for many of the Evolutionarily Significant Units (ESUs)/Distinct Population Segments (DPSs) are degraded. Riparian zones are the areas of land adjacent to rivers and streams. These systems serve as the interface between the aquatic and terrestrial environments. Riparian vegetation is characterized by emergent aquatic plants and species that thrive on close proximity to water, such as willows. This vegetation maintains a healthy river system by reducing erosion, stabilizing main channels, and providing shade. Leaf litter that enters the river becomes an important source of nutrients for invertebrates (Bisson and Bilby 2001). Riparian zones are also the major source of large woody debris (LWD). When trees fall and enter the water, they become an important part of the ecosystem. The LWD alters the flow, creating the pools of slower moving water preferred by salmon (Bilby et al. 2001). While not necessary for pool formation, LWD is associated with around 80% of pools in northern California, Washington, and the Idaho panhandle (Bilby and Bisson 2001).

Bilby and Bisson (2001) discuss several studies that associate increased LWD with increased pools, and both pools and LWD with salmonid productivity. Their review also includes documented decreases in salmonid productivity following the removal of LWD. Other benefits of LWD include deeper pools, increased sediment retention, and channel stabilization.

Floodplains are relatively flat areas adjacent to streams and rivers that stretch from the banks of the channel to the base of the enclosing valley walls. They allow for the lateral movement of the main channel and provide storage for floodwaters during periods of high flow. The floodplain includes the floodway, which consists of the stream channel, and adjacent areas that actively carry flood flows downstream; and the flood fringe, which are areas that are inundated, but which do not experience a strong current. Water stored in the floodplain is later released during periods of low flow. This process ensures adequate flows for salmonids during the summer months, and reduces the possibility of high-energy flood events destroying salmonid redds (Smith 2005).

Periodic flooding of these areas creates habitat used by salmonids. Thus, floodplain areas vary in depth and widths and may be intermittent or seasonal. Storms also wash sediment and LWD into the main stem river, often resulting in blockages. These blockages may force the water to take an alternate path and result in the formation of side channels and sloughs (Benda et al. 2001). Side channels and sloughs are important spawning and rearing habitat for salmonids. The degree to which these off-channel habitats are linked to the main channel via surface water connections is referred to as connectivity (PNERC 2002). As river height increases with heavier flows, more side channels form and connectivity increases. Juvenile salmonids migrate to and rear in these channels for a certain period of time before swimming out to the open sea.

Healthy riparian habitat and floodplain connectivity are vital for supporting a salmonid population. Chinook salmon and steelhead have life history strategies that rely on floodplains during their juvenile life stages. Chum salmon use adjacent floodplain areas for spawning. Soon after their emergence, chum salmon use the riverine system to rapidly reach the estuary where they mature, rear, and migrate to the ocean. Coho salmon use the floodplain landscape extensively for rearing. Estuarine floodplains can provide value to juveniles of all species once they reach the salt water interface.

Once floodplain areas have been disturbed, it can take decades for their recovery (Smith 2005). Consequently, most land use practices cause some degree of impairment. Development leads to construction of levees and dikes, which isolate the mainstem river from the floodplain. Agricultural development and grazing in riparian areas also significantly change the landscape. Riparian areas managed for logging, or logged in the past, are often impaired by a change in species composition. Most areas in the northwest were historically dominated by conifers. Logging results in recruitment of deciduous trees, decreasing the quality of LWD in the rivers. Deciduous trees have smaller diameters than conifers; they decompose faster and are more likely to be displaced (Smith 2005).

Without a properly functioning riparian zone, salmonids contend with a number of limiting factors. They face reductions in quantity and quality of both off-channel and pool habitats. Also, when seasonal flows are not moderated, both higher and lower flow conditions exist. Higher flows can displace fish and destroy redds, while lower flows cut off access to parts of their habitat. Finally, decreased vegetation limits the available shade and cover, exposing individuals to higher temperatures and increased predation.

9.3 Pacific Northwest Region

9.3.1 Land Use and Population Growth

The Pacific Northwest subregion includes all of Washington and parts of California, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming. The subregion totals roughly 700,000 km^2 of which about 600,000 km^2 is classified as undeveloped, 30,000 km^2 is classified as developed and about 70,000 km^2 is classified as agriculture (Figure 45).

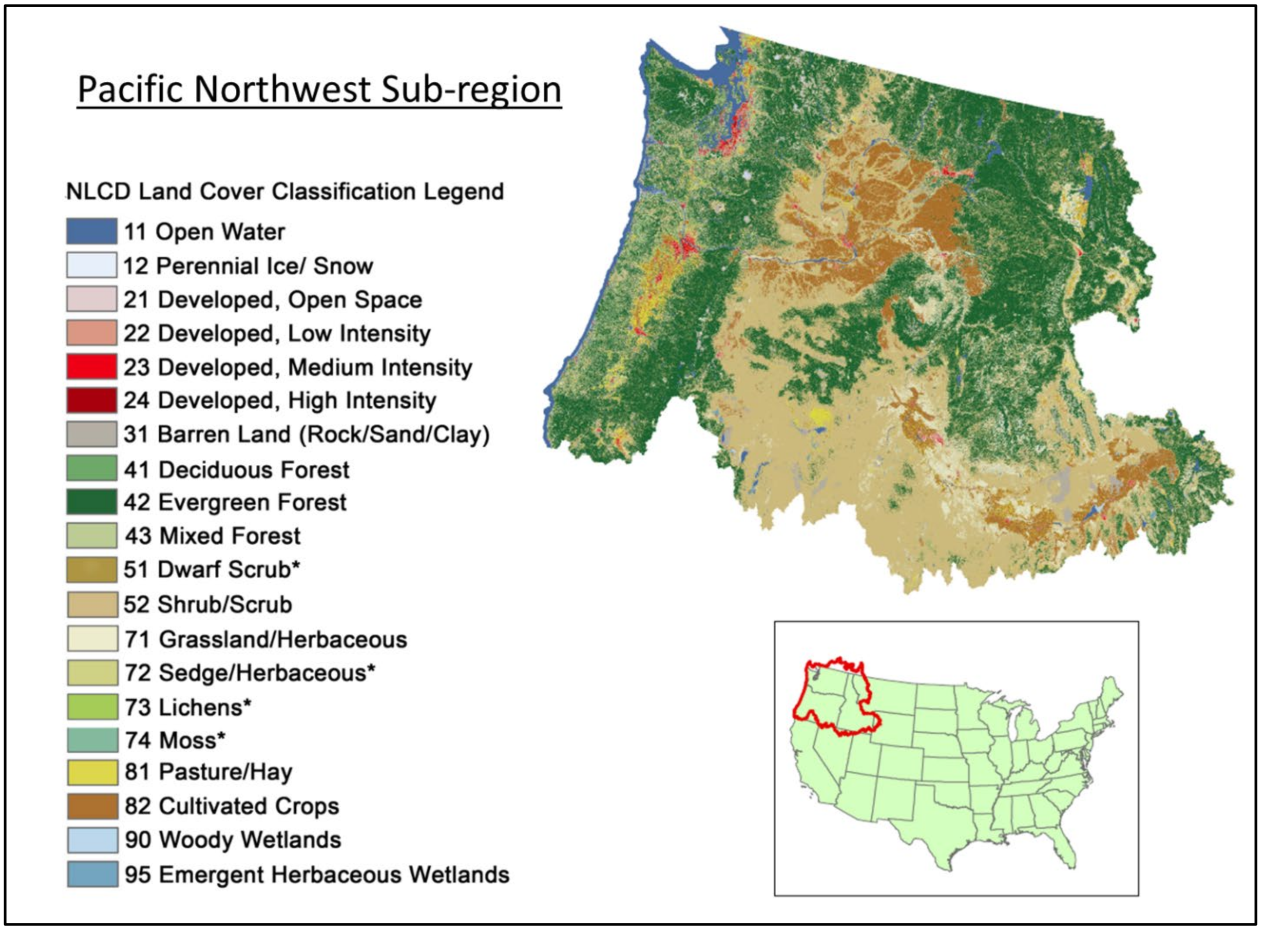


Figure 45. Landuse in the Pacific Northwest sub-region. Data from the NLCD 2011 (www.mrlc.gov).

Nineteen of the 28 species addressed in the Opinion occur in this subregion. They are: chinook salmon (ESUs: Snake River spring/summer-run, Snake River fall-run, Puget Sound, Upper Columbia River spring-run, Lower Columbia River, and Upper Willamette River), chum salmon (ESUs: Columbia River, and Hood Canal summer-run), coho salmon (ESUs: Oregon coast, Southern Oregon/Northern California coast, Lower Columbia River), sockeye salmon (ESUs:

Ozette Lake, and Snake River), steelhead (DPSs: Upper Columbia River, Upper Willamette River, Middle Columbia River, Lower Columbia River, Snake River basin, Puget Sound). *Table 112, Table 113*, and *Table 114* show the types and areas of land use within each of the species' ranges.

Table 112. Area of land use categories within Pacific Northwest subregion selected Chinook salmon ranges in km². The total area for each category is given in bold. Land cover was determined via the NLCD 2011. Land cover class definitions are available at: http://www.mrlc.gov/nlcd_definitions.php

Land Cover	Chinook salmon					
NLCD Sub category	Snake River spring/ summer	Snake River fall	Puget Sound	Upper Columbia River spring	Lower Columbia River	Upper Willamette River
Water	**1,813**	**1,694**	**807**	**1,814**	**747**	**651**
Open Water	1,780	1,694	534	1,802	717	651
Perennial Ice/Snow	33	0	273	12	30	-
Developed Land	**2,643**	**1,719**	**4,883**	**2,343**	**2,161**	**2,259**
Open Space	1,009	674	1,528	742	807	653
Low Intensity	571	478	1,524	691	581	744
Medium Intensity	322	300	766	386	330	461
High Intensity	119	117	303	133	138	194
Barren Land	622	150	762	392	305	208
Undeveloped Land	**72,964**	**14,730**	**20,204**	**19,657**	**15,330**	**14,396**
Deciduous Forest	335	319	1,024	318	616	305
Evergreen Forest	38,727	4,277	12,395	6,789	9,584	9,242
Mixed Forest	444	429	2,210	435	968	711
Shrub/Scrub	18,996	5,637	2,917	9,463	2,788	2,471
Grassland/Herbaceous	13,771	3,587	966	2,032	718	983
Woody Wetlands	371	270	502	362	436	465
Emergent Wetlands	320	210	191	257	218	220
Agriculture	**8,761**	**4,552**	**1,395**	**3,892**	**1,076**	**4,744**
Pasture/Hay	789	372	1,140	710	745	2,968
Cultivated Crops	7,971	4,180	255	3,183	330	1,776
TOTAL (inc. open water)	**86,180**	**22,696**	**27,289**	**27,706**	**19,314**	**22,051**
TOTAL (w/o open water)	**84,367**	**21,001**	**26,482**	**25,892**	**18,567**	**21,400**

Table 113. Area of land use categories within Pacific Northwest subregion selected chum, coho and sockeye species' ranges in km². The total area for each category is given in bold. Land cover was determined via the NLCD 2011. Land cover class definitions are available at: http://www.mrlc.gov/nlcd_definitions.php

Land Cover	Chum salmon		Coho salmon			Sockeye salmon	
NLCD Sub category	Columbia River	Hood Canal summer-run	Oregon Coast	Southern Oregon/ Northern California	Lower Columbia River	Ozette Lake	Snake River
Water	**691**	**57**	**193**	**1,657**	**745**	**30**	**1,699**
Open Water	687	13	193	1,646	715	30	1,682
Perennial Ice/Snow	4	44	0	12	30	-	17
Developed Land	**1,894**	**369**	**1,676**	**2,063**	**2,139**	**4**	**1,685**
Open Space	668	130	1,106	1,394	795	1	622
Low Intensity	541	78	168	235	574	0	478
Medium Intensity	334	23	61	114	329	0	297
High Intensity	137	7	24	31	137	-	116
Barren Land	213	131	317	289	304	3	172
Undeveloped Land	**8,629**	**3,053**	**25,050**	**43,886**	**14,938**	**198**	**18,880**
Deciduous Forest	522	99	334	1,041	611	4	304
Evergreen Forest	4,116	2,096	13,762	27,973	9,311	138	6,955
Mixed Forest	836	185	3,774	2,425	962	3	426
Shrub/Scrub	1,912	431	4,991	9,490	2,703	30	7,155
Grassland/Herbaceous	672	168	1,619	2,710	702	13	3,527
Woody Wetlands	363	55	305	155	430	9	286
Emergent Wetlands	210	19	265	92	218	1	226
Agriculture	**1,069**	**80**	**919**	**1,228**	**1,071**	**-**	**3,833**
Pasture/Hay	694	79	857	761	742	-	501
Cultivated Crops	375	2	61	467	330	-	3,332
TOTAL (inc. open water)	**12,283**	**3,558**	**27,838**	**48,834**	**18,893**	**232**	**26,097**
TOTAL (w/o open water)	**11,592**	**3,502**	**27,645**	**47,177**	**18,148**	**202**	**24,399**

Table 114. Area of land use categories within Pacific Northwest subregion selected steelhead species' ranges in km². The total area for each category is

given in bold. Land cover was determined via the NLCD 2011. Land cover class definitions are available at: http://www.mrlc.gov/nlcd_definitions.php

Land Cover	Steelhead salmon DPS					
NLCD Sub category	Upper Columbia River	Upper Willamette River	Middle Columbia River	Lower Columbia River	Snake River Basin	Puget Sound
Water	**768**	**704**	**1,633**	**1,191**	**1,813**	**597**
Open Water	12	-	1,616	1,160	1,780	392
Perennial Ice/Snow	756	704	17	30	33	205
Developed Land	**1,959**	**2,076**	**3,566**	**2,070**	**2,643**	**4,836**
Open Space	701	832	1,677	734	1,009	1,517
Low Intensity	389	514	969	574	571	1,521
Medium Intensity	134	209	444	330	322	777
High Intensity	418	174	144	137	119	302
Barren Land	318	347	331	295	622	719
Undeveloped Land	**20,658**	**11,476**	**64,159**	**13,939**	**72,964**	**18,912**
Deciduous Forest	7,138	4,483	341	572	335	1,005
Evergreen Forest	436	1,104	19,856	8,840	38,727	11,202
Mixed Forest	9,901	2,019	451	809	444	2,210
Shrub/Scrub	2,087	845	39,441	2,446	18,996	2,859
Grassland/Herbaceous	830	2,804	3,015	630	13,771	970
Woody Wetlands	266	220	505	427	371	506
Emergent Wetlands	1	1	550	215	320	161
Agriculture	**3,868**	**2,361**	**13,797**	**1,061**	**8,761**	**1,345**
Pasture/Hay	3,495	1,908	1,155	732	789	1,094
Cultivated Crops	373	453	12,643	329	7,971	251
TOTAL (inc. open water)	**27,254**	**16,617**	**83,155**	**18,260**	**86,180**	**25,690**
TOTAL (w/o open water)	**26,485**	**15,913**	**81,522**	**17,069**	**84,367**	**25,094**

Population growth within communities in areas where salmon occur will place pressures on water availability and water quality. Oregon's estimated population reached 4.14 million on July 1, 2017. This is an increase of 310,026 persons or 8.1 percent since the 2010 Census count. While growth slowed during the 2008 recession, Oregon's growth rate now ranks in the top 10 in the nation (Vaidya 2017). Between 2017 and 2018, Oregon's population grew by an additional 54,000 people, The largest gains are in metropolitan areas, with Oregon's three most populous counties in the Portland metropolitan area. Multnomah and Washington counties each added more than 10,000 residents, and Clackamas County added over 6,000. The largest percentage growth occurred in Deschutes and Crook Counties in Central Oregon (PSU Population Research Center 2018). According to Washington's 2018 Population Trends report, the state grew by 117,300 persons, or 1.6 percent. Growth was concentrated in the five largest metropolitan counties: King, Pierce, Snohomish, Spokane and Clark. Eastern Washington grew by 1.4 percent and Western Washington by 1.7 percent. Counties along the Interstate 5 corridor grew by 1.7 percent versus 1.4 percent for rest of the state. Metropolitan counties grew 1.6 percent compared to nonmetropolitan counties, which grew 1.3 percent. Counties that border, or are within, Puget Sound grew by 1.7 percent versus non-Puget Sound counties, which grew by 1.5 percent. Rural counties grew by 1.3 percent versus 1.7 percent for nonrural counties (Washington Office of Financial Management 2018).

9.3.2 Water Temperature

Temperature is significant for the health of aquatic life. Water temperatures affect the distribution, health, and survival of native cold-blooded salmonids in the Pacific Northwest and elsewhere. These fish will experience adverse health effects when exposed to temperatures outside their optimal range. For listed Pacific salmonids, water temperature tolerance varies between species and life stages. Optimal temperatures for rearing salmonids range from 10ºC to 16ºC. In general, the increased exposure to stressful water temperatures and the reduction of suitable habitat caused by drought conditions reduce the abundance of salmon. Warm temperatures can reduce fecundity, reduce egg survival, retard growth of fry and smolts, reduce rearing densities, increase susceptibility to disease, decrease the ability of young salmon and trout to compete with other species for food, and to avoid predation (McCullough 1999; Spence et al. 1996). Migrating adult salmonids and upstream migration can be delayed by excessively warm stream temperatures. Excessive stream temperatures may also negatively affect incubating and rearing salmonids (Gregory and Bisson 1997). ***Figure 46*** depicts waterbodies with 303(d) temperature exceedances within the Pacific Northwest subregion.

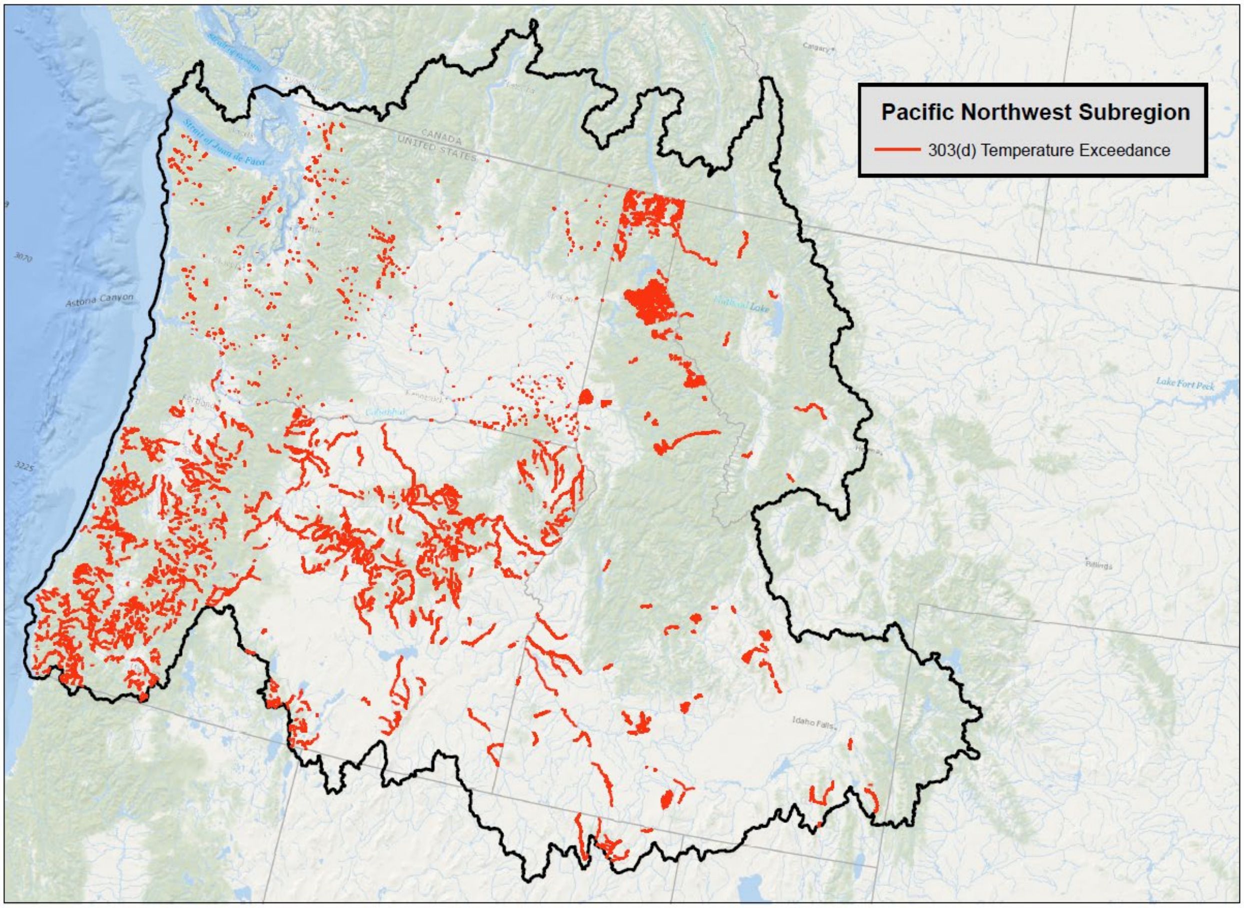


Figure 46. 303(d) temperature exceedances within the Pacific Northwest subregion. Data downloaded from USEPA ATTAINS website; "303(d) May 1, 2015 National Extract layer".

We used GIS layers made publically available through USEPA's Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS) to determine the number of km on the 303(d) list for exceeding temperature thresholds within the boundaries of those species which utilize freshwater habitats (Table 115). Because the 303(d) list is limited to the subset of rivers tested, the chart values should be regarded as lower-end estimates. While some ESU/DPS ranges do not contain any 303(d) rivers listed for temperature, others show considerable overlap. These comparisons demonstrate the relative significance of elevated temperature among ESUs/DPSs. Increased water temperature may result from wastewater discharge, decreased water flow, minimal shading by riparian areas, and climatic variation.

Table 115. Number of kilometers of river, stream and estuaries included in ATTAINS 303(d) lists due to temperature that are located within selected Pacific

Northwest species (ESU/DPS) ranges. Data were taken from USEPA ATTAINS website: May 1, 2015 National Extract.

Species	River-kilometers of recorded temperature exceedance 303(d)
Chinook, Snake River spring/summer-run ESU	1,378
Chinook, Snake River fall-run ESU	395
Chinook, Puget Sound ESU	269
Chinook, Upper Columbia River spring-run ESU	310
Chinook, Lower Columbia River ESU	286
Chinook, Upper Willamette River ESU	1,516
Chum, Columbia River ESU	302
Chum, Hood Canal summer-run ESU	45
Coho, Oregon Coast ESU	2,498
Coho, Southern Oregon/Northern California coasts ESU	5,509
Coho, Lower Columbia River ESU	281
Sockeye, Ozette Lake ESU	2
Sockeye, Snake River ESU	305
Steelhead, Upper Columbia River DPS	312
Steelhead, Upper Willamette River DPS	944
Steelhead, Middle Columbia River DPS	3,509
Steelhead, Lower Columbia River DPS	276
Steelhead, Snake River Basin DPS	1,378
Steelhead, Puget Sound DPS	267

9.3.3 Pesticide Usage

The sources of information used to characterize the occurrence of pesticide environmental mixtures within specie's habitats include: land use information, species recovery plans, status updates, listing documents, pesticide monitoring data, incident data, existing pesticide consultations, and pesticide usage information.

Sources of pesticide usage information and analyses considered in this baseline assessment include United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) census of agriculture and chemical use programs; USGS national water quality assessment (NAWQA) project – pesticide national synthesis project; State-based surface and groundwater monitoring programs; State-based usage collection programs (e.g. see Attachment A for WA-State data); California Department of Pesticide Regulation – Pesticide Use Reporting (PUR); as well as survey data from proprietary sources as summarized by EPA (see Attachment 1).

Washington

In 2017, pesticides were applied to over 8.7 million acres in Washington State to control for insects; weeds, grass or brush; nematodes; diseases in crops and orchards; or to control growth, thin fruit, ripen, or defoliate (USDA, 2017). The previous census (2012) reported about 8.1 million acres treated for these use categories. During the period 2010-2016 an average of about 230 different active ingredients were applied annually in Washington State to control pests on crop groups: corn, wheat, vegetables and fruit, orchards and grapes, alfalfa, pasture and hay, and other crops. EPA has provided NMFS with national and state use and usage summaries for both metolachlor and telone which cover the years 2013-2017. The usage information within these reports come from both direct pesticide usage reporting (e.g. California Department of Pesticide Regulation) as well as usage estimates based on surveys (e.g. USDA NASS and proprietary estimates from Kynetec USA, Inc). See Table 116 and Table 117 for the available usage information for metolachlor and telone in Washington. See also Attachment A for WSDA usage summary for metolachlor. Note that the consideration of pesticide usage in the environmental baseline is not limited to metolachlor and telone, rather the environmental baseline considers the usage of all pesticides within the species range. The metolachlor and telone usage tables are thus provided as an example of the type of information available.

Table 116. Washington 1,3-Dichloropropene Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Alfalfa	400,000	Surveyed but no usage reported			
Almonds	Not Surveyed[2]				
Apples	200,000	4,000	0	<2.5	<1
Apricots	Not Surveyed[2]				
Artichoke	Not Surveyed[2]				
Asparagus	3,000	Surveyed but no usage reported			
Avocados	Not Surveyed[2]				
Barley	100,000	Surveyed but no usage reported			
Beans, Lima	2,000	Surveyed but no usage reported			
Beans, Dry	300,000	Surveyed but no usage reported			
Beans, Snap, Bush, Pole, String	Not Surveyed[2]				
Beets	Not Surveyed[2]				
Bitter Melon	Not Surveyed[2]				
Blueberry	10,000	Surveyed but no usage reported			
Broccoli	Not Surveyed[2]				
Brussel Sprouts	Not Surveyed[2]				
Cabbage	Not Surveyed[2]				
Caneberries	5,000	Surveyed but no usage reported			
Canola	Not Surveyed[2]				

Cantaloupe	Not Surveyed[2]				
Carrots	6,000	600,000	35	85	65
Cauliflower	Not Surveyed[2]				
Celery	Not Surveyed[2]				
Cherries	40,000	6,000	0	<2.5	<1
Chinese Cabbage	Not Surveyed[2]				
Corn	200,000	Surveyed but no usage reported			
Corn, Forage-Fodder	Not Surveyed[2]				
Cotton	Not Surveyed[2]				
Cucumbers	<500	Surveyed but no usage reported			
Dates	Not Surveyed[2]				
Daikon	Not Surveyed[2]				
Eggplant	<500	Surveyed but no usage reported			
Figs	Not Surveyed[2]				
Garlic	Not Surveyed[2]				
Grape, Table/Raisin	Not Surveyed[2]				
Grape, Wine	60,000	Surveyed but no usage reported			
Grapefruit	Not Surveyed[2]				
Hazelnuts	Not Surveyed[2]				
Honeydew	D	Surveyed but no usage reported			
Kale	Not Surveyed[2]				
Kiwifruit	Not Surveyed[2]				
Leeks	Not Surveyed[2]				
Lemons	Not Surveyed[2]				
Lettuce	Not Surveyed[2]				
Peppermint	Not Surveyed[2]				
Nectarines	2,000	Surveyed but no usage reported			
Nursery Crops	Not Surveyed[2]				
Oats	4,000	Surveyed but no usage reported			
Olives	Not Surveyed[2]				
Onions	20,000	200,000	0	10	5
Oranges	Not Surveyed[2]				
Parsley	Not Surveyed[2]				
Pasture	900,000	Surveyed but no usage reported			
Peaches	1,000	Surveyed but no usage reported			
Peanuts	Not Surveyed[2]				
Pears	20,000	Surveyed but no usage reported			
Peas	40,000	Surveyed but no usage reported			
Pecans	Not Surveyed[2]				
Peppers	Not Surveyed[2]				
Persimmons	Not Surveyed[2]				
Pineapple	Not Surveyed[2]				
Pistachio	Not Surveyed[2]				
Plums	Not Surveyed[2]				
Pomegranates	Not Surveyed[2]				
Prunes	Not Surveyed[2]				
Potatoes	200,000	10,600,000	35	60	45
Pumpkins	2,000	Surveyed but no usage reported			

Rice	Not Surveyed[2]	
Rye	Not Surveyed[2]	
Safflower	Not Surveyed[2]	
Sorghum	Not Surveyed[2]	
Soybeans	Not Surveyed[2]	
Spinach	Not Surveyed[2]	
Squash	Not Surveyed[2]	
Strawberries	<500	Surveyed but no usage reported
Sugar Beets	Not Surveyed[2]	
Sugarcane	Not Surveyed[2]	
Sunflower	Not Surveyed[2]	
Sweet Corn	90,000	Surveyed but no usage reported
Sweet Potato	Not Surveyed[2]	
Tangelo	Not Surveyed[2]	
Tangerines	Not Surveyed[2]	
Tobacco	Not Surveyed[2]	
Tomato	Not Surveyed[2]	
Walnuts	Not Surveyed[2]	
Watermelon	Not Surveyed[2]	
Wheat, spring	600,000	Surveyed but no usage reported
Wheat, summer	1,700,000	Surveyed but no usage reported
Golf Course	Surveyed but no usage reported at national level	

[1]*Not surveyed at national level*
[2]*Not surveyed for within Washington*

Table 117. Washington Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Corn	NA	Surveyed but no usage reported			
Sorghum	Not surveyed				
Sweet Corn	NA	Surveyed but no usage reported			
Tomato	Not surveyed				
Beans (Snap, Bush, Pole, String)	Not surveyed				
Dry Beans/Peas	300,000	900	0	<2.5	<1
Lima Beans	Not surveyed				
Peanuts	Not surveyed				
Peas (Fresh, Green, Sweet)	NA	Surveyed but no usage reported			
Soybeans	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sunflowers	Not surveyed				
Potatoes	NA	Surveyed but no usage reported			

[1]*Not surveyed at national level*

[2]*Not surveyed for within Washington*

Table 118. Washington S-Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Blueberries	Not surveyed				
Currant	Not surveyed				
Elderberry	Not surveyed				
Gooseberry	Not surveyed				
Huckleberry	Not surveyed				
Strawberries	Not surveyed				
Blackberries	Not surveyed				
Raspberries	Not surveyed				
Loganberry	Not surveyed				
Chive	Not surveyed				
Garlic	Not surveyed				
Leek	Not surveyed				
Onions	Not surveyed				
Shallot	Not surveyed				
Corn	200,000	30,000	0	35	20
Sorghum	Not surveyed				
Sweet Corn	90,000	10,000	5	25	10
Cantaloupes	Not surveyed				
Citron	Not surveyed				
Cucumbers	Not surveyed				
Muskmelon	Not surveyed				
Pumpkins	Surveyed but no use reported				
Squash	Not surveyed				
Watermelons	Not surveyed				
Eggplant	Not surveyed				
Okra	Not surveyed				
Peppers	Not surveyed				
Tomatoes	Not surveyed				
Broccoli	Not surveyed				
Brussel Sprouts	Not surveyed				
Chinese Cabbage	Not surveyed				
Cauliflower	Not surveyed				
Cabbage	Not surveyed				
Broccoli Raab	Not surveyed				
Mustard Spinach	Not surveyed				
Rape Greens	Not surveyed				
Collards	Not surveyed				
Mizuna	Not surveyed				

Mustard Greens	Not surveyed				
Kale	Not surveyed				
Celery	Not surveyed				
Cilantro	Not surveyed				
Rhubarb	Not surveyed				
Spinach	Not surveyed				
Swiss Chard	Not surveyed				
Turnip Greens	Not surveyed				
Beans (Snap, Bush, Pole, String)	Not surveyed				
Dry Beans/Peas	300,000	30,000	<2.5	25	15
Lentils	Not surveyed				
Lima Beans	2,000	3,000	55	100	85
Peas (Fresh, Green, Sweet)	40,000	<500	0	<2.5	<1
Soybeans	Not surveyed				
Alfalfa	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sesame	Not surveyed				
Sunflowers	Not surveyed				
Daikon Radish	Not surveyed				
Horseradish	Not surveyed				
Parsnip	Not surveyed				
Rutabaga	Not surveyed				
Sweet Potatoes	Not surveyed				
Sugar Beets	Not surveyed				
Garden Beets	Not surveyed				
Carrots	Not surveyed				
Celeriac	Not surveyed				
Radish	Not surveyed				
Asparagus	Not surveyed				
Potatoes	200,000	20,000	10	30	15
Peanuts	Not surveyed				
Stevia	Not surveyed				
Rights of Way	Surveyed but no usage reported – at national level				
Agricultural Turf	Surveyed but no usage reported – at national level				
Ornamental Lawns, Turf and associated Ornamentals	Surveyed but no usage reported – at national level				
Institutional Turf Facilities	Surveyed but no usage reported – at national level				
Golf Courses	Surveyed but no usage reported – at national level				
Nursery and Greenhouse Ornamentals	Surveyed but no usage reported – at national level				

Oregon

In 2017, pesticides were applied to over 4.6 million acres in Oregon to control for insects; weeds, grass or brush; nematodes; diseases in crops and orchards; or to control growth, thin fruit, ripen, or defoliate (USDA 2017). The previous census (2012) reported about 4.3 million acres treated for these use categories. During the period 2010-2016 an average of about 230 different active ingredients were applied annually in Oregon to control pests on crop groups: corn, wheat, vegetables and fruit, orchards and grapes, alfalfa, pasture and hay, and other crops.

EPA has provided NMFS with national and state use and usage summaries for both metolachlor and telone which cover the years 2013-2017. The usage information within these reports come from both direct pesticide usage reporting (e.g. California Department of Pesticide Regulation) as well as usage estimates based market research surveys (e.g. Agricultural Market Research Data). See Table 119 and Table 120 for the available usage information for metolachlor and telone in Oregon. Note that the consideration of pesticide usage in the environmental baseline is not limited to metolachlor and telone, rather the environmental baseline considers the usage of all pesticides within the species range. The metolachlor and telone usage tables are thus provided as an example of the type of information available.

Table 119. Oregon 1,3-Dichloropropene Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Alfalfa	400,000	Surveyed but no usage reported			
Almonds	Not Surveyed[2]				
Apples	2,000	Surveyed but no usage reported			
Apricots	Not Surveyed[2]				
Artichoke	Not Surveyed[2]				
Asparagus	Not Surveyed[2]				
Avocados	Not Surveyed[2]				
Barley	50,000	Surveyed but no usage reported			
Beans, Lima	Not Surveyed[2]				
Beans, Dry	Not Surveyed[2]				
Beans, Snap, Bush, Pole, String	10,000	Surveyed but no usage reported			
Beets	Not Surveyed[2]				
Bitter Melon	Not Surveyed[2]				
Blueberry	10,000	Surveyed but no usage reported			
Broccoli	Not Surveyed[2]				
Brussel Sprouts	Not Surveyed[2]				
Cabbage	Not Surveyed[2]				
Caneberries	10,000	Surveyed but no usage reported			
Canola	Not Surveyed[2]				
Cantaloupe	Not Surveyed[2]				
Carrots	Not Surveyed[2]				
Cauliflower	Not Surveyed[2]				
Celery	Not Surveyed[2]				

Cherries	6,000	Surveyed but no usage reported			
Chinese Cabbage	Not Surveyed[2]				
Corn	Not Surveyed[2]				
Corn, Forage-Fodder	Not Surveyed[2]				
Cotton	Not Surveyed[2]				
Cucumbers	Not Surveyed[2]				
Dates	Not Surveyed[2]				
Daikon	Not Surveyed[2]				
Eggplant	<500	Surveyed but no usage reported			
Figs	Not Surveyed[2]				
Garlic	Not Surveyed[2]				
Grape, Table/Raisin	Not Surveyed[2]				
Grape, Wine	Not Surveyed[2]				
Grapefruit	Not Surveyed[2]				
Hazelnuts (filbert)	40,000	Surveyed but no usage reported			
Honeydew	D	Surveyed but no usage reported			
Kale	Not Surveyed[2]				
Kiwifruit	Not Surveyed[2]				
Leeks	Not Surveyed[2]				
Lemons	Not Surveyed[2]				
Lettuce	Not Surveyed[2]				
Peppermint	Not Surveyed[2]				
Nectarines	<500	Surveyed but no usage reported			
Nursery Crops	Not Surveyed[2]				
Oats	10,000	Surveyed but no usage reported			
Olives	<500	Surveyed but no usage reported			
Onions	20,000	200,000	0	25	10
Oranges	Not Surveyed[2]				
Parsley	Not Surveyed[2]				
Pasture	1,700,000	Surveyed but no usage reported			
Peaches	Not Surveyed[2]				
Peanuts	Not Surveyed[2]				
Pears	20,000	Surveyed but no usage reported			
Peas	20,000	Surveyed but no usage reported			
Pecans	Not Surveyed[2]				
Peppers	Not Surveyed[2]				
Persimmons	Not Surveyed[2]				
Pineapple	Not Surveyed[2]				
Pistachio	Not Surveyed[2]				
Plums	Not Surveyed[2]				
Pomegranates	Not Surveyed[2]				
Prunes	Not Surveyed[2]				
Potatoes	40,000	1,600,000	5	40	25
Pumpkins	2,000	Surveyed but no usage reported			
Rice	Not Surveyed[2]				
Rye	Not Surveyed[2]				
Safflower	Not Surveyed[2]				
Sorghum	Not Surveyed[2]				

Soybeans	Not Surveyed[2]	
Spinach	Not Surveyed[2]	
Squash	3,000	Surveyed but no usage reported
Strawberries	1,000	Surveyed but no usage reported
Sugar Beets	Not Surveyed[2]	
Sugarcane	Not Surveyed[2]	
Sunflower	Not Surveyed[2]	
Sweet Corn	20,000	Surveyed but no usage reported
Sweet Potato	Not Surveyed[2]	
Tangelo	Not Surveyed[2]	
Tangerines	Not Surveyed[2]	
Tobacco	Not Surveyed[2]	
Tomato	Not Surveyed[2]	
Walnuts	Not Surveyed[2]	
Watermelon	Not Surveyed[2]	
Wheat, spring	90,000	Surveyed but no usage reported
Wheat, summer	700,000	Surveyed but no usage reported
Golf Course	Surveyed but no usage reported at national level	

[1]*Not surveyed at national level*
[2]*Not surveyed for within Oregon*

Table 120. Oregon Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Corn	Not surveyed				
Sorghum	Not surveyed				
Sweet Corn	NA	Surveyed but no usage reported			
Tomato	Not surveyed				
Beans (Snap, Bush, Pole, String)	10,000	<500	0	5	<1
Dry Beans/Peas	Not surveyed				
Lima Beans	Not surveyed				
Peanuts	Not surveyed				
Peas (Fresh, Green, Sweet)	NA	Surveyed but no usage reported			
Soybeans	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sunflowers	Not surveyed				
Potatoes	NA	Surveyed but no usage reported			

Table 121. Oregon S-Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Blueberries	9,000	(D)	(D)	(D)	(D)
Currant	Not surveyed				
Elderberry	Not surveyed				
Gooseberry	Not surveyed				
Huckleberry	Not surveyed				
Strawberries	Surveyed but no use reported				
Blackberries	Not surveyed				
Raspberries	3,000	(D)	(D)	(D)	(D)
Loganberry	Not surveyed				
Chive	Not surveyed				
Garlic	Not surveyed				
Leek	Not surveyed				
Onions	Not surveyed				
Shallot	Not surveyed				
Corn	Not surveyed				
Sorghum	Not surveyed				
Sweet Corn	20,000	10,000	5	25	10
Cantaloupes	Not surveyed				
Citron	Not surveyed				
Cucumbers	Not surveyed				
Muskmelon	Not surveyed				
Pumpkins	2,000	<500	0	15	10
Squash	Not surveyed				
Watermelons	Not surveyed				
Eggplant	Not surveyed				
Okra	Not surveyed				
Peppers	Not surveyed				
Tomatoes	Not surveyed				
Broccoli	Not surveyed				
Brussel Sprouts	Not surveyed				
Chinese Cabbage	Not surveyed				
Cauliflower	Not surveyed				
Cabbage	Not surveyed				
Broccoli Raab	Not surveyed				
Mustard Spinach	Not surveyed				
Rape Greens	Not surveyed				
Collards	Not surveyed				
Mizuna	Not surveyed				
Mustard Greens	Not surveyed				
Kale	Not surveyed				
Celery	Not surveyed				

Cilantro	Not surveyed				
Rhubarb	Not surveyed				
Spinach	Not surveyed				
Swiss Chard	Not surveyed				
Turnip Greens	Not surveyed				
Beans (Snap, Bush, Pole, String)	10,000	7,000	55	70	65
Dry Beans/Peas	Not surveyed				
Lentils	Not surveyed				
Lima Beans	Not surveyed				
Peas (Fresh, Green, Sweet)	20,000	<500	0	5	<2.5
Soybeans	Not surveyed				
Alfalfa	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sesame	Not surveyed				
Sunflowers	Not surveyed				
Daikon Radish	Not surveyed				
Horseradish	Not surveyed				
Parsnip	Not surveyed				
Rutabaga	Not surveyed				
Sweet Potatoes	Not surveyed				
Sugar Beets	Not surveyed				
Garden Beets	Not surveyed				
Carrots	Not surveyed				
Celeriac	Not surveyed				
Radish	Not surveyed				
Asparagus	Not surveyed				
Potatoes	40,000	20,000	15	55	35
Peanuts	Not surveyed				
Stevia	Not surveyed				
Rights of Way	Surveyed but no usage reported – at national level				
Agricultural Turf	Surveyed but no usage reported – at national level				
Ornamental Lawns, Turf and associated Ornamentals	Surveyed but no usage reported – at national level				
Institutional Turf Facilities	Surveyed but no usage reported – at national level				
Golf Courses	Surveyed but no usage reported – at national level				
Nursery and Greenhouse Ornamentals	Surveyed but no usage reported – at national level				

Idaho

In 2017, pesticides were applied to over 7.1 million acres in Idaho to control for insects; weeds, grass or brush; nematodes; diseases in crops and orchards; or to control growth, thin fruit, ripen, or defoliate (USDA 2017). The previous census (2012) reported about 6.7 million acres treated for these use categories.. During the period 2010-2016 an average of about 200 different active ingredients were applied annually in Idaho to control pests on crop groups: corn, wheat, vegetables and fruit, orchards and grapes, alfalfa, pasture and hay, and other crops.

EPA has provided NMFS with national and state use and usage summaries for both metolachlor and telone which cover the years 2013-2017. The usage information within these reports come from both direct pesticide usage reporting (e.g. California Department of Pesticide Regulation) as well as usage estimates based market research surveys (e.g. Agricultural Market Research Data). See Table 122 and Table 123 for the available usage information for metolachlor and telone in Idaho. Note that the consideration of pesticide usage in the environmental baseline is not limited to metolachlor and telone, rather the environmental baseline considers the usage of all pesticides within the species range. The metolachlor and telone usage tables are thus provided as an example of the type of information available.

Table 122. Idaho 1,3-Dichloropropene Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Alfalfa	1,100,000	Surveyed but no usage reported			
Almonds	Not Surveyed[2]				
Apples	Not Surveyed[2]				
Apricots	Not Surveyed[2]				
Artichoke	Not Surveyed[2]				
Asparagus	Not Surveyed[2]				
Avocados	Not Surveyed[2]				
Barley	600,000	Surveyed but no usage reported			
Beans, Lima	Not Surveyed[2]				
Beans, Dry	200,000	Surveyed but no usage reported			
Beans, Snap, Bush, Pole, String	Not Surveyed[2]				
Beets	Not Surveyed[2]				
Bitter Melon	Not Surveyed[2]				
Blueberry	<500	Surveyed but no usage reported			
Broccoli	Not Surveyed[2]				
Brussel Sprouts	Not Surveyed[2]				
Cabbage	Not Surveyed[2]				
Caneberries	Not Surveyed[2]				
Canola	Not Surveyed[2]				
Cantaloupe	Not Surveyed[2]				
Carrots	Not Surveyed[2]				
Cauliflower	Not Surveyed[2]				
Celery	Not Surveyed[2]				
Cherries	Not Surveyed[2]				
Chinese Cabbage	Not Surveyed[2]				

Corn	300,000	Surveyed but no usage reported			
Corn, Forage-Fodder	Not Surveyed[2]				
Cotton	Not Surveyed[2]				
Cucumbers	Not Surveyed[2]				
Dates	Not Surveyed[2]				
Daikon	Not Surveyed[2]				
Eggplant	<500	Surveyed but no usage reported			
Figs	Not Surveyed[2]				
Garlic	Not Surveyed[2]				
Grape, Table/Raisin	Not Surveyed[2]				
Grape, Wine	Not Surveyed[2]				
Grapefruit	Not Surveyed[2]				
Hazelnuts (filbert)	Not Surveyed[2]				
Honeydew	-	Surveyed but no usage reported			
Kale	Not Surveyed[2]				
Kiwifruit	Not Surveyed[2]				
Leeks	Not Surveyed[2]				
Lemons	Not Surveyed[2]				
Lettuce	Not Surveyed[2]				
Peppermint	Not Surveyed[2]				
Nectarines	<500	Surveyed but no usage reported			
Nursery Crops	Not Surveyed[2]				
Oats	10,000	Surveyed but no usage reported			
Olives	Not Surveyed[2]				
Onions	8,000	20,000	0	15	<2.5
Oranges	Not Surveyed[2]				
Parsley	Not Surveyed[2]				
Pasture	1,300,000	Surveyed but no usage reported			
Peaches	Not Surveyed[2]				
Peanuts	Not Surveyed[2]				
Pears	Not Surveyed[2]				
Peas	Not Surveyed[2]				
Pecans	Not Surveyed[2]				
Peppers	Not Surveyed[2]				
Persimmons	Not Surveyed[2]				
Pineapple	Not Surveyed[2]				
Pistachio	Not Surveyed[2]				
Plums	Not Surveyed[2]				
Pomegranates	Not Surveyed[2]				
Prunes	Not Surveyed[2]				
Potatoes	300,000	2,700,000	5	10	10
Pumpkins	Not Surveyed[2]				
Rice	Not Surveyed[2]				
Rye	Not Surveyed[2]				
Safflower	Not Surveyed[2]				
Sorghum	Not Surveyed[2]				
Soybeans	Not Surveyed[2]				
Spinach	Not Surveyed[2]				

Squash	Not Surveyed[2]	
Strawberries	Not Surveyed[2]	
Sugar Beets	200,000	Surveyed but no usage reported
Sugarcane	Not Surveyed[2]	
Sunflower	Not Surveyed[2]	
Sweet Corn	Not Surveyed[2]	
Sweet Potato	Not Surveyed[2]	
Tangelo	Not Surveyed[2]	
Tangerines	Not Surveyed[2]	
Tobacco	Not Surveyed[2]	
Tomato	Not Surveyed[2]	
Walnuts	Not Surveyed[2]	
Watermelon	Not Surveyed[2]	
Wheat, spring	500,000	Surveyed but no usage reported
Wheat, summer	800,000	Surveyed but no usage reported
Golf Course	Surveyed but no usage reported at national level	

[1]Not surveyed at national level
[2]Not surveyed for within Idaho

Table 123. Idaho Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Corn	300,000	20,000	<1	10	5
Sorghum	Not surveyed				
Sweet Corn	Not surveyed				
Tomato	Not surveyed				
Beans (Snap, Bush, Pole, String)	Not surveyed				
Dry Beans/Peas	200,000	2,000	0	<2.5	<1
Lima Beans	Not surveyed				
Peanuts	Not surveyed				
Peas (Fresh, Green, Sweet)	Not surveyed				
Soybeans	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sunflowers	Not surveyed				
Potatoes	300,000	2,000	0	<1	<1

[1]Not surveyed at national level
[2]Not surveyed for within Washington

Table 124. Idaho S-Metolachlor Agricultural and Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Blueberries	Not surveyed				
Currant	Not surveyed				
Elderberry	Not surveyed				
Gooseberry	Not surveyed				
Huckleberry	Not surveyed				
Strawberries	Not surveyed				
Blackberries	Not surveyed				
Raspberries	Not surveyed				
Loganberry	Not surveyed				
Chive	Not surveyed				
Garlic	Not surveyed				
Leek	Not surveyed				
Onions	8,000	600	0	40	15
Shallot	Not surveyed				
Corn	300,000	20,000	<2.5	10	5
Sorghum	Not surveyed				
Sweet Corn	Not surveyed				
Cantaloupes	Not surveyed				
Citron	Not surveyed				
Cucumbers	Not surveyed				
Muskmelon	Not surveyed				
Pumpkins	Not surveyed				
Squash	Not surveyed				
Watermelons	Not surveyed				
Eggplant	Not surveyed				
Okra	Not surveyed				
Peppers	Not surveyed				
Tomatoes	Not surveyed				
Broccoli	Not surveyed				
Brussel Sprouts	Not surveyed				
Chinese Cabbage	Not surveyed				
Cauliflower	Not surveyed				
Cabbage	Not surveyed				
Broccoli Raab	Not surveyed				
Mustard Spinach	Not surveyed				
Rape Greens	Not surveyed				

Collards	Not surveyed				
Mizuna	Not surveyed				
Mustard Greens	Not surveyed				
Kale	Not surveyed				
Celery	Not surveyed				
Cilantro	Not surveyed				
Rhubarb	Not surveyed				
Spinach	Not surveyed				
Swiss Chard	Not surveyed				
Turnip Greens	Not surveyed				
Beans (Snap, Bush, Pole, String)	Not surveyed				
Dry Beans/Peas	200,000	20,000	<2.5	15	10
Lentils	Not surveyed				
Lima Beans	Not surveyed				
Peas (Fresh, Green, Sweet)	Not surveyed				
Soybeans	Not surveyed				
Alfalfa	Not surveyed				
Cotton	Not surveyed				
Safflower	Not surveyed				
Sesame	Not surveyed				
Sunflowers	Not surveyed				
Daikon Radish	Not surveyed				
Horseradish	Not surveyed				
Parsnip	Not surveyed				
Rutabaga	Not surveyed				
Sweet Potatoes	Not surveyed				
Sugar Beets	200,000	<500	0	<1	<1
Garden Beets	Not surveyed				
Carrots	Not surveyed				
Celeriac	Not surveyed				
Radish	Not surveyed				
Asparagus	Not surveyed				
Potatoes	300,000	60,000	15	20	15
Peanuts	Not surveyed				
Stevia	Not surveyed				
Rights of Way	Surveyed but no usage reported – at national level				
Agricultural Turf	Surveyed but no usage reported – at national level				
Ornamental Lawns, Turf and associated Ornamentals	Surveyed but no usage reported – at national level				
Institutional Turf Facilities	Surveyed but no usage reported – at national level				

Golf Courses	Surveyed but no usage reported – at national level
Nursery and Greenhouse Ornamentals	Surveyed but no usage reported – at national level

9.3.4 Monitoring Data

Washington

The Washington State Department of Agriculture – Natural Resources Assessment Section (NRAS) program focuses on monitoring and evaluating the impacts of agriculture chemicals on Washington State's natural resources, including ESA-listed endangered species. Several programs at NRAS have high relevance to this consultation including: 1) the agricultural land use mapping geodatabase; 2) the surface and groundwater monitoring program; and 3) the development of crop-based typical use profiles which describe factors including rate, application timing, percent crop treated, and application method.

The WSDA agricultural land use geodatabase combines targeted fieldwork, expertise in agricultural practice/crop identification, and existing land use data to provide high quality crop mapping data. The crop data is classified by several categories: 1) general crop group (berry, cereal grain, orchard, vegetable, etc.); 2) crop types (blueberry, wheat, apple, potato, etc.), and 3) irrigation method (center pivot, drip, rill, none, etc.). Additional information on WSDA's agricultural land use mapping program, including an interactive land use web map, are available at https://agr.wa.gov/departments/land-and-water/natural-resources/agricultural-land-use.

The WSDA has monitored surface water throughout the state since 2003. The program adds and removes sampling sites and subbasins based on pesticide detection history, changing pesticide use practices, site conditions, land use patterns, and the presence of listed threatened or endangered species (Tuttle et al. 2017). Currently, the program is monitoring waters at 16 locations including three locations in urban settings. The complete set of surface water monitoring reports, as well as an interactive surface water monitoring web map, are available at https://agr.wa.gov/departments/land-and-water/natural-resources.

WSDA's Surface Water Monitoring Program conducts annual monitoring at multiple locations across the state and includes regular analysis of metolachlor, bromoxynil, and prometryn in surface water grab samples. Sampling events occur once per week on the weeks when monitoring is scheduled between March and September. Sampling events at new monitoring locations are scheduled weekly to bi-weekly. Sampling events at established monitoring locations are scheduled for periods of time where monitoring in past years shows exceedances of EPA's aquatic life benchmarks or EPA's National Recommended Water Quality Criteria. Scheduling and site selection are evaluated prior to the beginning of each sampling season. The monitoring program prepares annual reports and actively shares data with the pesticide user community and other partners that include federal, local, and other state agencies.

Monitoring data are used to estimate risk to aquatic ecosystems and for identifying opportunities for targeted outreach, education, and technical assistance. The data are also used to inform several aspects of WSDA's adaptive management strategy for specific pesticides that uses targeted monitoring, best management practice (BMP) implementation, effectiveness monitoring, and use prohibition. Summaries of all surface water monitoring data collected by WSDA to date for metolachlor are provided below.

Table 125. WSDA surface water monitoring data for metolachlor

Metolachlor (CAS# 51218-45-2)						
Year	*Detections*[1]	*Non-detects*[2]	*Max Concentration (ug/L)*[3]	*Mean Concentration (ug/L)*[3]	*Standard Deviation of Concentrations (ug/L)*[3]	*Method Detection Limit (ug/L)*
2003	1	135	0.017	0.02	--	N/A
2004	2	152	0.0038	0.00	0.00	N/A
2005	10	136	0.013	0.01	0.00	N/A
2006	25	246	0.11	0.02	0.02	N/A
2007	21	447	0.21	0.03	0.04	N/A
2008	38	368	31	1.89	5.88	N/A
2009	34	388	1.9	0.18	0.38	0.007
2010	40	379	0.59	0.06	0.10	0.007
2011	47	371	6.2	0.21	0.90	0.007
2012	62	342	2.3	0.15	0.36	0.007
2013	63	394	1.1	0.10	0.18	0.007
2014	56	349	0.29	0.05	0.05	0.007
2015	48	291	2.7	0.13	0.40	0.007
2016	36	234	0.271	0.07	0.06	0.007
2017	47	246	0.34	0.04	0.06	0.007
2018	135	163	0.655	0.02	0.06	0.0006
2019	127	169	0.127	0.01	0.02	0.000564

[1] Detections are sample results where the presence of the target analyte was confirmed and was detected above the lower limit of quantitation (LLOQ) or where the presence of the target analyte was confirmed but where the concentrations was estimated to be between the LLOQ and the method detection limit (MDL).
[2] Non-detects are sample results where the target analyte was not detected at or above the MDL.
[3] Maximum Concentration, Mean Concentration, and Standard Deviation of Concentrations listed in the table account only for results where the presence of the target analyte was confirmed and the concentration was detected above the MDL.

Washington State also has a voluntary program that assists growers in addressing water rights issues within a watershed. Several watersheds have elected to participate, forming Comprehensive Irrigation District Management Plans (CIDMPs). The CIDMP is a collaborative process between government and landowners and growers; the parties determine how they will ensure growers get the necessary volume of water while also guarding water quality. This structure allows for greater flexibility in implementing mitigation measures to comply with both the CWA and the ESA.

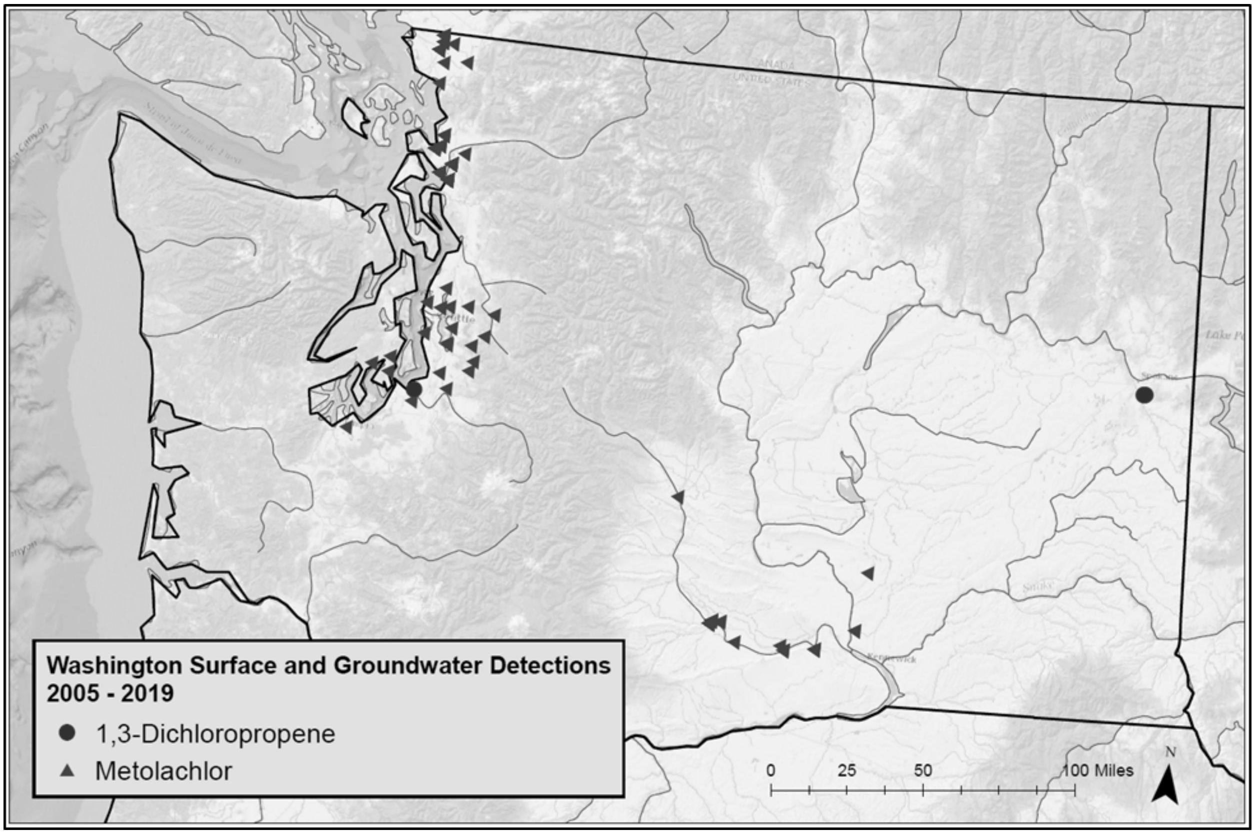


Figure 47. Water monitoring detections of 1,3-Dichloropropene and metolachlor in Washington state, 2005 to 2019. Data were accessed via the National Water Quality Portal (https://www.waterqualitydata.us/) and Washington State's Environmental Information Management System database.

Oregon

In Oregon, water quality policies related to pesticides are handled by several state agencies. An interagency team was thus formed: the Water Quality Pesticide Management Team (WQPMT). WQPMT facilitates and coordinates water quality activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. The initial goal of the WQPMT was to develop and implement a statewide pesticide management plan (PMP), which was approved by EPA in 2011. The overall objective of the program are: 1) to identify and characterize pesticides that may pose a risk to water resources; 2) actively manage them by facilitating efforts to reduce or prevent contamination below the reference point (an established benchmark or standard); and 3) demonstrate how management efforts are keeping concentrations at acceptable levels.

The Oregon Pesticide Stewardship Partnership (PSP) Program is a cooperative, voluntary process that is designed to identify potential concerns regarding surface and groundwater affected by pesticide use within Oregon. The PSP Program began with a small number of pilot projects in north Mid-Columbia watersheds in the late 1990s and early 2000s as an alternative to regulatory approaches for achieving reductions in current use pesticides from application activities. Since 2013, the Oregon Legislature has supported the implementation and expansion of the PSP Program, that now addresses pesticides applied in watersheds that encompass applications from urban, forested, agricultural and mixed land uses (taken from the Pesticide Stewardship Partnership Program 2015 – 2017 Biennial Report; Cook and Masterson, 2018).

Between 2015 and 2017 the PSP surface water monitoring program collected samples across nine watersheds and two additional pilot studies. The program analyzes for 89 registered pesticides, 26 non-registered pesticides, and 18 pesticide metabolites. Ground water monitoring is conducted by the Oregon Department of Environmental Quality in the Walla Walla and Middle Rogue watersheds. The PSP also maintains a Waste Pesticide Collection program which, between 2015 and 2017 resulted in the removal of 152,679 pounds of unused or unusable pesticides from sensitive watersheds (Cook and Masterson, 2018). NMFS sees high potential in programs like this in aiding the recovery of listed aquatic species. Additional information on the PSP, including biennial summaries can be found at https://www.oregon.gov/ODA/programs/Pesticides/Water/Pages/PesticideStewardship.aspx.

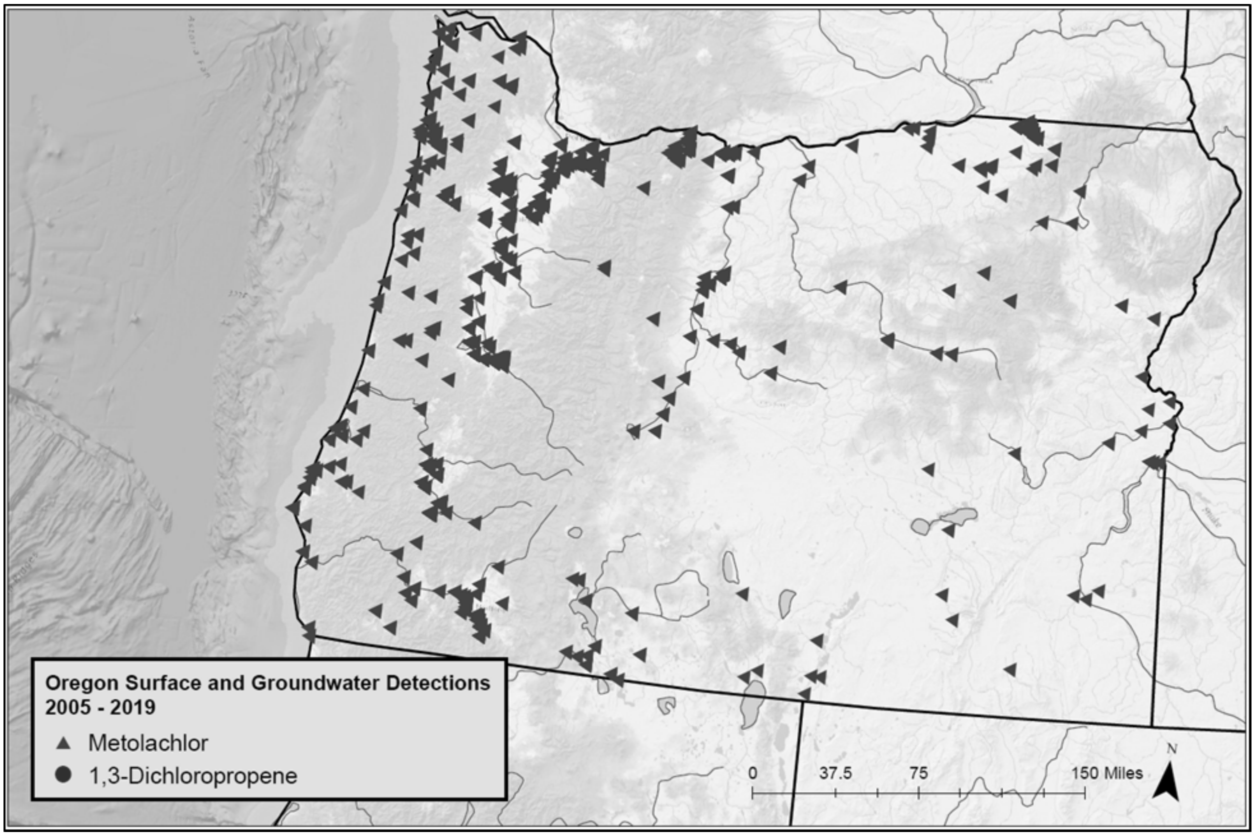


Figure 48. Water monitoring detections of 1,3-Dichloropropene and Metolachlor in Oregon, 2005 to 2019. Data were accessed via the National Water Quality Portal (https://www.waterqualitydata.us/) and the Oregon Ambient Water Quality Monitoring System data portal.

Idaho

The Idaho State Department of Agriculture (ISDA) has developed regional and local agricultural ground and surface water monitoring programs. The goal of these programs are to conduct monitoring to fill data and information gaps to effectively and efficiently monitor pesticides. ISDA conducts monitoring in partnership with the Idaho Department of Environmental Quality (DEQ), Idaho Department of Water Resources (IDWR), and many other state, local, and private agencies, organizations, businesses, and individuals. Every year, about 400 monitoring sites are sampled. Most sites are sampled once every five years. Water quality results include: bacteria, nutrients, common ions (e.g. calcium, magnesium), trace elements (e.g. iron, arsenic, lead), pesticides, volatile organic compounds, and radioactivity. Additional information on the statewide groundwater quality monitoring program, including reports, maps, and publications, can be found at https://idwr.idaho.gov/water-data/groundwater-quality/.

The Idaho State Department of Agriculture has published a Best Management Practices (BMP) guide for pesticide use. The BMPs include “core” voluntary measures that will prevent pesticides from leaching into soil and groundwater. These measures include applying pest-specific controls, being aware of the depth to ground water, and developing an Irrigation Water Management Plan.

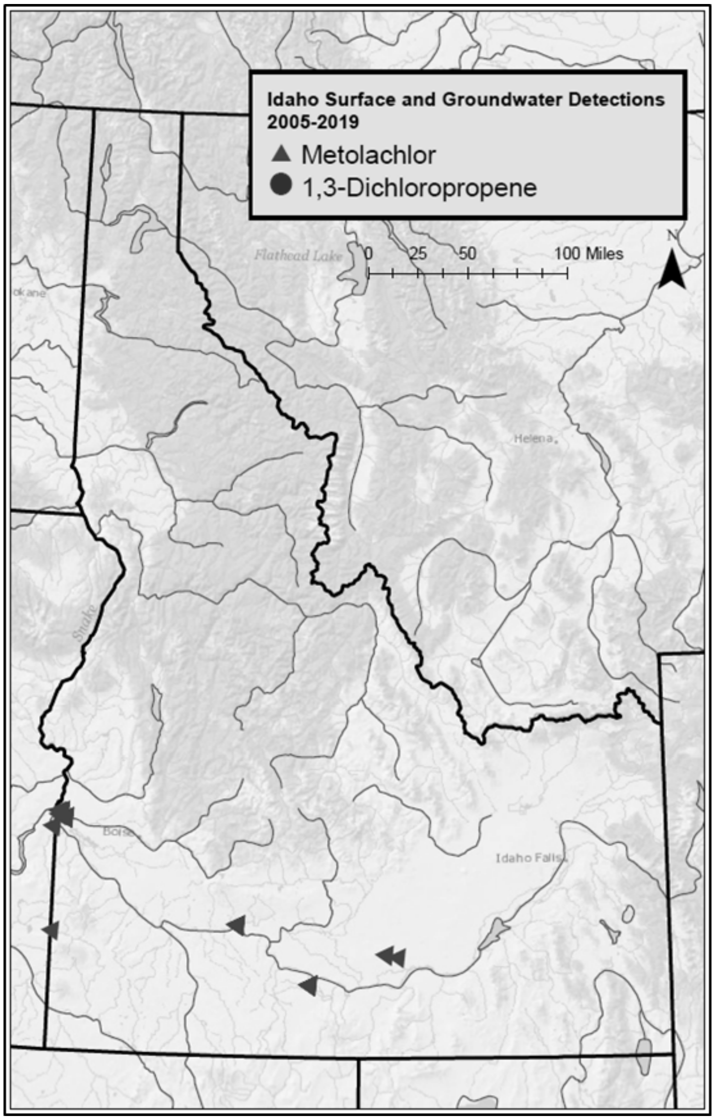


Figure 49. Water monitoring detections of 1,3-Dichloroprene and Metolachlor in Idaho, 2005 to 2019. Data were accessed via the National Water Quality Portal (https://www.waterqualitydata.us/).

Additional Highlighted Programs

The Columbia Gorge Fruit Growers Association is a non-profit organization dedicated to the needs of growers in the mid-Columbia area. The association brings together over 440 growers and 20 shippers of fruit from Oregon and Washington. It has issued a BMP handbook for pesticide use, including information on alternative methods of pest control. The mid-Columbia area is of particular concern, as many orchards are in close proximity to streams.

Stewardship Partners is a non-profit organization in Washington State that works to build partnerships between landowners, government, and non-profit organizations. In large part, its work focuses on helping landowners to restore fish and wildlife habitat while maintaining the economic viability of their farmland. Projects include restoring riparian areas, reestablishing floodplain connectivity, and removing blocks to fish passage. Another current project is to promote rain gardens as a method of reducing surface water runoff from developed areas. Rain gardens mimic natural hydrology, allowing water to collect and infiltrate the soil.

Stewardship Partners also collaborates with the Oregon-based Salmon-Safe certification program (www.salmonsafe.org). Salmon-Safe is an independent eco-label recognizing organizations who have adopted conservation practices that help restore native salmon habitat in Pacific Northwest, California, and British Columbia. These practices protect water quality, fish and wildlife habitat, and overall watershed health. While the program began with a focus on agriculture, it has since expanded to include industrial and urban sites as well. The certification process includes pesticide restrictions. Salmon-Safe has produced a list of “high risk” pesticides which, if used, would prevent a site from becoming certified. If a grower wants an exception, they must provide written documentation that demonstrates a clear need for use of the pesticide, that no safer alternatives exist, and that the method of application (such as timing, location, and amount used) represents a negligible risk to water quality and fish habitat. Over 300 farms, 250 vineyards, and 240 parks currently have the Salmon-Safe certification. Salmon-Safe has also worked with over 20 corporate / industrial sites and is beginning programs that focus on golf courses and nurseries.

9.3.5 Regional Mortality Factors

Ranching and Agriculture Ranching, agriculture, and related services in the Pacific Northwest employ more than nine times the national average (19% of the households within the basin) (NRC 2004). Ranching practices have led to increased soil erosion and sediment loads within adjacent tributaries. The worst of these effects may have occurred in the late 1800s and early 1900s from deliberate burning to increase grass production (NRC 2004). Several measures are currently in place to reduce the impacts of grazing. Measures include restricted grazing in degraded areas, reduced grazing allotments, and lowered stocking rates. Today, the agricultural industry impacts water quality within the basin. Agriculture is second only to the large-scale influences of hydromodification projects regarding power generation and irrigation. Water quality impacts from agricultural activities include alteration of the natural temperature regime, insecticide and herbicide contamination, and increased suspended sediments. During general agricultural operations, pesticides are applied on a variety of crops for pest control. These pesticides may contaminate surface water via runoff especially after rain events following application. Agricultural uses of the a.i.s assessed in this Opinion are discussed in the *Description of the Proposed Action*.

Water Diversions for Agriculture. Agriculture and ranching increased steadily within the Columbia River basin from the mid- to late-1800s. By the early 1900s, agricultural opportunities began increasing at a much more rapid pace with the creation of more irrigation canals and the passage of the Reclamation Act of 1902 (NRC 2004). Today, agriculture represents the largest water user within the basin (>90%).

Roughly 6% of the annual flow from the Columbia River is diverted for the irrigation of 7.3 million acres of croplands within the basin. The vast majority of these agricultural lands are located along the lower Columbia River, the Willamette, Yakima, Hood, and Snake rivers, and the Columbia Plateau (Hinck et al. 2004).

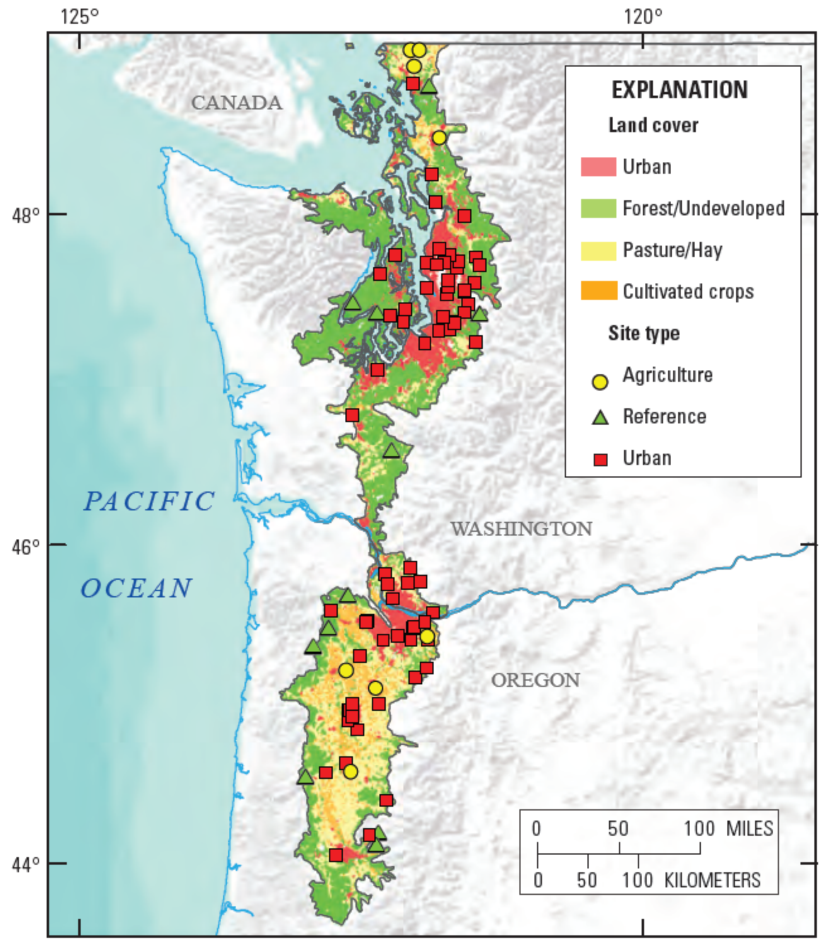
The impacts of these water diversions include increases in nutrient load, sediments (from bank erosion), and temperature. Flow management and climate changes have further decreased the delivery of suspended particulate matter and fine sediment to the estuary. The conditions of the habitat (shade, woody debris, over hanging vegetation) whereby salmonids are constrained by low flows also may make fish more or less vulnerable to predation, elevated temperatures, crowding, and disease. Water flow effects on salmonids may seriously impact adult migration and water quality conditions for spawning and rearing salmonids. High temperature may also result from the loss of vegetation along streams that used to shade the water and from new land uses (buildings and pavement) whereby rainfall picks up heat before it enters into an adjacent stream. Runoff inputs from multiple land use may further pollute receiving waters inhabited by fish or along fish migratory corridors.

Analysis of surface and ground water contaminants were conducted for a number of basins within the Pacific Northwest Region by the NAWQA program. The USGS has a number of fixed water quality sampling sites throughout various tributaries of the Columbia River. Many of the water quality sampling sites have been in place for decades. Water volumes, crop rotation patterns, crop type, and basin location are some of the variables that influence the distribution and frequency of pesticides within a tributary. Detection frequencies for a particular pesticide can vary widely. In addition to current use-chemicals, legacy chemicals continue to pose a serious problem to water quality and fish communities despite their ban in the 1970s and 1980s (Hinck et al. 2004).

Fish and macroinvertebrate communities exhibit an almost linear decline in condition as the level of agriculture intensity increases within a basin (Cuffney et al. 1997; Fuhrer et al. 2004). A study conducted in the late 1990s examined 11 species of fish, including anadromous and resident fish collected throughout the basin, for a suite of 132 contaminants. They included 51 semi-volatile chemicals, 26 pesticides, 18 metals, 7 PCBs, 20 dioxins, and 10 furans. Sampled fish tissues revealed PCBs, metals, chlorinated dioxins and furans (products of wood pulp bleaching operations), and other contaminants.

USGS NAWQA Regional Stream Quality Assessment

In 2015, the USGA sampled 88 sites as part of the Pacific Northwest Stream Quality Assessment (Figure 50). Water samples were analyzed for about 230 dissolved pesticides and pesticide degradates. Results from the 2015 water quality assessment were considered and are available at https://webapps.usgs.gov/rsqa/#!/region/PNSQA.



Base-map image is the intellectual property of Esri and isused herein under license. Copyright © 2014 Esri and its licensors. All rights reserved. Base modified from Esri digital data, 1:70,000 (Esri, 2009) Land cover from National Land Cover Database, 2006, Web Mercator Projection, World Geodetic System of 1984 (WGS 84)

Figure 50. The Pacific Northwest Stream Quality Assessment study area. Taken from Van Metre et al. 2017: Figure 1: "Study area boundary is based on the Willamette Valley and Puget Lowlands level 3 ecological regions (ecoregions) of the United States."

NAWQA Analysis: Yakima River Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

The Yakima River Basin is one of the most agriculturally productive areas in the U.S. (Fuhrer et al. 2004). Croplands within the Yakima Basin account for about 16% of the total basin area of which 77% is irrigated. The extensive irrigation-water delivery and drainage system in the Yakima River Basin greatly controls water quality conditions and aquatic health in agricultural streams, drains, and the Yakima River (Fuhrer et al. 2004). From 1999 to 2000, the USGS conducted a NAWQA study in the Yakima River Basin. Fuhrer *et al.* (2004) reported that nitrate and orthophosphate were the dominant forms of nitrogen and phosphorus found in the Yakima River and its agricultural tributaries. Arsenic, a known human carcinogen, was also detected in agricultural drains at elevated concentrations.

The USGS also detected 76 pesticide compounds in the Yakima River Basin. They include 38 herbicides, 17 insecticides (such as carbaryl, diazinon, and malathion), 15 breakdown products, and 6 others (Fuhrer et al. 2004). In agricultural drainages, insecticides were detected in 80% of samples and herbicides were present in 91%. They were also detected in mixed land use streams – 71% and 90 %, respectively. The most frequently detected pesticides were 2,4-D, terbacil, azinphos methyl, atrazine, carbaryl, and deethylatrazine. Generally, compounds were detected in tributaries more often than in the Yakima River itself.

Ninety-one percent of the samples collected from the small agricultural watersheds contained at least two pesticides or pesticide breakdown products. Samples contained a median of 8 and a maximum of 26 chemicals (Fuhrer et al. 2004). The herbicide 2,4-D, occurred most often in the mixtures, along with azinphos methyl, the most heavily applied pesticide, and atrazine, one of the most aquatic mobile pesticides (Fuhrer et al. 2004). The most frequently detected pesticides in the Yakima River Basin are total DDTs, dichloro-diphenyl-dichloroethane (DDD), and dieldrin (Fuhrer et al. 2004; Johnson and Newman 1983; Joy 2002; Joy and Madrone 2002). Nevertheless, concentrations of total DDT in water have decreased since 1991. These reductions are attributed to erosion-controlling BMPs.

Another study conducted by the USGS between May 1999 and January 2000 in the surface waters of Yakima Basin detected 25 pesticide compounds (Ebbert and Embry 2001). Atrazine was the most widely detected herbicide and azinphos methyl was the most widely detected insecticide. Other detected compounds include simazine, terbacil, trifluralin; deethylatrazine, carbaryl, diazinon, malathion, and DDE.

NAWQA Analysis: Central Columbia Plateau

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

The Central Columbia Plateau is a prominent apple growing region. The USGS sampled 31 surface-water sites representing agricultural land use, with different crops, irrigation methods, and other agricultural practices for pesticides in Idaho and Washington from 1992 - 1995 (Williamson et al. 1998). Pesticides were detected in samples from all sites, except for the Palouse River at Laird Park (a headwaters site in a forested area). Many pesticides were detected in surface water at very low concentrations. Concentrations of six pesticides exceeded freshwater-chronic criteria for the protection of aquatic life in one or more surface-water samples. They include the herbicide triallate and five insecticides (azinphos methyl, chlorpyrifos, diazinon, *gamma*-HCH, and parathion).

Detections at four sites were high, ranging from 12 to 45 pesticides. The two sites with the highest detection frequencies are in the Quincy-Pasco subunit, where irrigation and high chemical use combine to increase transport of pesticides to surface waters. Pesticide detection frequencies at sites in the dryland farming (non-irrigated) areas of the North-Central and Palouse subunits are below the national median for NAWQA sites. All four sites had at least one pesticide concentration that exceeded a water-quality standard or guideline.

Concentrations of organochlorine pesticides and PCBs are higher than the national median (50^{th} percentile) at seven of 11 sites; four sites were in the upper 25% of all NAWQA sites. Although most of these compounds have been banned, they still persist in the environment. Elevated concentrations were observed in dryland farming areas and irrigated areas.

NAWQA Analysis: Willamette Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

From 1991 to 1995, the USGS also sampled surface waters in the Willamette Basin, Oregon. Wentz *et al.* (1998) reported that 50 pesticides and pesticide degradates of the 86 were detected in streams. Atrazine, simazine, metolachlor, deethylatrazine, diuron, and diazinon were detected in more than one-half of stream samples (Wentz et al. 1998). The highest pesticide concentrations generally occurred in streams draining predominantly agricultural land. Forty-nine pesticides were detected in streams draining predominantly agricultural land. About 25 pesticides were detected in streams draining mostly urban areas.

NAWQA Analysis: Lower Clackamas River Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

Carpenter *et al.* (2008) summarized four different studies that monitored pesticide levels in the lower Clackamas River from 2000 to 2005. Water samples were collected from sites in the lower mainstem Clackamas River, its tributaries, and in pre- and post-treatment drinking-water. In all, 63 pesticide compounds (33 herbicides, 15 insecticides, 6 fungicides, and 9 degradates) were detected in samples collected during storm and nonstorm conditions. Fifty-seven pesticides or degradates were detected in the tributaries (mostly during storms), whereas fewer compounds (26) were detected in samples of source water from the lower mainstem Clackamas River, with fewest (15) occurring in drinking water. The two most commonly detected pesticides were the triazine herbicide simazine and atrazine, which occurred in about one- half of samples. The a.i. in common household herbicides Roundup (glyphosate) and Cross bow (triclopyr and 2,4-D) were frequently detected together.

NAWQA Analysis: Upper Snake River Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

The USGS conducted a water quality study from 1992 - 1995 in the upper Snake River basin, Idaho and Wyoming (Clark et al. 1998). This basin does not overlap with any of the 28 ESU/DPSs, though it does feed into the migratory corridor of all Snake River species, and eventually into the Columbia River. In basin wide stream sampling in May and June 1994, Eptam, atrazine (and desethylatrazine), metolachlor, and alachlor were the most commonly detected pesticides. These compounds accounted for 75% of all detections. Seventeen different pesticides were detected downstream from American Falls Reservoir.

Hood River Basin

The Hood River Basin ranks fourth in the state of Oregon in total agricultural pesticide usage (Jenkins et al. 2004). The land in Hood River basin is used to grow five crops: alfalfa, apples, cherries, grapes, and pears. About 61 a.i.s, totaling 1.1 million pounds, are applied annually to roughly 21,000 acres. Of the top nine, three are carbamates and three are organophosphate insecticides (*Table 126*).

Table 126. Summarized detection information from (Carpenter et al. 2008).

Active Ingredient	Class	Lbs applied
Oil	-	624,392
Lime Sulfur	-	121,703
Mancozeb	Carbamate	86,872
Sulfur	-	60,552

Active Ingredient	Class	Lbs applied
Ziram	Carbamate	45,965
Azinphos methyl	Organophosphate	22,294
Metam-Sodium	Carbamate	17,114
Phosmet	Organophosphate	15,919
Chlorpyrifos	Organophosphate	14,833

The Hood River basin contains approximately 400 miles of perennial stream channel, of which an estimated 100 miles is accessible to anadromous fish. These channels are important rearing and spawning habitat for salmonids, making pesticide drift a major concern for the area.

NAWQA Analysis: Puget Sound Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in the general overview.

The USGS sampled waters in the Puget Sound Basin between 1996 and 1998. Ebbert et al. (2000) reported that 26 of 47 analyzed pesticides were detected. A total of 74 manmade organic chemicals were detected in streams and rivers, with different mixtures of chemicals linked to agricultural and urban settings NAWQA results reported that the herbicides atrazine, prometon, simazine and tebuthiuron were the most frequently detected herbicides in surface and ground water (Bortleson and Ebbert 2000). Herbicides were the most common type of pesticide found in an agricultural stream (Fishtrap Creek) and the only type of pesticide found in shallow ground water underlying agricultural land (Bortleson and Ebbert 2000). The most commonly detected VOC in the agricultural land use study area was associated with the application of fumigants to soils prior to planting (Bortleson and Ebbert 2000). One or more fumigant-related compounds (1,2-dichloropropane, 1,2,2-trichloropropane, and 1,2,3-trichloropropane) were detected in over half of the samples. Insecticides, in addition to herbicides, were detected frequently in urban streams (Bortleson and Ebbert 2000). Sampled urban streams showed the highest detection rate for the three insecticides: carbaryl, diazinon, and malathion. No insecticides were found in shallow ground water below urban residential land (Bortleson and Ebbert 2000).

Urban and Industrial Development The largest urban area in the Columbia River basin is the greater Portland metropolitan area, located at the mouth of the Willamette River. Portland’s population exceeds 500,000 (Hinck et al. 2004). Although the basin’s land cover is about 8% of the U.S. total land mass, its human population is one-third the national average (about 1.2% of the U.S. population) (Hinck et al. 2004).

Discharges from sewage treatment plants, paper manufacturing, and chemical and metal production represent the top three permitted sources of contaminants within the lower Columbia River basin according to discharge volumes and concentrations (Rosetta and Borys 1996). Rosetta and Borys (1996) review of 1993 data indicate that 52% of the point source waste water discharge volume is from sewage treatment plants, 39% from paper and allied products, 5% from chemical and allied products, and 3% from primary metals. However, the paper and allied products industry are the primary sources of the suspended sediment load (71%). Additionally, 26% of the point source waste water discharge volume comes from sewage treatment plants and 1% is from the chemical and allied products industry. Nonpoint source discharges (urban stormwater runoff) account for significant pollutant loading to the lower basin, including most organics and over half of the metals. Although rural nonpoint source contributions were not calculated, Rosetta and Borys (1996) surmised that in some areas and for some contaminants, rural areas may contribute a large portion of the nonpoint source discharge. This is particularly true for pesticide contamination in the upper river basin where agriculture is the predominant land use.

Water quality has been reduced by phosphorus loads and decreased water clarity, primarily along the lower and middle sections of the Columbia River Estuary. Although sediment quality is generally very good, benthic indices have not been established within the estuary. Fish tissue contaminant loads (PCBs, DDT, DDD, DDE, and mercury) are high and present a persistent and long lasting effect on estuary biology. Health advisories have been recently issued for people eating fish in the area that contain high levels of dioxins, PCBs, and pesticides.

In the 1930s, all of western Washington contained about 15.5 million acres of "harvestable" forestland. By 2004, the total acreage was nearly half that originally surveyed (PSAT 2007). Forest cover in Puget Sound alone was about 5.4 million acres in the early 1990s. About a decade later, the region had lost another 200,000 acres of forest cover with some watersheds losing more than half the total forested acreage. The most intensive loss of forest cover occurred in the Urban Growth Boundary, which encompasses specific parts of the Puget Lowland. In this area, forest cover declined by 11% between 1991 and 1999 (Ruckelshaus and McClure 2007). Projected land cover changes indicate that trends are likely to continue over the next several decades with population changes (Ruckelshaus and McClure 2007). Coniferous forests are also projected to decline at an alarming rate as urban uses increase.

According to the 2001 State of the Sound report (PSAT 2007), impervious surfaces covered 3.3% of the region, with 7.3% of lowland areas (below 1,000 ft elevation) covered by impervious surfaces. From 1991 to 2001, the amount of impervious surfaces increased 10.4% region wide. Consequently, changes in rainfall delivery to streams alter stream flow regimes. Peak flows are increased and subsequent base flows are decreased and alter in-stream habitat. Stream channels are widened and deepened and riparian vegetation is typically removed which can cause increases in water temperature and will reduce the amounts of woody debris and organic matter to the stream system.

Pollutants carried into streams from urban runoff include pesticides, heavy metals, PCBs, polybrominated diphenyl ethers (PBDEs) compounds, PAHs, nutrients (phosphorus and nitrogen), and sediment (*Table 127*). Other ions generally elevated in urban streams include calcium, sodium, potassium, magnesium, and chloride ions where sodium chloride is used as the principal road deicing salt (Paul and Meyer 2001). The combined effect of increased concentrations of ions in streams is the elevated conductivity observed in most urban streams.

Table 127. Examples of Water Quality Contaminants in Residential and Urban Areas.

Contaminant groups	Select constituents	Select example(s)	Source and Use Information
Fertilizers	Nutrients	Phosphorus Nitrogen	lawns, golf courses, urban landscaping
Heavy Metals	Pb, Zn, Cr, Cu, Cd, Ni, Hg, Mg	Cu	brake pad dust, highway and parking lot runoff, rooftops
Pesticides including- Insecticides (I) Herbicides (H) Fungicides (F) Wood Treatment chemicals (WT) Legacy Pesticides (LP) Other ingredients in pesticide formulations (OI)	Organophosphates (I) Carbamates (I) Organochlorines (I) Pyrethroids (I) Triazines (H) Chloroacetanilides (H) Chlorophenoxy acids (H) Triazoles (F) Copper containing fungicides (F) Organochlorines (LP) Surfactants/adjuvants (OI)	Chlorpyrifos (I) Diazinon (I) Carbaryl (I) Atrazine (H) Esfenvalerate (I) Creosote (WT) DDT (LP) Copper sulfate (F) Metalaxyl (F) Nonylphenol (OI)	golf courses, right of ways, lawn and plant care products, pilings, bulkheads, fences
Pharmaceuticals and personal care products	Natural and synthetic hormones soaps and detergents	Ethinyl estradiol Nonylphenol	hospitals, dental facilities, residences, municipal and industrial waste water discharges
Polyaromatic hydrocarbons (PAHs)	Tricyclic PAHs	Phenanthrene	fossil fuel combustion, oil and gasoline leaks, highway runoff, creosote-treated wood
Industrial chemicals	PCBs PBDEs Dioxins	Penta-PBDE	utility infrastructure, flame retardants, electronic equipment

Many other metals have been found in elevated concentrations in urban stream sediments including arsenic, iron, boron, cobalt, silver, strontium, rubidium, antimony, scandium, molybdenum, lithium, and tin (Wheeler et al. 2005). The concentration, storage, and transport of metals in urban streams are connected to particulate organic matter content and sediment characteristics. Organic matter has a high binding capacity for metals and both bed and suspended sediments with high organic matter content frequently exhibit 50 - 7,500 times higher concentrations of zinc, lead, chromium, copper, mercury, and cadmium than sediments with lower organic matter content.

Although urban areas occupy only 2% of the Pacific Northwest land base, the impacts of urbanization on aquatic ecosystems are severe and long lasting (Spence et al. 1996). O'Neill *et al.* (2006) found that Chinook salmon returning to Puget Sound had significantly higher concentrations of PCBs and PBDEs compared to other Pacific coast salmon populations. Furthermore, Chinook salmon that resided in Puget Sound in the winter rather than migrate to the Pacific Ocean (residents) had the highest concentrations of persistent organic pollutants (POPs), followed by Puget Sound fish populations believed to be more ocean-reared. Fall-run Chinook salmon from Puget Sound have a more localized marine distribution in Puget Sound and the Georgia Basin than other populations of Chinook salmon from the west coast of North America. This ESU is more contaminated with PCBs (2 to 6 times) and PBDEs (5 to 17 times). O'Neill *et al.* (2006) concluded that regional body burdens of contaminants in Pacific salmon, and Chinook salmon in particular, could contribute to the higher levels of contaminants in federally-listed endangered southern resident killer whales.

Endocrine disrupting compounds are chemicals that mimic natural hormones, inhibit the action of hormones and/or alter normal regulatory functions of the immune, nervous and endocrine systems and can be discharged with treated effluent (King County 2002). Endocrine disruption has been attributed to DDT and other organochlorine pesticides, dioxins, PAHs, alkylphenolic compounds, phthalate plasticizers, naturally occurring compounds, synthetic hormones and metals. Natural mammalian hormones such as 17β-estradiol are also classified as endocrine disruptors. Both natural and synthetic mammalian hormones are excreted through the urine and are known to be present in wastewater discharges.

Jobling *et al.* (1995) reported that 10 chemicals known to occur in sewage effluent interacted with the fish estrogen receptor by reducing binding of 17β-estradiol to its receptor, stimulating transcriptional activity of the estrogen receptor or inhibiting transcription activity. Binding of the 10 chemicals with the fish endocrine receptor indicates that the chemicals could be endocrine disruptors and forms the basis of concern about w effluent and fish endocrine disruption.

Fish communities are impacted by urbanization (Wheeler et al. 2005). Urban stream fish communities have lower overall abundance, diversity, taxa richness and are dominated by pollution tolerant species. Lead content in fish tissue is higher in urban areas. Furthermore, the proximity of urban streams to humans increases the risk of non-native species introduction and establishment. Thirty-nine non-native species were collected in Puget Sound during the 1998 Puget Sound Expedition Rapid Assessment Survey (Brennan et al. 2004). Lake Washington, located within a highly urban area, has 15 non-native species identified (Ajawani 1956).

PAH compounds also have distinct and specific effects on fish at early life history stages (Incardona et al. 2004). PAHs tend to adsorb to organic or inorganic matter in sediments, where they can be trapped in long-term reservoirs (Johnson et al. 2002). Only a portion of sediment-adsorbed PAHs are readily bioavailable to marine organisms, but there is substantial uptake of these compounds by resident benthic fish through the diet, through exposure to contaminated water in the benthic boundary layer, and through direct contact with sediment. Benthic invertebrate prey are a particularly important source of PAH exposure for marine fishes, as PAHs bioaccumulate in many invertebrate species (Meador et al. 1995; Varanasi et al. 1989; Varanasi et al. 1992).

PAHs and their metabolites in invertebrate prey can be passed on to consuming fish species, PAHs are metabolized extensively in vertebrates, including fishes (Johnson et al. 2002). Although PAHs do not bioaccumulate in vertebrate tissues, PAHs cause a variety of deleterious effects in exposed animals. Some PAHs are known to be immunotoxic and to have adverse effects on reproduction and development. Studies show that PAHs exhibit many of the same toxic effects in fish as they do in mammals (Johnson et al. 2002).

Habitat Modification This section briefly describes how anthropogenic land use has altered aquatic habitat conditions for salmonids in the Pacific Northwest Region. Basin wide, critical ecological connectivity (mainstem to tributaries and riparian floodplains) has been disconnected by dams and associated activities such as floodplain deforestation and urbanization. Dams have flooded historical spawning and rearing habitat with the creation of massive water storage reservoirs. More than 55% of the Columbia River Basin that was accessible to salmon and steelhead before 1939 has been blocked by large dams (NWPPC 1986). Construction of the Grand Coulee Dam blocked 1,000 miles (1,609 km) of habitat from migrating salmon and steelhead (Wydoski and Whitney 1979). Similarly, over one third (2,000 km) of coho salmon habitat is no longer accessible (Good et al. 2005). The mainstem habitats of the lower Columbia and Willamette rivers have been reduced primarily to a single channel. As a result, floodplain area is reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of LWD in the mainstem has been reduced. Remaining areas are affected by flow fluctuations associated with reservoir management for power generation, flood control, and irrigation. Overbank flow events, important to habitat diversity, have become rare as a result of controlling peak flows and associated revetments. Portions of the basin are also subject to impacts from cattle grazing and irrigation withdrawals. Consequently, estuary dynamics have changed substantially.

Habitat loss has fragmented habitat and human density increase has created additional loads of pollutants and contaminants within the Columbia River Estuary (Anderson et al. 2007). About 77% of swamps, 57% of marshes, and over 20% of tree cover have been lost to development and industry. Twenty four threatened and endangered species occur in the estuary, some of which are recovering while others (*i.e.*, Chinook salmon) are not.

Stream habitat degradation in the Columbia Central Plateau is relatively high (Williamson et al. 1998). In the most recent NAWQA survey, a total of 16 sites were evaluated - all of which showed signs of degradation (Williamson et al. 1998). Streams in this area have an average of

20% canopy cover and 70% bank erosion. These factors have severely affected the quality of habitat available to salmonids. The Palouse subunit of the Lower Snake River exceeds temperature levels for the protection of aquatic life (Williamson et al. 1998).

The Willamette Basin Valley has been dramatically changed by modern settlement. The complexity of the mainstem river and extent of riparian forest have both been reduced by 80% (PNERC 2002). About 75% of what was formerly prairie and 60% of what was wetland have been converted to agricultural purposes. These actions, combined with urban development, extensive (96 miles) bank stabilization, and in-river and nearshore gravel mining, have resulted in a loss of floodplain connectivity and off-channel habitat (PNERC 2002).

Much of the estuarine wetlands in Puget Sound have been heavily modified, primarily from agricultural land conversion and urban development (NRC 1996). Although most estuarine wetland losses result from conversions to agricultural land by ditching, draining, or diking, these wetlands also experience increasing effects from industrial and urban causes. By 1980, an estimated 27,180 acres of intertidal or shore wetlands had been lost at 11 deltas in Puget Sound (Bortleson et al. 1980). Tidal wetlands in Puget Sound amount to roughly 18% of their historical extent (Collins and Sheikh 2005). Coastal marshes close to seaports and population centers have been especially vulnerable to conversion with losses of 50 - 90%. By 1980, an estimated 27,180 acres of intertidal or shore wetlands had been lost at 11 deltas in Puget Sound (Bortleson et al. 1980). More recently, tidal wetlands in Puget Sound amount to about 17 - 19% of their historical extent (Collins and Sheikh 2005). Coastal marshes close to seaports and population centers have been especially vulnerable to conversion with losses of 50 - 90% common for individual estuaries. Salmon use freshwater and estuarine wetlands for physiological transition to and from salt-water and rearing habitat. The land conversions and losses of Pacific Northwest wetlands constitute a major impact. Salmon use marine nearshore areas for rearing and migration, with juveniles using shallow shoreline habitats (Brennan et al. 2004).

About 800 miles of Puget Sound's shorelines are hardened or dredged (PSAT 2004; Ruckelshaus and McClure 2007). The area most intensely modified is the urban corridor (eastern shores of Puget Sound from Mukilteo to Tacoma). Here, nearly 80% of the shoreline has been altered, mostly from shoreline armoring associated with the Burlington Northern Railroad tracks (Ruckelshaus and McClure 2007). Levee development within the rivers and their deltas has isolated significant portions of former floodplain habitat that was historically used by salmon and trout during rising flood waters.

Urbanization has caused direct loss of riparian vegetation and soils and has significantly altered hydrologic and erosion rates. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have increased sedimentation, raised water temperatures, decreased LWD recruitment, decreased gravel recruitment, reduced river pools and spawning areas, and dredged and filled estuarine rearing areas (Bishop and

Morgan 1996 in (NMFS 2008f)). Large areas of the lower rivers have been channelized and diked for flood control and to protect agricultural, industrial, and residential development.

The principal factor for decline of Puget Sound steelhead is the destruction, modification, and curtailment of its habitat and range. Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetland and riparian habitats, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitats in Puget Sound (NMFS 2008f).

More than 100 years of industrial pollution and urban development have affected water quality and sediments in Puget Sound. Many different kinds of activities and substances release contamination into Puget Sound and the contributing waters. According to the State of the Sound Report (PSAT 2007) in 2004, more than 1,400 fresh and marine waters in the region were listed as "impaired." Almost two-thirds of these water bodies were listed as impaired due to contaminants, such as toxics, pathogens, and low dissolved oxygen or high temperatures, and less than one-third had established cleanup plans. More than 5,000 acres of submerged lands (primarily in urban areas; 1% of the study area) are contaminated with high levels of toxic substances, including polybrominated diphenyl ethers (PBDEs; flame retardants), and roughly one-third (180,000 acres) of submerged lands within Puget Sound are considered moderately contaminated. In 2005 the Puget Sound Action Team (PSAT) identified the primary pollutants of concern in Puget Sound and their sources listed below in ***Table 128***.

Table 128. Pollutants of Concern in Puget Sound (PSAT 2005).

Pollutant	Sources
Heavy Metals: Pb, Hg, Cu, and others	vehicles, batteries, paints, dyes, stormwater runoff, spills, pipes.
Organic Compounds: Polycyclic aromatic hydrocarbons (PAHs)	Burning of petroleum, coal, oil spills, leaking underground fuel tanks, creosote, asphalt.
Polychlorinated biphenyls (PCBs)	Solvents electrical coolants and lubricants, pesticides, herbicides, treated wood.
Dioxins, Furans	Byproducts of industrial processes.
Dichloro-diphenyl-trichloroethane (DDTs)	Chlorinated pesticides.
Phthalates	Plastic materials, soaps, and other personal care products. Many of these compounds are in wastewater from sewage treatment plants.
Polybrominated diphenyl ethers (PBDEs)	PBDEs are added to a wide range of textiles and plastics as a flame retardant. They easily leach from these materials and have been found throughout the environment and in human breast milk.

While much of the coastal region is forested, it has still been impacted by land use practices. Less than 3% of the Oregon coastal forest is old growth conifers (Gregory 2000). The lack of mature conifers indicates high levels of habitat modification. As such, overall salmonid habitat quality is poor, though it varies by watershed. The amount of remaining high quality habitat ranges from 0% in the Sixes to 74% in the Siltcoos (ODFW 2005). Approximately 14% of freshwater winter habitat available to juvenile coho is of high quality. Much of the winter habitat is unsuitable due to high temperatures. For example, 77% of coho salmon habitat in the Umpqua basin exceeds temperature standards.

Reduction in stream complexity is the most significant limiting factor in the Oregon coastal region. An analysis of the Oregon coastal range determined the primary and secondary life cycle bottlenecks for the 21 populations of coastal coho salmon (Nicholas et al. 2005). Nicholas *et al.* (2005) determined that stream complexity is either the primary (13) or secondary (7) bottleneck for every population. Stream complexity has been reduced through past practices such as splash damming, removing riparian vegetation, removing LWD, diking tidelands, filling floodplains, and channelizing rivers.

Habitat loss through wetland fills is also a significant factor. Table 129 summarizes the change in area of tidal wetlands for several Oregon estuaries (Good 2000).

Table 129. Change in total area (acres2) of tidal wetlands in Oregon (tidal marshes and swamps) due to filling and diking between 1870 and 1970 (Good 2000).

Estuary	Diked or Filled Tidal Wetland	Percent of 1870 Habitat Lost
Necanicum	15	10
Nehalem	1,571	75
Tillamook	3,274	79
Netarts	16	7
Sand Lake	9	2
Nestucca	2,160	91
Salmon	313	57
Siletz	401	59
Yaquina	1,493	71
Alsea	665	59
Siuslaw	1,256	63
Umpqua	1,218	50

Estuary	Diked or Filled Tidal Wetland	Percent of 1870 Habitat Lost
Coos Bay	3,360	66
Coquille	4,600	94
Rogue	30	41
Chetco	5	56
Total	20,386	72%

The only listed salmonid population in coastal Washington is the Ozette Lake sockeye. The range of this ESU is small, including only one lake (31 km^2) and 71 km of stream. Like the Oregon Coastal drainages, the Ozette Lake area has been heavily managed for logging. Logging resulted in road building and the removal of LWD, which affected the nearshore ecosystem (NMFS Salmon Recovery Division 2008). LWD along the shore offered both shelter from predators and a barrier to encroaching vegetation (NMFS Salmon Recovery Division 2008). Aerial photograph analysis shows near-shore vegetation has increased significantly over the past 50 years (Ritchie 2005). Further, there is strong evidence that water levels in Ozette Lake have dropped between 1.5 and 3.3 ft from historic levels [Herrera 2005 *in* (NMFS Salmon Recovery Division 2008)]. The impact of this water level drop is unknown. Possible effects include increased desiccation of sockeye redds and loss of spawning habitat. Loss of LWD has also contributed to an increase in silt deposition, which impairs the quality and quantity of spawning habitat. Very little is known about the relative health of the Ozette Lake tributaries and their impact on the sockeye salmon population.

Habitat Restoration Since 2000, land management practices included improving access by replacing culverts and fish habitat restoration activities at Federal Energy Regulatory Commission (FERC)-licensed dams. Habitat restoration in the upper (reducing excess sediment loads) and lower Grays River watersheds may benefit the Grays River chum salmon population as it has a sub-yearling juvenile life history type and rears in such habitats. Short-term daily flow fluctuations at Bonneville Dam sometimes create a barrier (*i.e.*, entrapment on shallow sand flats) for fry moving into the mainstem rearing and migration corridor. Some chum fry have been stranded on shallow water flats on Pierce Island from daily flow fluctuations. Coho salmon are likely to be affected by flow and sediment delivery changes in the Columbia River plume. Steelhead may be affected by flow and sediment delivery changes in the plume (Casillas 1999).

In 2000, NOAA Fisheries completed consultation on issuance of a 50-year incidental take permit to the State of Washington for its Washington State Forest Practices Habitat Conservation Plan (HCP). The HCP is expected to improve habitat conditions on state forest lands within the action area. Improvements include removing barriers to migration, restoring hydrologic processes, increasing the number of large trees in riparian zones, improving stream bank integrity, and reducing fine sediment inputs (NMFS 2008d).

Positive changes in water quality in the Puget Sound region are evident. One of the most notable improvements was the elimination of sewage effluent to Lake Washington in the mid-1960s. This significantly reduced problems within the lake from phosphorus pollution and triggered a concomitant reduction in cyanobacteria (Ruckelshaus and McClure 2007). Even so, as the population and industry has risen in the region a number of new and legacy pollutants are of concern.

Mining Mining has a long history in Washington. In 2004, the state was ranked 13th nationally in total nonfuel mineral production value and 17th in coal production (NMA 2007; Palmisano et al. 1993). Metal mining for all metals (zinc, copper, lead, silver, and gold) peaked between 1940 and 1970 (Palmisano et al. 1993). Today, construction sand and gravel, Portland cement, and crushed stone are the predominant materials mined. Where sand and gravel is mined from riverbeds (gravel bars and floodplains) it may result in changes in channel elevations and patterns, instream sediment loads, and seriously alter instream habitat. In some cases, instream or floodplain mining has resulted in large scale river avulsions. The effect of mining in a stream or reach depends upon the rate of harvest and the natural rate of replenishment, as well as flood and precipitation conditions during or after the mining operations.

Most of the mining in the Columbia River basin is focused on minerals such as phosphate, limestone, dolomite, perlite, or metals such as gold, silver, copper, iron, and zinc. Mining in the region is conducted in a variety of methods and places within the basin. Alluvial or glacial deposits are often mined for gold or aggregate. Ores are often excavated from the hard bedrocks of the Idaho batholiths. Eleven percent of the nation’s output of gold has come from mining operations in Washington, Montana, and Idaho. More than half of the nation’s silver output has come from a few select silver deposits.

Many of the streams and river reaches in the Columbia River basin are impaired from mining. Several abandoned and former mining sites are also designated as superfund cleanup areas (Anderson et al. 2007; Stanford et al. 2005). According to the U.S. Bureau of Mines, there are about 14,000 inactive or abandoned mines within the Columbia River Basin. Of these, nearly 200 pose a potential hazard to the environment [Quigley, 1997 *in* (Hinck et al. 2004)]. Contaminants detected in the water include lead and other trace metals.

Oregon is ranked 35th nationally in total nonfuel mineral production value in 2004. In that same year, Washington was ranked 13th nationally in total nonfuel mineral production value and 17th in coal production (NMA 2007; Palmisano et al. 1993). Metal mining for all metals (*e.g.*, zinc, copper, lead, silver, and gold) peaked in Washington between 1940 and 1970 (Palmisano et al. 1993). Today, construction sand, gravel, Portland cement, and crushed stone are the predominant materials mined in both Oregon and Washington. Where sand and gravel are mined from riverbeds (gravel bars and floodplains) changes in channel elevations and patterns, and also changes in instream sediment loads, may result and alter instream habitat. In some cases, instream or floodplain mining has resulted in large scale river avulsions. The effect of mining in a stream or reach depends upon the rate of harvest and the natural rate of replenishment. Additionally, the severity of the effects is influenced by flood and precipitation conditions during or after the mining operations.

Hydromodification Projects More than 400 dams exist in the Columbia River basin, ranging from mega dams that store large amounts of water to small diversion dams for irrigation. Every major tributary of the Columbia River except the Salmon River is totally or partially regulated by dams and diversions. More than 150 dams are major hydroelectric projects. Of these, 18 dams are located on the mainstem Columbia River and its major tributary, the Snake River. The FCRPS encompasses the operations of 14 major dams and reservoirs on the Columbia and Snake rivers. These dams and reservoirs operate as a coordinated system. The Corps operates 9 of 10 major federal projects on the Columbia and Snake rivers, and the Dworshak, Libby and Albeni Falls dams. The Bureau of Reclamation operates the Grand Coulee and Hungry Horse dams. These federal projects are a major source of power in the region. These same projects provide flood control, navigation, recreation, fish and wildlife, municipal and industrial water supply, and irrigation benefits.

BOR has operated irrigation projects within the basin since 1904. The irrigation system delivers water to about 2.9 million acres of agricultural lands. About 1.1 million acres of land are irrigated using water delivered by two structures, the Columbia River Project (Grand Coulee Dam) and the Yakima Project. The Grand Coulee Dam delivers water for the irrigation of over 670,000 acres of croplands and the Yakima Project delivers water to nearly 500,000 acres of croplands (Bouldin et al. 2007).

The Bonneville Power Administration (Corps et al.), an agency of the U.S. Department of Energy, wholesales electric power produced at 31 federal dams (67% of its production) and non-hydropower facilities in the Columbia-Snake Basin. The BPA sells about half the electric power consumed in the Pacific Northwest. The federal dams were developed over a 37-year period starting in 1938 with Bonneville Dam and Grand Coulee in 1941, ending with construction of Libby Dam in 1973 and Lower Granite Dam in 1975.

Development of the Pacific Northwest regional hydroelectric power system, dating to the early 20th century, has had profound effects on the ecosystems of the Columbia River Basin (ISG 1996). These effects have been especially adverse to the survival of anadromous salmonids. The construction of the FCRPS modified migratory habitat of adult and juvenile salmonids. In many cases, the FCRPS presented a complete barrier to habitat access for salmonids. Approximately 80% of historical spawning and rearing habitat of Snake River fall-run Chinook salmon is now inaccessible due to dams. The Snake River spring/summer run has been limited to the Salmon, Grande Ronde, Imnaha, and Tuscanon rivers. Damming has cut off access to the majority of Snake River Chinook salmon spawning habitat. The Sunbeam Dam on the Salmon River is believed to have limited the range of Snake River sockeye salmon as well.

Both upstream and downstream migrating fish are impeded by the dams. Additionally, a substantial number of juvenile salmonids are killed and injured during downstream migrations. Physical injury and direct mortality occurs as juveniles pass through turbines, bypasses, and spillways. Indirect effects of passage through all routes may include disorientation, stress, delay in passage, exposure to high concentrations of dissolved gases, warm water, and increased predation. Non-federal hydropower facilities on Columbia River tributaries have also partially or completely blocked higher elevation spawning.

Qualitatively, several hydromodification projects have improved the productivity of naturally produced SR Fall-run Chinook salmon. Improvements include flow augmentation to enhance water flows through the lower Snake and Columbia Rivers [USBR 1998 *in* (NMFS 2008d)]; providing stable outflows at Hells Canyon Dam during the fall Chinook salmon spawning season and maintaining these flows as minimums throughout the incubation period to enhance survival of incubating fall-run Chinook salmon; and reduced summer temperatures and enhanced summer flow in the lower Snake River [see (Corps et al. 2007), *Appendix 1 in* (NMFS 2008d)]. Providing suitable water temperatures for over-summer rearing within the Snake River reservoirs allows the expression of productive “yearling” life history strategy that was previously unavailable to SR Fall-run Chinook salmon.

The mainstem FCRPS corridor has also improved safe passage through the hydrosystem for juvenile steelhead and yearling Chinook salmon with the construction and operation of surface bypass routes at Lower Granite, Ice Harbor, and Bonneville dams and other configuration improvements (Corps et al. 2007).

For salmon, with a stream-type juvenile life history, projects that have protected or restored riparian areas and breached or lowered dikes and levees in the tidally influenced zone of the estuary have improved the function of the juvenile migration corridor. The FCRPS action agencies recently implemented 18 estuary habitat projects that removed passage barriers. These activities provide fish access to good quality habitat.

The Corps *et al.* (2007) estimated that hydropower configuration and operational improvements implemented from 2000 to 2006 have resulted in an 11.3% increase in survival for yearling juvenile LCR Chinook salmon from populations that pass Bonneville Dam. Improvements during this period included the installation of a corner collector at Powerhouse II (PH2) and the partial installation of minimum gap runners at Powerhouse 1 (PH1) and of structures that improve fish guidance efficiency at PH2. Spill operations have been improved and PH2 is used as the first priority powerhouse for power production because bypass survival is higher than at PH1. Additionally, drawing water towards PH2 moves fish toward the corner collector. The bypass system screen was removed from PH1 because tests showed that turbine survival was higher than through the bypass system at that location.

More than 20 dams occur within the Puget Sound region's rivers and overlap with the distribution of salmonids. A number of basins contain water withdrawal projects or small impoundments that can impede migrating salmon. The resultant impact of these and land use changes (forest cover loss and impervious surface increases) has been a significant modification in the seasonal flow patterns of area rivers and streams, and the volume and quality of water delivered to Puget Sound waters. Several rivers have been modified by other means including levees and revetments, bank hardening for erosion control, and agriculture uses. Since the first dike on the Skagit River delta was built in 1863 for agricultural development (Ruckelshaus and McClure 2007), other basins like the Snohomish River are diked and have active drainage systems to drain water after high flows that top the dikes. Dams were also built on the Cedar, Nisqually, White, Elwha, Skokomish, Skagit, as well as several other rivers in the early 1900s to supply urban areas with water, prevent downstream flooding, allow for floodplain activities (like agriculture or development), and to power local timber mills (Ruckelshaus and McClure 2007).

In 1990, only one-third of the water withdrawn in the Pacific Northwest was returned to the streams and lakes (NRC 1996). Water that returns to a stream from agricultural irrigation is often substantially degraded. Problems associated with return flows include increased water temperature, which can alter patterns of adult and smolt migration; increased toxicant concentrations associated with pesticides and fertilizers; increased salinity; increased pathogen populations; decreased dissolved oxygen concentration; and increased sedimentation (NRC 1996). Water-level fluctuations and flow alterations due to water storage and withdrawal can affect substrate availability and quality, temperature, and other habitat requirements of salmon. Indirect effects include reduction of food sources; loss of spawning, rearing, and adult habitat; increased susceptibility of juveniles to predation; delay in adult spawning migration; increased egg and alevin mortalities; stranding of fry; and delays in downstream migration of smolts (NRC 1996).

Compared to other areas in the greater Northwest Region, the coastal region has fewer dams and several rivers remain free flowing (*e.g.*, Clearwater River). The Umpqua River is fragmented by 64 dams, the fewest number of dams on any large river basin in Oregon (Carter and Resh 2005). According to Palmisano *et al.* (1993) dams in the coastal streams of Washington permanently block only about 30 miles of salmon habitat. In the past, temporary splash dams were constructed throughout the region to transport logs out of mountainous reaches. The general practice involved building a temporary dam in the creek adjacent to the area being logged, and filling the pond with logs. When the dam broke the floodwater would carry the logs to downstream reaches where they could be rafted and moved to market or downstream mills.

Thousands of splash dams were constructed across the Northwest in the late 1800s and early 1900s. While the dams typically only temporarily blocked salmon habitat, in some cases dams remained long enough to wipe out entire salmon runs. The effects of the channel scouring and loss of channel complexity resulted in the long-term loss of salmon habitat (NRC 1996).

Artificial Propagation There are several artificial propagation programs for salmon production within the Columbia River Basin. These programs were instituted under federal law to lessen the effects of lost natural salmon production within the basin from the dams. Federal, state, and tribal managers operate the hatcheries. For more than 100 years, hatcheries in the Pacific Northwest have been used to produce fish for harvest and replace natural production lost to dam construction. Hatcheries have only minimally been used to protect and rebuild naturally produced salmonid populations (*e.g.*, Redfish Lake sockeye salmon). In 1987, 95% of the coho salmon, 70% of the spring Chinook salmon, 80% of the summer Chinook salmon, 50% of the fall-run Chinook salmon, and 70% of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). More recent estimates suggest that almost half of the total number of smolts produced in the basin come from hatcheries (Beechie et al. 2005).

The impact of artificial propagation on the total production of Pacific salmon and steelhead has been extensive (Hard et al. 1992). Hatchery practices, among other factors, are a contributing factor to the 90% reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995). Past hatchery and stocking practices have resulted in the transplantation of salmon and steelhead from non-native basins. The impacts of these hatchery practices are largely unknown. Adverse effects of these practices likely included: loss of genetic variability within and among populations (Busack 1990; Hard et al. 1992; Reisenbichler 1997; Riggs 1990), disease transfer, increased competition for food, habitat, or mates, increased predation, altered migration, and the displacement of natural fish (Fresh 1997; Hard et al. 1992; Steward and Bjornn 1990). Species with extended freshwater residence may face higher risk of domestication, predation, or altered migration than species that spend only a brief time in freshwater (Hard et al. 1992). Nonetheless, artificial propagation may also contribute to the conservation of listed salmon and steelhead. However, it is unclear whether or how much artificial propagation during the recovery process will compromise the distinctiveness of natural populations (Hard et al. 1992).

The Hatchery Scientific Review Group (HSRG) was established and funded by Congress to provide an independent review of the current hatchery program in the Columbia River Basin. The HSRG has completed its work on Lower Columbia River populations and provided its recommendations. A general conclusion is that the current production programs are inconsistent with practices that reduce impacts on naturally-spawning populations, and will have to be modified to reduce adverse effects on key natural populations.

The adverse effects are caused by hatchery-origin adults spawning with natural-origin fish or competing with natural-origin fish for spawning sites (NMFS 2008d). Oregon and Washington initiated a comprehensive program of hatchery and associated harvest reforms (ODFW 2007; Washington Department of Fish and Wildlife (WDFW) 2005). The program is designed to achieve HSRG objectives related to controlling the number of hatchery-origin fish on the spawning grounds and in the hatchery broodstock.

Coho salmon hatchery programs in the lower Columbia have been tasked to compensate for impacts of fisheries. However, hatchery programs in the LCR have not operated specifically to conserve LCR coho salmon. These programs threaten the viability of natural populations. The long-term domestication of hatchery fish has eroded the fitness of these fish in the wild and has reduced the productivity of wild stocks where significant numbers of hatchery fish spawn with wild fish. Large numbers of hatchery fish have also contributed to more intensive mixed stock fisheries. These programs largely overexploited wild populations weakened by habitat degradation. Most LCR coho salmon populations have been heavily influenced by hatchery production over the years.

The artificial propagation of late-returning Chinook salmon is widespread throughout Puget Sound (Good et al. 2005). Summer/fall Chinook salmon transfers between watersheds within and outside the region have been commonplace throughout this century. Therefore, the purity of naturally spawning stocks varies from river to river. Nearly 2 billion Chinook salmon have been released into Puget Sound tributaries since the 1950s. The vast majority of these have been derived from local late-returning adults.

Returns to hatcheries have accounted for 57% of the total spawning escapement. However, the hatchery contribution to spawner escapement is probably much higher than that due to hatchery-derived strays on the spawning grounds. The genetic similarity between Green River late-returning Chinook salmon and several other late-returning Chinook salmon in Puget Sound suggests that there may have been a significant and lasting effect from some hatchery transplants (Marshall et al. 1995).

Overall, the use of Green River stock throughout much of the extensive hatchery network in this ESU may reduce the genetic diversity and fitness of naturally spawning populations (Good et al. 2005).

Commercial, Recreational and Subsistence Fishing Despite regulated fishing programs for salmonids, listed salmonids are also caught as bycatch. There are several approaches under the ESA to address tribal and state take of ESA-listed species that may occur as a result of harvest activities. For example, NMFS has issued permits under Section 10 that have allowed these activities to be exempted from Section 9 prohibitions. Section 4(d) rules issued by NMFS provide exemptions from take for resource, harvest, and hatchery management plans. Furthermore, there are several treaties that have reserved the right of fishing to tribes in the North West Region.

Management of salmon fisheries in the Columbia River Basin is a cooperative process involving federal, state, and tribal representatives. The Pacific Fishery Management Council sets annual fisheries in federal waters from three to 200 miles off the coasts of Washington, Oregon, and California. Salmon and steelhead fisheries in the Columbia River and its tributaries are co-managed by the states of Washington, Oregon, Idaho, four treaty tribes, and other tribes that traditionally have fished in those waters. A federal court oversees Columbia River harvest management through the U.S. v. Oregon proceedings. Inland fisheries are those in waters within state boundaries, including those extending out three miles from the coasts. The states of Oregon, Idaho, and Washington issue salmon fishing licenses for these areas.

Fisheries in the Columbia River basin are managed within the winter/spring, summer, and fall seasons. There are Treaty Indian and non-Treaty fisheries which are managed subject to state and tribal regulation, consistent with provisions of a U.S. v. Oregon 2008 agreement. The winter/spring season extends from January 1 to June 15. Commercial, recreational, and ceremonial subsistence fisheries target primarily upriver spring Chinook stocks and spring Chinook salmon that return to the Willamette and lower Columbia River tributaries. Some steelhead are also caught incidentally in these fisheries. The summer season extends from June 16 to July 31. Commercial, recreational, and ceremonial and subsistence fisheries are managed primarily to provide harvest opportunity directed at unlisted UCR summer Chinook salmon. Summer fisheries are constrained primarily by the available opportunity for UCR summer Chinook salmon, and by specific harvest rate limits for SR sockeye salmon and harvest rate limits on steelhead in non-Treaty fisheries. Fall season fisheries begin on August 1 and end on December 31. Commercial, recreational, and ceremonial and subsistence fisheries target primarily harvestable hatchery and natural origin fall Chinook and coho salmon. Fall season fisheries are constrained by specific ESA related harvest rate limits for listed SR fall Chinook salmon, and SR steelhead.

Treaty Indian fisheries are managed subject to the regulation of the Columbia River Treaty Tribes. They include all mainstem Columbia River fisheries between Bonneville Dam and McNary Dam, and any fishery impacts from tribal fishing that occurs below Bonneville Dam. Tribal fisheries within specified tributaries to the Columbia River are included.

Non-Treaty fisheries are managed under the jurisdiction of the states. These include mainstem Columbia River commercial and recreational salmonid fisheries at the river mouth of Bonneville Dam, designated off channel Select Area fisheries, mainstem recreational fisheries between Bonneville Dam and McNary Dam, recreational fisheries between McNary Dam and Highway 305 Bridge in Pasco, Washington, recreational and Wanapum tribal spring Chinook fisheries from McNary Dam to Priest Rapids Dam, and recreational spring Chinook fisheries in the Snake River upstream to Lower Granite Dam.

Archeological records indicate that indigenous people caught salmon in the Columbia River more than 7,000 years ago. One of the most well-known tribal fishing sites within the basin was located near Celilo Falls, an area in the lower river that has been occupied by Dalles Dam since 1957. Salmon fishing increased with better fishing methods and preservation techniques, such as drying and smoking. Salmon harvest substantially increased in the mid-1800s with canning techniques. Harvest techniques also changed over time, from early use of hand-held spears and dip nets, to riverboats using seines and gill nets. Harvest techniques eventually transitioned to large ocean-going vessels with trolling gear and nets and the harvest of Columbia River salmon and steelhead from California to Alaska (Beechie et al. 2005).

During the mid-1800s, an estimated 10 to 16 million adult salmon of all species entered the Columbia River each year. Large annual harvests of returning adult salmon during the late 1800s ranging from 20 million to 40 million pounds of salmon and steelhead significantly reduced population productivity (Beechie et al. 2005). The largest known harvest of Chinook salmon occurred in 1883 when Columbia River canneries processed 43 million pounds of salmon (Lichatowich 1999). Commercial landings declined steadily from the 1920s to a low in 1993. At that time, just over one million pounds of Chinook salmon were harvested (Beechie et al. 2005).

Harvested and spawning adults reached 2.8 million in the early 2000s, of which almost half are hatchery produced (Beechie et al. 2005). Most of the fish caught in the river are steelhead and spring/summer run Chinook salmon. Ocean harvest consists largely of coho and fall-run Chinook salmon. Most ocean catches are made north of Cape Falcon, Oregon. Over the past five years, the number of spring and fall salmon commercially harvested in tribal fisheries has averaged between 25,000 and 110,000 fish (Beechie et al. 2005). Recreational catch in both ocean and in-river fisheries varies from 140,000 to 150,000 individuals (Beechie et al. 2005).

Non-Indian fisheries in the lower Columbia River are limited to a harvest rate of 1%. Treaty Indian fisheries are limited to a harvest rate of 5 to 7%, depending on the run size of upriver Snake River sockeye stocks. Actual harvest rates over the last 10 years have ranged from 0 to 0.9%, and 2.8 to 6.1%, respectively [see TAC 2008, Table 15 *in* (NMFS 2008d)].

Columbia River chum salmon are not caught incidentally in tribal fisheries above Bonneville Dam. However, Columbia River chum salmon are incidentally caught occasionally in non-Indian fall season fisheries below Bonneville Dam. There are no fisheries in the Columbia River that target hatchery or natural-origin chum salmon. The species' later fall return timing make them vulnerable to relatively little potential harvest in fisheries that target Chinook salmon and coho salmon. CR chum salmon rarely take the sport gear used to target other species. Incidental catch of chum amounts to a few tens of fish per year (TAC 2008). The harvest rate of CR chum salmon in proposed state fisheries in the lower river is estimated to be 1.6% per year and is less than 5%.

LCR coho salmon are harvested in the ocean and in the Columbia River and tributary freshwater fisheries of Oregon and Washington. Incidental take of coho salmon prior to the 1990s fluctuated from approximately 60 to 90%. However, this number has been reduced since its listing to 15 to 25% (LCFRB 2004). The exploitation of hatchery coho salmon has remained approximately 50% through the use of selective fisheries.

LCR steelhead are harvested in Columbia River and tributary freshwater fisheries of Oregon and Washington. Fishery impacts of LCR steelhead have been limited to less than 10% since implementation of mark-selective fisheries during the 1980s. Recent harvest rates on UCR steelhead in non-Treaty and treaty Indian fisheries ranged from 1% to 2%, and 4.1% to 12.4%, respectively (NMFS 2008d).

Despite regulated fishing programs for salmonids, listed salmonids are also caught as bycatch. There are several approaches under the ESA to address tribal and state take of ESA-listed species that may occur as a result of harvest activities. For example, NMFS has issued permits under Section 10 that have allowed these activities to be exempted from Section 9 prohibitions. Section 4(d) rules issued by NMFS provide exemptions from take for resource, harvest, and hatchery management plans. Furthermore, there are several treaties that have reserved the right of fishing to tribes in the North West Region.

Management of salmon fisheries in the Puget Sound Region is a cooperative process involving federal, state, tribal, and Canadian representatives. The Pacific Fishery Management Council sets annual fisheries in federal waters from three to 200 miles off the coasts of Washington, Oregon, and California. The annual North of Falcon process sets salmon fishing seasons in waters such as Puget Sound, Willapa Bay, Grays Harbor, and Washington State rivers. Inland fisheries are those in waters within state boundaries, including those extending out three miles from the coasts. The states of Oregon, Idaho, and Washington issue salmon fishing licenses for these areas. Adult salmon returning to Washington migrate through both U.S. and Canadian waters and are harvested by fishermen from both countries. The 1985 Pacific Salmon Treaty helps fulfill conservation goals for all members and is implemented by the eight-member bilateral Pacific Salmon Commission. The Commission does not regulate salmon fisheries, but provides regulatory advice.

Most of the commercial landings in the region are groundfish, Dungeness crab, shrimp, and salmon. Many of the same species are sought by Tribal fisheries and by charter and recreational anglers. Nets and trolling are used in commercial and Tribal fisheries. Recreational anglers typically use hook and line, and may fish from boat, river bank, or docks.

Harvest impacts on Puget Sound Chinook salmon populations average 75% in the earliest five years of data availability and have dropped to an average of 44% in the most recent five-year period (Good et al. 2005). Populations in Puget Sound have not experienced the strong increases in numbers seen in the late 1990s in many other ESUs. Although more populations have increased than decreased since the last BRT assessment, after adjusting for changes in harvest rates, trends in productivity are less favorable. Most populations are relatively small, and recent abundance within the ESU is only a small fraction of estimated historic run size.

Management of salmon fisheries in the Washington-Oregon-Northern California drainage is a cooperative process involving federal, state, and tribal representatives. The Pacific Fishery Management Council sets annual fisheries in federal waters from three to 200 miles off the coasts of Washington, Oregon, and California. Inland fisheries are those within state boundaries, including those extending out three miles from state coastlines. The states of Oregon, Idaho, California and Washington issue salmon fishing licenses for these areas.

Most commercial landings in the region are groundfish, Dungeness crab, shrimp, and salmon. Many of the same species are sought by Tribal fisheries, as well as by charter, and recreational anglers. Nets and trolling are used in commercial and Tribal fisheries. Recreational anglers typically use hook and line and may fish from boat, river bank, or docks.

Non-native Species Many non-native species have been introduced to the Columbia River Basin since the 1880s. At least 81 non-native species have currently been identified, composing one-fifth of all species in some areas. New non-native species are discovered in the basin regularly; a new aquatic invertebrate is discovered approximately every 5 months (Sytsma et al. 2004). It is clear that the introduction of non-native species has changed the environment, though whether these changes will impact salmonid populations is uncertain (Sytsma et al. 2004).

9.4 California Region

9.4.1 Land Use and Population Growth

The California subregion includes parts of California, Nevada, and Oregon. The subregion totals roughly 430,000 km^2 of which about 320,000 km^2 is classified as undeveloped, 50,000 km^2 is classified as developed and about 50,000 km^2 is classified as agriculture (Figure 51).

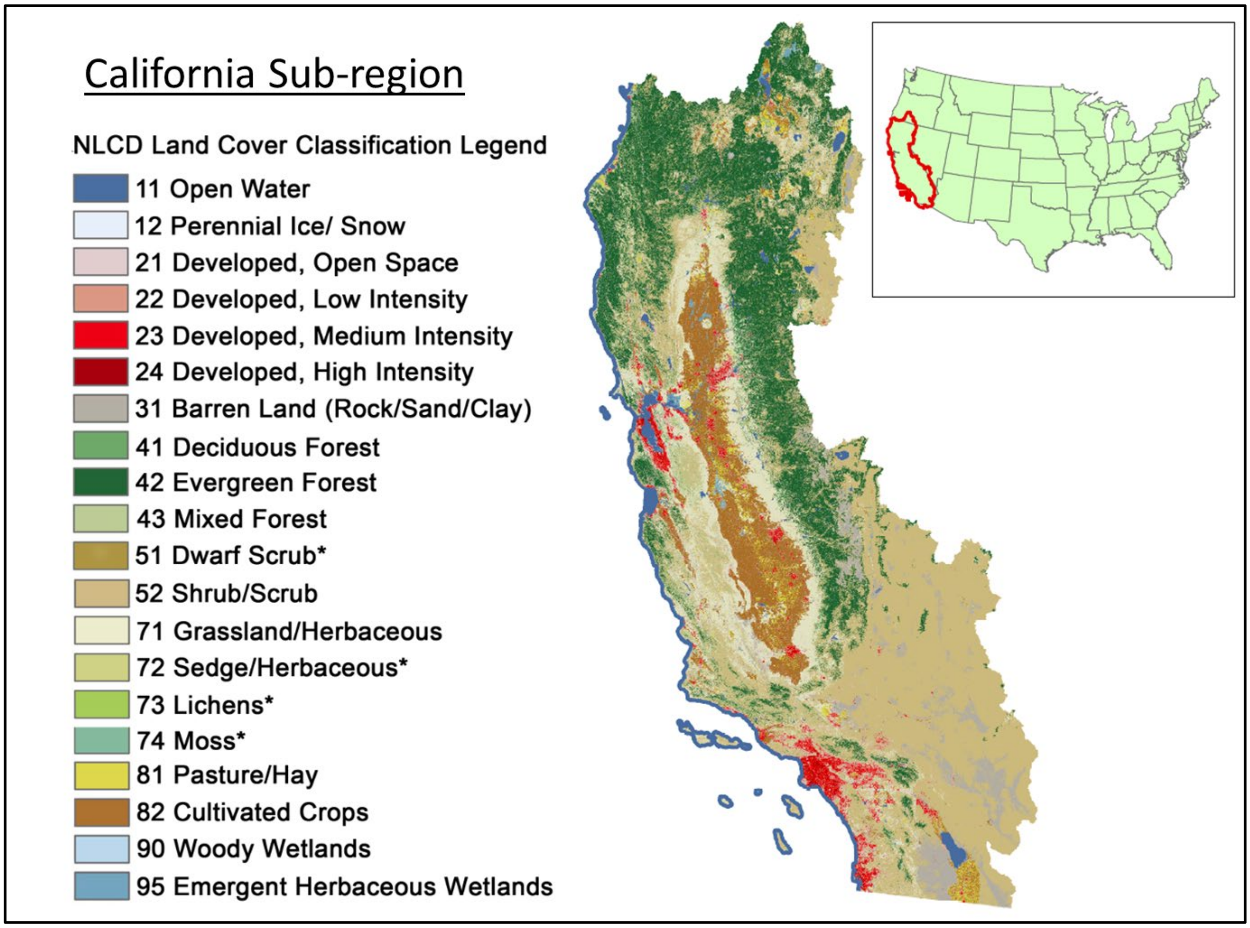


Figure 51. Land use in the California sub-region. Data from the NLCD 2011 (www.mrlc.gov).

Ten of the 28 species addressed in the Opinion occur in this subregion. They are: chinook salmon (ESUs: Central Valley spring-run, California coastal, Sacramento River winter-run), coho salmon (ESUs: southern Oregon/northern California coastal, central California coast), steelhead salmon (DPSs: northern California, south-central California coast, central California coast, California Central Valley, southern California). ***Table 130*** and ***Table 131*** show the types and areas of land use within each of the species' ranges.

Table 130. Area of land use categories within California subregion selected salmonid ranges in km². The total area for each category is given in bold. Land

cover was determined via the NLCD 2011. Land cover class definitions are available at: http://www.mrlc.gov/nlcd_definitions.php

Land Cover	Chinook			Coho	
NLCD Sub category	Central Valley spring	California Coastal	Sacramento River winter	Central California Coast	Southern Oregon/ Northern California
Water	**493**	**2,684**	**1,751**	**4,800**	**1,657**
Open Water	493	2,684	1,751	4,800	1,646
Perennial Ice/Snow	-	-	-	-	12
Developed Land	**5,119**	**1,166**	**2,426**	**3,579**	**2,063**
Open Space	2,105	793	757	1,285	1,394
Low Intensity	1,126	143	546	804	235
Medium Intensity	1,246	112	734	1,088	114
High Intensity	345	20	266	340	31
Barren Land	296	97	122	62	289
Undeveloped Land	**23,064**	**18,468**	**5,226**	**11,905**	**43,886**
Deciduous Forest	900	826	113	235	1,041
Evergreen Forest	4,349	10,258	648	5,340	27,973
Mixed Forest	427	1,494	196	1,539	2,425
Shrub/Scrub	3,815	3,757	632	1,997	9,490
Grassland/Herbaceous	12,557	1,998	2,765	2,495	2,710
Woody Wetlands	288	77	129	72	155
Emergent Wetlands	729	59	743	228	92
Agriculture	**19,298**	**476**	**5,759**	**573**	**1,228**
Pasture/Hay	2,598	243	641	63	761
Cultivated Crops	16,700	233	5,118	510	467
TOTAL (inc. open water)	**47,975**	**22,795**	**15,162**	**20,857**	**48,834**
TOTAL (w/o open water)	**47,482**	**20,110**	**13,411**	**16,057**	**47,177**

Table 131. Area of land use categories within California subregion selected steelhead, sturgeon, sea turtle ranges in km². The total area for each category is given in bold. Land cover was determined via the NLCD 2011. Land cover class definitions are available at: http://www.mrlc.gov/nlcd_definitions.php

Land Cover	Steelhead DPS			
NLCD Sub category	Central California Coast	California Central Valley	Southern California	Northern California
Water	**3,463**	**2,075**	**3,131**	**2,558**
Open Water	3,463	2,075	3,131	2,558
Perennial Ice/Snow	-	-	-	-
Developed Land	**3,570**	**7,021**	**6,396**	**779**
Open Space	1,140	2,732	1,667	590
Low Intensity	848	1,509	1,433	55
Medium Intensity	1,165	1,756	2,390	38
High Intensity	363	549	810	6
Barren Land	54	475	96	90
Undeveloped Land	**8,599**	**30,130**	**10,826**	**15,758**
Deciduous Forest	163	954	1	744
Evergreen Forest	2,346	4,478	892	9,411
Mixed Forest	1,412	1,147	909	1,132
Shrub/Scrub	1,598	5,719	6,742	2,906
Grassland/Herbaceous	2,608	16,291	2,101	1,442
Woody Wetlands	41	318	95	67
Emergent Wetlands	430	1,223	86	56
Agriculture	**622**	**21,417**	**1,025**	**233**
Pasture/Hay	73	2,869	160	218
Cultivated Crops	548	18,548	865	16
TOTAL (inc. open water)	**16,253**	**60,643**	**21,379**	**19,328**
TOTAL (w/o open water)	**12,790**	**58,568**	**18,247**	**16,770**

Population growth within communities in areas where salmon occur will place pressures on water availability and water quality. As of 2017, California has grown at an estimated annual rate of 333,000 per year since 2010. Growth is strongest in the more densely populated counties in the Bay Area, the Central Valley, and Southern California: specifically Merced, Placer, and San Joaquin counties (California Department of Finance 2018).

9.4.2 Water Temperature

Temperature is significant for the health of aquatic life. Water temperatures affect the distribution, health, and survival of native cold-blooded salmonids in the Pacific Northwest and elsewhere. These fish will experience adverse health effects when exposed to temperatures outside their optimal range. For listed Pacific salmonids, water temperature tolerance varies between species and life stages. Optimal temperatures for rearing salmonids range from 10ºC to 16ºC. In general, the increased exposure to stressful water temperatures and the reduction of suitable habitat caused by drought conditions reduce the abundance of salmon. Warm temperatures can reduce fecundity, reduce egg survival, retard growth of fry and smolts, reduce rearing densities, increase susceptibility to disease, decrease the ability of young salmon and trout to compete with other species for food, and to avoid predation (McCullough 1999; Spence et al. 1996). Migrating adult salmonids and upstream migration can be delayed by excessively warm stream temperatures. Excessive stream temperatures may also negatively affect incubating and rearing salmonids (Gregory and Bisson 1997). ***Figure 52*** depicts waterbodies with 303(d) temperature exceedances within the California subregion.

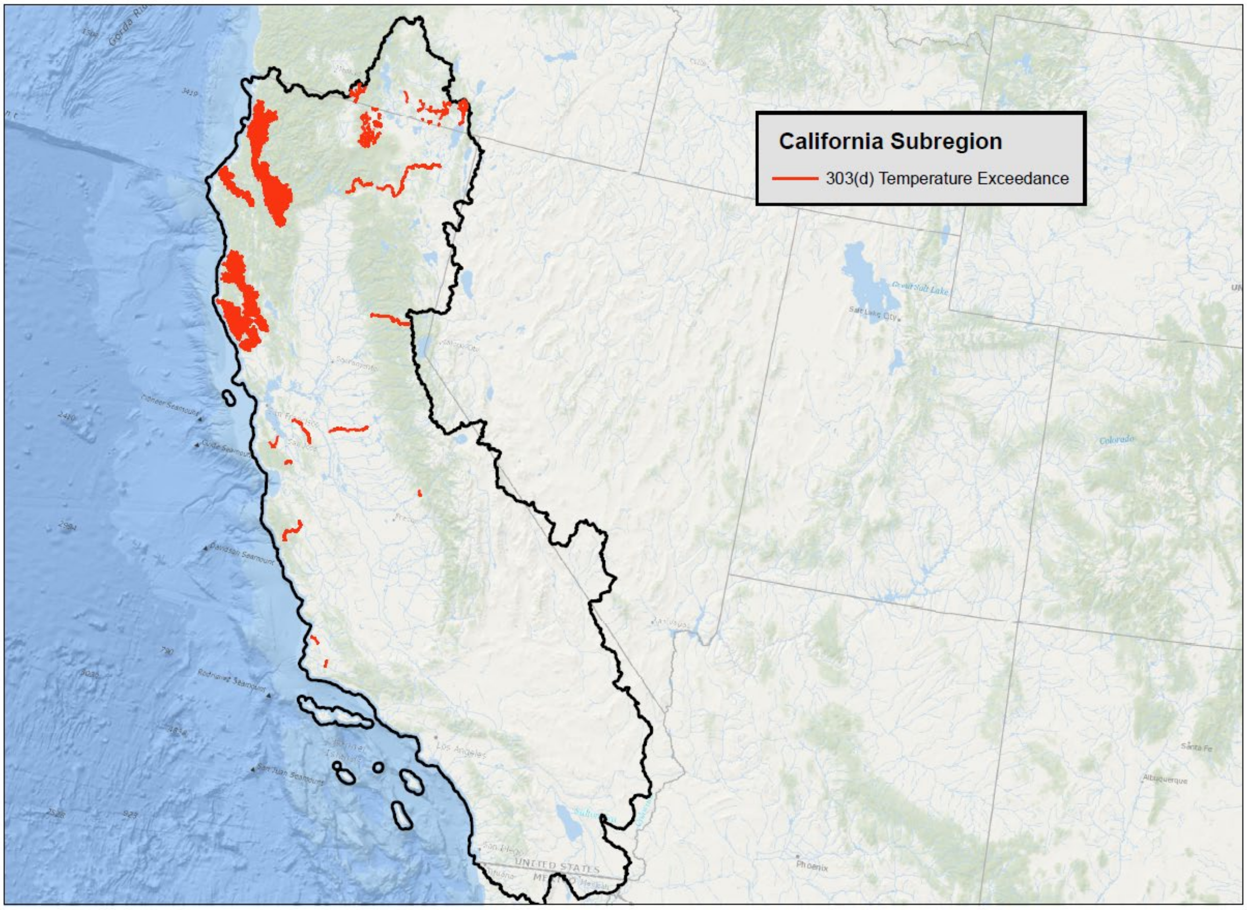


Figure 52. 303(d) temperature exceedances within the California subregion. Data downloaded from USEPA ATTAINS website; "303(d) May 1, 2015 National Extract layer".

We used GIS layers made publically available through USEPA's Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS) to determine the number of km on the 303(d) list for exceeding temperature thresholds within the boundaries of those species which utilize freshwater habitats (***Table 132***). Because the 303(d) list is limited to the subset of rivers tested, the chart values should be regarded as lower-end estimates. While some ESU/DPS ranges do not contain any 303(d) rivers listed for temperature, others show considerable overlap. These comparisons demonstrate the relative significance of elevated temperature among ESUs/DPSs. Increased water temperature may result from wastewater discharge, decreased water flow, minimal shading by riparian areas, and climatic variation.

Table 132. Number of kilometers of river, stream and estuaries included in ATTAINS 303(d) lists due to temperature that are located within selected

California subregion species (ESU/DPS) ranges. Data were taken from USEPA ATTAINS website: May 1, 2015 National Extract.

Species	Kilometers of recorded temperature exceedance
Chinook, Central Valley spring-run ESU	92
Chinook, California Coastal ESU	4,467
Chinook, Sacramento River winter-run ESU	No exceedances recorded[11]
Coho, Central California Coast ESU	3,272
Steelhead, Northern California DPS	3,100
Steelhead, South-Central California Coast DPS	84
Steelhead, Central California Coast DPS	1,397
Steelhead, California Central Valley DPS	92
Steelhead, Southern California DPS	29

9.4.3 Pesticide Usage

The sources of information used to characterize the occurrence of pesticide environmental mixtures within specie's habitats include: land use information, species recovery plans, status updates, listing documents, pesticide monitoring data, incident data, existing pesticide consultations, and pesticide usage information.

Sources of pesticide usage information and analyses considered in this baseline assessment include United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) census of agriculture and chemical use programs; USGS national water quality assessment (NAWQA) project – pesticide national synthesis project; State-based surface and groundwater monitoring programs; California Department of Pesticide Regulation – Pesticide Use Reporting (PUR); as well as survey data from proprietary sources as summarized by EPA (see Attachment 1).

In 2017, pesticides were applied to over 18 million acres in California to control for insects; weeds, grass or brush; nematodes; diseases in crops and orchards; or to control growth, thin fruit, ripen, or defoliate (USDA, 2017). The previous census (2012) reported about 15.6 million acres treated for these use categories. During the period 2010-2016 an average of about 320 different active ingredients were applied annually in California to control pests on crop groups: corn, wheat, vegetables and fruit, orchards and grapes, alfalfa, pasture and hay, and other crops.

EPA has provided NMFS with national and state use and usage summaries for both metolachlor and telone which cover the years 2013-2017. The usage information within these reports come

[11] While temperature exceedances are not recorded in the 303(d) list they are anticipated within this species range.

from both direct pesticide usage reporting (e.g. California Department of Pesticide Regulation) as well as usage estimates based on market research surveys (e.g. Agricultural Market Research Data). See Table 133 and Table 134 for the available usage information for metolachlor and telone in California. Note that the consideration of pesticide usage in the environmental baseline is not limited to metolachlor and telone, rather the environmental baseline considers the usage of all pesticides within the species range. The metolachlor and telone usage tables are thus provided as an example of the type of information available.

Table 133. California 1,3-Dichloropropene Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Alfalfa	1,600,000	1,000	*	*	*
Almonds	900,000	2,300,000	*	*	*
Apples	10,000	10,000	*	*	*
Apricots	9,000	8,000	0	<2.5	<1
Artichoke	7,000	<500	*	*	*
Asparagus	9,000	10,000	<1	10	<2.5
Avocados	50,000	Surveyed but no usage reported			
Barley	80,000	Surveyed but no usage reported			
Beans, Lima	6,000	Surveyed but no usage reported			
Beans, Dry	50,000	Surveyed but no usage reported			
Beans, Snap, Bush, Pole, String	6,000	2,000	*	*	*
Beets	1,000	4,000	*	*	*
Bitter Melon	Not Surveyed[2]				
Blueberry	6,000	10,000	*	*	*
Broccoli	100,000	100,000	<1	5	<2.5
Brussel Sprouts	4,000	200,000	*	*	*
Cabbage	10,000	50,000	<2.5	10	5
Caneberries	10,000	60,000	0	35	10
Canola	Not Surveyed[2]				
Cantaloupe	30,000	20,000	0	5	<1
Carrots	70,000	1,000,000	10	20	15
Cauliflower	40,000	30,000	0	5	<2.5
Celery	30,000	<500	*	*	*
Cherries	40,000	40,000	0	<2.5	<1
Chinese Cabbage	NA	30,000	*	*	*
Corn	500,000	4,000	*	*	*
Corn, Forage-Fodder	Not Surveyed[2]				
Cotton	200,000	20,000	*	*	*
Cucumbers	9,000	Surveyed but no usage reported			

Dates	6,000	Surveyed but no usage reported			
Daikon	NA	<500	*	*	*
Eggplant	1,000	20,000	*	*	*
Figs	7,000	3,000	0	<2.5	<1
Garlic	30,000	40,000	0	5	<2.5
Grape, Table/Raisin	300,000	600,000	<1	<2.5	<1
Grape, Wine	600,000	400,000	<1	<2.5	<1
Grapefruit	10,000	1,000	*	*	*
Hazelnuts	Not Surveyed[2]				
Honeydew	10,000	10,000	0	5	5
Kale	6,000	<500	*	*	*
Kiwifruit	4,000	<500	0	<2.5	<1
Leeks	1,000	1,000	*	*	*
Lemons	50,000	20,000	0	<2.5	<1
Lettuce	200,000	1,000	0	<2.5	<1
Peppermint	2,000	Surveyed but no usage reported			
Nectarines	20,000	50,000	*	*	*
Nursery Crops	Not Surveyed[2]				
Oats	10,000	Surveyed but no usage reported			
Olives	40,000	4,000	0	<2.5	<1
Onions	50,000	20,000	<1	<2.5	<1
Oranges	200,000	30,000	0	10	5
Parsley	4,000	20,000	*	*	
Pasture	10,000,000	<500	*	*	*
Peaches	50,000	20,000	0	<2.5	<1
Peanuts	Not Surveyed[2]				
Pears	10,000	1,000	0	10	<1
Peas	Not Surveyed[2]				
Pecans	3,000	1,000	*	*	*
Peppers	30,000	90,000	0	10	5
Persimmons	NA	<500	0	<2.5	<1
Pineapple	Not Surveyed[2]				
Pistachio	200,000	10,000	*	*	*
Plums	20,000	30,000	0	<2.5	<1
Pomegranates	20,000	<500	*	*	*
Prunes	50,000	100,000	<1	5	<1
Potatoes	40,000	100,000	<1	5	<1
Pumpkins	6,000	Surveyed but no usage reported			
Rice	500,000	Surveyed but no usage reported			
Rye	5,000	3,000	*	*	*
Safflower	30,000	<500	*	*	*
Sorghum	Not Surveyed[2]				
Soybeans	Not Surveyed[2]				
Spinach	30,000	1,000	*	*	*
Squash	6,000	1,000	*	*	*
Strawberries	40,000	2,100,000	30	55	40
Sugar Beets	10,000	Surveyed but no usage reported			
Sugarcane	Not Surveyed[2]				

Sunflower	Not Surveyed[2]				
Sweet Corn	30,000	<500	*	*	*
Sweet Potato	NA	800,000	*	*	*
Tangelo	2,000	4,000	*	*	*
Tangerines	50,000	D	D	D	D
Tobacco	Not Surveyed[2]				
Tomato	300,000	100,000	0	<2.5	<1
Walnuts	300,000	500,000	*	*	*
Watermelon	10,000	20,000	0	5	<2.5
Wheat, spring	50,000	Surveyed but no usage reported			
Wheat, summer	400,000	Surveyed but no usage reported			
Golf Course	Surveyed but no usage reported – at national level				

[1]*Not surveyed at national level*
[2]*Not surveyed for within California*

Table 134. California Metolachlor Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Corn	500,000	20,000	0	5	5
Sorghum	10,000	Surveyed but no usage reported			
Sweet Corn	NA	Surveyed but no usage reported			
Tomato	300,000	50,000	5	15	10
Beans (Snap, Bush, Pole, String)	NA	Surveyed but no usage reported			
Dry Beans/Peas	50,000	3,000	0	15	5
Lima Beans	6,000	<500	0	<2.5	<1
Peanuts	Not surveyed				
Peas (Fresh, Green, Sweet)	Not surveyed				
Soybeans	Not surveyed				
Cotton	NA	Surveyed but no usage reported			
Safflower	50,000	<500	Usage has been reported, but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Sunflowers	50,000	<500	Usage has been reported, but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Potatoes	NA	Surveyed but no usage reported			

Table 135. California S-Metolachlor Agricultural and Non-Agricultural Usage. Modified from EPA National and State Use and Usage Summary (Attachment 1).

Crop	Avg. Annual Crop Acres Grown	Avg. Annual Total Lbs. AE Applied	Min. Annual PCT	Max. Annual PCT	Avg. Annual PCT
Blueberries	Not surveyed				
Currant	Not surveyed				
Elderberry	Not surveyed				
Gooseberry	Not surveyed				
Huckleberry	Not surveyed				
Strawberries	Not surveyed				
Blackberries	Not surveyed				
Raspberries	Not surveyed				
Loganberry	Not surveyed				
Chive	Not surveyed				
Garlic	Not surveyed				
Leek	Not surveyed				
Onions	Surveyed but no use reported				
Shallot	Not surveyed				
Corn	500,000	50,000	<1	25	10
Sorghum	Surveyed but no use reported				
Sweet Corn	30,000	6,000	5	30	15
Cantaloupes	Not surveyed				
Citron	Not surveyed				
Cucumbers	Not surveyed				
Muskmelon	Not surveyed				
Pumpkins	6,000	<500	0	<2.5	<1
Squash	Not surveyed				
Watermelons	Not surveyed				
Eggplant	Not surveyed				
Okra	Not surveyed				
Peppers	30,000	9,000	10	40	25
Tomatoes	300,000	300,000	60	70	65
Broccoli	Not surveyed				
Brussel Sprouts	Not surveyed				
Chinese Cabbage	Not surveyed				
Cauliflower	Not surveyed				
Cabbage	Not surveyed				
Broccoli Raab	Not surveyed				
Mustard Spinach	Not surveyed				
Rape Greens	Not surveyed				
Collards	Not surveyed				
Mizuna	Not surveyed				
Mustard Greens	Not surveyed				
Kale	Not surveyed				
Celery	30,000	<500	0	<1	<1

Cilantro	Not surveyed				
Rhubarb	Not surveyed				
Spinach	30,000	2,000	5	15	10
Swiss Chard	--	<500	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Turnip Greens	Not surveyed				
Beans (Snap, Bush, Pole, String)	8,000	900	0	25	10
Dry Beans/Peas	50,000	30,000	10	55	40
Lentils	Not surveyed				
Lima Beans	6,000	4,000	15	80	50
Peas (Fresh, Green, Sweet)	Not surveyed				
Soybeans	--	<500	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Alfalfa	Not surveyed				
Cotton	200,000	100,000	0	10	<2.5
Safflower	50,000	2,000	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Sesame	Not surveyed				
	Not surveyed				
Sunflowers	50,000	10,000	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Daikon Radish	Not surveyed				
Horseradish	Not surveyed				
Parsnip	Not surveyed				
Rutabaga	Not surveyed				
Sweet Potatoes	Not surveyed				
Sugar Beets	Surveyed but no use reported				
Garden Beets	3,000	<500	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Carrots	70,000	1,000	0	5	<1
Celeriac	--	<500	Usage has been reported but due to a reporting issue the data are not sufficiently reliable to provide an estimate		
Radish	Not surveyed				
Asparagus	Not surveyed				
Potatoes	40,000	10,000	0	55	15
Peanuts	Not surveyed				
Stevia	Not surveyed				
Rights of Way	Surveyed but no usage reported – at national level				
Agricultural Turf	Surveyed but no usage reported – at national level				
Ornamental Lawns, Turf and associated Ornamentals	Surveyed but no usage reported – at national level				
Institutional Turf Facilities	Surveyed but no usage reported – at national level				

Golf Courses	Surveyed but no usage reported – at national level
Nursery and Greenhouse Ornamentals	Surveyed but no usage reported – at national level

9.4.4 Monitoring Data

The California Department of Pesticide Regulation (CADPR) has developed and maintained a number of excellent programs with the overall mission to "protect human health and the environment by regulating pesticide sales and use, and by fostering reduced-risk pest management". As further described on the CADPR website - The Environmental Monitoring Branch monitors the environment to determine the fate of pesticides, protecting the public and the environment from pesticide contamination through analyzing hazards and developing pollution prevention strategies. The Branch provides environmental monitoring data required for emergency eradication projects, environmental contamination assessments, pesticide registration, pesticide use enforcement, and human exposure evaluations. It also takes the lead in implementing many of DPR's environmental protection programs (https://www.cdpr.ca.gov/).

The CADPR surface water database (SURF) was developed in 1997 and currently contains data representing 58 counties, over 4,000 sample sites, and over 760,000 chemical analysis records from water samples. Access to SURF is available at:
(https://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm).

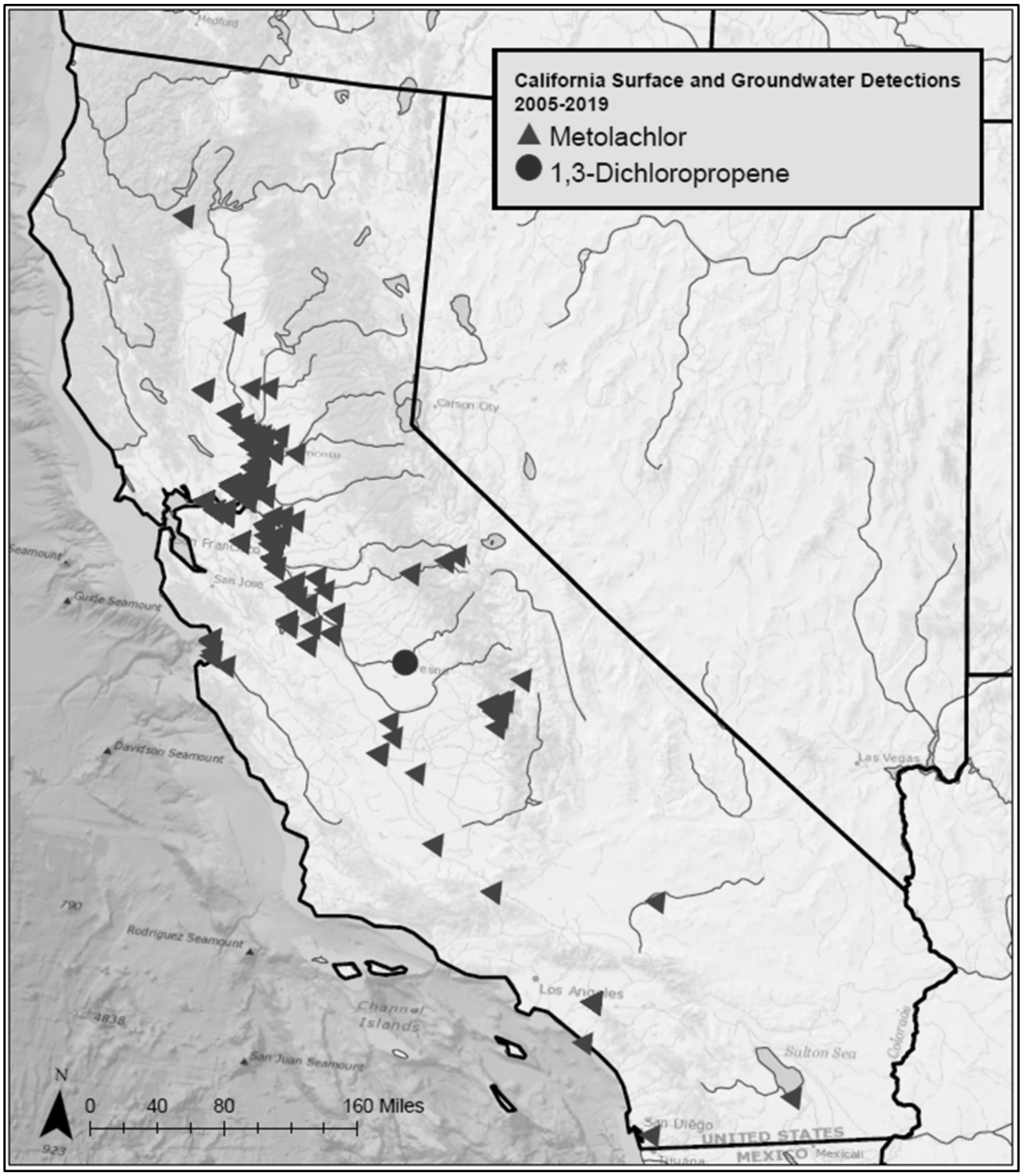


Figure 53. Water monitoring detections of 1,3-Dichloropropene and Metolachlor in California, 2005 to 2019. Data were accessed via the National Water Quality Portal (https://www.waterqualitydata.us/).

9.4.5 Pesticide Use Reports

California is the only state in the nation to require full reporting of pesticide use. Pesticide Use Reporting (PUR) has been required since 1990 and covers all agricultural uses as well as applications to parks, golf courses, cemeteries, rangeland, pastures, and along roadside and railroad rights-of-way. Pesticide reporting is not currently required for home and garden, industrial and institutional uses. PUR data for metolachlor and telone are provided as part of EPA's National and State Use and Usage Summary (Table 133 and Table 134). The PUR data can also help inform a broader picture of chemical usage in California because it provides the reported usage of all pesticides applied in crops and other use sites

9.4.6 Pesticide Reduction Programs

When using these two a.i.s, growers must adhere to the court-ordered injunctive relief, requiring buffers of 20 yards for ground application and 100 yards for any aerial application. These measures are mandatory in all four states, pending completion of consultation.

California State Code does not include specific limitations on pesticide application aside from human health protections. It only includes statements advising that applicators are required to follow all federal, state, and local regulations.

Additionally, pesticide reduction programs already exist in California to minimize levels of the above a.i.s into the aquatic environment. Monitoring of water resources is handled by the California State Water Resources Control Boards. Each Regional Board makes water quality decisions for its region including setting standards and determining waste discharge requirements. The Central Valley Regional Water Quality Control Board (CVRWQCB) addresses issues in the Sacramento and San Joaquin River Basins. These river basins are characterized by crop land, specifically orchards, which historically rely heavily on organophosphates for pest control.

In 2003, the CVRWQCB adopted the Irrigated Lands Waiver Program (ILWP). Participation was required for all growers with irrigated lands that discharge waste which may degrade water quality. However, the ILWP allowed growers to select one of three methods for regulatory coverage (Markle et al. 2005). These options included: 1) join a Coalition Group approved by the CVRWQCB, 2) file for an Individual Discharger Conditional Waiver, and 3) comply with zero discharge regulation (Markle et al. 2005). Many growers opted to join a Coalition as the other options were more costly. Coalition Groups were charged with completing two reports – a Watershed Evaluation Report and a Monitoring and Reporting Plan. The Watershed Evaluation Report included information on crop patterns and pesticide/nutrient use, as well as mitigation measures that would prevent orchard runoff from impairing water quality. Similar programs are in development in other agricultural areas of California.

As a part of the Waiver program, the Central Valley Coalitions undertook monitoring of "agriculture dominated waterways". Some of the monitored waterways are small agricultural streams and sloughs that carry farm drainage to larger waterways. The coalition was also required to develop a management plan to address exceedance of State water quality standards. Currently, the Coalitions monitor toxicity to test organisms, stream parameters (*e.g.*, flow, temperature, etc.), nutrient levels, and pesticides used in the region, including diazinon and chlorpyrifos. Diazinon exceedances within the Sacramento and Feather Rivers resulted in the development of a TMDL. The Coalitions were charged with developing and implementing management and monitoring plans to address the TMDL and reduce diazinon runoff.

The Coalition for Urban/Rural Environmental Stewardship (CURES) is a non-profit organization that was founded in 1997 to support educational efforts for agricultural and urban communities focusing on the proper and judicious use of pest control products. CURES educates growers on methods to decrease pesticide surface water contamination in the Sacramento River Basin. The organization has developed best-practice literature for pesticide use in both urban and agricultural settings (www.curesworks.org). CURES also works with California's Watershed Coalitions to standardize their Watershed Evaluation Reports and to keep the Coalitions informed. The organization has worked with local organizations, such as the California Dried Plum Board and the Almond Board of California, to address concerns about diazinon, pyrethroids, and sulfur. The CURES site discusses alternatives to organophosphate dormant spray applications. It lists pyrethroids and carbaryl as alternatives, but cautions that these compounds may impact non-target organisms. The CURES literature does not specifically address the a.i.s discussed in this Opinion.

California also has PURS legislation whereby all agricultural uses of registered pesticides must be reported. In this case "agricultural" use includes applications to parks, golf courses, and most livestock uses. The CDPR publishes voluntary interim measures for mitigating the potential impacts of pesticide usage to listed species. These measures are available online as county bulletins.

9.4.7 Regional Mortality Factors

Habitat Modification The Central Valley area, including San Francisco Bay and the Sacramento and San Joaquin River Basins, has been drastically changed by development. Salmonid habitat has been reduced to 300 miles from historic estimates of 6,000 miles (CDFG 1993). In the San Joaquin Basin alone, the historic floodplain covered 1.5 million acres with 2 million acres of riparian vegetation (CDFG 1993). Roughly 5% of the Sacramento River Basin's riparian forests remain. Impacts of development include loss of LWD, increased bank erosion and bed scour, changes in sediment loadings, elevated stream temperature, and decreased base flow. Thus, lower quantity and quality of LWD and modified hydrology reduce and degrade salmonid rearing habitat.

The Klamath Basin in Northern California has been heavily modified as well. Water diversions have reduced spring flows to 10% of historical rates in the Shasta River, and dams block access to 22% of historical salmonid habitat. The Scott and Trinity Rivers have similar histories. Agricultural development has reduced riparian cover and diverted water for irrigation (NRC 2003). Riparian habitat has decreased due to extensive logging and grazing. Dams and water diversions are also common. These physical changes resulted in water temperatures too high to sustain salmonid populations. The Salmon River, however, is comparatively pristine; some reaches are designated as Wild and Scenic Rivers. The main cause of riparian loss in the Salmon River basin is likely wildfires – the effects of which have been exacerbated by salvage logging (NRC 2003).

Mining Famous for the gold rush of the mid-1800s, California has a long history of mining. Extraction methods such as suction dredging, hydraulic mining, and strip mining may cause water pollution problems. In 2004, California ranked top in the nation for non-fuel mineral production with 8.23% of total production (NMA 2007). Today, gold, silver, and iron ore comprise only 1% of the production value. Primary minerals include construction sand, gravel, cement, boron, and crushed stone. California is the only state to produce boron, rare-earth metals, and asbestos (NMA 2007).

California contains approximately 1,500 abandoned mines. Roughly 1% of these mines are suspected of discharging metal-rich waters into the basins. The Iron Metal Mine in the Sacramento Basin releases more than 1,100 pounds of copper and more than 770 pounds of zinc to the Keswick Reservoir below Shasta Dam. The Iron Metal Mine also released elevated levels of lead (Cain et al. 2000 in Carter and Resh 2005). Metal contamination reduces the biological productivity within a basin. Metal contamination can result in fish kills at high levels or sublethal effects at low levels. Sublethal effects include a reduction in feeding, overall activity levels, and growth. The Sacramento Basin and the San Francisco Bay watershed are two of the most heavily impacted basins within the state from mining activities. The basin drains some of the most productive mineral deposits in the region. Methyl mercury contamination within San Francisco Bay, the result of 19th century mining practices using mercury to amalgamate gold in the Sierra Nevada Mountains, remains a persistent problem today. Based on sediment cores, pre-mining concentrations were about five times lower than concentrations detected within San Francisco Bay today (Conaway et al. 2003).

Hydromodification Projects Several of the rivers within California have been modified by dams, water diversions, drainage systems for agriculture and drinking water, and some of the most drastic channelization projects in the nation. There are about 1,400 dams within the State of California, more than 5,000 miles of levees, and more than 140 aqueducts (Mount 1995). In general, the southern basins have a warmer and drier climate and the more northern, coastal-influenced basins are cooler and wetter. About 75% of the runoff occurs in basins in the northern half of California, while 80% of the water demand is in the southern half. Two water diversion projects meet these demands—the federal Central Valley Project (CVP) and the California State Water Project (CSWP). The CVP is one of the world's largest water storage and transport systems. The CVP has more than 20 reservoirs and delivers about 7 million acre-ft per year to southern California. The CSWP has 20 major reservoirs and holds nearly 6 million acre-ft of water. The CSWP delivers about 3 million acre-ft of water for human use. Together, both diversions irrigate about 4 million acres of farmland and deliver drinking water to roughly 22 million residents.

Both the Sacramento and San Joaquin rivers are heavily modified, each with hundreds of dams. The Rogue, Russian, and Santa Ana rivers each have more than 50 dams, and the Eel, Salinas, and the Klamath Rivers have between 14 and 24 dams each. The Santa Margarita is considered one of the last free flowing rivers in coastal southern California with nine dams occurring in its watershed. All major tributaries of the San Joaquin River are impounded at least once and most have multiple dams or diversions. The Stanislaus River, a tributary of the San Joaquin River, has over 40 dams. As a result, the hydrograph of the San Joaquin River is seriously altered from its natural state. Alteration of the temperature and sediment transport regimes had profound influences on the biological community within the basin. These modifications generally result in a reduction of suitable habitat for native species and frequent increases in suitable habitat for non-native species. The Friant Dam on the San Joaquin River is attributed with the extirpation of spring-run Chinook salmon within the basin. A run of the spring-run Chinook salmon once produced about 300,000 to 500,000 fish (Carter and Resh 2005).

Artificial Propagation Anadromous fish hatcheries have existed in California since establishment of the McCloud River hatchery in 1872. There are nine state hatcheries: the Iron Gate (Klamath River), Mad River, Trinity (Trinity River), Feather (Feather River), Warm Springs (Russian River), Nimbus (American River), Mokelumne (Mokelumne River), and Merced (Merced River). The California Department of Fish and Game (CDFG) also manages artificial production programs on the Noyo and Eel rivers. The Coleman National Fish Hatchery, located on Battle Creek in the upper Sacramento River, is a federal hatchery operated by the USFWS. The USFWS also operates an artificial propagation program for Sacramento River winter run Chinook salmon.

Of these, the Feather River, Nimbus, Mokelumne, and Merced River facilities comprise the Central Valley Hatcheries. Over the last 10 years, the Central Valley Hatcheries have released over 30 million young salmon. State and the federal (Coleman) hatcheries work together to meet overall goals. State hatcheries are expected to release 18.6 million smolts in 2008 and Coleman is aiming for more than 12 million. There has been no significant change in hatchery practices over the year that would adversely affect the current year class of fish. A new program marking 25% of the 32 million Sacramento River Fall-run Chinook smolts may provide data on hatchery fish contributions to the fisheries in the near future.

Commercial and Recreational Fishing The region is home to many commercial fisheries. The largest in terms of total California landings in 2006 were northern anchovy, Pacific sardine, Chinook salmon, sablefish, Dover sole, Pacific whiting, squid, red sea urchin, and Dungeness crab (CDFG 2007). Red abalone is also harvested.

Despite regulated fishing programs for salmonids, listed salmonids are also caught as bycatch. There are several approaches under the ESA to address tribal and state take of ESA-listed species that may occur as a result of harvest activities. For example, NMFS has issues permits under Section 10 that have allowed these activities to be exempted from Section 9 prohibitions. Section 4(d) rules issued by NMFS provide exemptions from take for resource, harvest, and hatchery management plans.

Management of salmon fisheries in the Southwest Coast Region is a cooperative process involving federal, state, and tribal representatives. The Pacific Fishery Management Council sets annual fisheries in federal waters from three to 200 miles off the coasts of Washington, Oregon, and California. Inland fisheries are those within state boundaries, including those extending out three miles from state coastlines. The states of Oregon, Idaho, California, and Washington issue salmon fishing licenses for inland fisheries. The California Fish and Game Commission (CFGC) establishes the salmon seasons and issues permits for all California waters and the Oregon Department of Fish and Game sets the salmon seasons and issues permits for all Oregon waters.

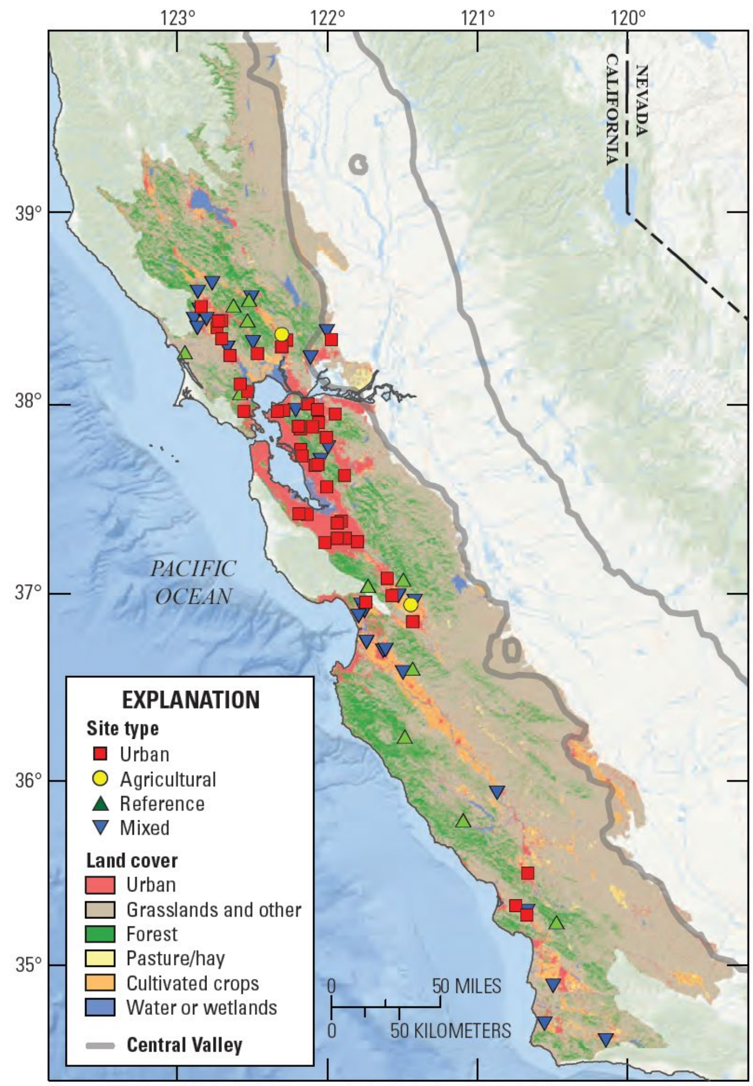
In 2008, there was an unprecedented collapse of the Sacramento River fall-run Chinook salmon that led to complete closure of the commercial and sport Chinook fisheries in California and in Oregon south of Cape Falcon. U.S. Department of Commerce Secretary Gary Locke released a 2008 West Coast salmon disaster declaration for California and Oregon in response to poor salmon returns to the Sacramento River, which led to federal management reducing commercial salmon fishing off southern Oregon and California to near zero. Secretary Locke also released $53.1 million in disaster funds to aid affected fishing communities.

Non-native Species Plants and animals that are introduced into habitats where they do not naturally occur are called non-native species. They are also known as non-indigenous, exotic, introduced, or invasive species, and have been known to affect ecosystems. Non-native species are introduced through infested stock for aquaculture and fishery enhancement, through ballast water discharge and from the pet and recreational fishing industries (http://biology.usgs.gov/s+t/noframe/x191.htm.). The Aquatic Nuisance Species Task Force suggests that it is inevitable that cultured species will eventually escape confinement and enter U.S. waterways. Non-native species were cited as a contributing cause in the extinction of 27 species and 13 subspecies of North American fishes over the past 100 years (Miller et al. 1989). Wilcove, Rothstein *et al.* (1998) note that 25% of ESA-listed fish are threatened by non-native species. By competing with native species for food and habitat as well as preying on them, non-native species can reduce or eliminate populations of native species.

Surveys performed by CDFG state that at least 607 non-native species are found in California coastal waterways (Foss et al. 2007). The majority of these species are representatives of four phyla: annelids (33%), arthropods (22%), chordates (13%), and mollusks (10%). Non-native chordate species are primarily fish and tunicates which inhabit fresh and brackish water habitats such as the Sacramento-San Joaquin Delta (Foss et al. 2007). The California Aquatic Invasive Species Management Plan includes goals and strategies for reducing the introduction rate of new invasive species as well as removing those with established populations.

USGS NAWQA Regional Stream Quality Assessment

In 2017, the USGA sampled 85 sites as part of the California Stream Quality Assessment (Figure 54). Water samples were analyzed for about 230 dissolved pesticides and pesticide degradates. Results from the 2017 water quality assessment were considered and are available at https://webapps.usgs.gov/rsqa/#!/region/CSQA.



Base modified from U.S. Geological Survey and other Federal and State digital data, various scales; Albers Equal-Area Conic projection, Standard parallels are 29° 30" and 45° 30", Central meridian -121°; North American Datum of 1983. Land cover modified from National Land Cover Database 2011. Base-map image is the intellectual property of Esri and is used herein under license. Copyright © 2014 Esri and its licensors. All rights reserved.

Figure 54. The California Stream Quality Assessment study area. Taken from Van Metre et al. 2017: Figure 1: "California Stream Quality Assessment study area and provisionally selected sampling sites; the boundary is based on the U.S. Environmental Protection Agency level III ecoregions of the United States"

NAWQA Analysis: Santa Ana Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in section 10.4.1.5.

The Santa Ana watershed is the most heavily populated study site out of more than 50 assessment sites studied across the nation by the NAWQA Program. According to Belitz *et al.* (2004), treated wastewater effluent is the primary source of baseflow to the Santa Ana River. Secondary sources that influence peak river flows include stormwater runoff from urban, agricultural, and undeveloped lands (Belitz et al. 2004). Stormwater and agricultural runoff frequently contain pesticides, fertilizers, sediments, nutrients, pathogenic bacteria, and other chemical pollutants to waterways and degrade water quality. The above inputs have resulted in elevated concentrations of nitrates and pesticides in surface waters of the basin. Nitrates and pesticides were more frequently detected here than in other national NAWQA sites (Belitz et al. 2004). Additionally, Belitz *et al.* (2004) found that pesticides and volatile organic compounds (VOCs) were frequently detected in surface and ground water in the Santa Ana Basin.

Of the 103 pesticides and degradates routinely analyzed for in surface and ground water, 58 were detected. Pesticides included diuron, diazinon, carbaryl, chlorpyrifos, lindane, malathion, and chlorothalonil. Diuron was detected in 92% of urban samples – a rate much higher than the national frequency of 25 % (Belitz et al. 2004). Of the 85 VOCs routinely analyzed for, 49 were detected. VOCs included methyl *tert*-butyl ether (MTBE), chloroform, and trichloroethylene (TCE). Organochlorine compounds were also detected in bed sediment and fish tissue. Organochlorine concentrations were also higher at urban sites than at undeveloped sites in the Santa Ana Basin. Organochlorine compounds include DDT and its breakdown product diphenyl dicloroethylene (DDE), and chlordane. Other contaminants detected at high levels included trace elements such as lead, zinc, and arsenic. According to Belitz *et al.* (2004), the biological community in the basin is heavily altered as a result from these pollutants.

NAWQA Analysis: San Joaquin-Tulare Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in section 10.4.1.5.

A study was conducted by the USGS in the mid-1990s on water quality within the San Joaquin-Tulare basins. Concentrations of dissolved pesticides in this study unit were among the highest of all NAWQA sites nationwide. The USGS detected 49 of the 83 pesticides it tested for in the mainstem and three subbasins. Pesticides were detected in all but one of the 143 samples. The most common detections were of the herbicides simazine, dacthal, metolachlor, and EPTC (Eptam), and the insecticides diazinon and chlorpyrifos. Twenty-two pesticides were detected in over 20% of the samples (Dubrovsky et al. 1998). Further, many samples contained mixtures of at least 7 pesticides, with a maximum of 22 different compounds. Diuron was detected in all three subbasins, despite land use differences.

Organochlorine insecticides in bed sediment and tissues of fish or clams were also detected. They include DDT and toxaphene. Levels at some sites were among the highest in the nation. Concentrations of trace elements in bed sediment generally were higher than concentrations found in other NAWQA study units (Dubrovsky et al. 1998).

NAWQA Analysis: Sacramento River Basin

The regional NAWQA summary presented here represents data collected during the period 1992-2001. USGS data from 2002-2011 is provided at the national-level (Ryberg et al. 2014) and is summarized in section 10.4.1.5.

Another study conducted by the USGS from 1996 - 1998 within the Sacramento River Basin compared the pesticides in surface waters at four specific sites – urban, agricultural, and two integration sites (Domagalski 2000). Pesticides included thiobencarb, carbofuran, molinate, simazine, metolachlor, dacthal, chlorpyrifos, carbaryl, and diazinon – as well as the three a.i.'s assessed in this Opinion. Land use differences between sites are reflected in pesticide detections. Thiobencarb was detected in 90.5 % of agricultural samples, but only 3.3% of urban samples (Domagalski 2000). This finding is unsurprising as rice is the dominant crop within the agricultural basin. Some pesticides were detected at concentrations higher than criteria for the protection of aquatic life in the smaller streams, but were diluted to safer levels in the mainstem river. Intensive agricultural activities also impact water chemistry. In the Salinas River and in areas with intense agriculture use, water hardness, alkalinity, nutrients, and conductivity are also high.

10 Cumulative Effects

10.1 Introduction

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered by this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, NMFS searched for information on future state, tribal, local, or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of the census bureau, departments of commerce for Idaho, Washington, Oregon, and California, business journals, trade journals, and newspapers using Google and other electronic search engines. Those searches produced reports on projected population growth, commercial and industrial growth, and global warming. Trends described below highlight the effects of population growth on existing populations and habitats for all 28 ESUs/DPSs. Changes in the near-term (five-years; 2024) are more likely to occur than longer-term projects (10-years; 2029). Projections are based upon recognized organizations producing best available information and reasonable rough-trend estimates of change stemming from these data. NMFS analysis provides a snapshot of the effects from these future trends on listed species.

The information from the Cumulative Effects section is treated as a "risk modifier" in the Integration and Synthesis section (Chapters 13 and 16). Factors which have the potential to "modify" the risk are those which are able to interact with the effects of the action. For example, elevated temperatures have been demonstrated to increase the toxicity of certain pesticide mixtures to juvenile coho salmon (Laetz 2014). While many of the factors described in this section have the potential to modify the action, and were thus considered, two of the factors were consistently found to have a high potential to modify the risk. The two factors are: 1) elevated temperatures in marine and freshwater habitats, and 2) hydrologic effects in freshwater habitats. We therefore developed two key questions to guide our synthesis of the information within the Cumulative Effects section:

1. Will future temperatures impair species aquatic habitats?

2. Will future hydrologic flows impair freshwater species habitats?

In order to assess potential changes in future aquatic temperatures and future hydrological flows, NMFS searched for information on future state, tribal, local, or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of business journals, trade journals, and newspapers using Google and other electronic search engines. Those searches produced reports on projected population growth, commercial and industrial growth, and climate change (see summaries below). Projections are based upon recognized organizations producing best available information and reasonable rough-trend estimates of change stemming from these data. NMFS analysis provides a snapshot of the effects from these future trends on listed ESUs/DPS. In general, NMFS found future elevated temperatures and altered hydrologic conditions are likely to affect salmonids.

Within the Integration and Synthesis section (Chapters 13 and 16), we characterize the overall magnitude of influence of the Cumulative Effect as either "low" or "high". This characterization includes directionality (i.e. positive influence or negative influence) as well as confidence. The magnitude, directionality, and confidence of the influence are determined primarily by answers provided to the two key questions outlined above. Confidence is determined by assessing the amount of evidence provided, as well as by further considering the species-specific implications induced through these two main factors. It is important to note that the key-question framework (described above) is a tool to help guide our risk assessors in making transparent and consistent determinations. However, the ultimate consideration of increased or decreased risk attributable to the cumulative effects is not restricted to the consideration of the key questions alone. All information relevant to the cumulative effects is considered in the risk assessment.

10.2 U.S. Population Growth

The U.S. population is growing at a net rate of one person every 52 seconds (https://www.census.gov/popclock/). Population growth within communities in areas where salmon occur will place pressures on water availability, which affects hydrological conditions and water quality, which includes increases in water temperatures associated with a "built environment." As of 2017, California has grown at an estimated annual rate of 333,000 per year since 2010. Growth is strongest in the more densely populated counties in the San Francisco Bay Area, the Central Valley, and Southern California: specifically Merced, Placer, and San Joaquin counties (California Department of Finance 2018). Oregon's estimated population reached 4.14 million on July 1, 2017. This is an increase of 310,026 persons or 8.1 percent since the 2010 Census count. While growth slowed during the 2008 recession, Oregon's growth rate now ranks in the top 10 in the nation (Vaidya 2017). Between 2017 and 2018, Oregon's population grew by an additional 54,000 people; the largest gains are in metropolitan areas, with Oregon's three most populous counties in the Portland metropolitan area. Multnomah and Washington counties each added more than 10,000 residents, and Clackamas County added over 6,000. The largest percentage growth occurred in Deschutes and Crook Counties in Central Oregon (PSU Population Research Center 2018). According to Washington's 2018 Population Trends report, the state grew by 117,300 persons, or 1.6 percent. Growth was concentrated in the five largest metropolitan counties: King, Pierce, Snohomish, Spokane and Clark. Eastern Washington grew by 1.4 percent and Western Washington by 1.7 percent. Counties along the Interstate 5 corridor grew by 1.7 percent versus 1.4 percent for the rest of the state. Metropolitan counties grew 1.6 percent compared to nonmetropolitan counties, which grew 1.3 percent. Counties that border, or are within, Puget Sound grew by 1.7 percent versus non-Puget Sound counties, which grew by 1.5 percent. Rural counties grew by 1.3 percent versus 1.7 percent for non-rural counties (Washington Office of Financial Management 2018).

Population growth will require greater and greater demand on resources, greater demand for food and water, and greater demand for energy. The increase in demand for these essential items are likely to extend pressures on many threatened and endangered species populations and their designated critical habitats. As many cities border coastal or riverine systems, diffuse and extensive growth will increase overall volume of contaminant loading from wastewater treatment plants and runoff from expanding urban and suburban development into riverine, estuarine, and marine habitats. Urban runoff from expanding impervious surfaces and existing and additional roadways is typically warmer than natural surface waters and may also contain oil, heavy metals, polycyclic aromatic hydrocarbons, and other chemical pollutants. Inputs of these point and non-point pollution sources into numerous rivers and their tributaries will affect water quality in available spawning and rearing habitat for salmon. Based on the increase in human population growth, we expect an associated increase in the number of National Pollution Discharge Elimination System (NPDES) permits issued and the potential listing of more 303(d) waters with impaired thermal, dissolved oxygen, and nutrient regimes and impairments by high pollutant concentrations. Continued growth into forested and other natural areas alter landscapes to the detriment of species habitat. Altered landscapes, such as the loss of riparian vegetation along rivers and increases in impervious surfaces, adversely affect the delivery of sediment and gravel and significantly alter stream hydrology and water quality.

A nationwide rise in the population necessitates a rise in agricultural output, and the potential conversion of forested and other natural lands to agriculture. As most of the coastal states have large tracts of irrigated agriculture, this rise in agricultural output is anticipated to affect coastal areas and aquatic species. Impacts from heightened agricultural production will likely result in two negative impacts on listed species. The first impact may come from a needed reliance and greater use and application of insecticides, herbicides, and fertilizers resulting in their increased concentrations and entry into freshwater systems. Toxics and other pollutants from agricultural runoff may further degrade habitats supporting listed species. Second, increased output and water diversions for agriculture may also place greater demands upon limited water resources. Water diversions will reduce flow rates and alter habitat throughout freshwater systems. Reductions in flows could mean higher water temperatures, and as water is drawn off, contaminants will become more concentrated in these systems, exacerbating toxicity issues in habitats for protected species.

A rise in population will also require pesticide use to protect public health from disease vectors, control invasive species, and maintain public areas such as recreational waters. This can require the application of pesticides at, near, or over waters where the ESA-listed salmonids occur. The residue left by non-agricultural pesticide applications affecting waters of the US are regulated as discharges under state-issued NPDES permits in Washington, Oregon, and California.[12] In July of 2020, EPA will delegate NPDES authority to issue NPDES permits to Idaho as well. Discharges of pesticides are also expected to occur in waters not designated as waters of the US such that ESA-listed species will be exposed to pesticide residues from unregulated discharges.

The above issues are likely to pose continuous unquantifiable negative effects on listed species addressed in this Opinion, particularly freshwater and anadromous species, and those species adapted to and requiring nearshore and estuarine habitats. Each activity has negative effects on water quality. They include increases in sedimentation, increased point and non-point pollution discharges, and decreased infiltration of rainwater resulting in increased runoff into surface waters. Decreased rainwater infiltration leads to decreases in shallow groundwater recharge, decreases in hyporrheic flow (e.g., water that spreads laterally beneath river gravels outside the

[12] EPA has delegated NPDES permitting authority to these states with the exception of federal lands in the state of Washington and tribal lands in all three states, EPA retains authority for these discharges in Idaho until July 2020.

channel where surface flows occur), decreases in summer base flows and elevated temperatures. For example, the EPA recently released National Rivers and Streams Assessment 2013-2014 – Collaborative Survey (EPA 2020) reported that only 51 percent of the 186,538 miles of western rivers and streams represented in the survey were in good biological condition based on macroinvertebrate data. These observations did not differ significantly from the 2008-2009 survey. The biological condition of fish communities was significantly lower in the 2013-2014 survey relative to the 2008-2009 survey: Only 38 percent of fish communities assessed in 126,846 miles of western rivers and streams were found to be in good biological condition. Biological condition is the most comprehensive indicator of water body health. When the biology of a stream is healthy, the chemical and physical components of the stream are also typically in good condition. Nationally, the amount of stream length in good quality for fish condition dropped from 34.8 percent in 2009 to 26.4 percent in 2014. Stream lengths in good condition for macroinvertebrate communities was essentially unchanged: with the proportion of assessed stream lengths in good condition at 29.6 percent in 2009 and 30.2 percent in 2014.

10.3 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, and changes in precipitation patterns, all of which are likely to impact ESA listed species. The National Oceanic and Atmospheric Administration's (NOAA) climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://www.climate.gov).

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered.

A set of four scenarios was developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. The scenarios are referred to as representative concentration pathways (RCPs), which capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100 (IPCC 2014). The RCP scenarios drive climate model projections for temperature, precipitation, sea level, and other variables: RCP2.6 is a stringent mitigation scenario; RCP2.5 and RCP6.0 are intermediate scenarios; and RCP8.5 is a scenario with no mitigation or reduction in the use of fossil fuels. The IPCC future global climate predictions (2014 and 2018) and national and regional climate predictions included in the Fourth National Climate Assessment for U.S. states and territories (2018) use the RCP scenarios.

The increase of global mean surface temperature change by 2100 is projected to be 0.3 to 1.7°C under RCP2.6, 1.1 to 2.6°C under RCP 4.5, 1.4 to 3.1°C under RCP6.0, and 2.6 to 4.8°C under RCP8.5 with the Arctic region warming more rapidly than the global mean under all scenarios (IPCC 2014). The Paris Agreement aims to limit the future rise in global average temperature to 2°C, but the observed acceleration in carbon emissions over the last 15 to 20 years, even with a lower trend in 2016, has been consistent with higher future scenarios such as RCP8.5 (Hayhoe et al. 2018).

The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0°C from 1901 through 2016 (Hayhoe et al. 2018). The 2018 IPCC Special Report on the Impacts of Global Warming (Allen et al. 2018) noted that human-induced warming reached temperatures between 0.8 and 1.2°C above pre-industrial levels in 2017, likely increasing between 0.1 and 0.3°C per decade. Warming greater than the global average has already been experienced in many regions and seasons, with most land regions experiencing greater warming than over the ocean. Annual average temperatures have increased by 1.8°C across the contiguous U.S. since the beginning of the 20th century. Global warming has led to more frequent heat waves in most land regions and an increase in the frequency and duration of marine heatwaves. Average global warming up to 1.5°C as compared to pre-industrial levels is expected to lead to regional changes in extreme temperatures, and increases of precipitation and drought.

NMFS cannot assume stationarity with regard to species response and habitat function. Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure (Evans and Bjørge 2013; IPCC 2014; Kintisch 2006; Learmonth et al. 2006; MacLeod et al. 2005; McMahon and Hays 2006; Robinson et al. 2005). Though predicting the precise consequences of climate change on highly mobile marine species is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring. These impacts will be exacerbated by sea level rise. The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased habitat loss (Antonelis et al. 2006; Baker et al. 2006).

Altered ocean conditions projected with climate change include ocean acidification (IPCC 2013). The oceans have absorbed much of the carbon dioxide released from the burning of fossil fuels, and other land-use emissions, resulting in chemical reactions that lower pH (Tans 2009). This has caused an increase in hydrogen ion (acidity) of about 30 percent since the start of the industrial age. A process known as "ocean acidification." A growing number of studies have demonstrated adverse impacts on marine organisms, including: 1) the rate at which reef-building corals produce their skeletons decreases, 2) the ability of marine algae and free-swimming zooplankton to maintain protective shells is reduced, and 3) the survival of larval marine species including commercial fish and shellfish is reduced (Cohen and Holcomb 2009; Cooley et al. 2009; Kleypas and Yates 2009).

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012). Hazen et al. (2013) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. They predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses.

10.3.1 Climate Change in the Pacific Northwest

Climate change is an important factor in the long-term survival and recovery of ESA listed species. Salmon and steelhead, sturgeon and eulachon throughout their respective range are likely to be affected by a changing climate both directly and indirectly with increasing water temperatures and reduced instream summer flows. Several studies have revealed that climate change has the potential to affect ecosystems in nearly all tributaries throughout the Northwest and California where abundant cold water flows are essential for the conservation of species habitats (Battin et al. 2007; Crozier and Zabel 2006; Stocker et al. 2013; Walters et al. 2013). While the intensity of effects will vary by region (ISAB 2007), climate change is generally expected to alter aquatic habitat (water yield, peak flows, and stream temperature). As climate change alters the structure and distribution of rainfall, snowpack, and glaciations, each factor will in turn alter riverine hydrographs. Given the increasing certainty that climate change is occurring and is accelerating (Battin et al. 2007), NMFS anticipates salmonid, sturgeon, and eulachon habitats will be affected. Climate and hydrology models project significant reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Zhang et al. 2009) – changes that will shrink the extent of the snowmelt-dominated habitat available to these threatened and endangered species. Such changes may restrict our ability to conserve diverse life histories for many of these species.

Hydrologic changes in streamflow may harm the spawning and migration of sturgeon, eulachon, salmon, and trout species. Continued warming of stream and lake temperatures may also affect the health of and the extent of suitable habitat for many other aquatic species. Salmonids and other species that currently live in conditions near the upper range of their thermal tolerance are particularly vulnerable to higher stream temperatures, increasing susceptibility to disease and rates of mortality. Upstream migration for thermally-stressed species may be impeded by changes in channel structure from altered low-flow regimes. Reduced glacier area and volume over the long-term, which is projected for the future in the North Cascades, may challenge Pacific salmonids in those streams in which glacier melt comprises a significant proportion of streamflow (Dalton et al. 2013).

11 Effects of the Action: Introduction to Species

Our analysis of the effects of the action on threatened and endangered species includes three primary components which are integrated into the risk analysis: exposure analysis, response analysis, and species life-history considerations.

Section 7 regulations define "effects of the action" as all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action.

A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (Sec § 402.02). This effects analysis section is organized following the stressor, exposure, response, risk assessment framework.

11.1 Stressors Associated with the Proposed Action

For this consultation, the EPA's proposed action encompasses all currently approved product labels containing the active ingredients 1,3-D and r-metolachlor. This opinion evaluates these separately to avoid the misinterpretation that the analysis is comparing the two herbicides. The potential stressors we expect to result from the proposed action include 1,3-D and metolachlor; other ingredients of these product formulations (including "inert" ingredients and other active ingredients); label recommended tank mixtures (including other pesticide formulations and adjuvants); and toxic metabolites and degradates of product formulation ingredients. We also consider abiotic stressors (e.g. temperature) and aquatic parameters (e.g., water hardness) that influence the response of the species to stressors associated with the proposed action.

Here, we describe our approach to assessing the toxicity of pesticide mixtures containing 1,3-D or metolachlor. Consideration of the toxicity resulting from exposure to pesticide mixtures is an important part of the Effects Analysis of this Opinion. This is due in part to the identified need to consider all effects of the action when making jeopardy determinations and establishing RPAs and RPMs. Pesticide mixtures are explicitly permitted on EPA-authorized product labels, and are therefore part of the action under consultation here. Additionally, monitoring data showing that pesticide mixtures are common in aquatic habitats throughout the United States (Gilliom et al 2007; Bradley et al 2017; Lisa et al. 2018) supports the expectation that ESA-listed species will be exposed to complex pesticide mixtures. Methods of predicting mixture toxicity are widely available and utilize readily available exposure and toxicity data. Finally, failing to consider mixtures may underestimate pesticide risk to such an extent as to lead to erroneous conclusions and ineffective protections for listed species.

11.1.1 Formulated products

Pesticide mixtures can be divided into three categories; formulated products, tank mixes, and environmental mixtures. Formulated products are produced and sold as one product containing multiple active ingredients. Since the exact types and amounts of the active ingredients are shown on the product labels, it is possible to predict the resulting aquatic concentrations following their use. Several formulated products containing 1,3-D and metolachlor have been identified as part of this action and are shown in Tables 3 and 5 of Chapter 5. Tank mixes refer to a situation where the pesticide user applies multiple pesticides simultaneously at the use site. Tank mixes are explicitly allowed on product labels and their use is often encouraged to increase pesticide efficacy. Environmental mixtures result from unrelated pesticide use over the landscape and are typically detected in ambient water quality monitoring efforts. Quantitative and qualitative estimates of risk from mixtures were generated here using current product labels, routine toxicity data, and expected exposure concentrations. These estimates of risk contribute to the overall qualitative mixtures analysis.

Current methodologies for calculating mixture toxicity indicate that additivity is the appropriate initial assumption (Cedergreen and Streibig 2005) unless available data suggest antagonism (less than additive toxicity) or synergism (greater than additive toxicity) is more appropriate. We found no published data showing antagonism or synergism in mixtures containing 1,3-D or metolachlor. Therefore, additive toxicity is the default assumption in this Opinion. Additive toxicity can be calculated by using either dose-additive or response-additive equations, depending on the nature of the pesticides under consideration. For chemicals with similar modes of action (i.e., organophosphate pesticide that inhibit AChE), dose-addition is appropriate. Conversely, response-addition is appropriate for chemicals with dissimilar modes of action. The preponderance of evidence supports this approach and is consistent with the best available scientific information and peer-reviewed publications.

Estimates of additive toxicity utilize two main pieces of information - exposure concentrations and taxa-specific toxicity values. For metolachlor, exposure concentrations were generated using EPA's Pesticide Water Calculator (PWC), which incorporates chemical-specific parameters (e.g., breakdown rates in water and soil) and application-specific parameters (e.g., application method and rate) to calculate anticipated water concentrations over several different averaging durations (e.g. 1-day and 4-day average peak concentrations). For 1,3-D, exposure concentrations were based on extrapolations from a field study assessing run-off (Heim et al., 2002) as recommended by the EPA (2019). Likewise, standard measures of toxicity (typically the LC50, or the concentration that is lethal to 50% of the test organisms) were gathered from various EPA sources for the relevant taxa groups to which NMFS listed species belong. Details regarding exposure and toxicity data can be found below. Calculating toxicity at the taxa level is important, since taxa groups can have vastly different sensitivities to a given pesticide. For example, aquatic invertebrates are more sensitive to organophosphates than are mammals (i.e., much lower LC50 values), and therefore will have different estimates of expected risk following exposure to the same mixture concentrations. Calculations of taxa-level toxicity are also useful for representing species for which no species-specific toxicity data are available.

Formulated products containing metolachlor were assessed qualitatively given the variety of additional active ingredients (Chapter 5). A semi-quantitative assessment was determined to be appropriate for 1,3-D given the frequency that it is co-formulated with the active ingredient chloropicrin and chloropicrin's toxicity. Estimates of toxicity were calculated for the formulated products containing 1,3-D that are part of EPA's action under consideration here. All of the formulated products assessed here contain the pesticides chloropicrin and 1,3-D. Since these two chemicals are toxic by different biological mechanisms, response-addition is the appropriate method for calculating mixture toxicity.
Calculations of response-addition of chemicals A and B (i.e., TOXmix), or the sum of the toxic response, were done using the following equation:

TOXmix = 100 * ((mortality A + mortality B) - (mortality A * mortality B))

Where mortality is a function of taxa-specific 48-hr or 96-hr LC50 values, chemical-specific EECs, and the standard probit slope of 4.5 for mortality. A summary of the expected mixture toxicity of a few of the currently-registered formulated products is shown below in Table 1.

Table 136. Predicted mixture toxicity of select formulated products to fish.

Formulated Product	EEC (ug/l)		Single Chemical Toxicity (%mortality)		Mixture Toxicity (%mortality)
	1,3-D	Chloropicrin	1,3-D	Chloropicrin	
Telone® C-35	5.84	3.20	0%	0.8%	0.8%
Pic-Clor 30	11.43	5.03	0%	6.3%	6.3%
Tri-form 40	11.83	7.94	0%	26.3%	26.3%

Predicted mixture toxicity, as measured by the percent of exposed organisms experiencing mortality, ranged from zero to nearly 30%. Nearly all of the expected mortality to fish is caused by exposure to chloropicrin, the other pesticide constituent of all current 1,3-D formulated products. Predicted mixture mortality to aquatic invertebrates is negligible due to that taxa group being less sensitive to both 1,3-D and chloropicrin. Mixture toxicity calculations for all 1,3-D formulated products at all use sites for both taxa groups are shown in Appendix B.

11.1.2 Tank mixtures and environmental mixtures

While pesticide labels explicitly allow, and sometimes even recommend, mixing the product with additional ingredients, including other pesticides, they typically do not define which ingredients to add at the time of application. So, while tank mixtures need to be considered as a part of the action, unlike formulated products it is not feasible to develop a list of all tank mixtures. Suggested tank mixtures from available product labels for 1,3-D and metolachlor were not summarized in this Opinion. Rather, all tank mixtures are assumed to produce additive toxicity and are described qualitatively. Sources of historical use data are available to provide some information about likely tank mixtures, with the CalDPR database (http://calpip.cdpr.ca.gov/main.cfm) being the most extensive. Environmental mixtures are also assumed to produce additive toxicity and are described qualitatively in this Opinion. Consequently, the effects that these other ingredients may have on listed salmonids and designated critical habitat remain an uncertainty and are a recognized data gap in EPA's action under this consultation. Remaining areas of uncertainty, and recognized data gaps in EPA's action under this consultation, include the toxic effects of degradates and metabolites, as well as the effects of abiotic stressors such as elevated temperature.

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11.2 Important Habitat Use and Life History Considerations for Anadromous Fish

Anadromous fish are born in freshwater and spend a portion of their life cycle in marine habitats. Generalized life history characteristics for listed anadromous fish are described in Table 137.

Table 137. General life histories of anadromous fish

Species	General Life History Descriptions		
(number of listed ESUs or DPSs[1])	Spawning Migration	Spawning Habitat	Juvenile Rearing and Migration
Chum (2)	Mature adults (usually three to four years old) enter rivers as early as July, with arrival on the spawning grounds occurring from September to January. Chum salmon are semelparous[3]	Generally spawn from just above tidewater in the lower reaches of mainstem rivers, tributary stream, or side channels to 100 km upstream.	The alevin life stage primarily resides just below the gravel surface until they approach or reach the fry stage. Immediately after leaving the gravel, swim-up fry migrate downstream to estuarine areas. They reside in estuaries near the shoreline for one or more weeks before migrating for extended distances, usually in a narrow band along the Pacific Ocean's coast. Preferred prey: fish, invertebrates

Species (number of listed ESUs or DPSs[1])	General Life History Descriptions		
	Spawning Migration	**Spawning Habitat**	**Juvenile Rearing and Migration**
Chinook (9)	Mature adults (usually three to five years old) enter rivers (spring through fall, depending on run). Adults migrate and spawn in river reaches extending from above the tidewater inland hundreds of miles from the Pacific. Migrating adults typically follow the thalweg. Chinook salmon migrate and spawn in four distinct runs (spring, fall, summer, and winter). Chinook salmon are semelparous.	Generally spawn in the middle and upper reaches of main stem rivers and larger tributary streams.	The alevin life stage primarily resides just below the gravel surface until they approach or reach the fry stage. Immediately after leaving the gravel, fry distribute to floodplain habitats that provide refuge from fast currents and predators. Juveniles exhibit two general life history types: Ocean-type fish migrate to sea in their first year, usually within six months of hatching. Ocean-type juveniles may rear in the estuary for extended periods. Stream-type fish migrate to the sea in the spring of their second year. Preferred prey: fish, invertebrates
Coho (4)	Mature adults (usually two to four years old) enter the rivers in the fall. The timing varies depending on location and other variables. Coho salmon are semelparous.	Spawn throughout smaller coastal tributaries, usually penetrating to the upper reaches to spawn. Spawning takes place from October to March.	Following emergence, fry move to shallow areas near stream banks. As fry grow they distribute up and downstream and establish territories in small streams, lakes, and off-channel ponds and other floodplain habitats. Here they rear for 12-18 months. In the spring of their second year juveniles rapidly migrate to sea. Initially, they remain in nearshore waters of the estuary close to the natal stream following downstream migration. Preferred prey: fish, invertebrates
Sockeye (2)	Mature adults (usually four to five years old) begin entering rivers from May to October. Sockeye are semelparous.	Spawn along lakeshores where springs occur and in outlet or inlet streams to lakes.	The alevin life stage primarily resides just below the gravel surface until they approach or reach the fry stage. Immediately after leaving the gravel, swim-up fry migrate to nursery lakes or intermediate feeding areas such as floodplain habitats along the banks of rivers. Populations that migrate directly to nursery lakes typically occupy shallow beach areas of the lake's littoral zone; a few cm in depth. As they grow larger they disperse into deeper habitats. Juveniles usually reside in the lakes for one to three years before migrating to off shore habitats in the ocean. Some are residual, and complete their entire lifecycle in freshwater. Preferred prey: fish, invertebrates

Species (number of listed ESUs or DPSs[1])	General Life History Descriptions		
	Spawning Migration	Spawning Habitat	Juvenile Rearing and Migration
Steelhead (11)	Mature adults (typically three to five years old) may enter rivers any month of the year, and spawn in late winter or spring. Migrating adults typically follow the thalweg. Steelhead are iteroparous.	Usually spawn in fine gravel in a riffle above a pool.	The alevin life stage primarily resides just below the gravel surface until they approach or reach the fry stage. Immediately after leaving the gravel, swim-up fry usually inhabit shallow water along banks of stream or floodplain habitats on streams margins. Steelhead rear in a wide variety of freshwater habitats, generally for two to three years, but up to six or seven years is possible. They smolt and migrate to sea in the spring. Preferred prey: fish, invertebrates

1 *Evolutionarily Significant Unit (ESU), Distinct Population Segment (DPS)*
2 *spawn only once*
3 *may spawn more than once*

11.3 Analyzing Exposure

In this section we describe the methods used to characterize pesticide exposure to listed species. The procedures rely on models that identify potential interactions of pesticides with listed species and quantify the magnitude of exposure based on how the pesticides and the listed species behave in the environment. We begin with a description of the development of aquatic habitat bins, linking physical characteristics that define aquatic habitats used by listed species with modeling parameters used to predict exposure. Finally, we describe incident reporting for pesticide uses that resulted in effects on non-target species.

11.3.1 Estimating Aquatic Exposure Concentrations Associated with Pesticide Uses

The National Research Council Committee of the National Academy of Sciences recommended that fate and transport models be used to estimate time-varying and space-varying pesticide concentrations in generic habitats relevant to listed species (NRC 2013). Physical characteristics of aquatic habitats, including depth, width, and flow rate affect the environmental concentrations and dissipation patterns of pesticides. A generic habitat defines these physical parameters and uses them to derive Estimated Environmental Concentrations (EECs). The 2-meter deep, static "Farm Pond" that is routinely used by EPA in screening level assessments is an example of a generic habitat. Defining generic habitats to represent all listed species is a challenge given the diversity in the habitats they occupy. Ultimately, the Services identified 10 habitat "bins," a number EPA felt could feasibly be evaluated given the scope of the analysis (Table 138)[13]. The generic habitats included one aquatic-associated terrestrial habitat, three static freshwater habitats of varying volume, three flowing water habitats of variable volume and flow rates, and three marine/estuarine habitats representative of nearshore tidal, nearshore subtidal, and offshore habitats.

Table 138. Generic aquatic habitats parameters for exposure modeling

Generic Habitat Bins	Depth (meters)	Width (meters)	Length (meters)	Flow (m^3/second)
1 – Aquatic-associated terrestrial habitats	NA	NA	NA	NA
2- Low-flow	0.1	2	length of field[1]	0.001
3- Moderate-flow	1	8	length of field	1
4- High-flow	2	40	length of field	100
5 – Low-volume	0.1	1	1	0
6- Moderate-volume	1	10	10	0
7- High-volume	2	100	100	0
8- Intertidal nearshore	0.5	50	Length of field	NA
9- Subtidal nearshore	5	200	Length of field	NA

[1]length of field – The habitat being evaluated is the reach or segment that abuts or is immediately adjacent to the treated field. The habitat is assumed to run the entire length of the treated area.

The Services identified the bin(s) representative of habitats utilized by each listed species. A single species may occur in a range of habitats represented by multiple bins. The EPA Preliminary Ecological Risk Assessments identify each of the species bin assignments (EPA 2017a; EPA 2017b; EPA 2017c). Bin 1 represents habitats in the terrestrial-aquatic transition zone, such as riparian habitats and rocky shorelines. These habitats are important to water quality and habitat structure and function. In particular, riparian vegetation acts as a buffer trapping

[13] Interim Approaches for National-Level Pesticide Endangered Species Act Assessments Based on the Recommendations of the National Academy of Sciences April 2013 Report. Available at https://www.epa.gov/sites/production/files/2015-07/documents/interagency.pdf

pollutants in stormwater runoff and provides shade and allocthonous materials[14] to aquatic food webs.

Flowing water habitats represented by bins 2, 3, and 4 vary considerably in depth, width, and velocity, which influence both initial concentration and rates of dissipation. These bins are defined by differing flow rates that are products of velocity (influenced by the gradient and other factors) and habitat volume (width and depth). Flow rates vary temporally and spatially in these habitats and are influenced by several factors. For example, bends in the shoreline, shoreline roughness, and organic debris can create back currents or eddies that can concentrate allocthonous inputs. Dams and other water control structures would also significantly influence flow. Some small streams and channels are intermittent and can become static and temporally cut off from connections with surface water flows during dry seasons. Low flow habitats may also occur on the margins of higher flow systems (e.g. floodplain habitats associated with higher flowing rivers).

Bin 2 is intended to represent habitats with flow rates occurring of 0.001-1 m^3/second including springs, seeps, brooks, small streams, and a variety of floodplain habitats (oxbows, side channels, alcoves, etc.) used by salmonids. Pacific salmonids inhabit lower flow habitats in some phase of their lifecycle for activities such as spawning, rearing, or migration. Bin 3 flow rates are representative of small to large streams (1-100 m^3/second) and bin 4 definitions (larger volumes and flow rates exceeding 100 m^3/second) correspond with larger riverine habitats. These habitats are used by listed salmonids during spawning migrations.

Bins 5, 6, and 7 represent freshwater habitats that are relatively static, where flow is less likely to substantially influence the rate of pesticide dissipation. Examples of bin 5 habitats (volumes <100 m^3) include vernal pools, small ponds, floodplain habitats that are cut off from main channel flows, and seasonal wetlands. Salmonid juveniles use a variety of small volume floodplain habitats to forage, over-winter, and shelter from larger predators such as backwater areas and off-channel ponds that are relatively static and may temporarily loose connection to the main stream channel. Bin 6 volumes (100 – 20,000 m^3) correspond with many ponds, vernal pools, wetlands, and small shallow lakes and Bin 7 represents larger volume habitats (>20,000 m^3) such as lakes, impoundments, and reservoirs. Impoundments are frequently encountered by anadromous fish during spawning migrations of adults and out-migrations of juveniles. Ponds and lakes are also utilized by salmonids for rearing, particularly juvenile sockeye salmon which rear in lakes for one to three years.

[14] In ecology, allochthonous material is something from outside an ecosystem that contributes organic matter and nutrients to that ecosystem. For example, leaves and branches from riparian vegetation fuel the invertebrate community which, in turn, feed larger invertebrates and fish.

Bins 8, 9, and 10 were designed to characterize marine habitats. Marine habitats are generally defined by water depth and distance from shoreline. The nearshore, or neritic zone is the relatively shallow area that extends from the coastlines to the edge of the continental shelf at depths of approximately 200 meters. Nearshore habitats are subdivided into the intertidal zone (Bin 8, the area between shoreline and mean low tide mark), and the subtidal zone (Bin 9, nearshore habitats that extend from the mean low tide mark to the continental shelf and are generally submerged). Bin 10 is intended to represent the deep offshore habitats (>200 meters in depth) that extend beyond the continental shelf. Depths within the intertidal zone are variable between locations but generally range from 0 to <10 meters. Depth within the intertidal habitat depends on the tidal cycle and tidal range. Surface waters can persist during low tides and are used by listed salmonids. Offshore habitats are also used by listed salmonids.

In addition to the above aquatic habitat Bins 2-10, NMFS also estimated pesticide concentrations present in direct runoff from a site following a pesticide application (Bin "0"). This aquatic bin does not represent a 'habitat' where salmon may reside, but does provide useful information regarding the concentration of pesticide entering aquatic habitats. Note that the runoff concentration (Bin 0) does not capture dilution upon entering an aquatic habitat Bin (which would decrease the exposure concentration) or the contribution of drift to an aquatic habitat Bin (which would increase the exposure concentration).

EPA's PWC (PWC version 1.52, available from https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment) was used to generate aquatic exposure estimates for the different habitat bins for each of the labeled uses. Detailed information on the PWC is available at the above URL. The PWC is an edge-of-field exposure model that estimates the concentration of pesticide in a water body adjacent to a single use site (e.g. a field of crops) resulting from drift and runoff following applications. The PWC incorporates factors that influence exposure concentrations including the pesticide's physical properties, application rates and methods, precipitation, and soil type. NMFS uses PWC EECs to calculate exposure concentrations that individuals could experience when located immediately adjacent to a use site following an authorized use of a pesticide. PWC EECs do not reflect the contribution to exposure risk due to any additional use to other sites within the range of the species.

The PWC scenarios were chosen from ESA Scenarios developed by EPA for previous assessments (EPA, 2017a) and that were developed for specific regions (Hydrologic Units at the HUC-2 scale). Generic habitat bins (rather than the standard Farm Pond or Reservoir) were used based on the dimensions of the aquatic habitats used by salmon and discussed above. The field length varied with the HUC2 region associated with the PWC Scenario.

Application efficiencies of 0.95 and 0.99 were used for aerial and ground applications (respectively). Application drift values for aerial and ground applications were calculated for each habitat bin using AgDRIFT (2.1.1). Like the PWC, AgDRIFT is a field-scale model in that it estimates the amount of pesticide transported off-site following application to a single use site. NMFS uses AgDRIFT as an additional exposure model to estimate the contribution of spray drift only to water bodies that are not immediately adjacent to a single use site. The model inputs and the estimated deposition rates of 1,3-D and metolachlor are presented in Table 139.

Table 139. Average estimated deposition as a fraction of the application rate (AgDRIFT 2.1.1)

AgDRIFT Simulation (bin range*)	Bin 2 (0-2 m)	Bin 5 (0-1 m)	Bin 6 (0-10 m)	Bin 7 (0-100 m)
Ground Tier 1[1]	0.2448	0.3833	0.0704	0.0101
Aerial Tier 1[2]	0.4372	0.4686	0.2968	0.0925

**Bin range = distance to near-side and far-side of habitat from treatment area*
[1] High Boom, ASAE fine-medium course, 50th percentile distribution
[2] Fine-Medium Droplet Distribution (EPA default)

Note that these values differ from the standard Farm Pond used by EPA in their Ecological Risk Assessments (EPA 2004). For some PWC inputs, NMFS choose to rely on values described in this Chapter as more representative of the habitats specific to the listed-species considered in this Opinion. These included the drift fractions and application rates (summary of pesticide labels in Tables 1&2 in Chapter 5). For other PWC inputs, NMFS relied on information provided in the EPA assessments (e.g. application timing and pesticide properties). The PWC inputs specific to 1,3-D and metolachlor are described below.

Estimates for runoff (Bin 0) are not directly available from the output of the PWC. Calculating the runoff concentrations (Bin 0) used the *.zts files generated as part of the PWC runs (i.e. by the PRZM component). The runoff concentration leaving the field can be calculated based on the runoff estimate (RUNF0 column) and the pesticide mass estimate (RFLX1 column).

NMFS did not calculate EECs for the larger flowing water bodies (Bins 3 & 4) or the marine water bodies (Bins 8-10). Adequate exposure models for these water bodies are not currently available. For example, NMFS considers the PWC to be a field-scale model and not appropriate for estimating pesticide concentrations at a watershed scale where multiple application sites will combine to produce an aggregate exposure. NMFS relied on estimates for Bins 0 & 2 as qualitatively representing upper estimates for EECs in Bins 3 & 4. Contributions from other sites within the watershed that did not see applications will serve to reduce these EECs via dilution.

In relying on field scale modeling NMFS did not assume that use will occur to every authorized use site, nor did NMFS assume that all uses are applied at the same day and time. The EECs NMFS derived with exposure modeling do not assume application to more than one site at a time and do not factor in potential increased risk from applications to multiple use sites. Rather than relying on watershed models which require making highly uncertain assumptions regarding the presence/absence and timing of multiple pesticide applications, we relied on field scale models which are intended to generate realistic exposure estimates for treatment to a single use site. The EECs generated represent concentrations that are expected to occur in an aquatic habitat at the edge of the treated field when the pesticide is applied according to product labeling (e.g. application rate specified on label). While they are quantitative in nature, we apply them qualitatively recognizing that they represent only the modeled situation. As discussed in the uncertainty section, use sites receiving lower application rates, or aquatic habitats that are not immediately adjacent to the treated sites are expected to have lower EECs. Ultimately, we look at several lines of evidence (such as the density of use sites within a species range, the proximity of use sites to species habitat, chemical persistence, etc.) to weigh the information for our qualitative determinations.

11.3.2 Estimating Terrestrial Exposure Concentrations Associated with Pesticide Uses

Products containing 1,3-D. Given the application methods (e.g. soil injection) and physical characteristics of the active ingredients in 1,3-D product formulations, the primary exposure pathways for non-target riparian vegetation are anticipated to include runoff, and aerial transport of vapor-phase. Information from field studies, monitoring data, and modeling efforts from previous risk assessments were used to estimate exposure from these two transport pathways as described later in this document.

Products containing metolachlor. AgDRIFT (Version 2.1.1) was used to generate estimates for pesticide drift deposition in riparian habitats for characterizing potential impacts to riparian plants. Application rates and methods were based on information from the pesticide labels summarized in the Master Use Summary Tables in Chapter 5 (e.g. a label will specify the maximum application rate and approved methods for authorized use). These estimates predict exposure from drift that would be expected in the 10 meters downwind of the target site. Labels do not currently require any buffer to aquatic habitats or riparian zones. The estimates were based on a single application.

Terrplant (Version 1.2.210-29-9009) was used to generate additional estimates for terrestrial exposures in riparian habitats. Inputs included the pesticide solubility in water as well as runoff and drift fractions specified below.

11.3.3 Estimating Co-Occurrence Associated with Pesticide Uses

NMFS evaluated co-occurrence of listed salmonids with the stressors of the actions by comparing the spatial distribution of salmonids with the labeled uses of the two a.i.s. We relied on previous analyses performed by EPA and provided as part of three recent Biological Evaluations (EPA 2017a; EPA 2017b; EPA 2017c). Details of the procedure and rationale are available in sections of the EPA BEs. In brief, use sites described on the pesticide labels (e.g. carrots) were assigned to land use categories. Some use sites were grouped into an aggregate category (e.g. carrots as part of Vegetables and Ground Fruit), while some crops (e.g. corn) were kept as an individual land use category. Geo-spatial information associated with the use sites and the land use categories were primarily based on 2010-2015 data from the National Land Cover Database and the NASS Cropland Data Layer. The use of aggregate land use categories for some use sites accounted for uncertainties associated with the spatial location of pesticide use. Over the 15-year period of the action, cropping patterns for many crops may change due to market demand or crop rotations. Additionally, there is the potential for mis-classification of crops. Relying on broader aggregate land use categories for specific use sites was considered conservative and less likely to undergo significant changes during the 15-year interim.

11.3.4 Mitigation to Minimize or Avoid Exposure

Mitigation has not been proposed beyond the restrictions described in product labeling that would minimize or avoid exposure of ESA-listed species to the potential stressors of the action.

11.3.5 Analyzing Exposure to 1,3-D and chloropicrin

Table 140 shows the extent of overlap for different authorized uses with each species' range. The GIS layers are based on information provided by EPA and used in previous assessments (EPA 2017a; EPA 2017b; EPA 2017c). Since the GIS location information is not specific to a.i., but to land use, it is applicable to 1,3-D applications. Each authorized use was assigned to a GIS layer (Table 141). The overlap data represent upper estimates of the area within a species range where authorized use of 1,3-D could occur. NMFS does not know the actual extent of use that will occur over the 15-years of the action. The uncertainty in the actual extent of use is discussed below and handled qualitatively in the assessment. Also, NMFS recognizes that authorized use sites may only represent a subset of a GIS layer. For example, 1,3-D is authorized for use on "Fruit and Nut Crops" that will be only a subset of the "Orchard and vineyards" and "Vegetables and ground fruit" GIS layers. NMFS does not have a method to refine the location of these authorized uses within these GIS layers. These uncertainties in estimating the overlap between use and species ranges will be addressed in the Risk Characterization section.

Table 140. Percent of an ESU range that overlaps with a GIS Layer associated with 1,3-D uses (mean over 2010-2015).

Species	Corn	Cotton	Soybeans	Wheat	Other Grains	Vegetables	Orchards	Pasture	Nursery	Cultivated
Chum salmon, Columbia River ESU	0.10	0.00	0.00	0.41	0.03	0.16	0.55	9.82	0.06	2.47
Chum salmon, Hood Canal summer-run ESU	0.01	0.00	0.00	0.00	0.01	0.00	0.00	4.17	0.01	0.28
Chinook salmon, California coastal ESU	0.00	0.00	0.00	0.00	0.01	0.00	0.94	9.52	0.00	1.28
Chinook salmon, Central Valley spring-run ESU	2.90	1.08	0.00	2.41	1.22	2.65	14.37	33.52	0.05	41.22
Chinook salmon, Lower Columbia River ESU	0.06	0.00	0.00	0.05	0.02	0.11	0.30	6.04	0.04	1.09
Chinook salmon, Puget Sound ESU	0.44	0.00	0.00	0.05	0.05	0.60	0.01	5.76	0.05	1.80
Chinook salmon, Sacramento River winter-run ESU	2.72	0.03	0.00	1.82	1.43	2.06	8.21	24.65	0.05	39.69
Chinook salmon, Snake River fall-run ESU	0.76	0.00	0.00	6.38	0.44	2.66	1.14	19.31	0.02	17.50
Chinook salmon, Snake River spring/summer run ESU	0.20	0.00	0.00	3.51	0.39	0.99	0.30	14.26	0.01	8.51
Chinook salmon, Upper Columbia River spring-run ESU	0.78	0.00	0.00	2.46	0.14	1.69	2.47	8.99	0.02	12.37
Chinook salmon, Upper Willamette River ESU	0.29	0.00	0.00	1.02	0.11	1.06	0.64	14.16	0.07	6.68
Coho salmon, Central California coast ESU	0.00	0.00	0.00	0.02	0.27	0.02	1.87	12.75	0.04	2.96
Coho salmon, Lower Columbia River ESU	0.06	0.00	0.00	0.05	0.02	0.11	0.30	6.13	0.04	1.10
Coho salmon, Oregon coast ESU	0.02	0.00	0.00	0.01	0.00	0.00	0.01	8.51	0.01	0.08
Coho salmon, S. Oregon and N. Calif coasts ESU	0.00	0.00	0.00	0.03	0.02	0.00	0.00	7.04	0.00	0.85
Sockeye, Ozette Lake ESU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.71	0.00	0.00
Sockeye, Snake River ESU	0.66	0.00	0.00	3.70	0.19	1.74	1.00	14.58	0.02	12.26
Steelhead, California Central Valley DPS	2.45	1.20	0.00	2.29	1.22	2.42	12.09	33.56	0.04	36.29
Steelhead, Central California coast DPS	0.00	0.00	0.00	0.12	0.39	0.03	2.45	17.25	0.05	4.30

Species	Corn	Cotton	Soybeans	Wheat	Other Grains	Vegetables	Orchards	Pasture	Nursery	Cultivated
Steelhead, Lower Columbia River DPS	0.06	0.00	0.00	0.05	0.02	0.11	0.31	6.03	0.04	1.14
Steelhead, Middle Columbia River DPS	0.48	0.00	0.00	5.44	0.19	1.10	1.19	6.49	0.01	15.31
Steelhead, Northern California DPS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.14	0.00	0.03
Steelhead, Puget Sound DPS	0.45	0.00	0.00	0.05	0.05	0.64	0.01	5.94	0.05	1.87
Steelhead, Snake River Basin DPS	0.20	0.00	0.00	3.51	0.39	0.99	0.30	14.26	0.01	8.51
Steelhead, South-Central California coast DPS	0.06	0.02	0.00	0.17	0.66	0.73	2.76	34.32	0.03	8.11
Steelhead, Southern California DPS	0.00	0.00	0.00	0.12	0.05	0.37	0.47	12.16	0.10	1.54
Steelhead, Upper Columbia River DPS	0.88	0.00	0.00	2.55	0.14	1.78	2.66	9.08	0.02	13.07
Steelhead, Upper Willamette River DPS	0.40	0.00	0.00	1.60	0.24	1.34	1.07	17.45	0.10	10.18

Estimates of Aquatic EECs following Uses of 1,3-D and chloropicrin

NMFS generated aquatic EECs for each authorized use of 1,3-D. Due to its presence in most formulated products, NMFS also generated EECs for chloropicrin that would be expected from use of products containing both pesticides. However, NMFS did not perform, or rely, on exposure models such as the PWC to derive EECs for both 1,3-D and chloropicrin. NMFS agrees with EPA's draft risk assessment for 1,3-D (2019) that those models should not be considered reliable for estimating EECs for highly volatile fumigants such as these pesticides. Instead, NMFS relied on extrapolations from a field study assessing 1,3-D run-off (Heim et al., 2002) as recommended by EPA (2019). Heim et al. (2002) reported maximum 1,3-D concentrations in run-off of 17.2 ppb following an application rate of 327.4 lbs/acre. NMFS considered this to be equivalent to a 1-d bin 0 EEC resulting from that application rate. 1-d bin 0 EECs associated with 1,3-D uses at other application rates were extrapolated from these values (i.e. 17.2 ppb per 327.4 lbs/acre). The maximum application rate for each use and extrapolated 1-d bin 0 EEC are shown in Table 141.

Table 141. Data used in estimating exposures to uses of 1,3-D.

Use Site	GIS Overlap Layers	Maximum Application Rate (lbs a.i./A)	1-d bin 0 EEC (µg/L)
Vegetable Crops	Vegetables and Ground Fruit	580.29	30.48
Field Crops	Corn, Cotton, Other grains, Pasture hay, Soybeans, Wheat	580.29	30.48
Fruit and Nut Crops	Orchards and vineyards, Vegetables and ground fruit	580.29	30.48
Nursery Crops	Nursery	580.29	30.48
Mint	Vegetables and Ground Fruit	295.5	15.52
Idaho potato – USDA Potato Cyst Nematode Eradication Program	Vegetables and Ground Fruit	354.6	18.63
Unspecified cropland in Idaho – certain weed control	Cultivated	246.25	12.94

Use Site	GIS Overlap Layers	Maximum Application Rate (lbs a.i./A)	1-d bin 0 EEC (µg/L)
Unspecified cropland in Oregon – certain weed control	Cultivated	394	20.70
Unspecified cropland in Washington – certain weed control	Cultivated	246.25	12.94

Similar to 1,3-D, NMFS did not rely on modeled estimates for chloropicrin EECs. NMFS is unaware of any equivalent field study for chloropicrin. A comparison of the physical/chemical and environmental fate properties of chloropicrin to those of 1,3-D found them to be sufficiently similar for the results of the 1,3-D study (Heim, 2002) to be a reasonable surrogate for chloropicrin run-off estimates (Attachment A). Therefore, NMFS applied the same extrapolation used for 1,3-D (17.2/327.4) to chloropicrin application rates to generate chloropicrin EECs. This approach makes the assumption that the relationship between application rate and runoff concentration is the same for both compounds. NMFS recognizes the uncertainties associated with this assumption and was careful to consider these uncertainties when making risk characterizations. In general, we anticipate that chloropicrin concentrations will be no greater than those estimated for 1,3-D with similar application rates. The maximum application rate for chloropicrin across all uses was 350.2 lbs/acre (Chapter 5) leading to a maximum 1-d bin 0 EEC for all uses of 18.4 ppb.

NMFS used the EECs extrapolated from the field study (Heim, 2002) to represent direct run-off at the edge of a field (i.e. 1-d bin 0 EECs). As mentioned above, NMFS does not consider bin 0 to be representative of an aquatic habitat but of the run-off contribution to aquatic habitats (e.g. bin 2). Given the application methods employed for 1,3-D (e.g. injection rather spray), NMFS does not consider that drift will contribute to an increase in exposures to aquatic habitats. However, NMFS does expect that pesticide concentrations will decrease with factors such as time, dilution, and degradation (i.e. for the same application the 4-d bin 2 EEC will be less than the 1-d bin 0 EEC). To estimate reduction factors that could be applied to the initial 1-d bin 0 EEC to estimate other EECs NMFS did use the PWC. A small set of PWC runs were done specifically to compare the 1-d bin 0 EECs to other EECs from the same application. NMFS recognizes the uncertainty introduced by this approach. The focus, however, is on the impact of aquatic dilution and degradation processes on EECs for which the model may be more reliable for 1,3-D and chloropicrin. Details of the PWC runs and calculations are in Appendix C The resulting reduction factors are shown in Table 142 and can be seen in the Risk Characterization (e.g. in the Risk Plots).

Table 142. Reduction Factors for converting 1-day bin 0 EECs

	Time-weighted-average		
	1-day	**4-day**	**21-day**
Bin 0	1.000	0.296	0.070
Bin 2	0.435	0.142	0.035
Bin 7	0.044	0.037	0.017

Analyzing terrestrial exposure to 1,3-D and chloropicrin

For reasons mentioned earlier, and described in more detail by EPA's Problem Formulation (2013) and Draft Risk Assessment (2019), NMFS did not generate modeled exposures for terrestrial riparian vegetation using AgDRIFT or Terrplant. Nonetheless, exposure to riparian terrestrial vegetation is considered from both run-off and vapor-phase transport routes.

Numerous sources of information are available to characterize the range of expected 1,3-D and chloropicrin concentrations in the vapor phase. For 1,3-D, the highest air concentrations (841 mg/m3, derived from a field study) are substantially less than concentrations at which no adverse effects were observed in the available vegetative vigor study (MRID 50883601). The vegetative vigor study investigated the potential adverse effects to ten different terrestrial plant species from a four hour vapor exposure of 1,3-D. Although some adverse effects were observed, the EC25, EC50, and NOEC values were all greater than the highest concentrations tested which ranged from 250ppm to 528ppm. For chloropicrin, the highest air concentrations available are those described by exposure models, in particular the ISCST3 model as described in EPA's 2008 Reregistration Eligibility Decision document. These concentrations are comparable to seedling emergence and vegetative vigor EC25 values for terrestrial plants which range from 0.0021 mg/L to >0.068 mg/L. Other available exposure estimates, including monitoring data and refined exposure models suggest environmental exposures substantially lower than those generated with the ISCST3 model. Below are high level summaries of available data from field studies, ambient monitoring as well as modeled concentrations.

EPA considered a number of different approaches to modeling vapor exposure in the problem formulation (EPA, 2013). The 2019 DRA, however, concluded that available field studies are considered the best available information to estimate this exposure. According to the DRA, the highest potential exposure reported in these studies is 4.556mg/m3 based on an application rate of 51 lbs. a.i./acre (MRID 45222501). Note, however, the application method associated with this vapor concentration (shallow application to turf) is not necessarily representative of agricultural applications. Another field volatility study (MRID 42545101) found 1,3-D concentrations at 15cm above the soil to be 0.533mg/m3. This concentration was associated with an 18-inch injection (more typical of agricultural applications) of 121 lb ai/acre. Another study examined air concentrations following an application of 5.12 gallons/acre at a depth of 5 inches on a golf course. Air concentrations were measured on the site of application as well as 100 and 300 feet off site. The average concentration detected on site, 100 feet, and 300 feet off site were 30.9, 1.9, and 3.3 ug/m3 respectively (Barnekow et al. 1999).

The ambient air monitoring effort by California Department of Pesticide Regulation (CDPR, 2018) on 1,3- D shows highest 1-day concentrations of 5.0 ppb (6 µg/m3) in Santa Maria, 2.8 ppb (3.4 µg/m3) in Watsonville, 8.7 ppb (10 µg/m3) in Oxnard, and 3.1 ppb (3.7 µg/m3) in Camarillo. For chloropicrin, the highest 1-day concentration was 1.1 ppb (0.16 ug/m3) in Santa Maria and 1.0 ppb (0.15 ug/m3) in Watsonville. In 2011, CDPR implemented an Air Monitoring Network (AMN) to weekly measure 32 pesticides, including 1,3-D and chloropicrin, in three agricultural communities: Ripon, Salinas, and Shafter. The highest 24-hour and 4-week exposure measurements were 45 µg/m3 and 18 µg/m3 for 1,3-D and 6.38 µg/m3 and 3.02 µg/m3 for chloropicrin (EPA, 2019).

EPA's 2019 draft human health risk assessment for the registration review of 1,3-D includes modeled ambient air concentrations which were generated using the Soil Fumigant Exposure Assessment (SOFEA) modeling system. The maximum 24-hour concentrations estimated for the Pacific Northwest region over the time periods modeled were 0.105 and 0.089 ppm (473 and 401 ug/m3 based on the conversion factor provided in the human health assessment). For chloropicrin, the 2008 RED included modeled concentrations based on the Industrial Source Complex Short Term version 3 (ISCST3) model as well as PERFUM. The highest concentrations estimated with these models were 19 mg/m3 and 0.004219 mg/m3 respectively.

Exposure of 1,3-D and chloropicrin to terrestrial non-target plants is also possible via surface runoff and subsurface flow. The 2019 DRA for 1,3-D identifies a run-off field study (Heim et al. 2002) as the best currently available information on run-off concentrations given the limitations in existing models. The maximum concentration detected in the field study was 17.2 ppb. Although the application rates in the field study do not represent the highest allowed, extrapolations based on maximum application rates authorized by product labeling suggest that run-off concentrations would be unlikely to exceed around 50 ppb. EECs generated using the Pesticide in Water Calculator ranged in the tens to hundreds of ppb, depending on the application scenario. For chloropicrin, maximum aquatic EECs calculated using PRZM/EXAMS in previous assessments (USEPA 2007c and 2009a) were 79, 19, and 6.8 µg/L for peak, 21-day average, and 60-day average, respectively. Aquatic EECs for chloropicrin are anticipated to be similar to those of 1,3-D, given similar application rates and methods.

11.3.6 Analyzing Exposure to Metolachlor

Table 143 shows the extent of overlap for different authorized uses of metolachlor with each species' range. The GIS layers are based on information provided by EPA and used in previous assessments (EPA 2017a; EPA 2017b; EPA 2017c). Since the GIS location information is not specific to a.i., but to land use, it is applicable to metolachlor applications. Each authorized use was assigned to a GIS layer (Table 145). The overlap data represent upper estimates of the area within a species range where authorized use of metolachlor could occur. NMFS does not know the actual extent of use that will occur over the 15-years of the action. The uncertainty in the actual extent of use is discussed below and handled qualitatively in the assessment. Also, NMFS recognizes that authorized use sites may only represent a subset of a GIS layer. For example, while metolachlor is authorized for use on a number of vegetables, they still represent a subset of all possible "Vegetables and ground fruit" within the GIS layer. Also, use on alfalfa in Oregon will occur on only a portion of "Pasture" land. For this use site, additional information from the NASS was used to inform the overlap. This uncertainty in estimating the overlap between use and species ranges will be considered in the Risk Characterization section of this Opinion.

Table 143. Percent of an ESU range that overlaps with GIS Layers associated with metolachlor uses (mean percent over 2010-2016).

Species	Corn	Cotton	Soybeans	Vegetables	Other Grains	Other Row Crops	Other Crops	Pasture	Nursery
Chum salmon, Columbia River ESU	0.10	0.00	0.00	0.16	0.03	0.00	0.52	9.82	0.06
Chum salmon, Hood Canal summer-run ESU	0.01	0.00	0.00	0.00	0.01	0.00	0.00	4.17	0.01
Chinook salmon, California coastal ESU	0.00	0.00	0.00	0.00	0.01	0.00	0.00	9.52	0.00
Chinook salmon, Central Valley spring-run ESU	2.90	1.08	0.00	2.65	1.22	0.31	5.42	33.52	0.05
Chinook salmon, Lower Columbia River ESU	0.06	0.00	0.00	0.11	0.02	0.00	0.12	6.04	0.04
Chinook salmon, Puget Sound ESU	0.44	0.00	0.00	0.60	0.05	0.01	0.10	5.76	0.05
Chinook salmon, Sacramento River winter-run ESU	2.72	0.03	0.00	2.06	1.43	0.95	7.65	24.65	0.05
Chinook salmon, Snake River fall-run ESU	0.76	0.00	0.00	2.66	0.44	0.01	3.55	19.31	0.02
Chinook salmon, Snake River spring/summer run ESU	0.20	0.00	0.00	0.99	0.39	0.02	1.52	14.26	0.01
Chinook salmon, Upper Columbia River spring-run ESU	0.78	0.00	0.00	1.69	0.14	0.01	2.21	8.99	0.02
Chinook salmon, Upper Willamette River ESU	0.29	0.00	0.00	1.06	0.11	0.08	6.43	14.16	0.07
Coho salmon, Central California coast ESU	0.00	0.00	0.00	0.02	0.27	0.00	0.08	12.75	0.04
Coho salmon, Lower Columbia River ESU	0.06	0.00	0.00	0.11	0.02	0.00	0.12	6.13	0.04
Coho salmon, Oregon coast ESU	0.02	0.00	0.00	0.00	0.00	0.00	0.03	8.51	0.01
Coho salmon, S. Oregon and N. California coasts ESU	0.00	0.00	0.00	0.00	0.02	0.00	0.11	7.04	0.00
Sockeye, Ozette Lake ESU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.71	0.00
Sockeye, Snake River ESU	0.66	0.00	0.00	1.74	0.19	0.00	2.77	14.58	0.02

Steelhead, California Central Valley DPS	2.45	1.20	0.00	2.42	1.22	0.27	5.13	33.56	0.04
Steelhead, Central California coast DPS	0.00	0.00	0.00	0.03	0.39	0.00	0.22	17.25	0.05
Steelhead, Lower Columbia River DPS	0.06	0.00	0.00	0.11	0.02	0.00	0.12	6.03	0.04
Steelhead, Middle Columbia River DPS	0.48	0.00	0.00	1.10	0.19	0.12	4.35	6.49	0.01
Steelhead, Northern California DPS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.14	0.00
Steelhead, Puget Sound DPS	0.45	0.00	0.00	0.64	0.05	0.01	0.10	5.94	0.05
Steelhead, Snake River Basin DPS	0.20	0.00	0.00	0.99	0.39	0.02	1.52	14.26	0.01
Steelhead, South-Central California coast DPS	0.06	0.02	0.00	0.73	0.66	0.00	1.30	34.32	0.03
Steelhead, Southern California DPS	0.00	0.00	0.00	0.37	0.05	0.00	0.10	12.16	0.10
Steelhead, Upper Columbia River DPS	0.88	0.00	0.00	1.78	0.14	0.01	2.23	9.08	0.02
Steelhead, Upper Willamette River DPS	0.40	0.00	0.00	1.34	0.24	0.10	8.35	17.45	0.10

Estimates of Aquatic EECs following Uses of Metolachlor

NMFS generated aquatic EECs for each authorized use of metolachlor using the PWC. Exposure modeling focused on racemic metolachlor as the applied chemical. While several formulated products consist of a mixture of racemic metolachlor and S-metolachlor, EECs were not generated for S-metolachlor since the chemical properties are similar to racemic metolachlor (EPA 2014). Any differences in EECs were considered likely to be minor. The chemical inputs for the PWC runs for metolachlor are shown in Table 144. Application information for the PWC runs are summarized in Table 145. Application rates are based on maximum rates allowed by the labels. Application timing information is based on information from EPA (2014). Efficiency and drift inputs were summarized earlier (Table 139). The PWC runs for metolachlor were performed using external batch files (Appendix E). The EECs generated by NMFS for metolachlor are displayed in the Risk Characterization and are also in Appendix E.

Table 144. Chemical Inputs Parameters for PWC runs.

Physical / Chemical Property	Metolachlor
Sorption Coefficient(mL/g)	132.4
Koc flag	TRUE
Water Column Metabolism Halflife (days)	39.7
Water Reference Temperature (°C)	25
Benthic Metabolism Halflife (days)	234
Benthic Reference Temperature (°C)	25
Aqueous Photolysis Halflife (days)	70
Photolysis Reference Latitude (°)	40
Hydrolysis Halflife (days)	0
Soil Halflife (days)	98.4
Soil Reference Temperature (°C)	25
Foliar Halflife (days)	0
Molecular Weight (g/mol)	283.8
Vapor Pressure (torr)	2.78E-05
Solubility (mg/L)	530

Table 145. Inputs used in estimating exposures to uses of Metolachlor.

Use Site	PWC Scenarios	GIS Overlap Layer	Application Rate(s) (kgs a.i./A)	Application Date(s) (Relative)	Application Efficiency/Drift
Beans and other pod crops	VegetableESA17a.scn VegetableESA17b.scn VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	2.19 1.1	-7 3	Ground (0.99) Air (0.95)
Horseradish; Rhubarb	VegetableESA17a.scn VegetableESA17b.scn VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	1.43	-7	Ground (0.99) Air (0.95)
Potato	VegetableESA17a.scn VegetableESA17b.scn VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	3.01 1.05	-7 3	Ground (0.99) Air (0.95)
Pumpkin	VegetableESA17a.scn VegetableESA17b.scn VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	1.43	-7	Ground (0.99)
Tomato	VegetableESA17a.scn VegetableESA17b.scn VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	2.23 2.23 2.23	-24 96 216	Ground (0.99)
Corn	CornESA17a.scn CornESA17b.scn CornESA18a.scn CornESA18b.scn	Corn	2.99 1.34	-7 3	Ground (0.99) Air (0.95)
Safflower	OtherGrainESA17a.scn OtherGrainESA17b.scn OtherGrainESA18a.scn OtherGrainESA18b.scn	Other Grains	2.15	-7	Ground (0.99) Air (0.95)
Sorghum	OtherGrainESA17a.scn OtherGrainESA17b.scn OtherGrainESA18a.scn OtherGrainESA18b.scn	Other Grains	1.87	-7	Ground (0.99) Air (0.95)
Soybean	SoybeanESA17a.scn SoybeanESA17b.scn SoybeanESA18a.scn SoybeanESA18b.scn	Soybean	3.08	-7	Ground (0.99) Air (0.95)
Sugarbeet	OtherRowESA17a.scn OtherRowESA17b.scn OtherRowESA18a.scn OtherRowESA18b.scn	Other Row Crops	1.78 1	-14 47	Ground (0.99) Air (0.95)
Sunflower	OtherRowESA17a.scn OtherRowESA17b.scn OtherRowESA18a.scn OtherRowESA18b.scn	Other Row Crops	2.14	-7	Ground (0.99) Air (0.95)
Turf – commercial, residential, sod farms	OtherCropESA17a.scn OtherCropESA17b.scn OtherCropESA18a.scn OtherCropESA18b.scn	Other Crops	2.78 1.7	7 49	Ground (0.99) Air (0.95)
Nursery and landscape plantings	NSLandcoverESA17a.scn NSLandcoverESA17b.scn NSLandcoverESA18a.scn NSLandcoverESA18b.scn	Nursery	2.78 1.71	-7 3	Ground (0.99) Air (0.95)
California Only: Swiss chard; Subgroup 1-B (beet, carrot, turnip, etc.) and 1-C (artichoke, ginger, yam, etc.)	VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	1.43	-7	Ground (0.99)
California Only: Pepper; Seeded and transplanted tomato	VegetableESA18a.scn VegetableESA18b.scn	Vegetables and Ground Fruit	1.79	-7	Ground (0.99)

Use Site	PWC Scenarios	GIS Overlap Layer	Application Rate(s) (kgs a.i./A)	Application Date(s) (Relative)	Application Efficiency/Drift
California Only: Spinach			1.07	-7	
California Only: Dry bulb onion			1.43 1.43	-14 8	
California Only: Celery			1.43 0.71	-7 3	
California Only: Cotton	CottonESA18a.scn CottonESA18b.scn	Cotton	1.49 1.49 1.49	-24 -7 7	Air (0.95)
Idaho Only: Carrot, collard, radish, beet, kale, mustard, parsnip, rutabaga, turnip	VegetableESA17a.scn VegetableESA17b.scn	Vegetables and Ground Fruit	0.72	-7	Ground (0.99)
Idaho Only: Pepper			1.79	-7	
Idaho Only: Dry bulb onion			1.43 1.43	-14 8	
Oregon Only: Seed crops including radish, spinach, beets, and Swiss chard; blueberry, blackberry, and raspberry; Sweet potato	VegetableESA17a.scn VegetableESA17b.scn	Vegetables and Ground Fruit	1.43	-7	Ground (0.99)
Oregon Only: Transplanted bell pepper			1.79	-7	
Oregon Only: Strawberry			1.06	-7	
Oregon Only: Alfalfa for seed	GrasslandESA17a.scn GrasslandESA17b.scn	Pasture	3.56	-7	Ground (0.99)

Estimates of Terrestrial EECs following Uses of Metolachlor

AgDRIFT (version 2.1.1) was used to generate estimates for pesticide drift deposition in riparian habitats for characterization of potential impacts to riparian plants and invertebrates. Application rates and methods were based on information summarized in the Master Use Summary Table in Chapter 5. These estimates predict exposure from drift that is expected to occur in the 10 meters downwind of the target site. Labels do not currently require any buffer to aquatic habitats or riparian zones. The estimates were based on a single application. Drift estimates for ground applications assumed a high boom, ASAE fine-medium course droplet size. The Estimated

Environmental Concentrations (EECs) provided in Table 1 below represent a 50th percentile distribution. Aerial estimates assumed the EPA default, fine-medium droplet size distribution. These assumptions predict an average drift deposition fraction of 0.0704 and 0.2968 for ground and aerial applications when the wind is blowing 10 miles per hour. Additional terrestrial EECs were generated using EPA's Terrplant model (version 1.2.210-29-9009). Inputs included the solubility of metolachlor (530 mg/L) as well as runoff and drift fractions (0.05 and 0.01, respectively). Table 146 presents the resulting terrestrial EECs.

Table 146. Estimated drift deposition onto riparian habitat adjacent to field following application of metolachlor.

Use Site	Maximum Single Application Rate (lbs a.i./A)	AgDRIFT EECs (lbs a.i./A)		Terrplant EECs (lbs a.i./A)			
		Ground	Aerial	Ground		Aerial	
				Dry	Semi-aquatic	Dry	Semi-aquatic
Beans and other pod crops	1.95	0.137	0.579	0.117	0.9945	0.195	1.0725
Corn	2.67	0.188	0.792	0.1602	1.3617	0.267	1.4685
California Cotton	1.33	0.094	0.395	0.0798	0.6783	0.133	0.7315
Horseradish	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Potato	2.68	0.189	0.795	0.1608	1.3668	0.268	1.474
Pumpkin	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Rhubarb	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Safflower	1.91	0.134	0.567	0.1146	0.9741	0.191	1.0505
Sorghum	1.67	0.118	0.496	0.1002	0.8517	0.167	0.9185
Soybean[c]	2.74	0.193	0.813	0.1644	1.3974	0.274	1.507
Sugarbeets	1.59	0.112	0.472	0.0954	0.8109	0.159	0.8745
Sunflower	1.91	0.134	0.567	0.1146	0.9741	0.191	1.0505
Tomato	1.99	0.140	0.591	0.1194	1.0149	0.199	1.0945
Turf - commercial, residential, sod farms	2.48	0.175	0.736	0.1488	1.2648	0.248	1.364
Nursery and landscape plantings	2.47	0.174	0.733	0.1482	1.2597	0.247	1.3585
California - Pepper	1.59	0.112	0.472	0.0954	0.8109	0.159	0.8745
California - Seeded and transplanted tomato	1.59	0.112	0.472	0.0954	0.8109	0.159	0.8745
California - Swiss chard	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985

Use Site	Maximum Single Application Rate (lbs a.i./A)	AgDRIFT EECs (lbs a.i./A)		Terrplant EECs (lbs a.i./A)			
		Ground	Aerial	Ground		Aerial	
				Dry	Semi-aquatic	Dry	Semi-aquatic
California - Spinach	0.95	0.067	0.282	0.057	0.4845	0.095	0.5225
California - Dry bulb onion	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
California - Celery	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
California - Subgroup 1-B (beet, carrot, turnip, etc.) and 1-C (artichoke, ginger, yam, etc.)	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Idaho - Carrot, collard, radish, beet, kale, mustard, parsnip, rutabaga, turnip	0.64	0.045	0.190	0.0384	0.3264	0.064	0.352
Idaho - Pepper	1.59	0.112	0.472	0.0954	0.8109	0.159	0.8745
Idaho - Dry bulb onion	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Oregon - Alfalfa for seed	3.17	0.223	0.941	0.1902	1.6167	0.317	1.7435
Oregon - Seed crops including radish, spinach, beets, and Swiss chard	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Oregon - Transplante	1.59	0.112	0.472	0.0954	0.8109	0.159	0.8745

Use Site	Maximum Single Application Rate (lbs a.i./A)	AgDRIFT EECs (lbs a.i./A)		Terrplant EECs (lbs a.i./A)			
		Ground	Aerial	Ground		Aerial	
				Dry	Semi-aquatic	Dry	Semi-aquatic
d bell pepper							
Oregon - blueberry, blackberry, and raspberry	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Oregon - Sweet potato	1.27	0.089	0.377	0.0762	0.6477	0.127	0.6985
Oregon - Strawberry	0.95	0.067	0.282	0.057	0.4845	0.095	0.5225

11.4 Analyzing Responses

The response analysis of this opinion evaluates toxicity information from the stressors of the action and organizes them into assessment endpoints which target potential effects to individual salmonids and their supporting habitats. The assessment endpoints represent biological and habitat attributes that, when adversely affected, lead to reduced fitness of individual salmonids or degrade the PBFs essential to the conservation of the species. For the reasons described in the following sections, we determine that in total the toxicity information included in this summary provides the best available scientific information for quantitative concentrations that would trigger a response. We place higher weight on those studies that are well-designed, more relevant to our species and habitat, and conducted with stressors of the action. Uncertainties in the available toxicity information are discussed as they are encountered and identified at the end of this section. Following the response analysis, the risk analysis compares anticipated environmental concentrations described in the exposure analysis with assessment endpoints to evaluate whether individual fitness or habitat endpoints might be compromised. Salmonid and designated critical habitat risk hypotheses are evaluated separately in the *Effects of the Proposed Action on Designated Critical Habitat Section*.

The EPA provided three documents to support NMFS' evaluation of 1,3-D: *1,3-Dichloropropene Analysis of Risks to Endangered and Threatened Salmon and Steelhead* (1,3-D Biological Evaluation), *Draft Risk Assessment (DRA) in Support of Registration Review* (1,3-D Draft Risk Assessment), and *Problem Formulation for the Environmental Fate, Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments in Support of the Registration Review of 1,3-Dichloropropene (Telone)* (1,3-D Problem Formulation). Collectively, this section calls these three documents "the 1,3-D risk analyses." Three documents were also provided for metolachlor: *Risks of Metolachlor Use to 26 Evolutionarily Significant Units of Endangered and Threatened Pacific Salmon and Steelhead* (Metolachlor Biological Evaluation), *Draft Ecological Risk Assessment for the Registration Review of Metolachlor/(S)-Metolachlor* (Metolachlor Draft Risk Assessment), and *Registration Review Problem Formulation for Metolachlor and S-Metolachlor* (Metolachlor Problem Formulation). These are collectively referred to as the "Metolachlor Risk Analyses" in this section. We relied on the information in these assessments and supplemented with data from the ECOTOX and EPA OPP's Pesticide Ecotoxicity Database, the open literature, and information provided by the applicant.[15] The OPP database includes the MRID submissions reviewed by EPA in conjunction with pesticide registrations or reregistrations that have been evaluated by EPA biologists and judged acceptable for use as core or supplemental data to support an ecological assessment. Here we describe the types of data that reflect effects that can influence the persistence of populations exposed to environmental toxicants and factors that affect the toxicity and vulnerability of salmonids to pesticides.

11.4.1 Data Quality Requirements

The ESA mandates the use of the best available scientific and commercial data when determining the effects of pesticides on threatened and endangered species. The following paragraphs describe NMFS' data quality acquisition and review process for the information used in this assessment. Sources of information include ecological effects data for pesticides provided by the registrants as part of the 40 CFR Part 158 guideline requirements, compiled in EPA databases, and found through searches of the open literature. For most pesticides, a substantial amount of ecological effects data are identified through using the ECOTOX as its search engine to access relevant data compiled from scientific journals, books, government reports, and theses and dissertations.

Data acceptable for inclusion into the ECOTOX must be from an English-language primary data source reporting measurable adverse responses occurring concurrently with exposures of ecologically relevant and taxonomically verifiable species to ambient concentrations, doses, or application rates over a discrete exposure duration. The ECOTOX reports these exposures in standardized environmentally relevant units of exposure intensity (i.e., mg active ingredient per liter for aquatic organisms) and exposure duration in days. NMFS also applies the additional data acceptability requirements required by OPP: the entire article must be a publically available document published in English, the information must be presented as a full article, treatments must be compared to an acceptable control, and the paper must clearly indicate whether the exposure occurred in the laboratory or field. Failure of data acceptability criteria means the data cannot be used in a quantitative assessment, it does not mean the data cannot inform the

[15] NMFS accessed the most recent version of Pesticide Ecotoxicity Database. The database is a preliminary copy presently under development. The data continues to receive additional quality assurance checks. NMFS reports these data with this consideration in mind. Overall EPA asserts that the majority of data accurately reflects the Agency data evaluation reports for these studies. EPA OPP is expected to review and make any additional corrections to the data reported in this opinion from this database prior to finalization of the opinion.

assessment in some other way. For example, exposures that are not expressed in environmentally relevant exposure units can still be used to inform the Effects Characterization.

A second tier of review may be applied to ECOTOX data, depending on how a study will be used in the assessment:

- Studies establishing an effects threshold concentration above which mortality or sublethal effects occur.
- Studies providing data used to assemble a species sensitivity distribution (SSD), with particular emphasis on studies providing influential data for the distribution (i.e., values near the 5^{th} and 95^{th} percentiles and the median).
- Studies that represent the most sensitive response thresholds for assessment endpoints (e.g., reproduction, behavior, or sensory effects).
- Other studies in the arrays that contain data influential in describing how a species may be affected by the registration of the pesticide.

Searches of the open literature are necessary to supplement data acquired through the ECOTOX for a number of reasons. The ECOTOX attempts to be comprehensive, but searches for content to populate the database do not locate all relevant literature and, once content is identified, it can take up to six months or more for it to be acquired and encoded into ECOTOX. Data included in ECOTOX are limited to single chemical exposures of substances with verifiable chemical abstract numbers. This means information on mixtures like pesticide products and tank mixes need to be identified through the open literature. The ECOTOX content identifies primarily adverse biological effects in live, whole organisms, so information describing mechanisms of effect at sub-organism levels or from in-vitro tests also need to be identified through open literature searches.

11.4.2 Direct Effects

Direct effects on survival resulting from exposure to pesticides that are deposited in surface waters through runoff and drift transport pathways are described by dose-response data from laboratory toxicity studies with results reported as median lethal concentrations (LC50s), median lethal doses (LD50s), slopes of dose response curves, and species sensitivity distributions (SSDs) showing variability in lethal responses among tested species. Effects on other responses affecting population persistence are described as statistically significant thresholds obtained from dose-response data with results reported as the Lowest Observed Effect Concentration (LOEC) and No Observed Effect Concentration (NOEC) tested in the study along with and the magnitude of effects observed at these thresholds. These responses include, but are not limited to:

- reproduction (e.g., percent hatch, egg viability),
- impaired growth that could increase individual mortality (e.g., predation risk and gape limitation on prey selection) or decrease reproduction (e.g., delayed sexual maturation, gonad size),

- behaviors and impaired motor function (i.e., swimming, ability to migrate) that could increase individual mortality (e.g., predator avoidance), or decrease growth or reproduction (e.g. feeding, reproductive behavior),
- impaired sensory function that could increase individual mortality, or decrease growth or reproduction (e.g. predator or prey detection, homing ability)

Survival

Individual survival is typically measured by incidences of death at the end of 96-hour (h) exposures (acute test[16]) and incidences of death at the end of 21 d, 30 d, 32 d, and "full life cycle" exposures (chronic tests[17]) to a subset of freshwater and marine fish species reared and exposed in laboratories under controlled conditions (temperature, pH, light, salinity, etc.; EPA 2004). The LC50 is the statistically derived concentration sufficient to kill 50% of the test population. It is derived from the number of surviving individuals at each concentration tested at the end of a 96 h exposure and is usually estimated by probit or logit analysis and more recently by non-linear curve fitting techniques. Ideally, to maximize the utility of a given LC50 study, a slope, variability around the LC50, and a description of the experimental design, such as experimental concentrations tested, number of treatments and replicates used, solvent controls, etc., are needed. The slope of the observed dose response relationship is particularly useful in interpolating incidences of death at concentrations below or above an estimated LC50. The variability of an LC50 is usually depicted by a confidence interval (95% CI) or error (standard deviation or standard error) and is illustrative of the degree of confidence associated with a given LC50 estimate (i.e., the smaller the range of uncertainty, the higher the confidence in the estimate). Without an estimate of the variability, it is difficult to infer the precision of the estimate. Furthermore, survival experiments are of most utility when conducted with the most sensitive life stage of a listed species or a representative surrogate. In the case of ESA-listed Pacific salmonids, there are several surrogates including hatchery reared coho salmon, Chinook salmon, steelhead, and chum salmon, as well as rainbow trout.[18] We consider the range in response of these surrogates to specified exposures to characterize the likely response of listed salmonids.

In addition to laboratory tests of survival, a summary of reported lethality incidents are provided from in EPA's incident database (Sections 11.4.5.7). Section 6(a)(2) of the Federal Insecticide,

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[16] Organisms are exposed for 96 hours in static or flowing water (flow-through) to varying concentrations of the chemical. At 96 hours, dead organisms are counted in each treatment. Concentrations may be renewed at various intervals (24, or 48 hr) or maintained through continuous introduction of the chemical.

[17] Organisms are exposed for longer than 96 hours, typically more than 14 days.

[18] Rainbow trout and steelhead are the same genus species (Oncorhynchus mykiss), with the key differentiation that steelhead migrate to the ocean while rainbow trout remain in freshwaters. Rainbow trout are therefore good toxicological surrogates for freshwater life stages of steelhead, but are less useful as surrogates for the life stages that use estuarine and ocean environments.

Fungicide and Rodenticide Act requires pesticide product registrants to report adverse effects information, such as incident data involving fish and wildlife. Criteria require reporting of large-scale incidents. For example, pesticide registrants are required to report the following (40 CFR part 159):

- Fish – Affecting 1,000 or more individuals of a schooling species or 50 or more individuals of a non-schooling species.
- Birds – Affecting 200 or more individuals of a flocking species, or 50 or more individuals of a songbird species, or 5 or more individuals of a predatory species.
- Mammals, reptiles, amphibians – Affecting 50 or more individuals of a relatively common or herding species or 5 or more individuals of a rare or solitary species.

The number of documented incidents is believed to be a very small fraction of total incidents caused by pesticides for a variety of reasons. Incident reports for non-target organisms typically provide information only on mortality events and plant damage. Sub-lethal effects in organisms such as abnormal behavior, reduced growth and/or impaired reproduction are rarely reported, except for phytotoxic effects in terrestrial plants. An absence of reports does not necessarily equate to an absence of incidents given the nature of the incident reporting.

Information on unintended pesticide effects on non-target plants and animals is compiled in the Ecological Incident Information System (EIIS). The EIIS is a database containing adverse effect reports, typically mortality of non-target organisms where such effects have been associated with the use of pesticides. Other Ecological Incident databases used are the Incident Data System (IDS), Aggregated Incident Database, and Avian Information Monitoring System (AIMS).

Each incident record indicates whether the incident occurred due to a misuse, registered use, or whether it is undetermined. Each incident is additionally classified with a certainty of the association with the identified a.i. and are classified as: “highly probable,” “probable,” “possible,” and “unlikely.”

Growth and Reproduction

The FIFRA guideline tests that EPA requires pesticide registrants to conduct evaluate select growth and reproduction endpoints (chronic tests). In these tests, fish are exposed to the a.i. for variable durations depending on the species tested and may have static renewal or flow through exposures, both techniques to maintain an exposure concentration. Fish are fed twice daily, ad libitum (i.e., an overabundance of food is available at time of feeding). The lowest concentration eliciting a statistically significant difference from controls (no treatment) to growth or reproductive endpoints is recorded (i.e., the LOEC), as well as the lowest exposure concentration tested that is not different than the control (i.e., the NOEC). Many researchers have commented on the poor application of environmental statistics and laboratory testing regarding NOECs and LOECs (Baas et al. 2009; Chapman et al. 1996; Landis and Chapman 2011; Laskowski 1995; Suter 1996). Prominent limitations include: (1) NOECs and LOECs are statistically derived, a function of the concentrations selected by the experimenters, and often are highly variable among studies; (2) ignore the fundamental model of toxicology i.e., does not use the dose-response relationship; (3) ignore critical data at other treatment concentrations i.e., effects at higher treatment concentrations are not reported; (4) use a lack of evidence as a no-effect; and (5) are limited to the concentrations tested. NOECs typically correspond to an EC10 to EC30 on an exposure response curve (Moore and Caux 1997). A 30% effect rate within a population can be striking, particularly if the effect is on a critical biological endpoint such as reproduction, growth, migration, or olfactory-mediated behaviors. Previous salmonid population modeling suggests that when 14% mortality occurs to juveniles population growth rate is substantially affected (NMFS 2009). We therefore exercise caution in interpreting a NOEC as a true "no response" to an exposure.

Growth of individual organisms is an assessment endpoint derived from the chronic fish and invertebrate toxicity tests described above. Reproduction, at the scale of an individual, can be measured by the number of eggs produced per female (fecundity), and at the population scale by measuring the number of offspring per female in a population over multiple generations. The EPA Preliminary Ecological Risk Assessments summarized reproductive endpoints at the individual scale from chronic, freshwater fish experiments described above. Other assessment measures of reproduction include egg size, spawning success, sperm and egg viability, gonadal development, and hormone levels-most of which are rarely measured in standardized toxicity tests conducted pursuant to pesticide registration.

Other Effects

Responses that are not typically evaluated in laboratory toxicity studies have significant implications for survival in the wild. Swimming is a critical function for anadromous salmonids to complete their life cycle. Impairment of swimming may affect feeding, migrating, predator avoidance, and spawning. It has been used to assess behavioral responses of fish to various toxicants, including pesticides (Little and Finger 1990). Swimming capacity is a measure of orientation to flow as well as the physical capacity to swim against it (Dodson and Mayfield 1979; Howard 1975). Swimming activity includes measurements of frequency and duration of movements, speed and travel distance, frequency and angle of turns, position in the water column, and form and pattern of swimming. Little and Finger (1990) concluded that swimming-mediated behaviors are frequently adversely affected at 0.3 – 5.0 % of reported fish LC50s, and that 75% of reported adverse effects to swimming occurred at concentrations lower than reported LC50s.

Olfaction conveys critical environmental information that fishes use to mate, locate food, discriminate kin, avoid predators, and home (i.e., navigate). Any or all of these essential olfactory-mediated behaviors may be affected by exposure to contaminants such as pesticides (reviewed by Tierney et al. 2010)(Tierney et al. 2009). For example, copper impairs and destroys salmonid olfactory sensory neurons in a matter of minutes at low µg/L levels and effects persist for hours to weeks depending on exposure concentration and duration. Measured behavioral effects in salmonids from impaired olfaction include compromised alarm response, loss of ability to avoid copper, interrupted spawning migrations, loss of homing ability, and delayed and reduced downstream migration of juveniles (Baldwin et al. 2003; Baldwin et al. 2011; Hansen et al. 1999; McIntyre et al. 2008; Mebane and Arthaud 2010; Sandahl et al. 2004). Disruption of these essential behaviors reduces the likelihood of an individual salmonid completing its life cycle.

Certain critical biochemical responses can indicate organism-level responses affecting survival and fitness in the wild. For example estrogen mimics like nonylphenol, used as a surfactant in tank mixes and fracking, has been linked to endocrine disrupting effects in aquatic systems (Arsenault et al. 2004; Brown et al. 2003; Brown et al. 1999; Brown et al. 2005; Madsen et al. 2004; Schoenfuss et al. 2008). Another example is impaired neurotransmitter function through changes in acetylcholinesterase levels. Acetylcholinesterase is a crucial enzyme in the proper functioning of cholinergic synapses in the central and peripheral nervous systems of vertebrates and invertebrates. Of consequence to salmon, anticholinesterase insecticides have been shown to interfere with salmon swimming behavior (Beauvais et al. 2000; Brewer et al. 2001; Sandahl et al. 2005), feeding behavior (Sandahl et al. 2005), foraging behavior (Morgan and Kiceniuk 1990), homing and antipredator behaviors (Scholz et al. 2000), and reproductive physiology (Moore and Waring 1996; Scholz et al. 2000; Waring et al. 1996).

We located no study results that evaluated swimming effects or olfactory responses in fish following exposure to the pesticides evaluated in this opinion. However, the absence of such information does not mean these effects do not occur. For example, one study reported metolachlor potentiation of organophosphate acetylcholinesterase inhibition in earthworms (Stepić et al. 2013).

11.4.3 Indirect Effects

Indirect effects to fish and habitats exposed to the pesticides evaluated in this opinion are evaluated using toxicity tests of species representing the prey and habitat salmonids depend on.

Invertebrate Prey

Fish can consume a very high proportion of the invertebrate community in aquatic habitats (Huryn 1998:Huryn, 1996 #82). Juvenile salmonids consume a wide range of invertebrates, including those from all functional feeding groups. Changes in abundance of any of these groups could change prey availability for these fish. Pesticides may kill or injure aquatic insects and other macroinvertebrates that serve as food for rearing juvenile salmonids of all five species and adult steelhead. Lack of food may affect a salmonid's growth and development, ultimately affecting their ability to complete their life cycle. Juvenile salmonids are generally opportunistic drift-feeders, and are therefore sensitive to factors that influence the general quantity and quality of invertebrate prey items. If, for instance, there were reductions in the production of invertebrate grazers or the inputs of invertebrate prey from riparian vegetation, salmonids may be forced to alter their foraging behavior (e.g., take more risks, select less energy-rich prey). Alternatively, changes in abundance and composition may have minimal impacts to salmonids if they do not alter the overall quality or quantity of prey, or impact foraging behaviors. Whether or not production of prey decreases or shifts (or increases) after exposure to pesticides will depend in part on the composition of the community (structure and function) and the relative sensitivities of those taxa. Multiple experiments conducted in mesocosms have demonstrated that the particular composition of the community at the time of pesticide exposure influences the magnitude of the impact as well as the trajectory of the recovery (Colville et al. 2008; Downing et al. 2008; Heckmann and Friberg 2005; Hessan et al. 1994; Lytle and Lytle 2002; Maund et al. 2009; Rohr and Crumrine 2005; Schulz et al. 2003a; Schulz et al. 2003b; Van den Brink et al. 2007; Van den Brink et al. 2006) and this would likely be the case in salmonid habitats.

Mixtures of pesticides present a particular challenge in assessing impacts on salmon habitat. Most of the experiments described above were conducted in mesocosms with a single exposure of a single pesticide, something that rarely occurs in salmonid habitat. In streams and rivers of the United States pesticides frequently co-occur with other pesticides (Gilliom 2007). A final consideration in assessing how pesticides may impact salmonids and their habitats is the question of resiliency of these aquatic ecosystems. The recovery of secondary production, to rates observed prior to exposure, depends on the communities themselves and the exposure. For example, univoltine species of macroinvertebrates (i.e. that produce one generation per year) will require a long time to recover. Additionally, if pesticides persist in the landscape, exposures may occur repeatedly (or continuously) depending on application rate, precipitation, and conditions in the watershed. In habitats that receive pesticidal inputs repeatedly throughout the year, salmonid prey may be chronically suppressed.

Riparian Vegetation and Aquatic Primary Producers

We evaluate the available information to assess whether riparian vegetation and aquatic primary producers may be affected by the a.i.s. Riparian vegetation is important for providing shade to the stream, stabilizing the stream banks, reducing sedimentation, and providing organic material inputs, both in terms of plant material and terrestrial insects. Riparian vegetation is a major focus of restoration efforts of salmonid habitat throughout their range to help reduce pesticide loading into aquatic resources. Riparian vegetation is an important assessment endpoint for herbicidal impacts on salmon habitats. Generally there are sparse data regarding the effects of herbicides (and much less with insecticides, aracnicides, or miticides) on wild plants within riparian systems, other than weed species. The EPA requires submission of crop effects data as part of the registration process for herbicides (EPA 1996). This information currently provides the only basis for evaluating effects on herbaceous plants unless data are available from other sources. The overall assumption is that the sensitivity of plant species tested (typically plants used in agriculture) in the registrant-provided guideline studies will be representative of riparian species. There is no way to know this is the case, therefore a high degree of uncertainty regarding the toxicity of the a.i.s to riparian vegetation exists. We also evaluate if and to what extent aquatic primary producers are affected by the stressors of the action. Primary producers including periphyton, diatoms, macrophytes, and plankton are integral components of aquatic food chains, serving as food for salmonid prey. Reductions in primary productivity may lead to impacts to salmonid prey. Although typically not tested for effects to freshwater and marine primary producers, we search for and evaluate any information on pesticide effects to primary producers.

11.4.4 Environmental Factors That Modify Pesticide Toxicity

The physical and chemical properties of water, its temperature, hardness, pH, oxidation/reduction potential, and content of naturally occurring substances like carbon, organic acids, can influence pesticide toxicity. The information submitted by the EPA only discussed these factors in the context of pesticide transformation, fate, and transport because these factors influence pesticide degradation half-life and biological availability. For example pesticide half-lives are longest at the optimum pH, with increasing hydrolysis at lower and higher pH values. Substances like minerals, silt, and organic acids can bind to pesticides, reducing their bioavailability to target and non-target organisms.

Searches of the open literature for the influence of environmental factors that modify the toxicity of 1,3-D and metolachlor only identified information on effects of salinity and temperature on metolachlor toxicity. Exposure to s-metolachlor at concentrations as low as 0.01 µg/L and temperatures that were four degrees above or four degrees below the optimal developmental temperature of 24° C (75.2° F) significantly increased frequency of larval abnormalities in Pacific oyster (Gamain et al. 2017). Salinities below 33 p.s.i. also synergistically impaired larval development at 0.01 µg/L S-metolachlor (Gamain et al. 2016).

Increased toxicity for fish at elevated temperatures is a generally accepted principle. As ectotherms, the metabolism of aquatic organisms increases at higher temperatures. This includes metabolism for life functions (e.g. oxygen consumption, excretion, homeostasis) and biotransformation of toxicants. For example, gold fish exposed to environmentally realistic mixtures of herbicides and fungicides, including S-metolachlor, exhibited concentration and temperature-dependent increases in molecular indicators of stressor injury, defense, repair, and cellular replacement (Gandar et al. 2017; Jacquin et al. 2019). A toxicant that affects energy metabolism or respiratory gas exchange may make it difficult for organisms to meet increased metabolic needs under higher temperatures. Increased metabolism requires higher rates of active uptake and diffusion of water and solute moving over the gills, increasing uptake and excretion of aquatic toxicants (Cairns et al. 1975).

We expect elevated temperatures across the freshwater habitats of listed cold-water fish to co-occur with both a.i.s. As shown in the Environmental Baseline, many listed cold-water fish reside in watersheds listed on State 303(d) lists as impaired due to temperature exceedances. We expect that cold-water fish and their prey exposed to both elevated temperature and the two herbicides and their degradates in the environment will be adversely affected at relatively lower concentrations compared to exposures to the two herbicides and their degradates at non-elevated temperatures in laboratory and field assays. While we cannot quantify the degree to which elevated temperature may increase toxicity of 1,3-D, we will treat temperature qualitatively as a factor expected to increase the risk of reregistration of both 1,3-D and metolachlor, to cold-water fish.

It is also important to note that the hardness of waters in much of the range of listed anadromous species is below 60 mg $CaCO_3$/L; this suggests that responses within the freshwater habitats of listed salmonids will be comparable or potentially more sensitive than responses observed under laboratory conditions (Figure 55).

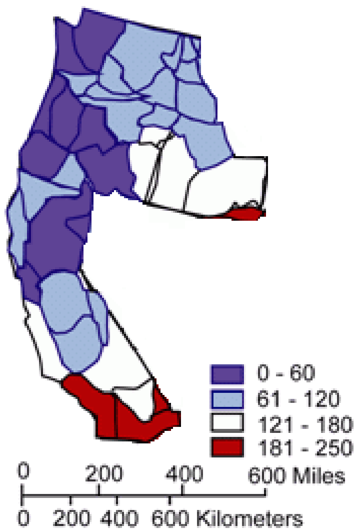


Figure 55. Water hardness among watershed accounting units (6 digit HUCs) within the range of ESA-listed salmonids (mg/L $CaCO_3$).

11.4.5 Analyzing Response to 1,3-D and its degradates

The soil fumigant 1,3-D restricts the function of vital enzymes of nematodes through substituting a sulfhydryl, ammonia or hydroxyl group of functioning enzyme systems with a 1,3,-D chlorine. Restriction of these enzyme systems results in the paralysis and death of exposed nematodes (Cox 1992). Information on the mechanism by which 1,3-D exerts toxic effects on aquatic animals or other species groups was not found in EPA assessments or a search of the open literature.

The most significant aquatic degradation route for 1,3-D is aerobic aquatic metabolism formation of 3-chloroallyl alcohol and, to a lesser extent, 3-chloroacrylic acid (Figure 56). The 1,3-D aerobic aquatic metabolism half-life of 5 days contrasts with the hydrolysis half-life of 196 hours at pH 7 and 20ºC. The degradate 3-chloroallyl alcohol is formed at a maximum 6.4% of applied 1,3-D one day after treatment. In the absence of metabolic activity, 3-chloroallyl alcohol formed at up to 77% of applied 1,3-D via hydrolysis upon termination of a 22-day study (MRID 44975503 as cited in USEPA, 2013). The degradate 3-chloroacrylic acid forms at a maximum of 9.5% of applied 1,3-D seven days after treatment. Long term exposure to both degradates is not expected because they dissipate rapidly in metabolically active waters, with half lives of 1.2 and 3.96 hours for 3-chloroallyl alcohol and 3-chloroacrylic acid, respectively.

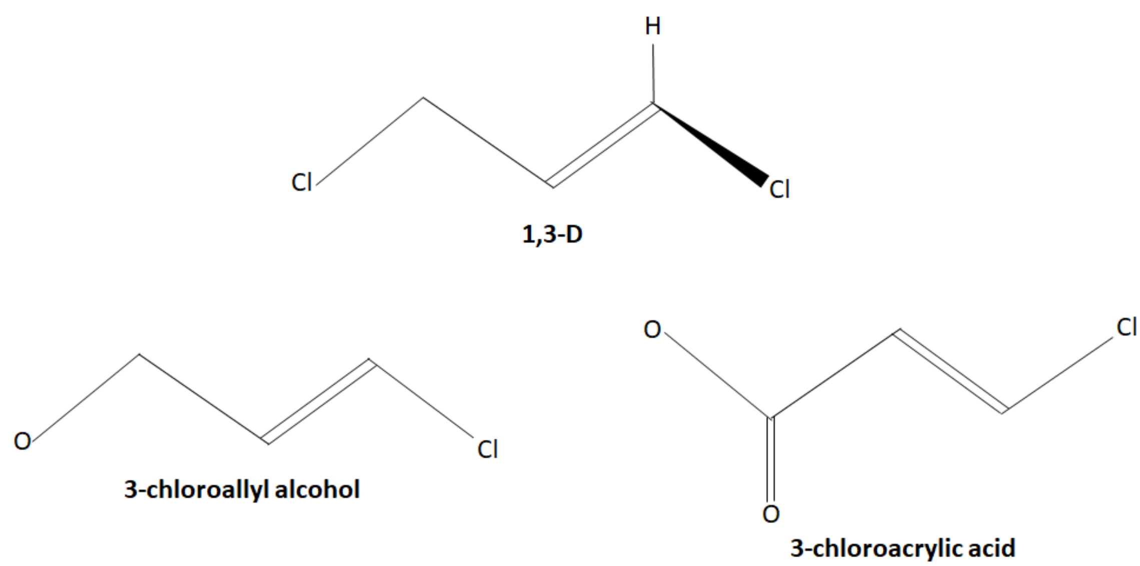


Figure 56. Structures of 1,3-D and degradates

Not all endpoint estimates were provided with confidence limits and exposure-response slopes. The ECOTOX does not include data for 3-chloroallyl alcohol or 3-chloroacrylic acid and does not report exposure response slopes. With the exception of the 1,3-D data from Mayer and Ellersieck (1986) and Buccafusco et al. (1981), the studies entered into ECOTOX have not undergone review by EPA, so they have not been classified as *acceptable*, *core*, or *supplemental*.

11.4.5.1 Salmonid Lethality

The 1,3-D lethality data reported in both the ECOTOX and EPA's Pesticide Ecotoxicity Database are presented in Table 147. The fish LC50s in EPA's risk analyses for 1,3-D were not adjusted for purity or recalculated from the original data. The 2013 1,3-D Problem Formulation used the Walleye LC50 of 1,080 ppb while the 2019 Draft Risk Assessment reported updated data which included an LC50 of 2,780 ppb for rainbow trout. The ECOTOX also included LC50s for fathead minnow that were lower than those LC50s for rainbow trout, the lowest of which, and LC50 of 239 ppb (Geiger et al. 1990). Nonetheless, NMFS considers rainbow trout to be the most suitable surrogate species for ESA-listed salmonids. Further, rainbow trout 96-hour LC50s are available for 3-chloroallyl alcohol and 3-chloroacrylic acid. This allows within-species comparison of the parent compound toxicity to these degradates. The LC50 of 986 ppb for 3-chloroallyl alcohol is about one third the 1,3-D LC50, while the LC50 for 3-chloroacrylic acid, at 69,500 ppb, is 25 times the LC50 for the parent compound.

The 1,3-D Problem Formulation stated that the degradates are sufficiently mobile and persistent to reach estuarine and marine environments. While there are no LC50 data for estuarine or marine fish exposures to the 1,3-D degradates, the sheepshead minnow LC50 for 1,3-D of 870 ppb is about one third the LC50 for rainbow trout. Taking in freshwater degradate toxicity into consideration, it is reasonable to expect LC50s for estuarine and marine fish exposed to the more toxic degradate, 3-chloroallyl alcohol, would be lower still.

Table 147 Fish LC50 data for 96 hour exposures to 1,3-dichloropropene and degradates.

Species	Purity	Exposure	Toxicity Value (ppb)	MRID or Author, year (ECOTOX number)	EPA data quality designation
1,3-Dichloropropene					
Rainbow trout	*100*	*static*	*LC50=2,780[a] (2,130-3,620); NOEC / LOEC =1,460 / 2130[a]*	*49382003*	*core*
	92	*static*	*LC50=3,940 (3,100-5,000)*	*39692*	*core*
	not reported	*static*	*LC50=5,360*	*Birge et al., 1982 (45758)*	
Walleye	*100*	*static*	*LC50=1,080 (990-1,200)*	*40098001; Mayer, Jr. and Ellersiek, 1986 (6797)*	*supplemental*

Bluegill	*96*	*flow through*	*LC50=3,700 (2,800-4,800); NOEC=1,000*	*44849101*	*core*
	92	*static*	*LC50=6,700 (5,800-7,760); NOEC=4,200*	*TN 1118*	*core*
	92	*static*	*LC50=7,090 (5,160-9,700)*	*39692*	*core*
	80+	*static*	*LC50=6,100 (5,100-6,800)*	*117043; Buccafusco et al., 1981 (5590)*	*supplemental*
Carp	*not reported*	*static*	*LC50=9000 (8000-11000)*	*Shell Oil Co, 1987 (93891)*	*not coded[b]*
Fathead minnow	*100*	*static*	*LC50=4,100 (3,400-4,970)*	*40098001; Mayer, Jr. and Ellersiek, 1986 (6797)*	*supplemental*
	95	*flow through*	*LC50=239 (211-271)*	*Geiger et al., 1990 (3217)*	*not coded*
	not reported	*flow through*	*LC50=1400 (1200-1500)*	*Turner, 1982 (9994)*	*not coded*
	not reported	*static*	*LC50=1600 (1400-1900); LOEC=710; NOEC=670*	*Turner, 1982 (9994)*	*not coded*
	not reported	*static*	*LC50=2320 (1520-2680)*	*Birge et al., 1982 (45758)*	*not coded*
Goldfish	*100*	*static*	*LC50<7500*	*Mayer, Jr. and Ellersiek, 1986 (6797)*	*not coded*
Largemouth bass	*100*	*static*	*LC50=3,650 (3,500-3,780)*	*40098001, Mayer, Jr. and Ellersiek, 1986 (6797)*	*supplemental*
Sheepshead minnow	*96*	*flow through*	*LC50=870 (570-1100); NOEC=570*	*44843901*	*core*
	80	*static*	*LC50=1800 (700-4500); NOEC=1200*	*Heitmuller et al., 1981 (10366)*	*not coded*
3-chloroallyl alcohol					

Rainbow trout	*not reported*	*static renewal*	*LC50=986[a] (747-1320), slope=6.5 (ppm); NOEC=303*	*44940306*	*supplemental*
3-chloroacrylic acid					
Rainbow trout	*not reported*	*static*	*LC50=69,500[a] (49,200-98,100); NOEC=49,200*	*44940307*	*core*

[a] Value appears in Risk-plots within Chapters 12 & 15

Not coded = EPA has not classified this study (e.g. "core", "supplemental", etc.)

11.4.5.2 Salmonid Growth And Fitness

Thresholds for growth and fitness effects were only available for 1,3-D and not the degradates (Table 148). The 2019 1,3-D Draft Risk Assessment included an early life stage fathead minnow growth LOEC of 15 ppb. The difference in mean dry weight at the 15 ppm treatment group from the pooled controls was considered slight, at 8.3% (MRID 49682401). NMFS also identified NOEC of 1,460 ppb and LOEC of 2,130 ppb for effects of 1,3-D on rainbow trout swimming behavior from the same study reporting the LC50 at 2,780 ppb in MRID 49382003. Data for the effects of chronic exposures to 1,3-D on estuarine and marine fish species were not available. The 2019 1,3-D Draft Risk Assessment estimated chronic values for sheepshead minnow based by applying fathead minnow and sheepshead minnow data in acute to chronic ratios.

Table 148 Fish LOEC and NOEC data for growth and fitness responses to 1,3-D exposures.

Response	Species	Purity	Exposure design	Toxicity Value (ppb)	MRID	Fulfills guideline?
Growth	Fathead Minnow	96.8	flow through, chronic early life stage at 28 days	NOEC = 15[a] LOEC = 34	49682401	core
Behavior	Rainbow Trout	100	flow through, 96 hours	NOEC = 1,460[a] LOEC = 2,130 (erratic swimming)	49382003	core
ACR estimate	Sheepshead minnow	N.A.	N.A.	NOEC = 1.8 LOEC = 3.2	N.A.	N.A.

[a] Values in this table appear in Risk-plots within Chapters 12 & 15

N.A. = not applicable (threshold is an ACR estimate, not empirical data.

11.4.5.3 Invertebrate Prey

The 1,3-D problem formulation classified the 1,3-D as very highly toxic to freshwater invertebrates and highly toxic to estuarine and marine invertebrates. There were abundant data for the effects of acute exposures to 1,3-D on invertebrates (

Table 149). The 2013 1,3-D Problem Formulation applied an acute LC50 of 90 ppb for the water flea in its analysis. This LC50 is one or more orders of magnitude lower than the 1,3-D LC50s for other invertebrates and the water flea LC50s for both 3-chloroallyl alcohol and 3-chloroacrylic acid. LC50s for marine species ranged from 640 ppb for 96 hour flow through exposure of eastern oyster to 3,900 ppb for a 48 hour static exposure of opossum shrimp.

Table 149 Toxicity data for acute exposures of invertebrates to 1,3-D and degradates.

Response	**Species**	**Purity**	**Exposure design**	*Toxicity Value (ppb)*	**MRID**
Dichloropropene					
Midge	92	48 hours, static	LC50=1,350 (1,080-1,670)	*Horne and Oblad, 1983 (14396)*	not coded
Scud	92	96 hours, static	LC50=2,000		
Marsh rams-horn snail	92	96 hours, static	LC50=8,100 (7,520-8,720)		
Stonefly	92	96 hours, static	LC50=5,420 (4,800-6,120)		
*W*ater Flea	100	48 hours, static	EC50=90[a] (63-129)	*40098001, Mayer and Ellersieck 1986 (6797)*	supplemental
	80+	48 hours, static	EC50=6,200[a] (4,300-9,000); NOEC=410	00117044	supplemental
	80	24 hours, static	LC50=7,200 (5,100-11,000)	LeBlanc, 1980 (5184)	not coded
		48 hours, static	NOEC=410; LC50=6,200 (4,300-9,000)		not coded
	not reported	24 hours, static	LC50>6,800	Turner, 1982 (9994)	not coded
		48 hours, static	NOEC=1,600; LOEC=2,600;		not coded

			LC50=4,500 (4,200-5,000)		
		48 hours, flow through	NOEC<990; LOEC=990; LC50=2,800 (2,400-3,400)		not coded
		24 hours, flow through	LC50=6,000 (5,600-6,500)		not coded
Eastern oyster	96	96 hours, flow through	EC50=640 (570-710); NOEC=350	44843903	Core
Opossum Shrimp	96	96 hours, flow through	LC50=700 (600-850), slope=6.9 (ppm); NOEC=170	44843904	Core
	not reported	96 hours, static	NOEC=410; LOEC=800; LC50=1,200 (650-2,300)	Turner, 1982 (9994)	not coded
		24 hours, static	LC50=3,900 (2,200-3,900)		not coded
		72 hours, static	LC50=1,400 (690-2,400)		not coded
		48 hours, static	LC50=1,700 (770-2,500)		not coded
		48 hours, flow through	LC50=1,300 (1,200-1,400)		not coded
		24 hours, flow through	LC50>1,700		not coded
		96 hours, flow through	NOEC=230; LOEC=400; LC50=640 (560-730)		not coded
		72 hours, flow through	LC50=940 (690-1,200)		not coded
3-Chloroacrylic acid					

Water flea	100	48 hours, static renewal	EC50=56,900[b] (49,500-65,400); NOEC=24,900	44940308	core
3-Chloroallyl alcohol					
Water flea		48 hours, static	EC50=2,300 (1,200-4,200); NOEC=1,200	44843902	supplemental

[a]Value appears in Risk-plots within Chapters 12 & 15

[b]The data in this table are as reported in the OPP database. The 1,3-D Problem formulation adjusted this value to 55,000 ppb and this is the value reported in the Risk-plot.

Not coded = EPA has not classified this study (e.g. "core", "supplemental", etc.)

There were two core studies available to assess chronic toxicity to invertebrate prey. These were a single study reporting chronic effects for invertebrates exposed to 1,3-D and one study for 3-chloroacrylic acid. The 18-day LOEC of 105 ppb (MRID 450075801) for water flea exposures to 1,3-D was similar to the 48 hour LC50 of 90 ppb (MRID 40098001). The degradate 3-chloroacrylic acid was substantially less toxic, with an 18-day LOEC of 5,080 ppb (MRID 49382005).

Table 150 Toxicity data for chronic exposures of aquatic invertebrates to 1,3-D and 3-chloroacrylic acid.

Species	Purity (%)	Exposure Duration	Toxicity Values (ppb)	MRID	EPA data quality designation
1,3 Dichloropropene					
Water flea	96	18 days, flow through	LOEC=105; NOEC=70	45007501	core
3-Chloroacrylic acid					
Water flea	100	18 days, static renewal	LOEC=5,080; NOEC=2,530	49382005	core

11.4.5.4 Phytoplankton And Aquatic Vascular Plants

The data in Table 151 are from the OPP database, but some of these data, denoted with "b" in superscript, do not match the values attributed to the same MRID in the 1,3-D Problem Formulation. Both the OPP database and the 1,3-D Draft Risk Assessment report the freshwater diatom (*Navicula pelliculosa*) 5-day EC_{50} from MRID 44843909 as 1,390 ppb, but the 1,3-D Problem Formulation reports a much higher EC_{50} for this study, at 7,900 ppb. This difference could not be attributed to a correction for percent purity and it was unclear whether the difference was due to a recalculation from the original exposure-response data. Both EC_{50} estimates indicate the freshwater diatom as is more sensitive than other aquatic plant species to 1,3-D. This opinion uses the EC_{25} of 30 ppb for *Navicula pelliculosa* in the Risk-plots as reported in MRID 44843909.

The relative toxicity of 1,3-D metabolites to aquatic plant life differs from that of fish and invertebrates. Data for 3-chloroacrylic acid indicate that it is actually more toxic The EC50 for 3-chloroacrylic acid is an order of magnitude lower than the 1,3-D EC50 for duckweed, with EC50s of 220 and 20,000 ppb, respectively. This metabolite is also more toxic than the parent compound to green algae, with EC50s of 432 ppb for exposure to 3-chloroacrylic acid and 15,000 ppb for exposure to 1,3-D. While the 3-chloroallyl alcohol EC50 for duckweed was an order of magnitude lower than the 1,3-D EC50 for this species. Freshwater diatom and green algae were more sensitive to 1,3-D than to 3-chloroallyl alcohol.

Table 151 Toxicity data for phytoplankton and aquatic plants exposed to 1,3-D and degradates.

Species	Purity (%)	Exposure Duration	Toxicity Values (ppb)	MRID	EPA data quality designation
1,3 Dichloropropene					
Blue-green algae	*96*	*5 days, static*	*EC50=108,000 (50,000-232,000); NOEC=11,300*	*44843911*	*core*
Duckweed	*96*	*7 days, static*	*EC25 = 1310[a]; EC50=20,000 (14,000-29,000); NOEC=1,200*	*44843914*	*core*
Freshwater diatom	*96*	*5 days, static*	*EC25 = 30[a]; EC50=1,390 (1,060-1,810); NOEC<74*	*44843909*	*supplemental*
Freshwater green algae	*96*	*96 hours, static*	*EC25 = 7850[a]; EC50=15,000 (10,200-22,000); NOEC=9,500*	*44940314*	*core*
Marine diatom	*96*	*5 days, static*	*EC50=15,500 (10,800-22,300); NOEC=8,800*	*44843910*	*core*
3-Chloroacrylic acid					
Blue-green algae	*not reported*	*5 days, static*	*EC50=4,200 (3,000-3,600), slope=4,400; NOEC=3,200*	*44940318*	*supplemental*

Species	Purity (%)	Exposure Duration	Toxicity Values (ppb)	MRID	EPA data quality designation
Duckweed	*not reported*	*196 hours, static*	*EC50=220 (120-400)*	*45007504*	*core*
Freshwater diatom	*not reported*	*5 days, static*	*EC50=5,400 (5,100-5,700), slope=8,800; NOEC=2,500*	*44940317*	*supplemental*
Freshwater green algae	*not reported*	*96 hours, static*	*EC50=432 (271-688); NOEC=181*	*44940319*	*supplemental*
Marine diatom	*not reported*	*5 days, static*	*EC50=50,200 (47,700-52,900); NOEC=23,700*	*45007503*	*core*
3-Chloroallyl alcohol					
Blue-green algae	*not reported*	*5 days, static*	*EC50>101,000; NOEC=52,000*	*44843912*	*supplemental*
Duckweed	*not reported*	*196 hours, static*	*EC50=1,694 (926-3,100); NOEC=42*	*44940320*	*supplemental*
Freshwater diatom	*not reported*	*5 days, static*	*EC50=32,900 (12,850-84,400); NOEC=48,000*	*44843913*	*supplemental*
Freshwater green algae	*not reported*	*96 hours, static*	*EC50=49,000 (38,000-63,000); NOEC=14,000*	*44940315*	*supplemental*
Marine diatom	*not reported*	*5 days, static*	*EC50=140 (43-490), slope=821; NOEC=22*	*44940316*	*supplemental*

[a]*Value appears in Risk-plots within Chapters 12 & 15*

11.4.5.5 Terrestrial (Riparian) Vegetation

Riparian vegetation is important for providing shade to the stream, stabilizing the stream banks, reducing sedimentation, and providing organic material inputs, both in terms of plant material and terrestrial insects. Riparian vegetation is a major focus of restoration efforts within California, and when present can reduce pesticide loading into aquatic resources. Riparian vegetation is an important assessment endpoint for herbicidal impacts on salmon habitats. Generally, there are sparse data regarding the effects of herbicides (and much less with insecticides, arachnicides, or miticides) on wild plants within riparian systems, other than weed species. The EPA requires submission of crop effects data as part of the registration process for herbicides. This information currently provides the only basis for evaluating effects on herbaceous plants unless data are available from other sources. The overall assumption is that the sensitivity of plant species tested (typically plants used in agriculture) in the registrant-provided guideline studies will be representative of riparian species. There is no way to know this is the case, therefore a high degree of uncertainty regarding the toxicity of the a.i.s to riparian vegetation exists.

Currently there are gaps in information on the effects of 3-chloroallyl alcohol and 3-chloroacrylic acid on terrestrial plants. The EC25 estimates from the OPP database for MRID 45007502 were converted from the ppm to pounds per acre for the 1,3-D Problem Formulation (Table 152).

Table 152. Toxicity data for terrestrial plants exposed to 1,3-D and degradates.

Study Type	% AI	Species	Lowest reported EC_{25} (dataset size) in lb ai/A	Most Sensitive Endpoint/ Measured Endpoint	MRID or ECOTOX reference	EPA data quality designation
Seedling emergence	*not reported*	*dicot (tomato)*	*4.81*	*Shoot weight*	*45007502*	*core*
		monocot (onion)	*>11.69*	*--*		
Vegetative vigor	*not reported*	*dicot (tomato)*	*6.86*	*Shoot weight*	*45007502*	*core*
		monocot (onion)	*3.5*	*Shoot length*		
Development	*not reported*	*monocot (garden ginger)*	*>446.09 (n=1)*	*Emergence*	*Smith et al., 2011 (174802)*	*not coded*
Population	*not reported*	*dicot (Canada thistle)*	*>249 (n=5)*	*Abundance*	*Ogg, Jr., 1975 (89203); Schneider et al., 2009 (153245); Hanson et al., 2010 (153138)*	*not coded*

	not reported	*monocot (garden ginger)*	*>446.09 (n=1)*	*Biomass*	*Smith et al., 2011 (174802)*	*not coded*
		Dicot (beet)	*>15 (n=5)*	*Biomass*	*Schwartz and Gale, 1979 (155570)*	*not coded*
Reproduction	*not reported*	*monocot* (yellow nutsedge)	*>332 (n=1)*	*Viability*	*Hanson et al., 2010 (153138)*	*not coded*
		dicot (multiple)	*>332 (n=8)*	*Viability*	*Hanson et al., 2010 (153138); Shrestha et al., 2008*	*not coded*

11.4.5.6 Field Studies

Field studies on the effects of 1,3-D on aquatic life were not identified in the ECOTOX or a search of the open literature.

11.4.5.7 Field Incidents

The 1,3-D Problem Formulation reported incidents from the Ecological Incident Information System (EIIS) database involving terrestrial plants (13), aquatic plants (1), and wildlife (1). Most plant incidents were attributed to applications of 1,3-D plus chloropicrin, with a few attributed to 1,3-D alone. Certainties for these incidents ranged from “possible” to “highly probable.” Certainty of a causal relationship between 1,3-D and the reported incident was not included for the wildlife incident or 5 of the 13 plant incidents. According to the 1,3-D Problem Formulation, the wildlife incident (#I016738-016) occurred when 1,3-D and chloropicrin applied to strawberry fields via irrigation accidently spilled into a nearby creek, resulting in 1000 fish killed. Residues taken from the fish confirmed the exposure.

The 2019 1,3-D Draft Risk Assessment Since publication of the 1,3-D Problem Formulation, registrants reported three new minor plant incidents between 2017 and 2018 in the aggregate incident reports. No additional details are available for these incidents. The new terrestrial plant incident (#I029870-0007) reported in the EIIS database occurred in 2017. A tomato crop was treated on several farms with Telone EC in Lazio, Italy. Transplanted seedlings were affected after the subsequent planting cycle. The certainty that this incident is attributed to Telone EC is classified as “possible.”

While incidents represent evidence of environmental exposures to 1,3-D, NMFS does not consider them contributing appreciably to the effects of the action.

11.4.5.8 Bioconcentration And Bioaccumulation

The ECOTOX database does not report data for bioconcentration or bioaccumulation of 1.3-D and this information is not typically reported in the OPP database. The 1,3-D Draft Risk Assessment concluded that 1,3-D is not likely to bioconcentrate in tissues of aquatic organisms due to the low octanol/water partition coefficient (log Kow) of 1.82.

11.4.5.9 Degradate Toxicity

The 1,3-D degradates 3-chloroallyl alcohol and 3-chloroacrylic acid are important considerations in this analysis because, as shown by the data summarized in Table 147, the alcohol degradate may be more toxic to salmonid species than 1,3-D (Table 153). To further evaluate the potential for increased risk of direct lethality to salmon we considered the available environmental fate data. 1,3-D and it's metabolites are expected to dissipate rapidly in surface waters. Aerobic aquatic metabolism studies reveal comparable half-lives at 25° C (EPA 2008; 1,3-D 4.9 days, 3-chloroallyl alcohol 1.2 days, and 3-chloroacrylic acid 3.4 days). EPA reports that 1,3-D is hydrolyzed to the alcohol at a rate of 72 percent of the applied parent. However, based on aquatic metabolism studies, no degradate has been found to exceed 6.5% of the applied 1,3-D (cite EPA 2008 RLF BE). A study evaluating environmental concentrations of 1,3-D and its degradates on a Florida golf course found that the peak concentrations of the alcohol in water collected in drains immediately below golf course fairways were <10% of the peak concentrations observed for 1,3-D (cite study labeled attachment 16 - provided by Dow April 14, 2020). In ponds, the alcohol was only detected only once, at a trace concentration of 0.025 ppb or <2% of the corresponding concentration observed for the parent 1,3-D. The available information to characterize exposure suggests the peak concentrations of the 1,3-D in surface waters are likely to be at least 10 times greater than that of the alcohol degradate. Whereas, salmonid acute toxicity data suggest the sensitivity of 1,3-D and the alcohol metabolite vary by a factor of < 3. Taken together, this suggests that 1,3-D likely poses a greater risk of direct lethality to salmonids than the alcohol degradate.

Table 153 Relative toxicity of 1,3-D and its degradates to salmonids and aquatic invertebrates.

Endpoint	Duration	Test Species	Toxicity Value (ppb)		
			1,3-D	3-chloroallyl alcohol	3-chloroacrylic acid
Direct Mortality	96-hr	Rainbow Trout	LC50 = 2780	LC50 = 986	LC50 = 69,500
Prey	48-hr	Water flea	EC50 = 747*	EC50 = 2,300	EC50 = 55,000
	48-hr	Water flea	EC50 = 90-6200		

*geometric species mean

The available toxicity data suggests that 3-chloroacrylic acid is more toxic to aquatic plants than 1,3-D (Table 154). Based on EC50 values, the sensitivities between the parent and acid degrade vary by a factor of 1.5-91 (1.5, 35, and 91, for non-vascular plants, algae, and vascular plants, respectively).

Table 154. Relative toxicity of 1,3-D and its degradates to aquatic plants

Aquatic Plants	7-day, 14-day	Vascular (Duckweed)	EC50 = 20,000 7-day	EC50 = 1,694 14-day	EC50 = 220 14-day
	5-day	Non-Vascular (Freshwater diatom)	EC50 = 7850		EC50 = 5,400 Slope = 8.8
	96-hr	Green Algae	EC50 = 15,000	EC50 = 49,000	EC50 = 432

However, the magnitude of exposure to the acid degradate is expected to be less than that of the parent. EPA reports that the acid degradate is formed at a rate of 1-6% of the applied parent, which equates to a reduction in potential peak exposure by a factor of 17-100 (EPA 2008 RLF BE). Therefore, the ratio of peak exposure to toxicity in aquatic plants is expected to be comparable between 1,3-D and the acid degradate. Given these considerations, we determined it is not necessary to derive quantitative estimates of exposure to the alcohol and acid degradates. Rather, risk of these degradates can be characterized by comparing expected exposure and responses of the parent compound.

Companion pesticide: Chloropicrin

NMFS' review of pesticide labels and products found that about 80 percent of products containing 1,3-D also contain chloropicrin as an active ingredient. Reregistration of 1,3-D is reasonably certain to result in continued co-application of chloropicrin within the action area. Table 155 summarizes the available toxicity data for chloropicrin from ECOTOX and the OPP database. Searches of the open literature did not identify additional papers. The data suggest that chloropicrin is at least an order of magnitude more toxic than 1,3-D to these freshwater fish and invertebrates.

Table 155 Toxicity of chloropicrin to fish, invertebrates, and plant species

Species	*Purity (%)*	*Response*	*Exposure duration*	*Endpoint (ppb)*	*MRID or ECOTOX reference*	*EPA data quality designation*
Fishes						
Bluegill	*99.00*	*Mortality*	*96 hours*	*NOEL<75; LC50<105*	*MRID 2035127/ECOTOX 344*	*S*
	99.80	*Mortality*	*96 hours*	*LC50=50; NOEL=19*	*MRID 48442406*	*C*

	99.90	Mortality	96 hours	LC50=44.1; NOEL=28.5	MRID 2079912/ECOTOX 344	S
Rainbow trout	99.00	Mortality	48 hours	LC50=16.5	U.S. EPA 1992 ECOTOX 344	not coded
			96 hours	NOEL<11.5; LC50<16.8	MRID 2035129/ECOTOX 344	S
	99.80	Mortality	96 hours	LC50=11[a]; NOEL=7.7	MRID 48442405	C
	99.90	Mortality	96 hours	NOEL=3.15; LC50=5.14	MRID 2079911/ECOTOX 344	S
Sheepshead minnow	99.80	Mortality	96 hours	LC50=100; NOEL=67	MRID 48442402	C
Invertebrate prey						
Daphnia magna	99.80	Immobilization	48 hours	EC50=120[a]; NOEL=46	MRID 48442401	C
	99.90	Intoxication	48 hours	EC50=170; NOEL=109	MRID 2079913/ECOTOX 344	S
Daphnia pulex	96.50	Immobilization	48 hours	NOEL<9	MRID 2035128	S
		Intoxication	48 hours	EC50<71; NOEL<5; NOEL<8; EC50=63	MRID 2032423/MRID 2035128/ECOTOX 344	C/S
Eastern oyster	99.80	Shell deposition	96 hours	LC50=10; NOEL=1.4	MRID 48442404	S
Mysid	93.00	Mortality	96 hours	LC50=30; LC50=257.8	Carr,R.S. 1987 ECOTOX 17308	not coded
	94.00	Mortality	96 hours	LC50=30; LC50=258	Carr,S. 1987 ECOTOX 155283	not coded
	99.80	Mortality	96 hours	LC50=27; NOEL=14	MRID 48442403	C
Aquatic Plant						

Duckweed	*99.70*	*Growth and reproduction*	*7 days*	*EC25 = 4.6[a]; EC50=6.5; NOEL=0.309*	*MRID 48442801*	*A*
Green Algae	*not reported*		*NS*	*IC50 = 120[a]*	*MRID 49559701*	*S*
Terrestrial Plant						
Rapeseed	*99.30*	*seedling emergence*	*48 hours*	*EC25>10,082; NOEL=10,082*	*MRID 48442802*	*S*
		vegetative vigor (dry wt)	*21 days*	*EC25=312; NOEL<204*		
Cucumber	*99.30*	*seedling emergence*	*48 hours*	*EC25>10,082; NOEL=10,082*		
		vegetative vigor (chlorosis)	*21 days*	*EC25>1,046; NOEL=1,046*		
Soybean	*99.30*	*seedling emergence*	*48 hours*	*EC25>10,082; NOEL=10,082*		
		vegetative vigor (dry wt)	*21 days*	*EC25=866; NOEL=204*		
Sunflower	*99.30*	*seedling emergence*	*48 hours*	*EC25>10,082; NOEL=10,082*		
		vegetative vigor (dry wt)	*21 days*	*EC25=2,094; NOEL=1,046*		
Ryegrass	*99.30*	*seedling emergence*	*48 hours*	*EC25>10,082; NOEL=10,082*		
		vegetative vigor (dry wt)	*21 days*	*EC25=9,049; NOEL=1,046*		

Corn	*99.30*	*seedling emergenc e*	*48 hours*	*EC25>10,082; NOEL=10,082*
		vegetative vigor	*21 days*	*EC25>9,880; NOEL=9,880*

[a]*Value appears in Risk-plots within Chapters 12 & 15*

11.4.6 Analyzing Response to Metolachlor

The molecular structures of metolachlor and S-metolachlor are illustrated in Figure 57. Metolachlor is a broad spectrum chloroacetamide herbicide that impairs seedling shoot and meristematic growth by inhibiting chlorophyll and biomolecule synthesis. Biosynthesis of fatty acids and lipids, protein, isoprenoids, and flavonoids is thought to be inhibited by conjugation with acetyl coenzyme A and other sulfhydryl-containing biomolecules (EPA 1997). EPAs 2014 problem formulation and 2019 Draft Risk Assessment both cite EPA's *Review of Documents Related to the Equivalency of Racemic Metolachlor (Metolachlor) and S-Metolachlor for Environmental Fate and Ecotoxicity* (EPA 2002), which concluded that it is appropriate to bridge the fate and toxicity data for metolaclor and S-metolachlor, but not the degradates metolachlor enthansulfonic acid, metolachlor oxanilic acid. However, in evaluating the toxicity data for these structurally similar metabolites, EPA's 2019 Draft Risk Assessment concluded that they are far less toxic than the parent metolachlor and were thus not residues of concern for ecological exposure. Accordingly, NMFS did not include these metabolites in its analyses.

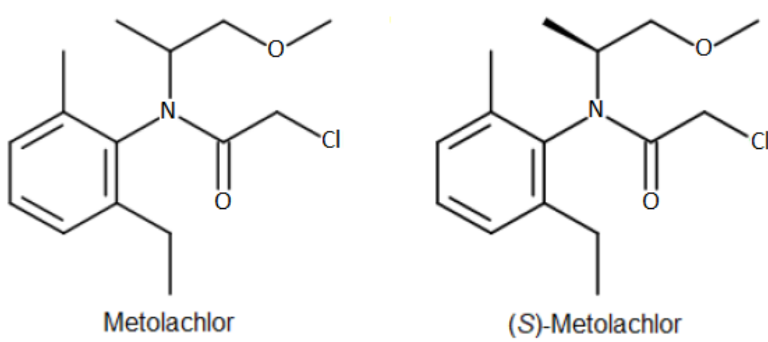


Figure 57. Molecular structure of metolachlor and (S)-metolachlor

Metolachlor acute toxicity is classified as "up to moderately toxic" for fish and aquatic invertebrates. With a Koc of 21.6-369 (L/kgOC), metolachlor is mobile to moderately mobile and is non-volatile from water and intermediate-to-nonvolatile on dry non-adsorbing surfaces (USEPA, 2010a). Metolachlor is unlikely to be significantly degraded via aqueous photolysis in clear water or on moist leaf surfaces (aqueous photolysis half-life = 70 d). The octanol-water partition coefficient (Kow) of 3.05 is high enough to have the potential to bioconcentrate in aquatic organisms, yet the measured bioconcentration factor BCF of 69X in fish and depuration value of 93% in 196 hours once fish were transferred to untreated water suggests that the potential for bioconcentration is low (EPA 2019).

In the absence of usable anaerobic aquatic metabolism data, EPA applied a 3x factor to the available anaerobic aquatic metabolism rate data in its assessment. Half-lives for aerobic metabolism in soils ranged from 13.9 to 2324 hours at 20 °C, placing it between non-persistent and persistent on the Goring persistance scale (Goring et al. 1975). Aerobic aquatic metabolism degradation half-life values ranged from 23.3 to 49.5 days over four soils and 2 temperatures (9 and 20 °C). Anaerobic aquatic metabolism data was only provided for a single s7oil, with a half-life of 78 days.

11.4.6.1 Salmonid Lethality

The metolachlor lethality data reported in both the ECOTOX and EPA's Pesticide Ecotoxicity Database are presented in Table 156. The fish LC50s in EPA's risk analyses for metolachlor were not adjusted for purity or recalculated from the original data. The 2013 Metolachlor Problem Formulation applied a rainbow trout LC50 of 3,800 ppb (MRID 00018722) for metolachlor and a bluegill LC50 of 3,200 for S-metolachlor (MRID 43928910). However, the Metolachlor Draft Risk Assessment applied the most sensitive endpoints from registrant-submitted guideline studies or open literature studies regardless of whether the endpoint was derived from a study conducted with metolachlor or S-metolachlor because EPA had determined that both the environmental fate and ecotoxicity data submitted for racemic metolachlor and S-metolachlor are comparable.[19]

Table 156. Fish LC50 data for 96 hour exposures to metolachlor and s-metolachlor.

Species	Purity (%)	Exposure	Endpoint	MRID or ECOTOX reference	EPA data quality designation
Metolachlor					
Chinook Salmon Rainbow Trout Silver Salmon	97.2		LC50=13,000	Wan et al., 2006 (89626)	not coded
Rainbow trout	Tech	static	LC50=3,900[a] (3,300-4,600); NOEC<2,800	00018722	Core
Fathead minnow	87EC	static	LC50=8,400 (6,400-11,000)	40098001; Mayer, Jr. and	Supplemental

[19] Federal Register. Volume 68, Number 63, Rules and Regulations, pp 15945-15958. April 2, 2003

				Ellersiek, 1986 (6797)	
	95.4	static	LC50=8,000 (5,400-12,000)		
Bluegill	Tech	static	LC50=10,000 (8,600-12,000); NOEC=6,000	00018723	Core
Channel catfish	Tech	static	LC50=4,900 (3,600-6,800); NOEC<2,100	00015534	core
Crucian carp	Tech	static	LC50=4,900 (3,600-6,800); NOEC<2,100	00015534	supplemental
Guppy	Tech	static	LC50=8,600 (7,400-10,500), slope=11.0 (ppm); NOEC<6,500	00015534	supplemental
Sheepshead minnow	97.3	flow through	LC50=9,800 (8,500-11,400); NOEC=3,600	43487101	core
	97	static	LC50=7,900 (4,400-inf); NOEC=4,400	43044602	supplemental
	Tech		NOEC = 1,300 LOEC = > 1.300	Sousa, 2000	NA
S-Metolachlor					
Rainbow trout	97.6	static	LC50=11,900[a] (8,300-15,000); NOEC=2,500	43928911	core
Bluegill	N.R.	static	LC50=3,200 (2,800-4,600), slope=14.8 (ppm); NOEC=1,500	43928910	Core
Zebra Danio	98.4	static	LC50=46,210 (40,800-52,730)	Quintaneiro et al., 2017 (178065)	not coded
Sheepshead minnow	98.9	static renewal	LC50=17,000 (12,100-23,300); NOEC=6,000	46829506	Supplemental

[a]*Value appears in Risk-plots within Chapters 12 & 15*

11.4.6.2 Salmonid Growth And Fitness

Only two thresholds for statistically significant impacts to growth (i.e., LOECs) were reported in the OPP database: one for a sheepshead minnow exposure to metolachlor and on for a fathead minnow exposure to S-metolachlor. A LOEC of >1,300 ppb and a NOEC of 1,300 ppb was reported for 34-day exposures of sheepshead minnow to metolachlor, technical (Sousa, 2000). A LOEC of 56 ppb and NOEC of 30 ppb was reported for a 30-day flow through study exposing fathead minnow to 98.6 percent S-metolachlor (MRID 44995903 – core). An additional study was identified for S-metolachlor and brown trout (Nusbaumer et al. 2021). In this study, embryos were exposed for 65-74 days to measured concentrations of 65 and 252 ng/L (while nominally 0.25 and 1 µg/l). Statistically significant effects were reported related to hatch time and length. Given the wide range of growth toxicities across three studies and concerns with the brown trout study, we focused our consideration of effects on growth on the fathead minnow results. For example, the very low effect concentrations, large differences between nominal and measured exposure concentrations, and small effect sizes seen in the brown trout study reduced our confidence in the results. Behavioral impacts were also observed in bluegill sunfish, rainbow trout, and sheepshead minnow (see Table 22).

Table 157 Fish LOEC and NOEC data for growth and fitness responses to metolachlor.

Response	Species	Toxicity Value (ppb)	MRID	Fulfills guideline?
Growth	Fathead Minnow	NOEC = 30[a] LOEC = 56	44995903	Acceptable
	Sheepshead Minnow	NOEC = 1300 LOEC > = 1300	Sousa, 2020	NA
	Brown Trout	LOEC = 0.065 – 0.252	Nusbaumer, 2021	NA
Behavior	Bluegill sunfish	NOEC = 2590[a] LOEC = 3290	43928910	Acceptable
	Rainbow Trout	NOEC = 2500[a] LOEC = 5300	43928911	Acceptable
	Sheepshead Minnow	NOEC = 6040[a] LOEC = 12100	46829506	Acceptable

[a]*Value appears in Risk-plots within Chapters 12 & 15*

11.4.6.3 Other Effects

Several studies investigated metolachlor's potential for endocrine disruption (e.g. Quintaneiro et al 2017; Rozmankova 2020). In these studies, multiple endpoints (e.g. morphological, behavioral, and biochemical) were considered together in order to assess whether sublethal effects may be attributable to thyroid disruption. These data were considered qualitatively in our evaluation of effects to species. We did consider endocrine disruption as a possible adverse outcome pathway for metolachlor potentially leading to individual level effects. However, the limited data available to-date for metolachlor and the wide range of effects thresholds reduced our confidence in using the data to support a risk hypothesis. We did not display these responses directly on the Risk plots in the effects analysis chapters.

Table 158. Other effects, metolachlor

Species	Purity (%)	Exposure	Endpoint	MRID or ECOTOX reference	EPA data quality designation
Metolachlor					
Japanese medaka	98	14-day, static	Up-regulation of thyroid-related genes at 10/110ppb (female/male)	Jin et al. 2011	Not coded
S-Metolachlor					
zebrafish	98.4	96-hr, static	EC50 (embryo malformation) = 29,400ppb	Quintaneiro et al. 2017	Not coded
	98	120-hr, static	Behavior (spontaneous tail movement), gene expression LOEC = 1ppb	Rozmankova et al. 2020	Not coded
	NA	72hr, daily renewal	Developmental (e.g. impairment of swim bladder) NOEC/LOEC = 7,100/14,200ppb	Yang et al. 2021	Not coded

Invertebrate Prey

Metolachlor is considered slightly to moderately toxic to aquatic invertebrates upon acute exposure, with marine invertebrates more sensitive than freshwater invertebrates. Data for the effects of acute and chronic exposures to metolachlor on invertebrate prey are presented in Table 159 and Table 160, respectively. An LC50 of 1,100 ppb for water flea (Foster et al. 1998), was applied quantitatively in the Metolachlor Draft Risk Assessment and Problem Formulation, but was not used in the Metolachlor BE. The S-metolachlor LC50 of 26,000 ppb was applied in all three of the EPA Metolachlor Risk Analyses.

Table 159 Acute toxicity data for aquatic invertebrates exposed to metolachlor.

Species	Purity (%)	Exposure Duration	Endpoint	MRID or ECOTOX reference	EPA data quality designation
Metolachlor					
Water Flea	87	48 hours, static	EC50=26,000 (19,400-34,900)	40098001; Mayer and Ellersiek, 1986 (6797)	not coded

	95.4	48 hours, static	EC50=23,500[a] (18,700-29,500)		supplemental
	97.2	24 hours,	LC50=80,000	Wan et al., 2006 (89626)	not coded
	97.2	48 hours,	LC50=13,000		
	not reported	24 hours, static	EC50=5,100 (1,600-16,000)	EO67777; Foster et al., 1998 (67777)	Supplemental; qualitative
		48 hours, static	EC50=1,100 (900-1,400)		
		48 hours, static	EC50=2,000 (1,600-2,400)		
	87EC	48 hours, static	EC50=23,500[a] (19,400-34,900)	40098001	supplemental
	Tech	48 hours, static	EC50=25,100 (21,600-29,200); NOEC=5,600	00015546	core
Midge	87	48 hours, static	EC50=4,400 (3,200-6,100)	40098001; Mayer, Jr. and Ellersiek, 1986 (6797)	not coded
	95.4	48 hours, static	LC50=3,800 (2,100-10,300)		supplemental
	95.4	48 hours, static	EC50=3,800 (2,100-10,300)		not coded
	97	72 hours, static	LOEC=1,000; NOEC=100	Jin-Clark et al., 2008 (105238)	not coded
	97.1	48 hours, static	NOEC=200	Perez et al., 2013 (165182)	not coded
	not reported	96 hours, static	LC50=13,282 (12,612-13,983)	Osano et al., 2002 (65836)	not coded
	87E	48 hours, static	LC50=4,400 (3,200-6,100)	40098001	supplemental
Rusty Crayfish	96.1	96 hours, renewal	LOEC=80; NOEC=70	Cook and Moore, 2008 (109340)	not coded
	NA	96 hours, renewal	LOEC=25	Wolf and Moore, 2002	Not coded
Scud	97.2	96 hours,	LC50=6,000	Wan et al., 2006 (89626)	not coded
Snail	84.4	24 hours, static	NOEC=100	Elias and Bernot, 2017 (175884)	not coded
European Physa	84.4	24 hours, static	LOEC=100	Elias and Bernot, 2017 (175884)	not coded
Eastern oyster	97.3	96 hours, flow through	EC50=1,600 (1,400-1,900), slope=4,970; NOEC=710	43487102	core
Mysid	97.3	96 hours, flow through	LC50=4,900 (4,200-5,900), slope=6,060; NOEC=2,300	43487103	core
S-Metolachlor					
Water flea	97.6	48 hours, static	EC50=26,000[b] (23,000-30,000), slope=9,100; NOEC=4,800	43928912	core
Amphipod	98.4	96 hours, static	EC50=42,900 (40,040-46,530)	Maazouzi et al., 2016 (174634)	not coded
Aquatic Sowbug	98.4	96 hours, static	EC50=11,780 (9,110-14,650)	Maazouzi et al., 2016 (174634)	not coded
Scud	98.4	96 hours, static	EC50=8,470 (6,870-10,430)	Maazouzi et al., 2016 (174634)	not coded
	98.4	96 hours, static	EC50=10,590 (9,390-12,770)		not coded
	98.4	96 hours, static	EC50=11,210 (9,600-13,490)		not coded
Eastern oyster	98.9	96 hours, flow through	EC50=4,000 (3,500-4,100); NOEC=645	46829505	Core

[a]*Value appears in Risk-plots within Chapters 12 & 15*

Among chronic data, a growth and reproduction LOEC of 6,900 ppb and NOEC of 3,200 ppb were applied from a supplemental study (MRID 43802601). Due to variability in the measured concentrations for this study, the LOEC and NOEC endpoints applied are the lowest measured replicate concentration at each respective treatment level (nominal concentrations of 10,000 ppb and 5,000 ppb, respectively).

Effects were observed at relatively low concentrations in several studies investigating impacts to crayfish (Velisek et al. 2018, 2019; Stara et al. 2019; Alacantra et al. 2019). In these studies, 28-45 day exposures resulted in various responses including behavior, growth, development, histopathological changes, and some mortality (Velisek et al. 2019). We recognize the ecological importance of crayfish to aquatic ecosystems and considered these studies, along with all other available prey-related data, while assessing prey-related risk hypotheses for species and designated critical habitat. In assessing the prey-related risk hypotheses we focused on data from species, life stages, and endpoints most closely linked to reductions in salmon prey abundance (thus the water flea NOEC of 3,200 used in the Risk-plots).

Table 160 Chronic toxicity data for aquatic invertebrates exposed to metolachlor.

Species	Purity (%)	Exposure	response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Metolachlor						
Water flea	97	21 days, flow through	Growth and reproduction	LOEC=6,900; NOEC=3,200[b]	43802601	supplemental
	97.2	21 days, flow through		EC50=12,400 (10,300-15,300); NOEC=9,400	46322101	core
	97.2	21 days, flow through		LOEC=9,400; NOEC=4,900		
Crayfish	98.2	NA, flow through	Behavior – increased food consumption	LOEC = 2.0	Alacantra et al. 2019	Not coded
S-Metolachlor						
Midge	98.5	28 days, spiked water, static	Growth	LOEC=7,200; NOEC=3,200	49579501	supplemental
	98.5	30 days, overwater, static	Growth	LOEC>5,300; NOEC=5,300		
Mysid	98.6	28 days, flow through	Growth	LOEC=250; NOEC=130	44995902	core
Water flea	98.9	21 days, flow through	Growth	LOEC=10,000; NOEC=5,170	46829507	Core
	96	21 days,	Population & Reproduction	LOEC=500; NOEC=100	EO83887; Liu et al., 2006 (83887)	Supplemental; Test substance

			Growth	LOEC=1,000; NOEC=500		was not quantified during test, qualitative use in risk characterization
			Survival	LOEC=10,000; NOEC=5,000		
Crayfish	98.2	45-day, semi-static	Survival, Growth, Development, Behavioral	LOEC=1.1	Velisek et al. 2019	Not coded
			Histopathological changes	NOEC=11 LOEC=110		
	98	28-day, semi-static	Hemolymph parameters, oxidative stress	LOEC=4.2	Stara et al. 2019	Not coded
			Histopathological changes	NOEC=4.2 LOEC=42		
Metolachlor oxanilic acid (metabolite)						
Crayfish	98.2	45-day, semi-static	Growth, oxidative stress	LOEC=4.2	Velisek et al. 2018	Not coded
			Development, histopathological changes	NOEC=4.2 LOEC=42		

[b] The Metolachlor Problem Formulation applied the lowest measured concentration at each treatment level due to variability in the measured concentrations.

11.4.6.4 Phytoplankton And Aquatic Vascular Plants

The ECOTOX contained abundant data for aquatic plant life (Table 161). The quality of this data varied, with some studies exposing test organisms to a single metolachlor concentration and more detailed studies, such as Vallotton et al. (2008), which reported responses at several concentrations over multiple points on the pre-exposure-exposure-recovery time scale. The ECOTOX data have not been coded as either core, supplemental, or invalid. Included here, these data place the coded data from the OPP database in context of the breadth of available information, particularly information about nonstandard lab species and the variability in sensitivity even within species groups (e.g., freshwater diatoms within the Larras et al. 2012 study). The lowest EC50 reported in ECOTOX was 50 ppb (St-Laurent et al. 1992) and about half of the EC50s reported in ECOTOX were below 380 ppb.

Table 161. Toxicity data for aquatic plants exposed to metolachlor.

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Metolachlor						
Algae	not reported	91.32 days, lotic	Ecosystem respiration	LOEC=274	Day, 1993 (13325)	not coded
Aquatic Macrophyte	not reported	196 hours, static	Growth	LOEC>3,000, NOEC>3,000	Fairchild et al., 1994 (152770)	not coded
Blue-green algae						
Unspecified species	97.3	5 days, static	Growth and reproduction	EC50=1,200 (900-1,600), slope=1,220, NOEC=63	43487104	core
Anabaena flosaquae (also *Microcystis* sp.)	95	96 hours, static	Population Chl-a	EC50>3,000	Fairchild et al., 1998 (19461)	not coded
Anabaena sp.	not reported	96 hours, static	Abundance	LOEC>3,000, NOEC>3,000	Fairchild et al., 1994 (152770)	not coded
Microcystis sp.			Abundance	LOEC=1,500, NOEC=750		
Chrysophyte	not reported	renewal	Population-growth rate	NOEC=2	Wei et al., 2013 (164067)	not coded
Coon-Tail	95	196 hours, static	Biomass	EC50=70 (62-78)	Fairchild et al., 1998 (19461)	not coded
	not reported	196 hours, static	Growth	LOEC=94, NOEC=47	Fairchild et al., 1994 (152770)	not coded
Diatoms						
Skeletonema marinoi		9 days, static		LOEC=15, NOEC=5		not coded

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
	not reported		Photosynthesis and population growth rate		Fiori and Pistocchi, 2014 (166984)	
Ulnaria ulna	98	96 hours, static	Population Chl-a	EC05=60 (52-68) EC50=3,314 (2609-3570)	Larras et al., 2012 (161002)	not coded
Achnanthidium minutissimum, Cyclotella meneghiniana, Encyonema silesiacum, Gomphonema parvulum, and *Mayamaea fossalis*	98	96 hours, static	Population Chl-a	EC05= 54 to 5,957 EC50= 3,476 to 10,313		
Eolimna minima, Fragilaria capucina ssp. *Rumpens, Nitzschia palea,* and *Fragilaria capucina* var. *vaucheriae*	98	96 hours, static	Population Chl-a	EC50>50,000		
Duckweed	95	96 hours, static	Abundance	EC50=360 (323-398)	Fairchild et al., 1998 (19461)	not coded
	97.3	196 hours, static	Growth and reproduction	EC50=48 (43-56), NOEC=8	43487105	core
	not reported	96 hours, static	Population changes	EC50=343 (187-872), LOEC=375, NOEC=187	Fairchild et al., 1997 (18093)	not coded
			Abundance	LOEC=375, NOEC=187	Fairchild et al., 1994 (152770)	not coded
		Static	Biomass	LOEC=75, NOEC=187	Fairchild et al., 1997 (18093)	not coded

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Floating Moss	not reported	28 days, static	Population Biomass	EC50=150	Goncz and Sencic, 1994 (13738)	not coded
Freshwater diatom	97.3	5 days, static	Growth and reproduction	EC25=42[a]; EC50=380 (270-560) slope=890, NOEC=4	43541302	core
Green algae	97.3	5 days, static	Growth and reproduction	EC50=10 (6-20), slope=1,700, NOEC=1	43541301	core
Chlamydomonas moewusii	95	12 days, static	Biomass and growth rate	LOEC=6,300, NOEC=63	Kotrikla et al., 1997 (178703)	not coded
Chlamydomonas reinhardtii	95	96 hours, static	Population Chl-a	EC50=1,138 (987-1290)	Fairchild et al., 1998 (19461)	not coded
Chlamydomonas sp.	not reported	96 hours, static	Abundance	LOEC=375, NOEC=188	Fairchild et al., 1994 (152770)	not coded
Chlorella fusca	95	12 days, static	Biomass, growth rate and abundance	EC50=101 to 108	Kotrikla et al., 1997 (20116)	not coded
Chlorella fusca ssp. *fusca*	95	96 hours, static	Population growth rate	EC50=157 to 178	Kotrikla et al., 1999 (174736)	not coded
Chlorella fusca var. *vacuolata*	97	24 hours, static		EC50=232 (217-247), NOEC=120	Junghans et al., 2006 (163051)	not coded
Chlorella pyrenoidosa	50	96 hours, static		EC50=12,704	Ma et al., 2002 (158793)	not coded
	96	96 hours, static	Abundance	EC50=152, Chl-a	Liu and Xiong, 2009 (118860)	not coded
	not reported	0.67 hours static	Photosynthesis	LOEC=28,380, NOEC=2,838	Pillai and Davis, 1975 (41594)	not coded

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
	not reported	1 hour static		LOEC=2,838, NOEC=284		
	not reported	1.3 to 2.3 hours		LOEC=28,380, NOEC=2,838		
Chlorella sp.	not reported	96 hours, static	Abundance	LOEC=150, NOEC=75	Fairchild et al., 1994 (152770)	not coded
Chlorella vulgaris	50	96 hours, static	Population growth rate	EC50=18,926	Ma et al., 2002 (65938)	not coded
	95	96 hours, static	Population Chl-a	EC50=203 (160-246)	Fairchild et al., 1998 (19461)	not coded
Pseudokirchneriella subcapitata	50	96 hours, static	Abundance	EC50=5,508	Ma et al., 2006 (83543)	not coded
	95	48 hours, static	Population growth rate	EC10=14 (5-36), EC50=210 (140-310)	Kusk et al., 2018 (180320)	not coded
	95	96 hours, static	Population Chl-a	EC50=84 (72-95)	Fairchild et al., 1998 (19461)	not coded
	97.1	48 hours	Population growth rate	EC50=159	Perez et al., 2011 (165277)	not coded
	97.1	72 hours		EC50=98, LOEC=77, NOEC=25		
	not reported	72 hours, static	Abundance	EC50=72 (44-119), NOEC=30	Sbrilli et al., 2005 (98204)	not coded
		96 hours, static	Population changes	EC50=77 (70-84), LOEC=75, NOEC=38	Fairchild et al., 1994 (152770)	not coded

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
		96 hours, static	Abundance	EC50=50.9-55.5	St. Laurent et al., 1992 (45196)	not coded
		static	Biomass	LOEC=75, NOEC=38	Fairchild et al., 1997 (18093)	not coded
Scenedesmus acutus var. *acutus*	50	96 hours, static	Population growth rate	EC50=19,381	Ma and Liang, 2001 (61984)	not coded
Scenedesmus quadricauda	50	96 hours, static		EC50=600	Ma et al., 2003 (71458)	not coded
			Population Chl-a	EC50>3,000	Fairchild et al., 1998 (19461)	not coded
Scenedesmus sp.	97	24 hours, static	Abundance	EC50=232, NOEC=120	Junghans et al., 2003 (73426)	not coded
	not reported	96 hours, static		LOEC>3,000, NOEC>3,000	Fairchild et al., 1994 (152770)	not coded
Marine diatom	97.3	5 days, static	Growth and reproduction	EC50=61 (49-76), slope=1,000, NOEC=2	43487106	core
Pennate Diatom	98	96 hours, static	Population Chl-a	EC05=2,575 (1729-2999), EC50=30,147 (17,134-44,657)	Larras et al., 2012 (161002)	not coded
Plant Kingdom	97.1	16 - 36 days, lentic	Population Chl-a and Biomass	NOEC=7.4	Relyea, 2009 (114296)	not coded
Sago Pondweed	not reported	3 hours static	Photosynthesis	IC50>10, LOEC=5	Fleming et al., 1995 (70739)	not coded
Two-Leaf Water-Milfoil	95	196 hours, static	Population Biomass	EC50>3,000	Fairchild et al., 1998 (19461)	not coded

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Water Milfoil	98	196 hours, static	Growth (various conditions)	IC25=150-675, IC50=580-1,896, NOEC=36.9-2,990,	Roshon, 1997 (74985)	not coded
	not reported	196 hours, static	Growth	LOEC>3,000, NOEC>3,000	Fairchild et al., 1994 (152770)	not coded
Water Nymph	95	196 hours, static	Population Biomass	EC50=242 (164-321)	Fairchild et al., 1998 (19461)	not coded
	not reported	196 hours, static	Growth	LOEC>750, NOEC>750	Fairchild et al., 1994 (152770)	not coded
Waterweed	95	196 hours, static	Population Biomass	EC50=2,355 (2,118-2,593)	Fairchild et al., 1998 (19461)	not coded
S-Metolachlor						
Wavyleaf Sealavender	not reported	29 days, foliar spray and 39 days, direct application	Growth	NOEC=2	Gilreath, 1985 (121097)	not coded
Blue-green algae	98.9	96 hours, static	Growth and reproduction	EC50=21,000 (19,000-23,000), slope=5,680, NOEC=9,600	46829510	core
Diatom Class	not reported	6 days, static	Cell density	NOEC< and LOEC= from t0=5.1 to 1.6 ppb at day 6	Debenest et al., 2009 (118861)	not coded
	not reported	72 hours exposed, 72 hours recovery, static	Cell density	NOEC from t0=24.2 to 1.8 ppb at day 6		

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Diatom Family	not reported	96 hours, static	Population Chl-a	EC50=10,271 (6,642-15,279), EC50=5,888 (4,337-7,607)	Roubeix et al., 2012 (178311)	not coded
Diatom: *Nitzschia obtusa* var. *nana*	not reported	96 hours, static	Population Chl-a	EC50~18,000, EC50=18,179 (15,823-20,522), EC50=20,580 (18,966-22,072), LOEC=11,850	Roubeix et al., 2012 (178311)	not coded
Duckweed	97.6	14 days, static	Growth and reproduction	EC25=13[a]; EC50=23 (frond density); EC50=31 (frond biomass)	43928931	core
	87.4	7-day, semi-static	Growth	EC50 growth rate/yield = 133/37 (frond numbers); EC50 growth rate/yield = >916/75 (dry weight)[b]	Eckenstein, 2014	not coded
Freshwater diatom	98.9	96 hours, static	Growth and reproduction	EC50=18,000 (17,000-20,000), slope=3,730, NOEC=4,080	46829509	core
Green algae	97.6	5 days, static	Growth and reproduction	EC25=4.8[a]; EC50=8 (2.6-25) slope=3, NOEC=2	43928929	core

Species	Purity (%)	Exposure	Response	Endpoint (ppb)	MRID or ECOTOX reference	EPA data quality designation
Chlamydomonas reinhardtii	not reported	48 hours, static	Reproduction	EC50=1,958 (1,760-2,157)	Korkaric et al., 2015 (172697)	not coded
C. reinhardtii strains	not reported	48 hours, static	Population growth rate	EC50=1,419 to 7,265	Fischer et al., 2012 (172723)	not coded
Chlorella fusca var. *vacuolata*	98.4	24 hours, static (t_0 to t_{24})	Population growth rate	EC50=341 (300-389) EC50s for segments within exposure period	Vallotton et al., 2008 (112203)	not coded
Chlorella pyrenoidosa	96	96 hours, static	Abundance	EC50=68	Liu and Xiong, 2009 (118860)	not coded
Scenedesmus acutus var. *acutus*	96	96 hours, static	Population growth rate	EC50=156 (107-227)	Bian et al., 2009 (118780)	not coded
Pseudokirchneriella subcapitata	88.7	96 hours, static	Growth	EC50 = 32 (biomass), 77 (growth rate)[c]	Memmert, 2006	not coded
Marine diatom	97.6	5 days, static	Growth and reproduction	EC50=110 (91-128), NOEC=21	43928930	core
Red foxtail watermilfoil	98.9	21 days, static renewal	Growth and reproduction	EC50>1,000, NOEC<100	46861401	core

[a] *Value appears in Risk-plots within Chapters 12 & 15*

[b] *Recovery after continuous exposure to test concentrations observed after 2-6 weeks.*

[C] *Recovery observed after 3-12 days following exposure to highest test concentration.*

11.4.6.5 Terrestrial (Riparian) Vegetation

Riparian vegetation is important for providing shade to the stream, stabilizing the stream banks, reducing sedimentation, and providing organic material inputs, both in terms of plant material and terrestrial insects. Riparian vegetation is a major focus of restoration efforts within California, and when present can reduce pesticide loading into aquatic resources. Riparian vegetation is an important assessment endpoint for herbicidal impacts on salmon habitats. Generally, there are sparse data regarding the effects of herbicides (and much less with insecticides, arachnicides, or miticides) on wild plants within riparian systems, other than weed species. The EPA requires submission of crop effects data as part of the registration process for herbicides. This information currently provides the only basis for evaluating effects on herbaceous plants unless data are available from other sources. The overall assumption is that the sensitivity of plant species tested (typically plants used in agriculture) in the registrant-provided guideline studies will be representative of riparian species. There is no way to know this is the case, therefore a high degree of uncertainty regarding the toxicity of the a.i.s to riparian vegetation exists.

The standardized and coded studies from the OPP database (Table 162) show that metolachor is generally more toxic to monocot seedling emergence and vegetative vigor than dicots with the most sensitive endpoint being dry weight. S-metolachlor seedling emergence EC25 concentrations for both dicots and monocots were an order of magnitude lower than seedling emergence EC25s for metolachlor. Shoot weight was the most sensitive endpoint for dicots and visible evidence of toxicity was the most sensitive endpoint for monocots. Visible evidence of toxicity was the sensitive endpoint for both dicot and monocots in vegetative vigor tests. At >0.02 pounds per acre for both dicots and monocots, the seedling emergence EC25s for S-metolachlor emulsified concentrate did not differ greatly from the metolachlor seedling emergence EC25s. The EC25s for vegetative vigor were an order of magnitude higher at >0.533 and >0.357 for dicots and monocots, respectively. The LOECs for seedling emergence ranged from 1.3 to 2.7 pounds per acre for Stoke's aster.

Table 162 Toxicity of metolachlor to terrestrial plants**.**

Study Type	*% AI*	*Species roup*	*Lowest EC_{25} (lb ai/A)*	*Most Sensitive Endpoint*	*MRID #*	*EPA data quality designation*
Metolachlor						
seedling emergence	*97.3*	*dicots* *monocots*	*>0.09 (n=6)* *>0.02 (n=4)*	*dry weight*	*43487107*	*core*
vegetative vigor	*97.3*	*dicots*	*>0.03 (n=6)*	*dry weight*	*43487108*	*core*

		monocots	>0.016 (n=4)			
S-Metolachlor						
seedling emergence	97.6	dicots monocots	>0.0057 (n=2) >0.0048 (n=4)	shoot weight toxicity/chlorosis	43928932	Supplemental
vegetative vigor	97.6	dicots monocots	>0.27 (n=2) >0.021 (n=4)	toxicity/chlorosis	43928933	Supplemental
S-Metolachlor EC						
seedling emergence	86.3	dicots monocots	>0.021 (n=6) >0.0223 (n=6)	shoot weight	49930012[a]	core
vegetative vigor	86.3	dicots monocots	>0.533 (n=6) >0.357 (n=6)	shoot height shoot weight	49930013[a]	core

[a]Values in this study appear in Risk-plots within Chapters 12 & 15

Data for terrestrial plants reported in ECOTOX as growth or population response EC50s ranging from 0.0022 pounds per acre for foxglove to 3.6 pounds per acre for bachelors button, a LOEC from the same study at 0.022 pounds per acre for catmint (artificial soil, Boutin et al. 2004) up to 3.6 pounds per acre for soybean (field exposure, Bowman 1985) and NOECs from 0.022 pounds per acre for black bindweed (artificial soil, Boutin et al. 2004) up to 8.8 pounds per acre for holly (natural soil, field exposure, Catanzaro et al. 1993). While these endpoints are not relatable to the endpoint data for the coded studies in the OPP database, they illustrate the breadth in response thresholds among non-standard test species and study designs and illustrate that the controlled studies reported in the OPP database are representative of the most sensitive responses.

11.4.6.6 Field Studies

Field studies on the effects of metolachlor or S-metolachlor on aquatic life were not identified in the ECOTOX or a search of the open literature.

11.4.6.7 Field Incidents

The Metolachlor Draft Ecological Risk Assessment summarized the results of an Incident Data System (IDS) query conducted on 6/5/2019. The IDS is an integrated summary of the EIIS and aggregate incident reports submitted by registrants to EPA since registration. The search returned a total of 623 reported ecological incidents associated with the use of S-metolachlor and metolachlor, most of which were reviewed in the Metolachlor Problem Formulation. Reports include 14 fish incidents; however, there is little other information on these and most are classified as unlikely or possible and involved products that included other active ingredients (e.g., atrazine). A few of the fish incidents, classified as highly-probable or probable, indicated metolachlor as the cause of fish kills following mis-use, no other details were provided. A total of 597 incidents were related to crop (e.g., corn, cotton, and soybean) damage following direct treatment of an agricultural field. While these incidents represent evidence of environmental exposures to metolachlor, NMFS does not consider them contributing appreciably to the effects of the action.

11.4.6.8 Bioconcentration And Bioaccumulation

Bioconcentration and bioaccumulation information is not typically reported in the OPP database. The ECOTOX database includes three records for accumulation of metolachlor, but the controls for these studies were considered to be insufficient and magnification factors were not calculated. Compounds with a log KOW of three and above are generally considered to have the potential to bioconcentrate in aquatic organisms. The potential for bioconcentration of metolachlor in organisms is considered low given the measured bioconcentration factor (BCF) of 69X in fish and depuration value of 93% in 14 days once fish were transferred to untreated water. (MRID 41154201). The Metolachlor Draft Risk Assessment concluded that, based on the octanol-water partition coefficient (KOW) of 3.05, there is potential for exposure to sediment dwelling organisms.

11.4.6.9 Degradate Toxicity

In evaluating the toxicity data for these structurally similar metabolites, EPA's 2019 Draft Risk Assessment concluded that they are far less toxic than the parent metolachlor and were thus not residues of concern for ecological exposure. Accordingly, NMFS did not include these metabolites in its analyses.

11.5 Assessing Risk

Population Models

Sufficient data were available to construct population models for four Pacific salmon life history strategies. We ran life-history matrix models for ocean-type and stream-type Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and sockeye salmon (*O. nerka*). The basic salmonid life history we modeled consisted of hatching and rearing in freshwater, smoltification in estuaries, migration to the ocean, maturation at sea, and returning to the natal freshwater stream for spawning followed shortly by death. An acute toxicity model was constructed that estimated the population-level impacts of sub-yearling juvenile mortality resulting from exposure. For specific information on the construction and parameterization of the models see Appendix A. Potential population-level impacts resulting from mortality following freshwater exposure to pesticides were integrated into the models as alterations in the first year survival rate. We also evaluated population level responses resulting from varying the proportion of the population exposed.

Population level impacts were assessed as changes in the intrinsic population growth rate and quantified as the percent change in population growth rate. The results of the models are shown in Table 163, Table 164, Table 165, and Table 166. Changes that exceeded the variability in the baseline (*i.e.,* a standard deviation) were considered to be different. Importantly, the acute toxicity models excluded sublethal and indirect effects of the pesticide exposures. For example, the potential population-level impacts of reduced prey abundance are not captured by these models.

Table 163. Acute mortality model output for ocean-type Chinook. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rate of greater than one standard deviation from control values. The baseline values for ocean-type Chinook are: lambda=1.09, standard deviation of 0.1, standard deviation as a percent of lambda is 9, and first year survival S1=5.64E-03. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (12.9)	0 (12.9)	-1 (12.8)	-1 (12.8)	-1 (12.7)
10	0 (130)	-1 (12.9)	-1 (12.8)	-3 (12.6)	-3 (12.4)
15	0 (12.9)	-1 (12.9)	-2 (12.8)	-4 (12.5)	-5 (12.2)
20	-1 (13.0)	-2 (13.0)	-3 (12.9)	-5 (12.5)	-6 (12.1)
25	-1 (13.1)	-2 (13.0)	-4 (13.3)	-6 (12.7)	-8 (11.8)
30	-1 (13.0)	-2 (13.3)	-5 (13.4)	-8 (12.7)	**-10 (11.5**)
35	-1 (13.3)	-3 (13.8)	-6 (13.9)	**-9 (13.0)**	**-12 (11.4)**
40	-1 (13.4)	-3 (14.0)	-7 (14.3)	**-11 (13.5)**	**-14 (11.1)**
45	-1 (133.6)	-4 (14.3)	-8 (15.4)	**-13 (14.1)**	**-16 (10.7)**
50	-2 (13.6)	-5 (14.9)	**-9 (16.0)**	**-15 (15.3)**	**-18 (10.5)**
55	-2 (14.0)	-5 (15.5)	**-11 (17.5)**	**-17 (16.5)**	**-21 (10.2)**
60	-2 (14.2)	-6 (16.9)	**-12 (18.6)**	**-20 (17.9)**	**-23 (9.7)**
65	-2 (14.3)	-7 (16.9)	**-14 (19.8)**	**-22 (19.1)**	**-26 (9.5)**
70	-3 (14.6)	-7 (17.8)	**-16 (21)**	**-24 (20.3)**	**-29 (8.9)**

75	-3 (15.2)	-8 (18.4)	**-17 (22.1)**	**-27 (21.6)**	**-33 (8.5)**
80	-3 (15.3)	**-9 (19.7)**	**-18 (23.2)**	**-30 (22.3)**	**-37 (8.1)**
85	-4 (15.8)	**-10 (20.4)**	**-20 (24)**	**-32 (23.1)**	**-42 (7.3)**
90	-4 (16.1)	**-10 (21.5)**	**-21 (24.9)**	**-34 (23.4)**	**-48 (6.6)**
95	-4 (16.5)	**-11 (22.7)**	**-22 (25.3)**	**-36 (23.2)**	**-56 (5.5)**
100	-4 (17.1)	**-12 (23.0)**	**-23 (25.9)**	**-38 (23.6)**	**-100 (NA)**

Table 164. Acute mortality model output for stream-type Chinook. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rate of greater than one standard deviation from control values. The baseline values for stream-type Chinook are: lambda=1.00, standard deviation of 0.03, standard deviation as a percent of lambda is 3, and first year survival S1=6.43E-03. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (4.4)	0 (4.4)	-1 (4.4)	-1 (4.4)	-1 (4.3)
10	0 (4.5)	-1 (4.5)	-1 (4.5)	-2 (4.4)	**-3 (4.3)**
15	0 (4.6)	-1 (4.7)	-2 (4.7)	**-3 (4.6)**	**-4 (4.2)**
20	-1 (4.7)	-1 (4.9)	**-3 (5.1)**	**-4 (4.8)**	**-5 (4.1)**
25	-1 (4.8)	-2 (5.1)	**-3 (5.5)**	**-6 (5.1)**	**-7 (4.1)**
30	-1 (4.9)	-2 (5.6)	**-4 (6.0)**	**-7 (5.6)**	**-8 (4.0)**
35	-1 (5.1)	-2 (6.0)	**-5 (6.8)**	**-8 (6.1)**	**-10 (4.0)**
40	-1 (5.4)	**-3 (6.5)**	**-6 (7.5)**	**-10 (6.9)**	**-12 (3.9)**
45	-1 (5.6)	**-3 (7.0)**	**-7 (8.5)**	**-11 (7.8)**	**-14 (3.7)**
50	-2 (5.8)	**-4 (7.5)**	**-8 (9.8)**	**-13 (9.3)**	**-16 (3.7)**
55	-2 (6.2)	**-4 (8.3)**	**-9 (11.1)**	**-15 (10.9)**	**-18 (3.6)**

60	-2 (6.5)	**-5 (9.3)**	**-11 (13.0)**	**-17 (13.1)**	**-20 (3.5)**
65	-2 (6.9)	**-6 (10.1)**	**-12 (14.7)**	**-19 (14.7)**	**-23 (3.4)**
70	-2 (7.2)	**-6 (11.1)**	**-13 (15.7)**	**-22 (16.7)**	**-26 (3.2)**
75	**-3 (7.7)**	**-7 (12.4)**	**-15 (17.5)**	**-24 (17.9)**	**-29 (3.1)**
80	**-3 (8.1)**	**-8 (13.5)**	**-15 (18.3)**	**-27 (18.8)**	**-33 (2.9)**
85	**-3 (8.6)**	**-8 (14.6)**	**-17 (19.3)**	**-29 (19.7)**	**-37 (2.7)**
90	**-3 (9.1)**	**-9 (15.4)**	**-18 (20.2)**	**-30 (20.0)**	**-43 (2.4)**
95	**-4 (9.5)**	**-10 (16.4)**	**-20 (21.1)**	**-32 (20.2)**	**-52 (2.0)**
100	**-4 (10.3)**	**-11 (17.6)**	**-21 (21.4)**	**-33 (20.0)**	**-100 (NA)**

Table 165. Acute mortality model output for sockeye. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rate of greater than one standard deviation from control values. The baseline values for sockeye are: lambda=1.01, standard deviation of 0.06, standard deviation as a percent of lambda is 6, and first year survival S1=2.57E-02. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (8.0)	0 (7.9)	-1 (7.9)	-1 (7.8)	-1 (7.8)
10	0 (8.0)	-1 (8.0)	-1 (8.0)	-2 (7.9)	-3 (7.7)
15	0 (8.0)	-1 (8.0)	-2 (8.1)	-3 (7.9)	-4 (7.7)
20	-1 (8.0)	-1 (8.2)	-3 (8.2)	-4 (8.1)	-5 (7.5)
25	-1 (8.1)	-2 (8.4)	-3 (8.5)	-5 (8.2)	**-7 (7.4)**
30	-1 (8.2)	-2 (8.8)	-4 (9.0)	**-7 (8.4)**	**-8 (7.3)**
35	-1 (8.4)	-2 (8.9)	-5 (9.6)	**-8 (8.8)**	**-10 (7.1)**
40	-1 (8.6)	-3 (9.2)	**-6 (10.1)**	**-9 (9.6)**	**-11 (7.0)**
45	-1 (8.7)	-3 (9.7)	**-7 (10.9)**	**-11 (10.4)**	**-13 (6.9)**

50	-1 (9.0)	-4 (10.4)	**-8 (12.0)**	**-13 (11.2)**	**-15 (6.7)**
55	-2 (9.2)	-4 (10.9)	**-9 (13.4)**	**-15 (12.9)**	**-17 (6.5)**
60	-2 (9.4)	-5 (11.9)	**-10 (14.4)**	**-17 (14.4)**	**-19 (6.4)**
65	-2 (9.7)	-5 (12.3)	**-12 (16.1)**	**-19 (15.7)**	**-22 (6.2)**
70	-2 (10.0)	**-6 (13.4)**	**-13 (16.9)**	**-21 (17.3)**	**-25 (5.9)**
75	-3 (10.4)	**-7 (14.3)**	**-14 (18.2)**	**-23 (18.1)**	**-28 (5.6)**
80	-3 (10.9)	**-8 (15.6)**	**-16 (19.0)**	**-26 (19.1)**	**-32 (5.4)**
85	-3 (11.3)	**-8 (16.3)**	**-17 (19.9)**	**-28 (19.7)**	**-39 (5.0)**
90	-3 (11.6)	**-9 (17.0)**	**-18 (20.8)**	**-29 (19.8)**	**-42 (4.5)**
95	-3 (12.3)	**-10 (17.7)**	**-19 (20.9)**	**-30 (19.9)**	**-51 (3.8)**
100	-4 (12.7)	**-10 (18.3)**	**-20 (21.5)**	**-32 (19.8)**	**-100 (NA)**

Table 166. Acute mortality model output for coho. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rate of greater than one standard deviation from control values. The baseline values for coho are: lambda=1.03, standard deviation of 0.05, standard deviation as a percent of lambda is 5, and first year survival S1=2.97E-02. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (7.4)	0 (7.5)	-1 (7.5)	-1 (7.4)	-2 (7.4)
10	0 (7.5)	-1 (7.6)	-2 (7.6)	-3 (7.4)	-3 (7.2)
15	0 (7.6)	-1 (7.7)	-3 (7.8)	-4 (7.5)	**-5 (7.1)**
20	-1 (7.7)	-2 (8.0)	-4 (8.1)	**-6 (7.7)**	**-7 (7.0)**
25	-1 (7.9)	-2 (8.4)	**-5 (8.5)**	**-7 (8.0)**	**-9 (6.9)**
30	-1 (7.9)	-3 (8.5)	**-6 (9.1)**	**-9 (8.4)**	**-11 (6.6)**
35	-1 (8.2)	-3 (9.2)	**-7 (9.9)**	**-11 (8.9)**	**-13 (6.5)**

40	-1 (8.5)	-4 (9.7)	**-8 (10.7)**	**-13 (9.8)**	**-16 (6.4)**
45	-2 (8.8)	-4 (10.3)	**-9 (11.8)**	**-14 (11.0)**	**-18 (6.1)**
50	-2 (9.1)	**-5 (11.1)**	**-10 (13.4)**	**-17 (12.2)**	**-21 (5.9)**
55	-2 (9.5)	**-6 (11.7)**	**-12 (14.9)**	**-20 (14.2)**	**-23 (5.8)**
60	-3 (9.9)	**-6 (12.6)**	**-14 (17.0)**	**-23 (16.5)**	**-26 (5.5)**
65	-3 (10.3)	**-7 (14.1)**	**-15 (18.5)**	**-25 (18.7)**	**-30 (5.3)**
70	-3 (10.7)	**-8 (15.1)**	**-17 (20.6)**	**-28 (20.6)**	**-33 (5.0)**
75	-3 (11.2)	**-9 (16.4)**	**-19 (22.3)**	**-31 (22.4)**	**-37 (4.7)**
80	-4 (11.6)	**-9 (17.7)**	**-20 (23.6)**	**-34 (23.7)**	**-42 (4.4)**
85	-4 (12.3)	**-11 (19.3)**	**-22 (25.0)**	**-37 (24.5)**	**-47 (4.0)**
90	-4 (12.9)	**-12 (20.4)**	**-24 (26.0)**	**-39 (25.2)**	**-54 (3.4)**
95	-4 (13.4)	**-13 (21.6)**	**-25 (27.3)**	**-42 (25.2)**	**-63 (2.8)**
100	**-5 (14.1)**	**-14 (22.9)**	**-27 (27.6)**	**-43 (25.7)**	**-100 (NA)**

In analyzing risk, we integrate the exposure and response information to evaluate the likelihood of adverse effects from stressors of the action at the population and species level. We use two tools to integrate exposure and response. Risk-plots and where applicable, population models. A weight-of-evidence approach which considers the limitations and uncertainties inherent in the available information is then applied to characterize risk. Whenever possible, most sensitive toxicological endpoints used in the Risk-plots are from those studies that were conducted on species with best fit as surrogates to Pacific Salmonids (e.g. rainbow trout).

The following risk hypotheses for the effects of 1,3-D and metolachlor on Pacific salmonids (chum, chinook, coho, sockeye, steelhead) are based on the life history, exposure, and response considerations described in the previous sections of this chapter.

11.5.1.1 Risk Hypotheses

Salmonid:

1. Exposure to the pesticide is sufficient to reduce abundance via acute lethality.
2. Exposure to the pesticide is sufficient to reduce abundance via reduction in prey availability.
3. Exposure to the pesticide is sufficient to reduce abundance via impacts to growth (direct toxicity).

4. Exposure to the pesticide is sufficient to reduce productivity via impairments to reproduction.
5. Exposure to the pesticide is sufficient to reduce abundance and productivity via impairments to ecologically significant behaviors.

Critical Habitat:

1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

Mixtures:

1. Mixtures: Formulated products and tank mixtures containing the active ingredient are anticipated to increase the risk of effects to fish in freshwater habitats.

11.6 Weighing the uncertainties in the best commercial and scientific information

All estimates of exposure and response must rely on assumptions with associated uncertainties that may contribute to the possibility of overestimating or underestimating risk, or in some circumstances may do either. Uncertainties may be due to natural variability, lack of knowledge, measurement error, or model error. Accounting for uncertainty is critical when weighing model outputs and when applying outputs in risk conclusions. This section describes how we utilized a variety of tools with different assumptions to increase our confidence in risk estimates, and how we weighed key assumptions and associated uncertainties of our risk assessment to reach conclusions consistent with the purpose of Section 7(a)(2)[20]. In Table 167, we identify key assumptions associated with estimates utilized in our assessment of the effects of the action. X's indicate if the assumption contributes to the possibility that risk will be underestimated or overestimated. In some cases, the assumption may contribute to the possibility of either underestimating or overestimating risk, depending on the specific circumstances being evaluated. In succeeding paragraphs below the table we discuss how these assumptions and associated uncertainties are factored into our weight-of-evidence approach presented in the risk characterization section below.

Table 167. Assessment assumptions and influence on risk estimates

Assumption (estimate)	Underestimate Risk	Overestimate Risk
1. Pesticide application rates- Pesticides will be applied at the highest labeled rate for the use site or crop grouping (EECs)		X

[20] Section 7(a)(2) of the ESA requires consultation with the Services by a Federal agency to insure a Federal action authorized, funded, or carried out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such a species.

Assumption (estimate)	Underestimate Risk	Overestimate Risk
2. Treatment of authorized use sites- Pesticides may be applied on authorized use sites (Risk-plot)		X
3. Annual maximal exposures– the risk calculation only considers the likelihood of exposure to maximum annual values (e.g. 24-hr EEC). It does not account for effects over the full effective range of predicted exposures (Risk-plot)	X	
4. GIS data layers accurately represent the presence and absence of use sites (pesticide/species overlap analysis)	X	X
5. Exposure to multiple stressors do not increase risk – The risk estimates or information do not account for other real world stressors known to exacerbate response (e.g. temperature, other pesticides, etc.) (Risk-plot)	X	
6. Species surrogacy – The sensitivity of endangered species and their prey to pesticide exposure is comparable to that of available surrogate species (Risk-plot)	X	X
7. Exposure estimates accurately predict pesticide concentrations in habitats relevant to listed species (EECs, Risk-plot)	X	X
8. Responses to pesticides that degrade over time in the environment can be accurately predicted using toxicity data generated under test conditions that maintain concentrations at relatively constant concentrations (EECs, Risk-plot, Population models).	X	X

Assumption (estimate)	Underestimate Risk	Overestimate Risk
9. Effects to essential behaviors are assumed to have fitness consequences regardless of the presence/absence of a quantitative link to an apical endpoint (mortality, reproduction, or growth).	X	X

1) Pesticide application rate assumptions tend to **overestimate** risk: Exposure estimates assume the pesticides are applied at the highest labeled rate for a particular crop, crop grouping, or other use site. This assumption contributes to the possibility that exposure and risk will be overestimated because applications may occur at lower than maximum rates. However, EPA's proposed action encompasses all uses authorized by approved product labels, so this assumption is needed to determine whether label requirements are likely to avoid jeopardy to listed species and adverse modification to designated critical habitat and to "ensure that no potentially unsafe pesticide applications are ignored" (NRC NAS 2013).

2) Treatment of authorized use sites assumptions tend to **overestimate** risk: Treatment of authorized use sites assumptions tend to overestimate risk: Risk-plots display exposure estimates for aquatic habitats adjacent to treated uses sites. In order to evaluate the full extent of EPA's authorization of pesticide use, we assume that pesticide treatment may occur to any use site authorized by product labeling. This assumption contributes to the possibility that exposure and risk may be overestimated. However, we do not assume that usage will occur everywhere that an authorized use site exists, nor do we assume that all usage occurs at the same day and time. Instead, we consider that pesticides may be applied to any authorized use site/location during the 15-year action. This distinction, between "will be applied to every" and "may be applied to any", is important in understanding the assumptions of our analysis. When we consider the extent of authorized use sites within a species range (e.g. acres of corn), we do not make the assumption that pesticides will be applied to every acre of corn. Instead, we assume that: 1) the pesticide may be applied to any acre of corn 2) the greater the extent of corn acres in the species range equates to a greater chance that application may occur in close proximity to species habitat. Our risk characterization incorporates a number of factors to characterize the likelihood of exposure to the concentrations predicted by modeling (e.g. spatial overlap of use sites with range of species, seasonal overlap in use and presence of species, persistence of the compound, number of applications, and the duration of the species residency in areas where treatment may occur). Uncertainties associated with each of these factors are incorporated into the confidence rankings that qualify each risk estimate. For example, we consider usage data compiled by EPA to help characterize the

uncertainty associated with the spatial overlap analysis. In this way, evidence that pesticide usage within a species range is probable represents one factor considered in the confidence rankings to evaluate each risk hypothesis (see Chapter 4 for details regarding the likelihood of exposure assessment).

3) Annual maximum exposure assumptions tend to **underestimate** risk: Risk-plots display annual time-weighted average concentrations for different durations (peak 1-day, 4-day, and 21-day EECs). However, exposure to lesser concentrations (submaximal) can also contribute to risk (Figure 58). While the maximum daily peak occurs one day a year, toxic residues may persist for days, weeks, or months, depending on the frequency of repeated applications and the persistence of the pesticide. The focus on annual maximum exposures de-emphasizes the range of submaximal exposures which may also be expected to cause mortality and other adverse effects, and thus contributes to the likelihood that risk will be underestimated. Therefore, to mitigate the impact of this assumption, chemical persistence and the number of applications allowed were adopted as factors in our analysis to weigh the likelihood of exposure.

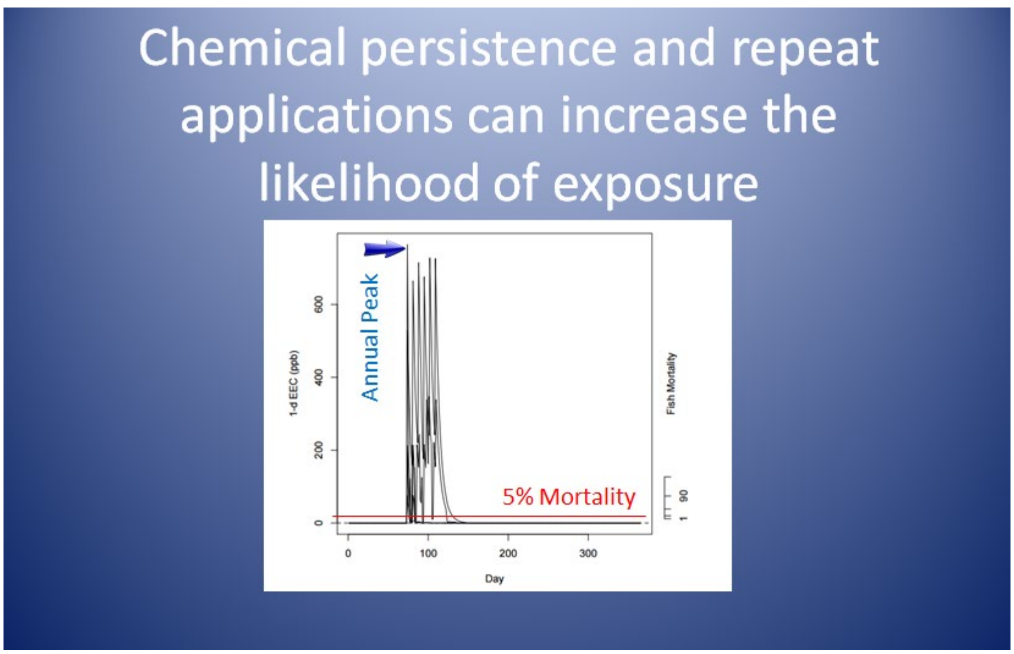


Figure 58. Conditions conducive to mortality and other adverse effects may persist for months due to the combinations of a chemical's persistence and repeat applications. The time series plot presented here is for illustrative purposes only and does not represent metolachlor or 1,3-D.

4) GIS data layer assumptions may **overestimate or underestimate** risk: Our analysis relies on GIS data layers representing land use classifications which we use as surrogates for locations where pesticides can be applied (pesticide use sites). Three issues arise that may contribute to an over- or under-estimate of risk.
   a. Accuracy of data layers. The GIS data layers contain inaccuracies, for example, local knowledge suggests that land use type is sometimes misclassified. The extent of the inaccuracies is uncertain as information quantifying the level of

inaccuracy is available for only a subset of the layers relied upon. The Cropland Data Layer (CDL) has over 100 different cultivated classes which were grouped by USEPA in order to reduce the likelihood of errors of omission and commission between similar crop categories. CDL groupings were designed to minimize uncertainties, however they also introduce the possibility that overlap percentages include uses for which metolachlor and/or 1,3-D have not been registered. Although we have confidence that registered use sites occur within the GIS layers, the extent and specific location of those use sites are somewhat less certain. We considered these uncertainties when evaluating the GIS layers as part of our "likelihood of exposure" analysis.

b. The estimates of acreage of use sites within a species range presented in Risk-plots rely on an assumption that recent land use (sampling from a 6-year data set) will represent future land use over the next 15 years. This assumption is uncertain as changes in cropping patterns and other land uses may contribute to assessment inaccuracies.

c. Data layer availability. In evaluating percent overlap we considered how well the available use-data-layer represented the labeled uses and, where feasible, made adjustments to the percent overlap value. Some 1,3-Dichloropropene labels approve applications to broadly defined use sites which required the evaluation of multiple GIS layers. For example, 1,3-Dichloropropene is approved for use on "field crops" which we assessed by evaluating 6 different CDL layers: corn, cotton, other grains, pasture, soybeans, and wheat. These GIS overlap layers are not always mutually exclusive of each other. This was taken into consideration when evaluating those labels which are represented by multiple GIS layers. Additionally, the overlap acreage and percent values associated with state-specific SLN labels represent the acreage within the species range overall, and are not specific to the state. Thus, in cases where species ranges crossed state boundaries, the state state-specific value includes acreage from outside the state. The uncertainties associated with acreage and percent overlap values were considered when making our risk and confidence characterizations. Overall, these different kinds of inaccuracy in GIS data would not tend to systematically over- or under-estimate risk, and we assumed these sources of uncertainty could contribute equally to the likelihood of underestimating or overestimating exposure. When data layers were not available to evaluate the presence/absence of use sites we expressed low confidence in risk estimates.

5) Assumption that exposure to multiple stressors will not increase risk may **underestimate** that risk: The risk summarized in the Risk-plots do not account for other real world stressors that may exacerbate responses to 1,3-D and metolachlor (i.e. temperature, exposure to other pesticides, etc.). This assumption contributes to the likelihood that risk will be underestimated. To account for potential increases in risk associated with multiple stressors, we evaluated the available information supporting the risk hypothesis that pesticide mixtures applied as multi-a.i. formulations or tank mixtures could increase risk from direct and indirect effects for the listed species. The mixtures' risk hypotheses were evaluated qualitatively by generating exposure and response estimates for examples of

multi-a.i. pesticide formulations and tank mixtures as described in the Effects of the Action below. Exposure to other stressors, including temperature stress, was evaluated in the Environmental Baseline based on the occurrence of impaired water quality due to exceedance of temperature thresholds (Clean Water Act section 303(d) listings) in the habitat of the listed species.

6) Species surrogacy assumptions may **underestimate or overestimate** risk: In most instances, the sensitivity of endangered species and their prey to the stressors of the action have not been tested; their sensitivities are assumed to be comparable to surrogate species that have been tested. These assumptions may underestimate or overestimate risk, depending on the relative sensitivity among the species. Species surrogacy represents a large source of uncertainty because sensitivities among even closely related species can span several orders of magnitude. Endpoints lacked sufficient data to construct Species Sensitivity Distributions. When more than one study was available for a particular endpoint (e.g. growth) consideration was given to both the sensitivity of response as well as the surrogacy of the test species. Relevant studies with sensitive endpoints were emphasized in order to weight the analysis in a way that errors were more likely to be protective of the listed species yet consider all of the available data.

7) Exposure estimate assumptions may **underestimate or overestimate** risk: Exposure estimates were developed for the aquatic habitat bins with the PWC model (an integration of PRZM5 and the VVWM), as described above (11.3). The accuracy of the exposure estimates depends on how well model inputs represent site-specific conditions. We generated geographically-specific EECs for a variety of aquatic habitats (bins) for all HUC2 regions within the distribution of listed Pacific salmonids. A substantial amount of variability in environmental conditions occurs at the HUC2 scale that influences exposure. Input variables were selected to represent sites vulnerable to runoff within the region as described in EPAs organophosphate BEs (EPA 2017a; EPA 2017b; EPA 2017c). The models are designed to predict pesticide concentrations in aquatic habitats on the edge of a treated field. We expect the models to provide reasonable estimates of exposure in habitats located in close proximity to treated areas, particularly when the size of the assumed drainage area is comparable with the size of single spray applications (e.g. smaller drainages areas such as those represented by the flowing aquatic bin 2, and the static freshwater bins 5, 6, and 7). While inputs are weighted to generate estimates at the higher end of the exposure range within the region, it’s possible that exposure is underestimated for some sites (e.g. those that receive greater rainfall than assumed, or sites with soil characteristics more conducive to runoff). However, overall we expect the EEC to provide reasonably accurate estimates with a tendency to overestimate exposure under most conditions. There is much greater uncertainty with regard to estimates generated for aquatic habitats represented by bin 3 and 4 with the PWC; unlike the other freshwater bin estimates which assume pesticide treatment of drainage areas consist with the size of single outdoor applications (<0.0001-600 acres), bins 3 and 4 assume drainage from much larger watersheds that would include multiple land uses, use sites, and areas where use may not be permitted (9,000-several million acres). The assumption that all of the use sites within these large watersheds are treated with pesticides tends to overestimate risk, while averaging concentrations over such large areas does not account

for potential variation within the watershed and may underestimate risk when individuals are distributed in close proximity to use sites. We did not rely on EECs for bin 3 and 4 given the lack of confidence in these estimates. Even greater uncertainty exists for marine habitats where model estimates that account for complex currents and tidal exchange are not available. Consequently, we took a qualitative approach and assumed exposure in larger flowing freshwater habitats (streams and rivers) and marine habitats (bins 8, 9, and 10) would be something less than the concentrations predicted in runoff and in smaller streams (bin 2). We consider exposures both qualitatively and quantitatively in our conclusions.

8) The assumption that field and laboratory exposure result in comparable responses may **underestimate or overestimate** risk: Standardized laboratory toxicity tests typically require that pesticide concentrations be maintained at a relatively stable concentration for the duration of the exposure period. In the natural environment, pesticides continue to degrade and dissipate at varying rates depending on site-specific conditions and the pesticide's physical-chemical properties. The conventional approach for handling the uncertainty associated with the differing exposure patterns was assumed; exposure estimates using time-weighted average (TWA) concentrations that factor in degradation and dissipation were assumed to produce similar responses to toxicity tests conducted under relatively constant exposure concentrations conducted with comparable exposure durations. TWA exposure estimate for acute durations (1d and 4d) were used to estimate responses based on acute toxicity studies and TWA estimates for chronic durations (21-d) were used to estimate responses using chronic studies. Utilizing average concentrations estimated under natural conditions can either underestimate or overestimate risk because response is a function of both exposure duration and concentration. Actual response may vary depending on site-specific dissipation pattern and toxicokinetic factors.

9) Assumptions on lack of information empirically linking effect endpoints with fitness level consequences may **underestimate or overestimate** risk: Sublethal effects to essential behaviors, such as impacts to a fish's ability to swim or a bird's ability to fly, can clearly translate to fitness level consequences by impairing an individual's ability to feed, escape predation, migrate, etc. If information is lacking to establish the degree to which impacts to a fish's ability to swim impact its ability to survive and reproduce, we can either assume the apical endpoints will not be impacted and likely underestimate the risk, or we can assume they will impact individual fitness which may overestimate risk. To ensure protection of the species, we logically infer observed impacts to a species essential behaviors (e.g. effects on the ability of salmon to feed, escape predation, migrate, home, osmoregulate, etc.) and impacts to the availability of food are capable of producing fitness level consequences regardless of the presence of empirical studies quantitatively linking these assessment measure to an apical endpoint. The paucity of studies evaluating ecologically relevant endpoints contributes to the uncertainty and may increase the likelihood of underestimating risk.

References for the metolachlor ecological effects studies cited in this chapter can be found in EPA's Registration Review Problem Formulation for Metolachlor and S-Metolachlor as well as the Metolachlor/S-Metolachlor Draft Ecological Risk Assessment for Registration Review. These documents can be found at https://www.regulations.gov/docket?D=EPA-HQ-OPP-2014-0772.

References for the 1,3-D ecological effects studies cited in this chapter can be found in EPA's Problem Formulation for the Environmental Fate and Ecological Risk, Endangered Species, and Drinking Water Assessments in Support of the Registration Review of 1,3-Dichloropropene (Telone) as well as the 1,3-dichloroporpene (1,3-D) Draft Risk Assessment (DRA) in Support of Registration Review. These documents can be found at https://www.regulations.gov/docket?D=EPA-HQ-OPP-2013-0154.

References for the chloropicrin ecological effects studies can be found at https://www.regulations.gov/docket?D=EPA-HQ-OPP-2013-0153.

Other references cited can be found in Chapter 19.

12 Effects of the Action Analysis: Species

12.1 Introduction

See Chapters 4 (Approach to the Assessment) and 11 (Effects Analysis Introduction) for descriptions of the methods and information used in this section. In this section we integrate the exposure and response information to evaluate the likelihood of adverse effects from stressors of the action at the population and species level. The information is organized by species. Within each species section the information is presented in the following order:

1. R- Plots figures: Demonstrate the relationship between geographically-specific potential exposure distributions and assessment measures (response distributions). These figures also convey the prevalence of registered use sites within the species range by providing potential acreage of allowed uses within the species range and what the percent overlap of that use relative to the size of the species range. See Table 168 below, the assessment framework (chapter 4), and the introduction to the effects analysis (Chapter 11) for more information on the interpretation of risk plots. Additional information on the effects information displayed in risk plots is provided in the beginning of each of the effects analysis sections.

Table 168. General risk plot components

Title Species name is given, with ESU or DPS abbreviated, for example:

Chinook salmon PS (Range)

"(Range)" indicates that the species range, rather than designated critical habitat, was used to calculate overlap percentages.

Effect Concentrations

See Tables below for 1,3-D, chloropricrin, and metolachlor specific information.

Exposure Concentrations

The overlap category is listed, followed by the acres within species range and percent of species range composed of those acres, for example:

Vegetables and Mint (40807, 0.6 %) 

Some use categories such as "field crops" and "fruit and nuts" show multiple overlap percentages. This reflects that more than one crop is lumped into this use category. See chapter 11 for a crosswalk of authorized use sites to overlap category. Circles represent estimated exposure concentrations for three modeled scenarios: bin 0 (open circles); bin 2 (gray circles); bin 7 (black circles). Note that there are three rows of estimated exposure concentrations for each overlap category; each row represents a different time-weighted average: 1-day (bottom row); 4-day (middle row); and 21-day (top row).

2. Likelihood of exposure tables: Tables summarizing assessment of likelihood of exposure to each pesticide use that can occur within the species range.

3. Risk Hypotheses Tables: tables for each risk hypothesis summarizing risk and confidence associated with each registered use that occurs within the species range.

4. Final effects analysis table and narrative summary: Each species section concludes with a Table indicating which risk hypotheses were supported and associated narrative summary of overall risk of the action to the species. Where applicable, the effects analysis table includes Pacific salmon population model output. Population model output is also provided in appendix A: Pacific Salmon Population Modeling. Ranges of acute mortality indicated by the risk-plots were combined with percent overlap values from the use area and species range data to identify ranges of acute mortality salmon population model outputs and estimate impacts on population productivity. The models assessed impacts to population growth rates for ocean-type Chinook, stream-type Chinook, sockeye, and coho salmon.

12.2 Products Containing 1,3-Dichloropropene Effects Analysis

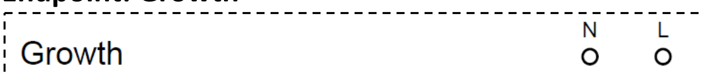
The response endpoints displayed in the 1,3-Dichloropropene and chloropicrin risk plots that follow are provided in Table 169 & Table 170. See the introduction to the effects analysis chapter for more information regarding the available relevant toxicological data for these compounds.

Table 169. Effects endpoints displayed in risk plots for 1,3-Dichloropropene

Endpoint: Behavior

Test species: Rainbow Trout
Duration: 96-hr
Toxicity value (ppb): NOAEC (N) = 1460; LOAEC (L) = 2130
Citation/MRID: 49382003

Endpoint: Growth



Test species: Fathead Minnow
Duration: Chronic (ELS)
Toxicity value (ppb): NOAEC (N) = 15; LOAEC (L) = 34
Citation/MRID: 49682401

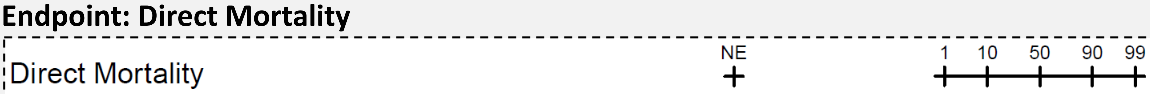
Endpoint: Aquatic Plants

Test species: Freshwater diatom (nv); Duckweed (v); Green algae (a)
Duration: 5-day; 7-day; 96-hr
Toxicity value (ppb): EC25= 30; 1310; 7850
Citation/MRID: 44843909; 44843914; 44940314

Endpoint: Prey Abundance

Test species: Water flea; Water flea
Duration: 48-hr
Toxicity value (ppb): EC50 (50) = 90; 6200; geometric mean* (gm) = 747; slope = 4.5 (assumed)
Citation/MRID: 40098001; 00117044

Endpoint: Direct Mortality



Test species: Rainbow Trout
Duration: 96-hr
Toxicity value (ppb): LC50 (50) = 2780; slope = 4.5 (assumed); None Expected (NE) = 244
Citation/MRID: 49382003

**The calculation and reference to the geometric mean of the two different LC50s was determined appropriate as the studies were otherwise comparable in regards to species tested, exposure duration, and overall data quality.*

Table 170. Effects endpoints displayed in risk plots for chloropicrin

Endpoint: Aquatic Plants

Test species: Duckweed (v); Green Algae (a)
Duration: not specified
Toxicity value (ppb): EC25 = 4.6; 85
Citation/MRID: 48442801; 49559701

Endpoint: Prey Abundance

Test species: Water flea
Duration: Acute
Toxicity value (ppb): EC50 (50) = 120; slope = 4.5 (assumed)
Citation/MRID: 48442401

Endpoint: Direct Mortality

Test species: Rainbow Trout
Duration: Acute
Toxicity value (ppb): LC50 (50) = 11; slope = 4.5 (assumed); None Expected (NE) = 1
Citation/MRID: 48442405

Characterizing the "effect of exposure" for chloropicrin.

The effects analysis for 1,3-Dichloropropene, like metolachlor, is an assessment of the effects of the action which includes (1) approved product labels containing the primary active ingredient, (2) degradates and metabolites of that active ingredient, (3) formulations, including other ingredients within formulations, (4) adjuvants, and (5) tank mixtures. Some aspects of the effects of the action are considered quantitatively (e.g. direct mortality response to the primary active ingredient), whereas others are considered more qualitatively (e.g. recommended tank mixtures). Here we present a semi-quantitative analysis of chloropicrin, a common co-active ingredient in 1,3-Dichloropropene formulated products. A semi-quantitative assessment was determined to be appropriate for chloropicrin given the frequency at which it is co-formulated with 1,3-Dichloropropene as well as its relatively greater toxicity to freshwater fish.

The effect of chloropicrin was considered in evaluating the direct mortality and prey availability risk hypotheses for each of the species considered. Data was not available to evaluate the effect of chloropicrin in the context of the other risk hypotheses. For direct mortality to fish, the effect of exposure associated with chloropicrin was characterized as medium. This follows from the criteria described in the assessment framework chapter i.e. relevant EECs falls between the one percent and the median effect level. Note in Figure 59 that bin 2 estimates (gray circles) fall between the 10 percent and 50 percent effect threshold for direct mortality. For invertebrate prey abundance, the effect of exposure was "none expected", this is due to the lack of overlap between EECs and effects endpoints. Our confidence associated with the direct mortality and prey abundance risk characterizations was decreased with the added consideration of chloropicrin. This was primarily due to uncertainties in the exposure estimates and response data. Note also that not all 1,3-D/chloropicrin formulated products contain chloropicrin at levels indicating the potential for adverse effects. For example, Figure 60 shows EECs associated with the maximum label rates of all formulated products authorized for use on vegetables and mint. In this example, about half of the label's maximum rates do not result in bin 2 estimates which exceed the 1% effects level for direct mortality.

The species-specific assessments that follow include effect of exposure characterizations for chloropicrin within the risk hypothesis tables. Chloropicrin risk plots are not provided for each ESU or DPS.

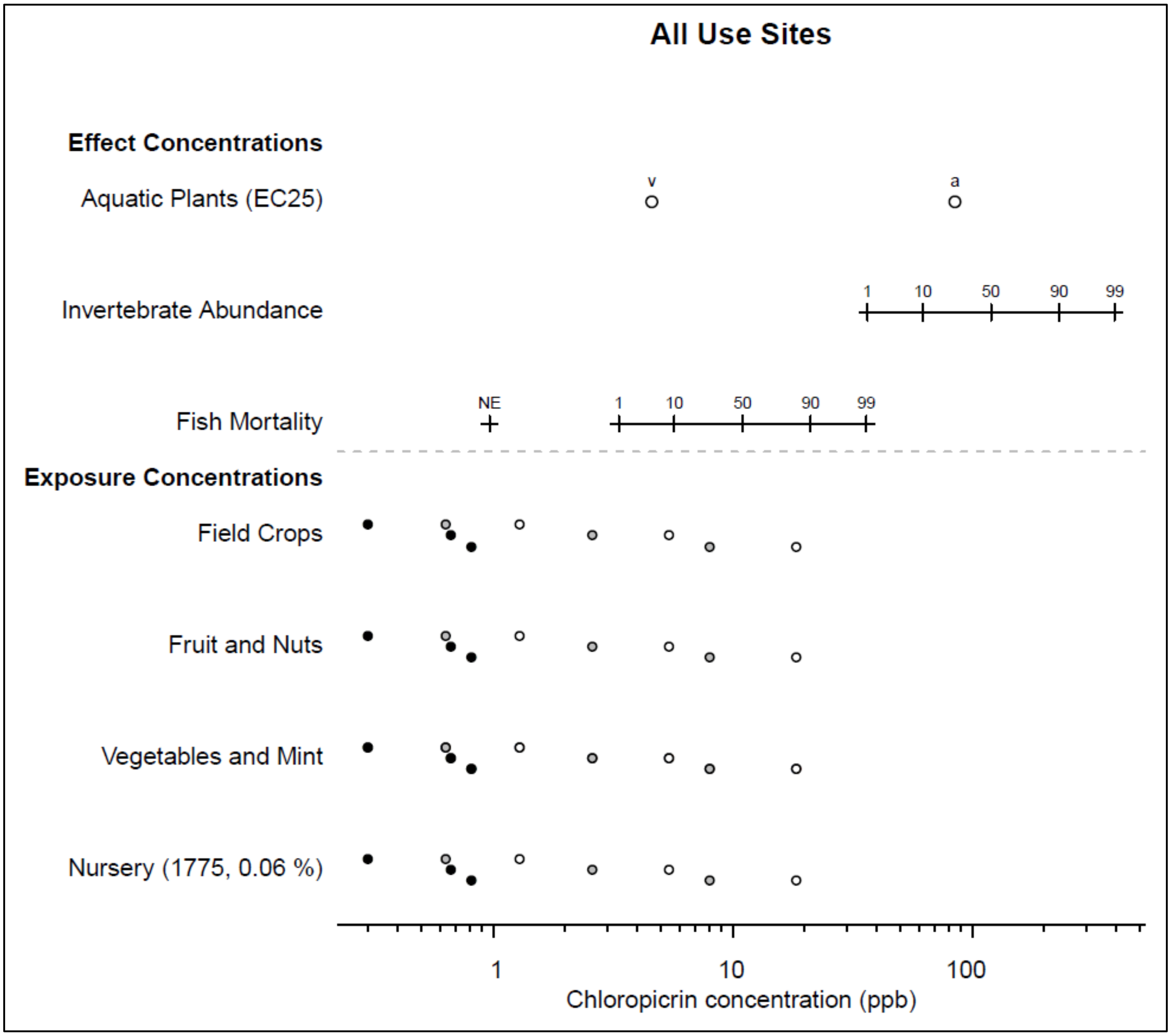


Figure 59. Chloropicrin estimated concentrations associated with the maximum label rates within each of the FIFRA section 3 uses authorized for 1,3-D/chloropicrin formulated products.

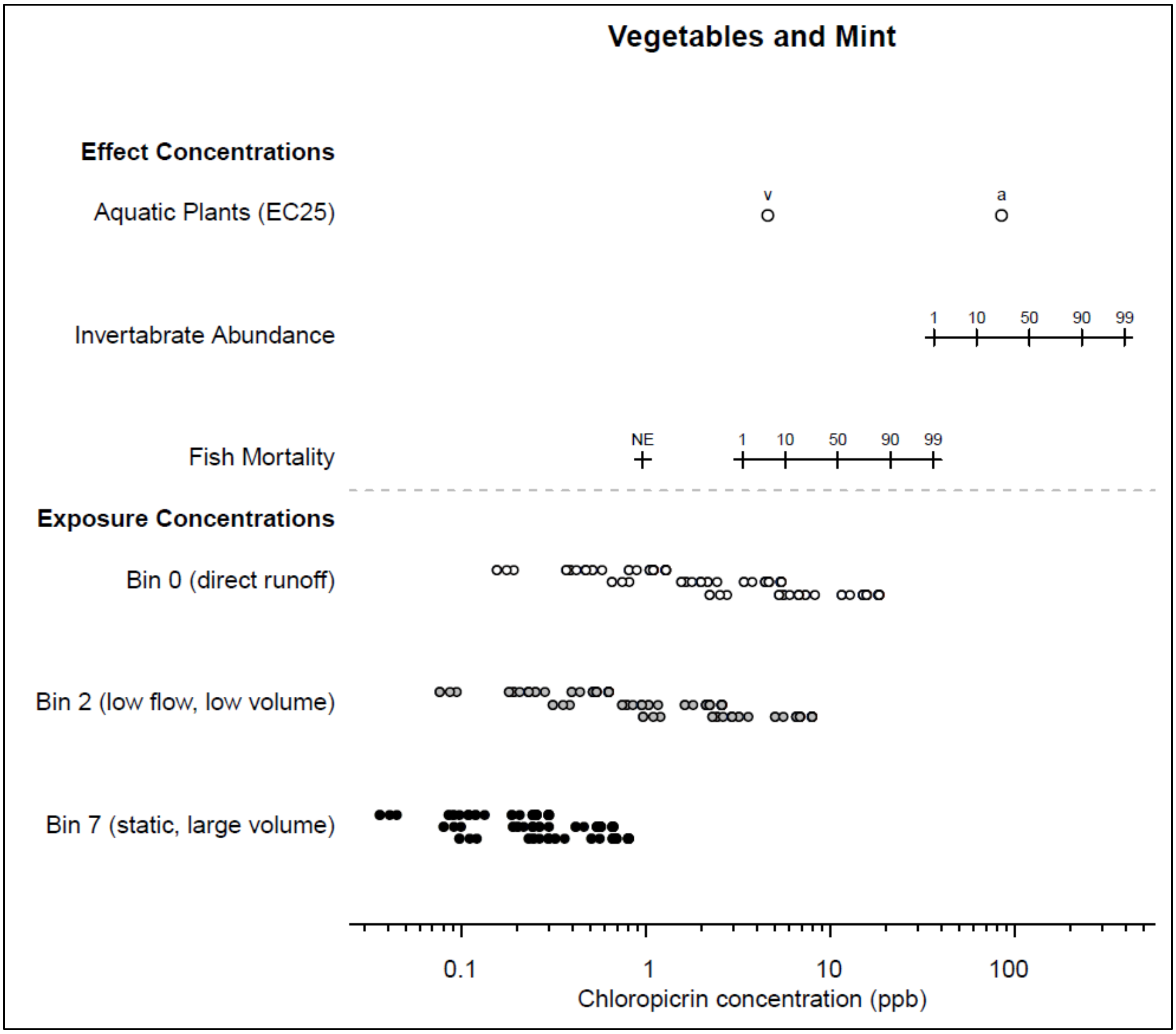


Figure 60. Chloropicrin estimated concentrations associated with the maximum rates in labels authorized for use on vegetables and mint.

12.2.1 Chum salmon, Columbia River ESU (*Oncorhynchus keta*)

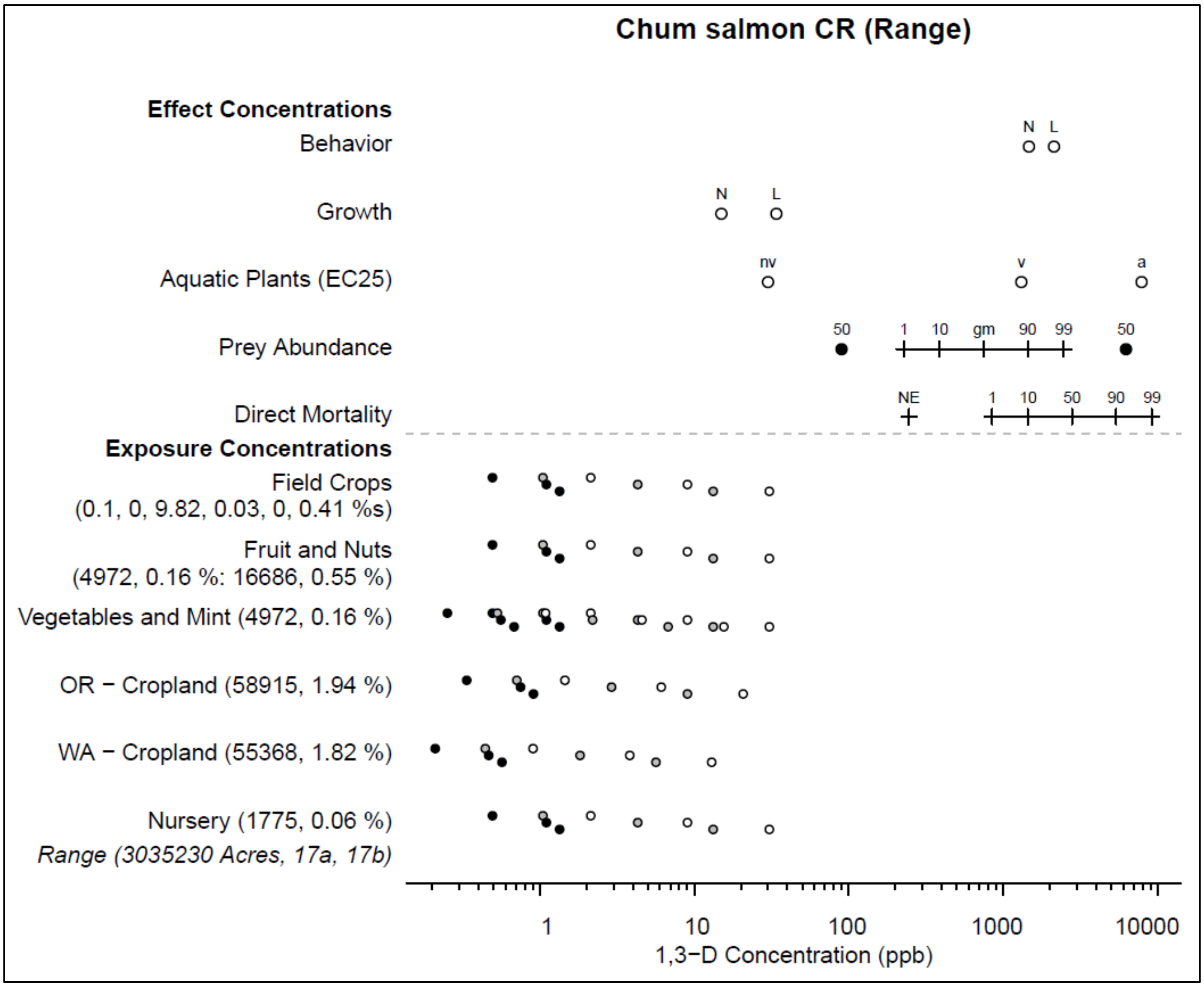


Figure 61. Effects analysis Risk-plot for Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Table 171. Likelihood of exposure determination for Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA - Cropland	2	yes	no	yes	NA	2	**Medium**
OR - Cropland	2	yes	no	yes	NA	2	**Medium**
Mint	1	yes	no	no	yes	2	**Low**
Nursery	1	yes	no	no	no	2	**Low**
Fruit and Nuts	1	yes	no	no	yes	2	**Low**
Field Crops	3	yes	no	no	NA	2	**Medium**
Vegetable Crops	1	yes	no	no	yes	2	**Low**

Table 172. Direct mortality risk hypothesis; Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	1.94	None Expected	Medium	Medium
OR – Cropland	1.82	None Expected	Medium	Medium
Mint	0.16	None Expected	Medium	Low
Nursery	0.06	None Expected	Medium	Low
Fruit and Nuts	0.16, 0.55	None Expected	Medium	Low
Field Crops	0.1, 0, 9.82, 0.03, 0, 0.41	None Expected	Medium	Medium
Vegetable Crops	0.16	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 173. Prey risk hypothesis; Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	1.94	None Expected	None Expected	Medium
OR – Cropland	1.82	None Expected	None Expected	Medium
Mint	0.16	None Expected	None Expected	Low
Nursery	0.06	None Expected	None Expected	Low
Fruit and Nuts	0.16, 0.55	None Expected	None Expected	Low
Field Crops	0.1, 0, 9.82, 0.03, 0, 0.41	None Expected	None Expected	Medium
Vegetable Crops	0.16	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 174. Growth risk hypothesis; Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA - Cropland	1.94	None Expected	Medium
OR – Cropland	1.82	None Expected	Medium
Mint	0.16	None Expected	Low
Nursery	0.06	None Expected	Low
Fruit and Nuts	0.16, 0.55	None Expected	Low
Field Crops	0.1, 0, 9.82, 0.03, 0, 0.41	None Expected	Medium
Vegetable Crops	0.16	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 175. Behavior risk hypothesis; Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA - Cropland	1.94	None Expected	Medium
OR – Cropland	1.82	None Expected	Medium
Mint	0.16	None Expected	Low
Nursery	0.06	None Expected	Low
Fruit and Nuts	0.16, 0.55	None Expected	Low
Field Crops	0.1, 0, 9.82, 0.03, 0, 0.41	None Expected	Medium
Vegetable Crops	0.16	None Expected	Low

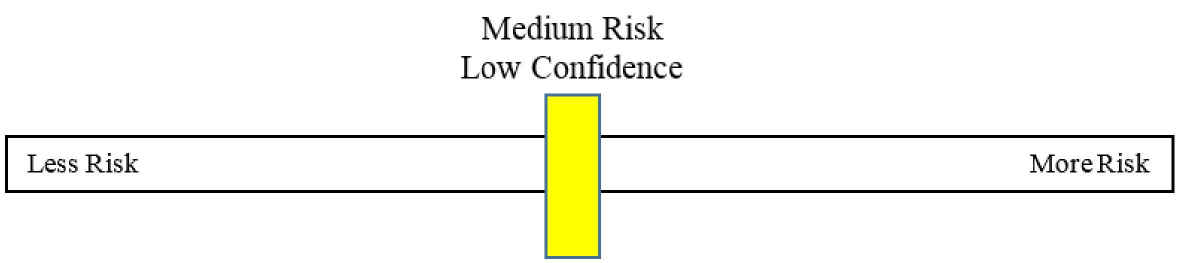
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 176. Effects analysis summary table: Chum salmon, Columbia River ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments	Low	High		No

to ecologically significant behaviors.				

Effects analysis summary: Chum salmon, Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.2 Chum Salmon, Hood Canal summer-run ESU (*Oncorhynchus keta*)

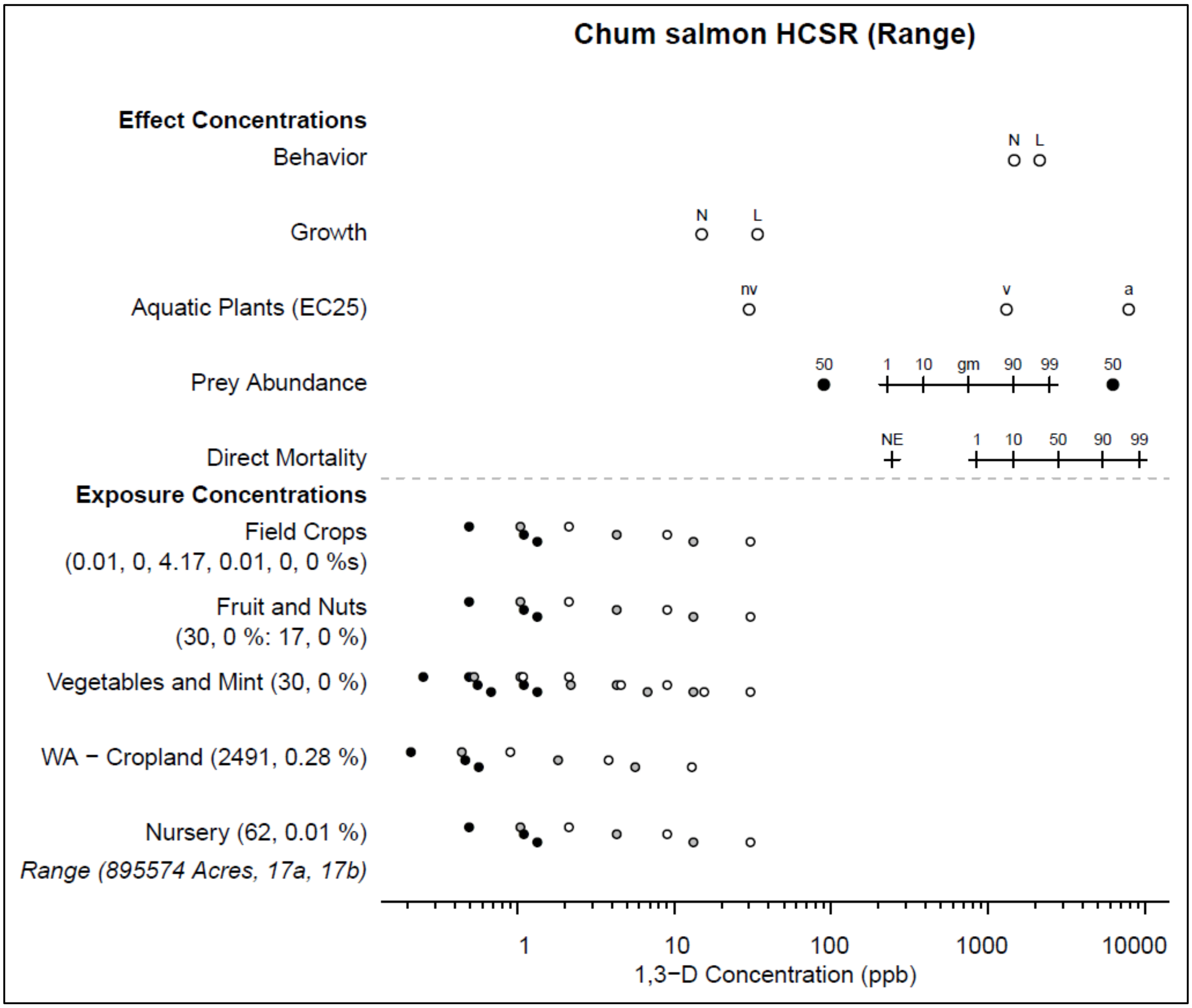


Figure 62. Effects analysis Risk-plot for Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Table 177. Likelihood of exposure determination for Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA - Cropland	1	yes	no	yes	NA	2	**Low**
Mint	1	yes	no	no	no	2	**Low**
Nursery	1	yes	no	no	no	2	**Low**
Fruit and Nuts	1	yes	no	no	no	2	**Low**
Field Crops	2	yes	no	no	NA	2	**Medium**
Vegetable Crops	1	yes	no	no	no	2	**Low**

Table 178. Direct mortality risk hypothesis; Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	0.28	None Expected	Medium	Low
Mint	0	None Expected	Medium	Low
Nursery	0.01	None Expected	Medium	Low
Fruit and Nuts	0,0	None Expected	Medium	Low
Field Crops	0.01, 0, 4.17, 0.01, 0, 0	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 179. Prey risk hypothesis; Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	0.28	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	0,0	None Expected	None Expected	Low
Field Crops	0.01, 0, 4.17, 0.01, 0, 0	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 180. Growth risk hypothesis; Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA - Cropland	0.28	None Expected	Low

Mint	0	None Expected	Low
Nursery	0.01	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0.01, 0, 4.17, 0.01, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

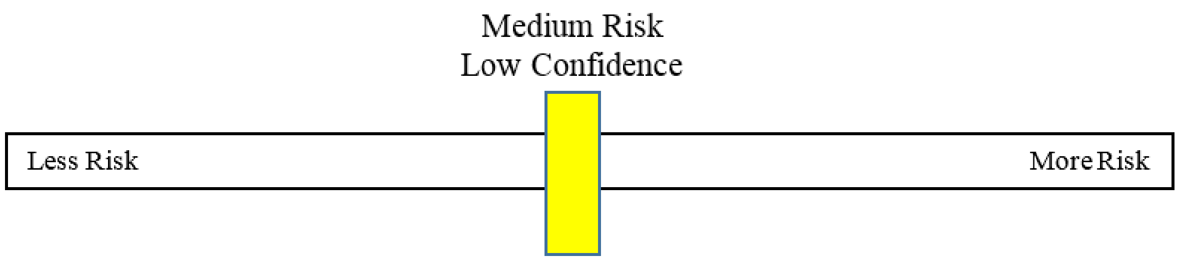
Table 181. Behavior risk hypothesis; Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA - Cropland	0.28	None Expected	Low
Mint	0	None Expected	Low
Nursery	0.01	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0.01, 0, 4.17, 0.01, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 182. Effects analysis summary table: Chum salmon, Hood Canal summer-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chum salmon, Hood Canal summer-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.3 Chinook, California Coastal (*Oncorhynchus tshawytscha*)

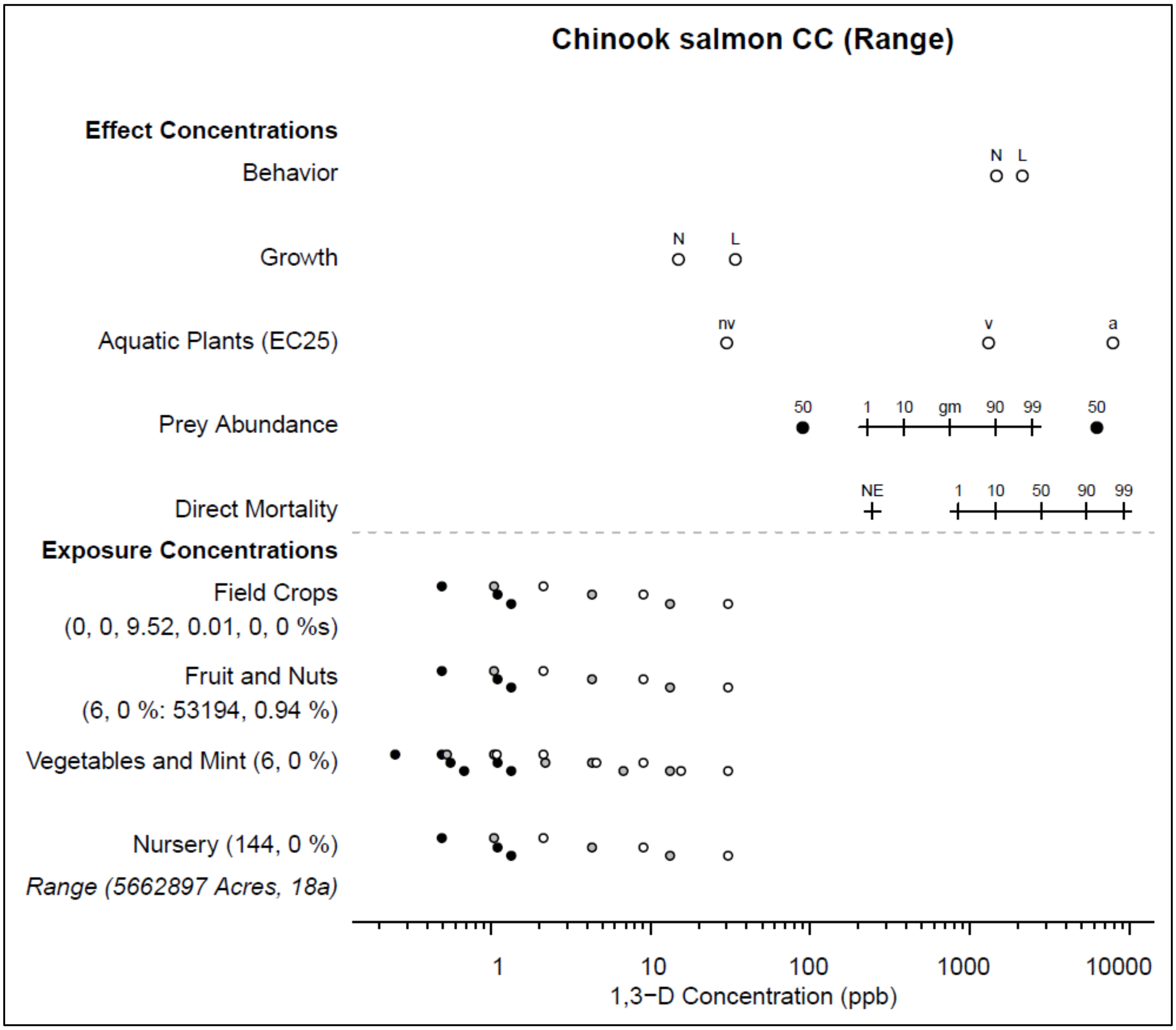


Figure 63. Effects analysis Risk-plot for Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

Table 183. Likelihood of exposure determination for Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	no	3	**Low**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 184. Direct mortality risk hypothesis; Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	Medium	Low
Nursery	0	None Expected	Medium	Low
Fruit and Nuts	0,0.94	None Expected	Medium	Low
Field Crops	0, 0, 9.52, 0.01, 0, 0	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Low	**High**			

Table 185. Prey risk hypothesis; Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0,0.94	None Expected	None Expected	Low
Field Crops	0, 0, 9.52, 0.01, 0, 0	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 186. Growth risk hypothesis; Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0.94	None Expected	Low
Field Crops	0, 0, 9.52, 0.01, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).		
Risk	**Confidence**	
Low	**High**	

Table 187. Behavior risk hypothesis; Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

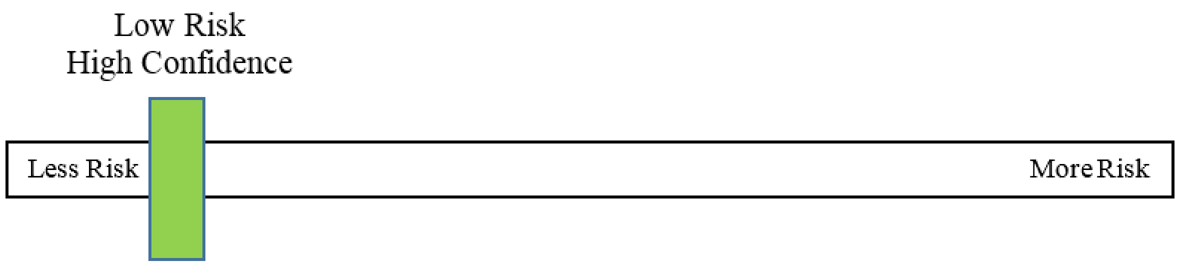
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0.94	None Expected	Low
Field Crops	0, 0, 9.52, 0.01, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 188. Effects analysis summary table: Chinook salmon, California Coastal ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce	Low	High	No impact for 1,3-D; some associated with chloropicrin	No

abundance via acute lethality.			(See chapter 11.5).	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, California Coastal ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to 1,3-D or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Where formulated products and tank mixtures containing 1,3-D occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.2.4 Chinook Salmon, Central Valley spring-run ESU (*Oncorhynchus tshawytscha*)

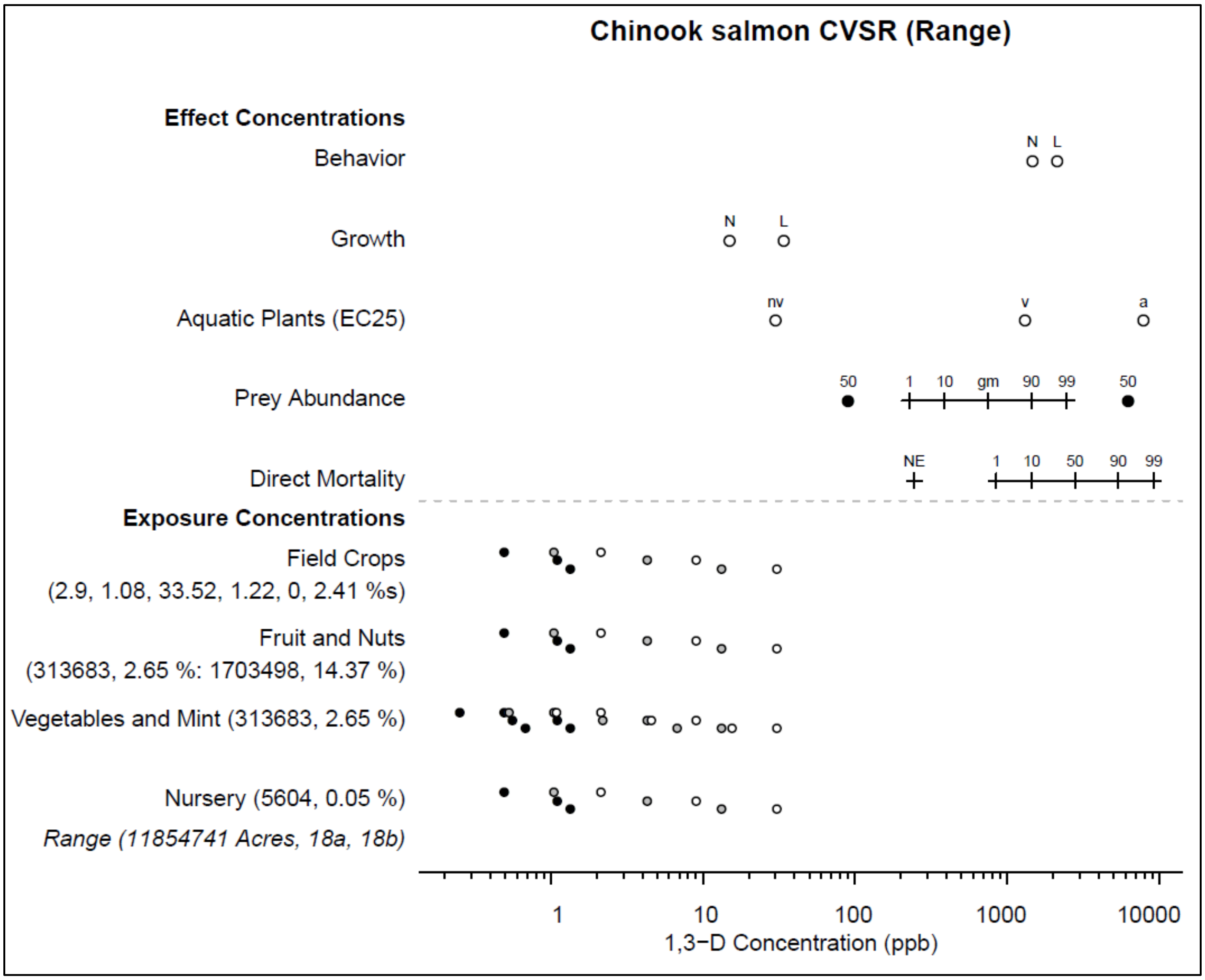


Figure 64. Effects analysis Risk-plot for Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

Table 189. Likelihood of exposure determination for Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	3	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 190. Direct mortality risk hypothesis; Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	2.65	None Expected	Medium	Medium
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	2.65, 14.37	None Expected	Medium	Medium
Field Crops	2.9, 1.08, 33.52, 1.22, 0, 2.41	None Expected	Medium	Medium
Vegetable Crops	2.65	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 191. Prey risk hypothesis; Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

<table>
<tr><td colspan="5">Endpoint: Prey</td></tr>
<tr><td rowspan="2">Use Category</td><td rowspan="2">% Overlap</td><td colspan="2">Effect of Exposure</td><td rowspan="2">Likelihood of Exposure</td></tr>
<tr><td>1,3-D</td><td>Chloropicrin</td></tr>
<tr><td>Mint</td><td>2.65</td><td>None Expected</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Nursery</td><td>0.05</td><td>None Expected</td><td>Medium</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>2.65, 14.37</td><td>None Expected</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Field Crops</td><td>2.9, 1.08, 33.52, 1.22, 0, 2.41</td><td>None Expected</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>2.65</td><td>None Expected</td><td>Medium</td><td>Medium</td></tr>
<tr><td colspan="5">Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.</td></tr>
<tr><td>Risk</td><td>Confidence</td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Low</td><td>Medium</td></tr>
</table>

Table 192. Growth risk hypothesis; Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

<table>
<tr><td colspan="4">Endpoint: Growth</td></tr>
<tr><td>Use Category</td><td>% Overlap</td><td>Effect of Exposure</td><td>Likelihood of Exposure</td></tr>
<tr><td>Mint</td><td>2.65</td><td>None Expected</td><td>Medium</td></tr>
<tr><td>Nursery</td><td>0.05</td><td>None Expected</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>2.65, 14.37</td><td>None Expected</td><td>Medium</td></tr>
<tr><td>Field Crops</td><td>2.9, 1.08, 33.52, 1.22, 0, 2.41</td><td>None Expected</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>2.65</td><td>None Expected</td><td>Medium</td></tr>
</table>

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).		
Risk	**Confidence**	
Low	**High**	

Table 193. Behavior risk hypothesis; Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

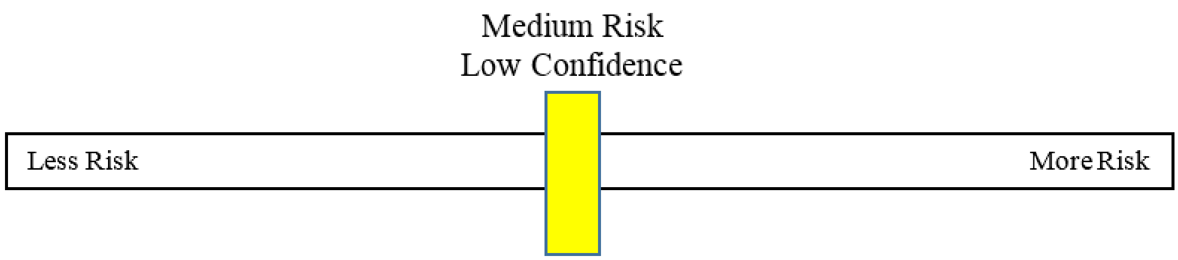
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	2.65	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	2.65, 14.37	None Expected	Medium
Field Crops	2.9, 1.08, 33.52, 1.22, 0, 2.41	None Expected	Medium
Vegetable Crops	2.65	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 194. Effects analysis summary table: Chinook salmon, Central Valley Spring-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	**Confidence** 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is	Medium	Low	No impact for 1,3-D; some associated with	No

sufficient to reduce abundance via acute lethality.			chloropicrin (See chapter 11.5).	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, California Central-Valley spring-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.5 Chinook Salmon, Lower Columbia River ESU (*Oncorhynchus tshawytscha*)

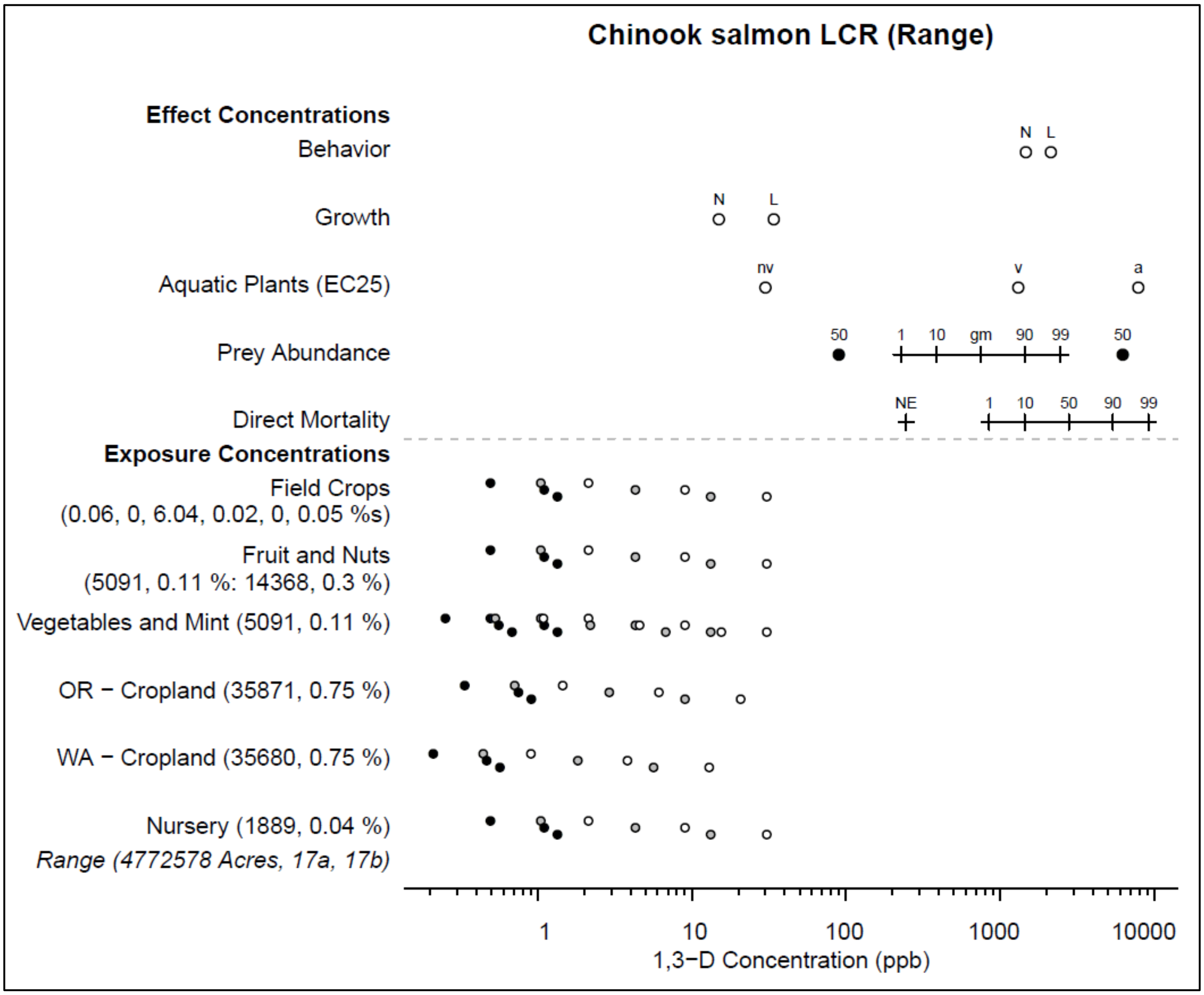


Figure 65. Effects analysis Risk-plot for Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Table 195. Likelihood of exposure determination for Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR - Cropland	1	yes	no	yes	yes	3	**High**
WA - Cropland	1	yes	no	yes	yes	3	**High**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 196. Direct mortality risk hypothesis; Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.75	None Expected	Medium	High
WA Cropland	0.75	None Expected	Medium	High
Mint	0.11	None Expected	Medium	Medium
Nursery	0.04	None Expected	Medium	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium	Medium
Field Crops	0.06, 0, 6.04, 0.02, 0, 0.05	None Expected	Medium	Medium
Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 197. Prey risk hypothesis; Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.75	None Expected	None Expected	High
WA Cropland	0.75	None Expected	None Expected	High
Mint	0.11	None Expected	None Expected	Medium
Nursery	0.04	None Expected	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	None Expected	Medium
Field Crops	0.06, 0, 6.04, 0.02, 0, 0.05	None Expected	None Expected	Medium
Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 198. Growth risk hypothesis; Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
OR Cropland	0.75	None Expected	High
WA Cropland	0.75	None Expected	High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium
Field Crops	0.06, 0, 6.04, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 199. Behavior risk hypothesis; Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.75	None Expected	High
WA Cropland	0.75	None Expected	High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium
Field Crops	0.06, 0, 6.04, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium

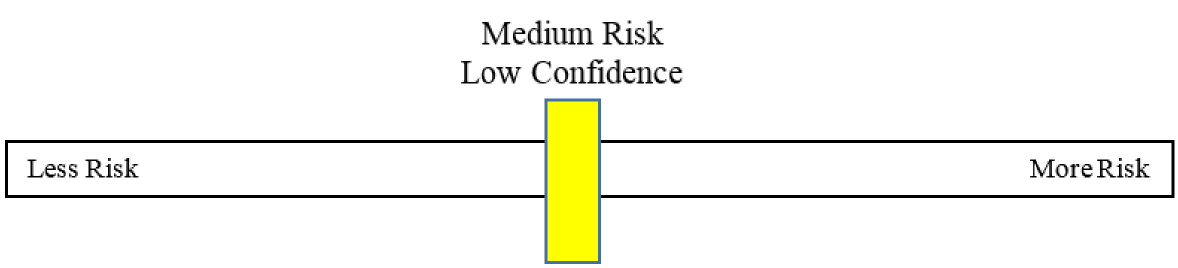
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 200. Effects analysis summary table: Chinook salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and	Low	High	Not modelled	No

adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Chinook salmon, Lower Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.6 Chinook Salmon, Puget Sound ESU (*Oncorhynchus tshawytscha*)

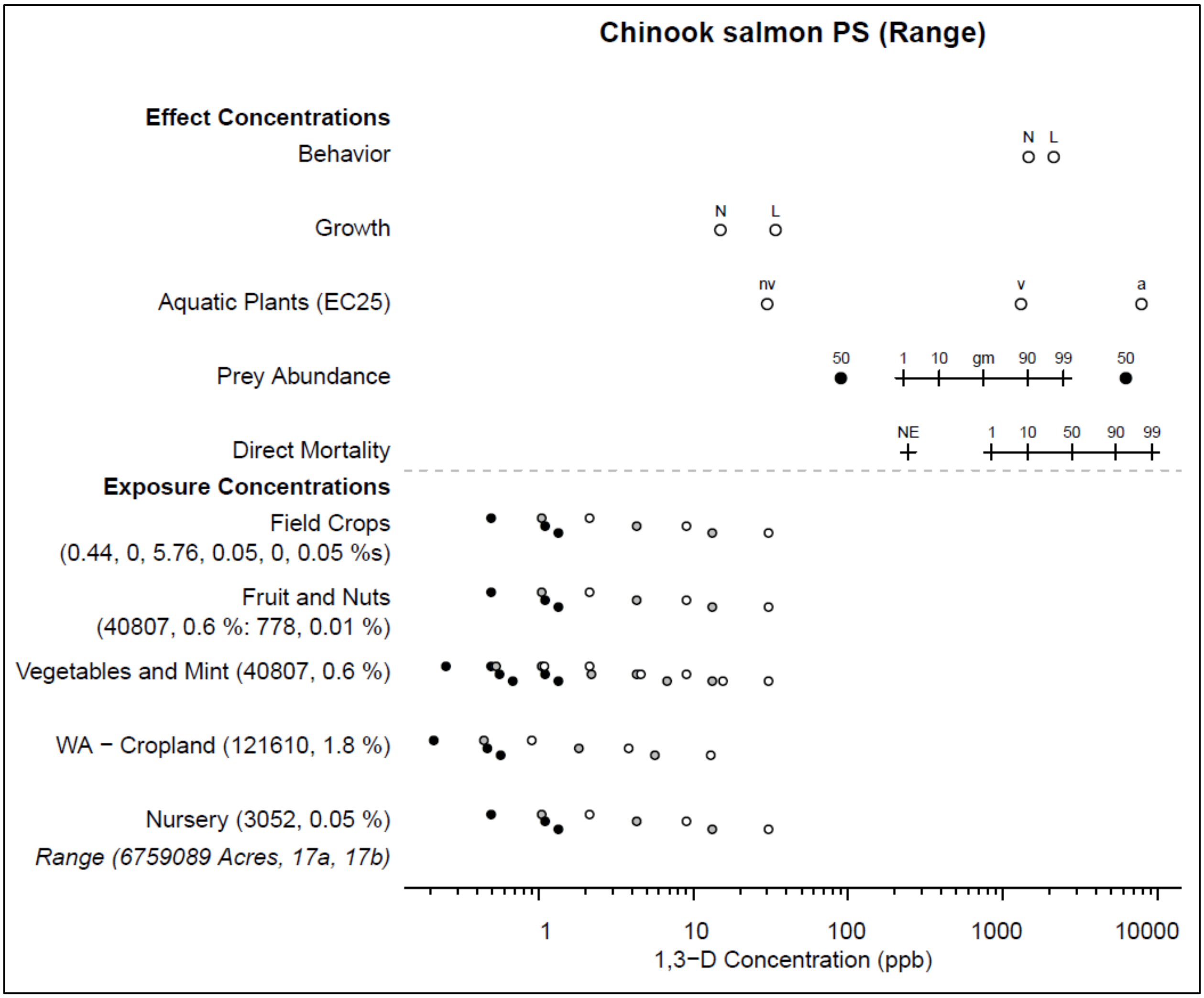


Figure 66. Effects analysis Risk-plot for Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Table 201. Likelihood of exposure determination for Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA - Cropland	2	yes	no	yes	NA	3	**Medium**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 202. Direct mortality risk hypothesis; Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	1.8	None Expected	Medium	Medium
Mint	0.6	None Expected	Medium	Medium
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	0.6, 0.01	None Expected	Medium	Medium
Field Crops	0.44, 0, 5.76, 0.05, 0, 0.05	None Expected	Medium	Medium
Vegetable Crops	0.6	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 203. Prey risk hypothesis; Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	1.8	None Expected	None Expected	Medium
Mint	0.6	None Expected	None Expected	Medium
Nursery	0.05	None Expected	None Expected	Low
Fruit and Nuts	0.6, 0.01	None Expected	None Expected	Medium
Field Crops	0.44, 0, 5.76, 0.05, 0, 0.05	None Expected	None Expected	Medium
Vegetable Crops	0.6	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 204. Growth risk hypothesis; Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	1.8	None Expected	Medium
Mint	0.6	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	0.6, 0.01	None Expected	Medium

Field Crops	0.44, 0, 5.76, 0.05, 0, 0.05	None Expected	Medium
Vegetable Crops	0.6	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 205. Behavior risk hypothesis; Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	1.8	None Expected	Medium
Mint	0.6	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	0.6, 0.01	None Expected	Medium
Field Crops	0.44, 0, 5.76, 0.05, 0, 0.05	None Expected	Medium
Vegetable Crops	0.6	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

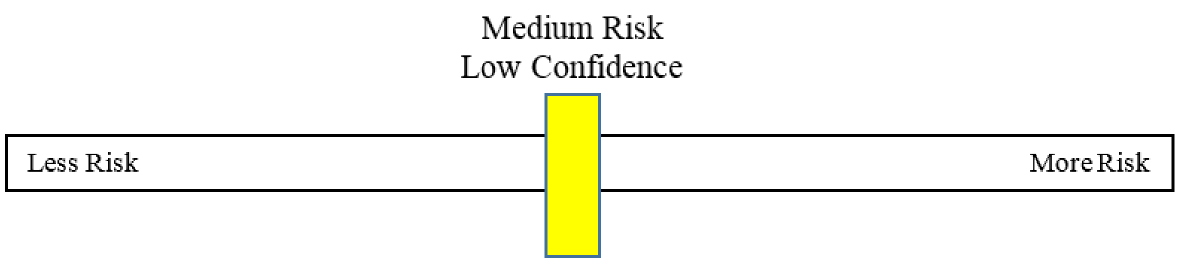
Table 206. Effects analysis summary table: Chinook salmon, Puget Sound ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?**
	Risk	**Confidence**		

	1,3-D Chloropicrin	1,3-D Chloropicrin		Yes/No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, Puget Sound ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior.

Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.7 Chinook Salmon, Sacramento River winter-run (*Oncorhynchus tshawytscha*)

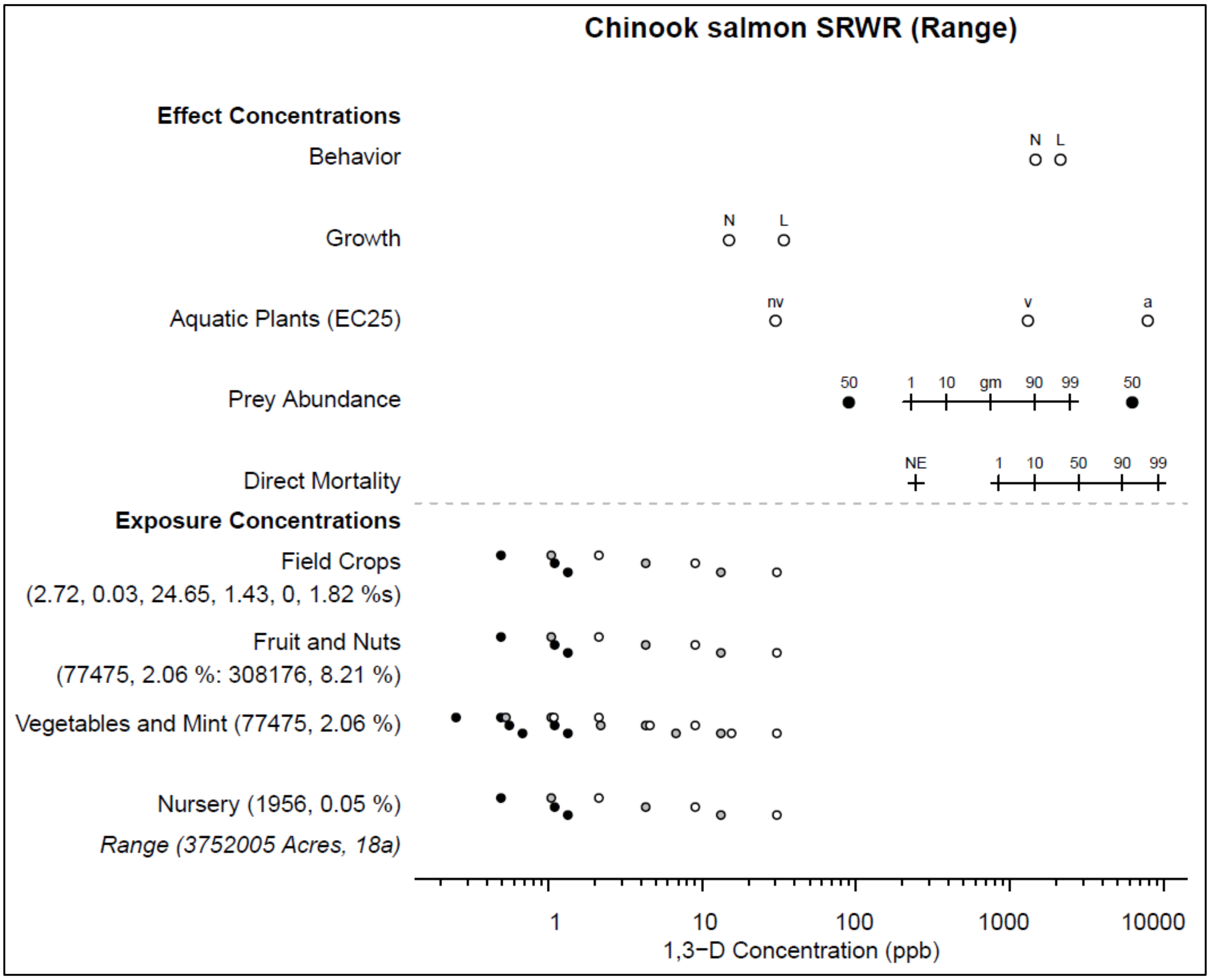


Figure 67. Effects analysis Risk-plot for Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Table 207. Likelihood of exposure determination for Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	3	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 208. Direct mortality risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	2.06	None Expected	Medium	Medium
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	2.06, 8.21	None Expected	Medium	Medium
Field Crops	2.72, 0.03, 24.65, 1.43, 0, 1.82	None Expected	Medium	Medium
Vegetable Crops	2.06	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 209. Prey risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	2.06	None Expected	Medium	Medium
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	2.06, 8.21	None Expected	Medium	Medium
Field Crops	2.72, 0.03, 24.65, 1.43, 0, 1.82	None Expected	Medium	Medium
Vegetable Crops	2.06	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 210. Growth risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	2.06	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	2.06, 8.21	None Expected	Medium
Field Crops	2.72, 0.03, 24.65, 1.43, 0, 1.82	None Expected	Medium

Vegetable Crops	2.06	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 211. Behavior risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	2.06	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	2.06, 8.21	None Expected	Medium
Field Crops	2.72, 0.03, 24.65, 1.43, 0, 1.82	None Expected	Medium
Vegetable Crops	2.06	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

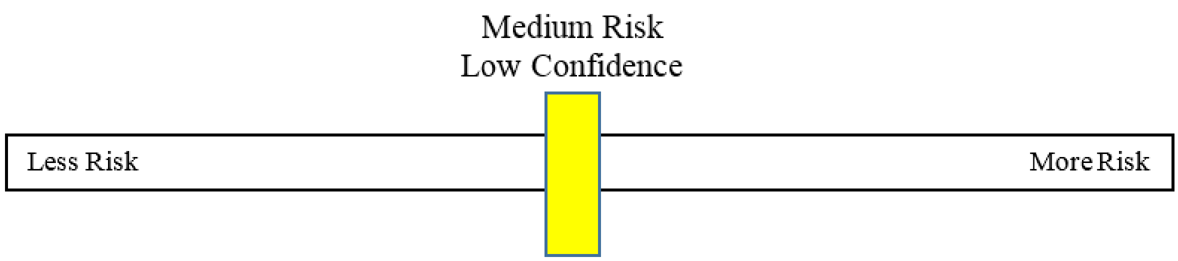
Table 212. Effects analysis summary table: Chinook salmon, Sacramento River Winter-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-	Medium	Low	No impact for 1,3-D; some	No

Dichloropropene is sufficient to reduce abundance via acute lethality.			associated with chloropicrin (See chapter 11.5).	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, Sacramento River Winter-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops).

No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.8 Chinook Salmon, Snake River fall-run ESU (*Oncorhynchus tshawytscha*)

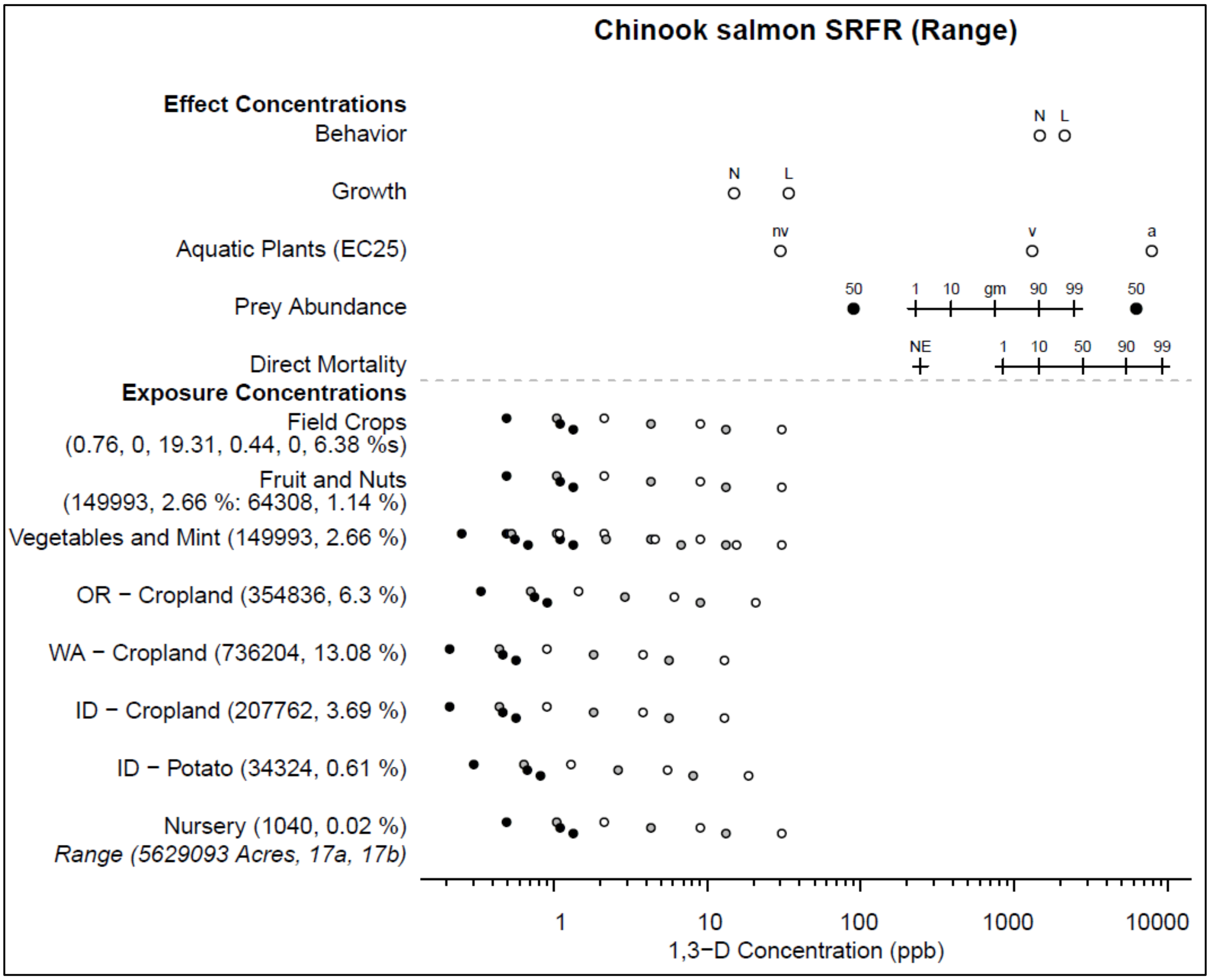


Figure 68. Effects analysis Risk-plot for Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Table 213. Likelihood of exposure determination for Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	3	yes	no	yes	NA	3	**Medium**
WA Cropland	3	yes	no	yes	NA	3	**Medium**
ID Cropland	2	yes	no	yes	NA	3	**Medium**
ID Potato	1	yes	no	yes	no	3	**Low**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	3	yes	no	no	NA	3	**Medium**
Field Crops	2	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 214. Direct mortality risk hypothesis; Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	6.3	None Expected	Medium	Medium
WA Cropland	13.08	None Expected	Medium	Medium
ID Cropland	3.69	None Expected	Medium	Medium
ID Potato	0.61	None Expected	Medium	Low
Mint	2.66	None Expected	Medium	Medium
Nursery	0.02	None Expected	Medium	Low
Fruit and Nuts	2.66, 1.14	None Expected	Medium	Medium

Field Crops	0.76, 0, 19.31, 0.44, 0, 6.38	None Expected	Medium	Medium
Vegetable Crops	2.66	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 215. Prey risk hypothesis; Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	6.3	None Expected	None Expected	Medium
WA Cropland	13.08	None Expected	None Expected	Medium
ID Cropland	3.69	None Expected	None Expected	Medium
ID Potato	0.61	None Expected	None Expected	Low
Mint	2.66	None Expected	None Expected	Medium
Nursery	0.02	None Expected	None Expected	Low
Fruit and Nuts	2.66, 1.14	None Expected	None Expected	Medium
Field Crops	0.76, 0, 19.31, 0.44, 0, 6.38	None Expected	None Expected	Medium
Vegetable Crops	2.66	None Expected	None Expected	Medium

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.		
Risk	**Confidence**	
Low	**Medium**	

Table 216. Growth risk hypothesis; Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	6.3	None Expected	Medium
WA Cropland	13.08	None Expected	Medium
ID Cropland	3.69	None Expected	Medium
ID Potato	0.61	None Expected	Low
Mint	2.66	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	2.66, 1.14	None Expected	Medium
Field Crops	0.76, 0, 19.31, 0.44, 0, 6.38	None Expected	Medium
Vegetable Crops	2.66	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 217. Behavior risk hypothesis; Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**

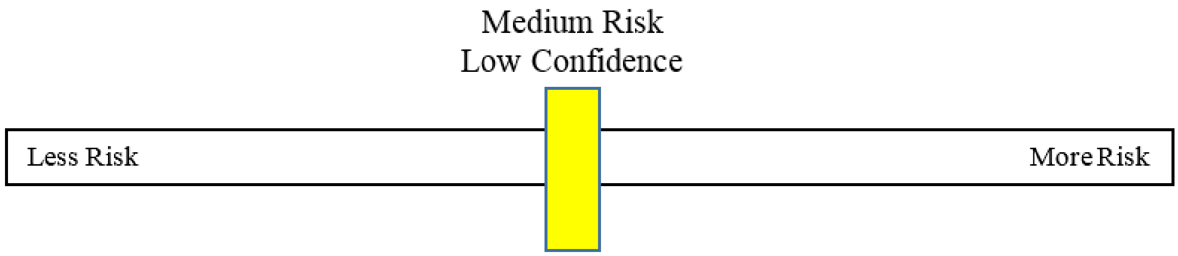
OR Cropland	6.3	None Expected	Medium
WA Cropland	13.08	None Expected	Medium
ID Cropland	3.69	None Expected	Medium
ID Potato	0.61	None Expected	Low
Mint	2.66	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	2.66, 1.14	None Expected	Medium
Field Crops	0.76, 0, 19.31, 0.44, 0, 6.38	None Expected	Medium
Vegetable Crops	2.66	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 218. Effects analysis summary table: Chinook salmon, Snake River Fall-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce	Low	Medium	Not modelled	No

abundance via reduction in prey availability.				
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, Snake River Fall-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.2.9 Chinook Salmon, Snake River spring/summer-run ESU (*Oncorhynchus tshawytscha*)

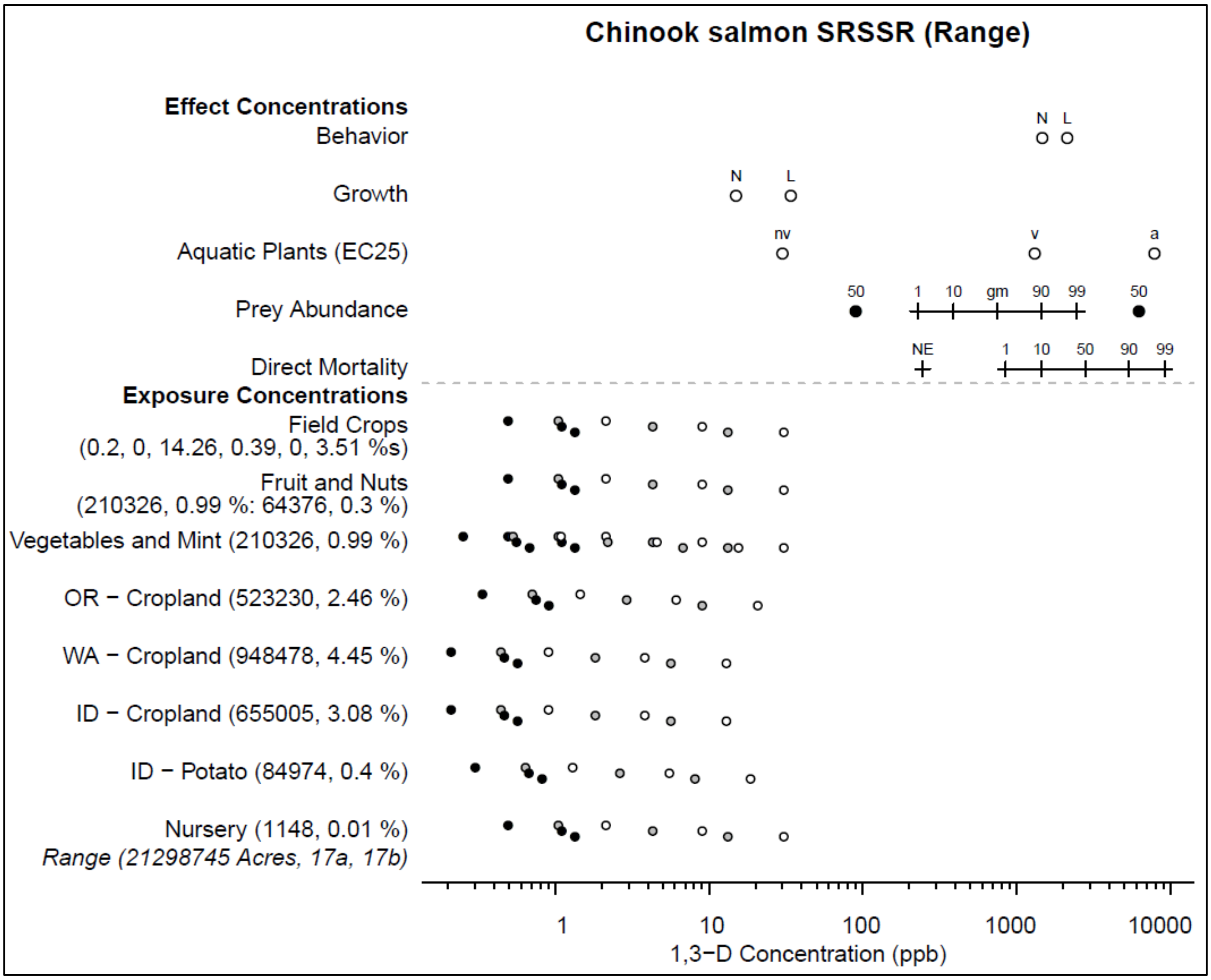


Figure 69. Effects analysis Risk-plot for Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Table 219. Likelihood of exposure determination for Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	2	yes	no	yes	NA	3	**Medium**
WA Cropland	2	yes	no	yes	NA	3	**Medium**
ID Cropland	2	yes	no	yes	NA	3	**Medium**
ID Potato	1	yes	no	yes	no	3	**Low**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 220. Direct mortality risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	2.46	None Expected	Medium	Medium
WA Cropland	4.45	None Expected	Medium	Medium
ID Cropland	3.08	None Expected	Medium	Medium
ID Potato	0.4	None Expected	Medium	Low
Mint	0.99	None Expected	Medium	Medium
Nursery	0.01	None Expected	Medium	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium	Medium

Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium	Medium
Vegetable Crops	0.99	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 221. Prey risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	2.46	None Expected	None Expected	Medium
WA Cropland	4.45	None Expected	None Expected	Medium
ID Cropland	3.08	None Expected	None Expected	Medium
ID Potato	0.4	None Expected	None Expected	Low
Mint	0.99	None Expected	None Expected	Medium
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	0.99, 0.3	None Expected	None Expected	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	None Expected	Medium
Vegetable Crops	0.99	None Expected	None Expected	Medium

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.		
Risk	**Confidence**	
Low	**Medium**	

Table 222. Growth risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	2.46	None Expected	Medium
WA Cropland	4.45	None Expected	Medium
ID Cropland	3.08	None Expected	Medium
ID Potato	0.4	None Expected	Low
Mint	0.99	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium
Vegetable Crops	0.99	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 223. Behavior risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**

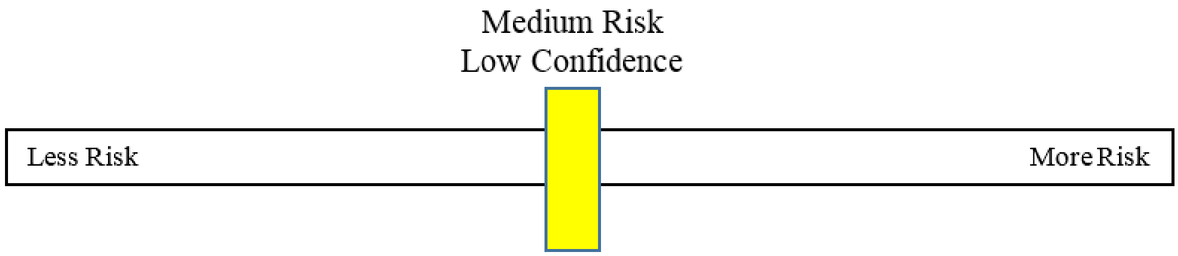
OR Cropland	2.46	None Expected	Medium
WA Cropland	4.45	None Expected	Medium
ID Cropland	3.08	None Expected	Medium
ID Potato	0.4	None Expected	Low
Mint	0.99	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium
Vegetable Crops	0.99	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 224. Effects analysis summary table: Chinook salmon, Snake River Spring/Summer-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce	Low	Medium	Not modelled	No

abundance via reduction in prey availability.				
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Chinook salmon, Snake River Spring/Summer-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.2.10 Chinook salmon, Upper Columbia River spring-run ESU (*Oncorhynchus tshawytscha*)

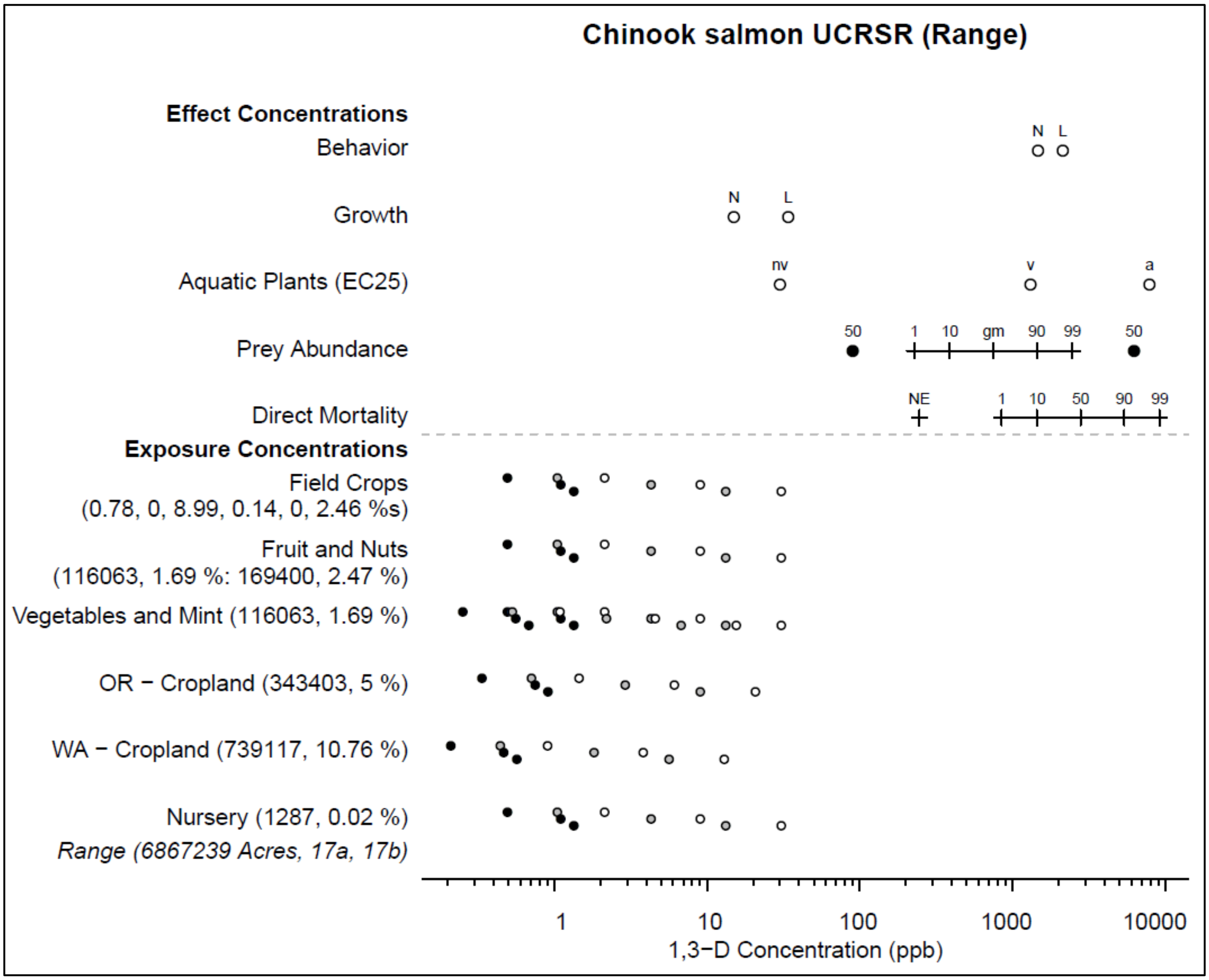


Figure 70. Effects analysis Risk-plot for Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Table 225. Likelihood of exposure determination for Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	3	yes	no	yes	NA	3	**Medium**
WA Cropland	3	yes	no	yes	NA	3	**Medium**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 226. Direct mortality risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	5.0	None Expected	Medium	Medium
WA Cropland	10.76	None Expected	Medium	Medium
Mint	1.69	None Expected	Medium	Medium
Nursery	0.02	None Expected	Medium	Low
Fruit and Nuts	1.69, 2.47	None Expected	Medium	Medium
Field Crops	0.78, 0, 8.99, 0.14, 0, 2.46	None Expected	Medium	Medium

Vegetable Crops	1.69	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 227. Prey risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	5.0	None Expected	None Expected	Medium
WA Cropland	10.76	None Expected	None Expected	Medium
Mint	1.69	None Expected	None Expected	Medium
Nursery	0.02	None Expected	None Expected	Low
Fruit and Nuts	1.69, 2.47	None Expected	None Expected	Medium
Field Crops	0.78, 0, 8.99, 0.14, 0, 2.46	None Expected	None Expected	Medium
Vegetable Crops	1.69	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 228. Growth risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	5.0	None Expected	Medium
WA Cropland	10.76	None Expected	Medium
Mint	1.69	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.69, 2.47	None Expected	Medium
Field Crops	0.78, 0, 8.99, 0.14, 0, 2.46	None Expected	Medium
Vegetable Crops	1.69	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 229. Behavior risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	5.0	None Expected	Medium
WA Cropland	10.76	None Expected	Medium
Mint	1.69	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.69, 2.47	None Expected	Medium
Field Crops	0.78, 0, 8.99, 0.14, 0, 2.46	None Expected	Medium

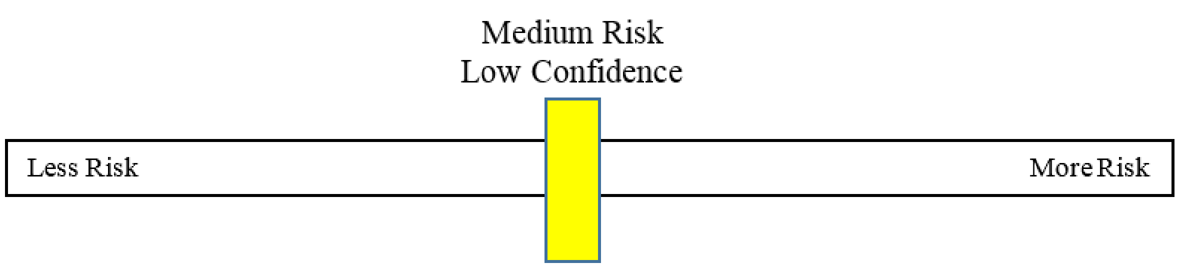
Vegetable Crops	1.69	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 230. Effects analysis summary table: Chinook salmon, Upper Columbia River Spring-run ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult	Low	High	Not modelled	No

and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Chinook salmon, Upper Columbia River Spring-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.11 Chinook Salmon, Upper Willamette River ESU (*Oncorhynchus tshawytscha*)

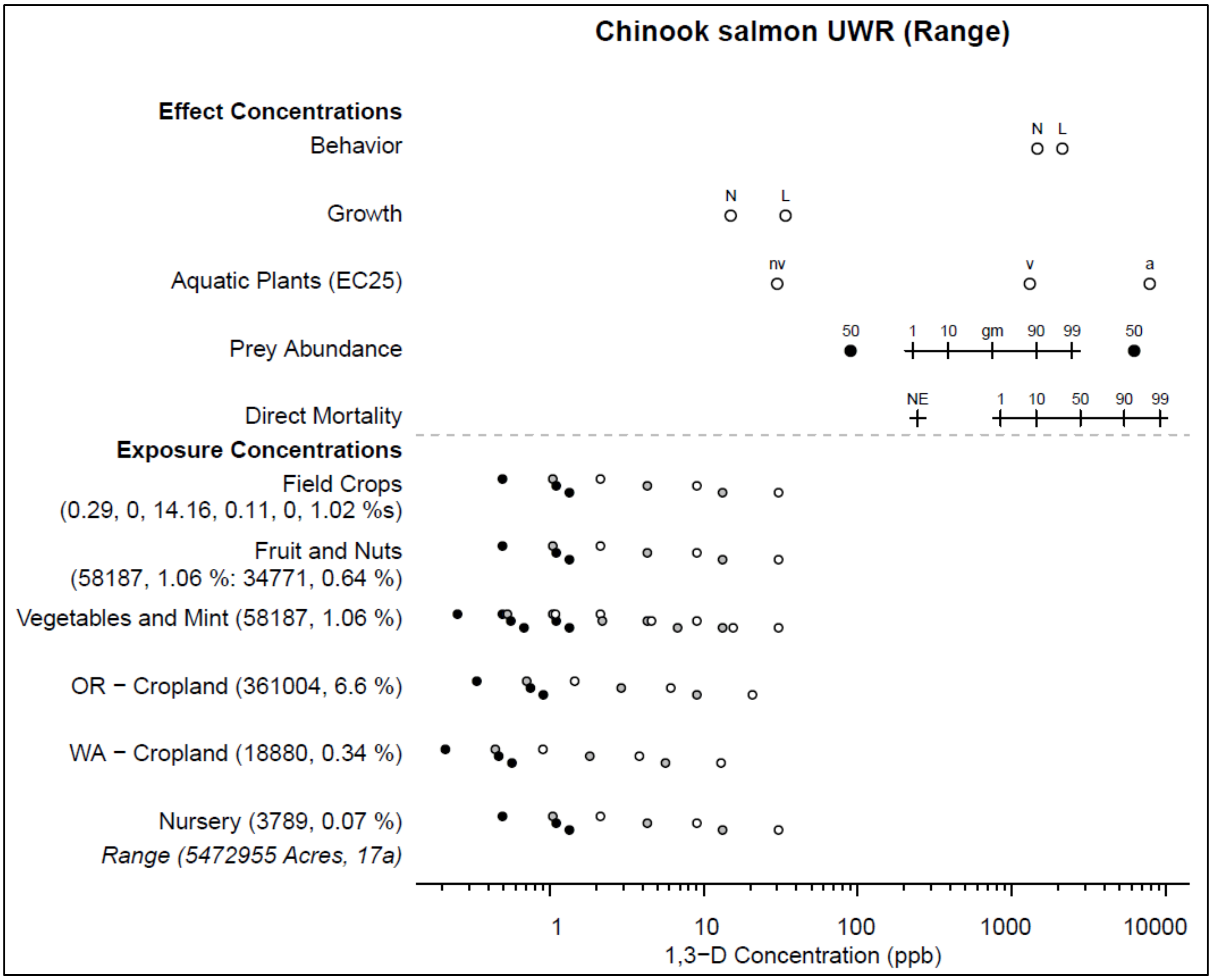


Figure 71. Effects analysis Risk-plot for Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Table 231. Likelihood of exposure determination for Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	3	yes	no	yes	NA	3	**High**
WA Cropland	1	yes	no	yes	yes	3	**High**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 232. Direct mortality risk hypothesis; Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	6.6	None Expected	Medium	High
WA Cropland	0.34	None Expected	Medium	High
Mint	1.06	None Expected	Medium	Medium
Nursery	0.07	None Expected	Medium	Low
Fruit and Nuts	1.06, 0.64	None Expected	Medium	Medium
Field Crops	0.29, 0, 14.16, 0.11, 0, 1.02	None Expected	Medium	Medium
Vegetable Crops	1.06	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 233. Prey risk hypothesis; Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	6.6	None Expected	None Expected	High
WA Cropland	0.34	None Expected	None Expected	High
Mint	1.06	None Expected	None Expected	Medium
Nursery	0.07	None Expected	None Expected	Low
Fruit and Nuts	1.06, 0.64	None Expected	None Expected	Medium
Field Crops	0.29, 0, 14.16, 0.11, 0, 1.02	None Expected	None Expected	Medium
Vegetable Crops	1.06	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 234. Growth risk hypothesis; Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
OR Cropland	6.6	None Expected	High
WA Cropland	0.34		High
Mint	1.06	None Expected	Medium
Nursery	0.07	None Expected	Low
Fruit and Nuts	1.06, 0.64	None Expected	Medium
Field Crops	0.29, 0, 14.16, 0.11, 0, 1.02	None Expected	Medium
Vegetable Crops	1.06	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 235. Behavior risk hypothesis; Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	6.6	None Expected	High
WA Cropland	0.34		High
Mint	1.06	None Expected	Medium
Nursery	0.07	None Expected	Low
Fruit and Nuts	1.06, 0.64	None Expected	Medium
Field Crops	0.29, 0, 14.16, 0.11, 0, 1.02	None Expected	Medium
Vegetable Crops	1.06	None Expected	Medium

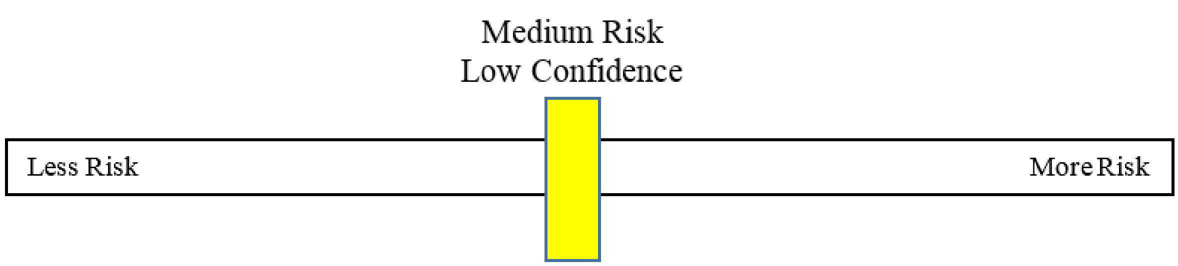
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 236. Effects analysis summary table: Chinook salmon, Upper Willamette River ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and	Low	High	Not modelled	No

adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Chinook salmon, Upper Willamette River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.12 Coho Salmon, Central California Coast ESU (*Oncorhynchus kisutch*)

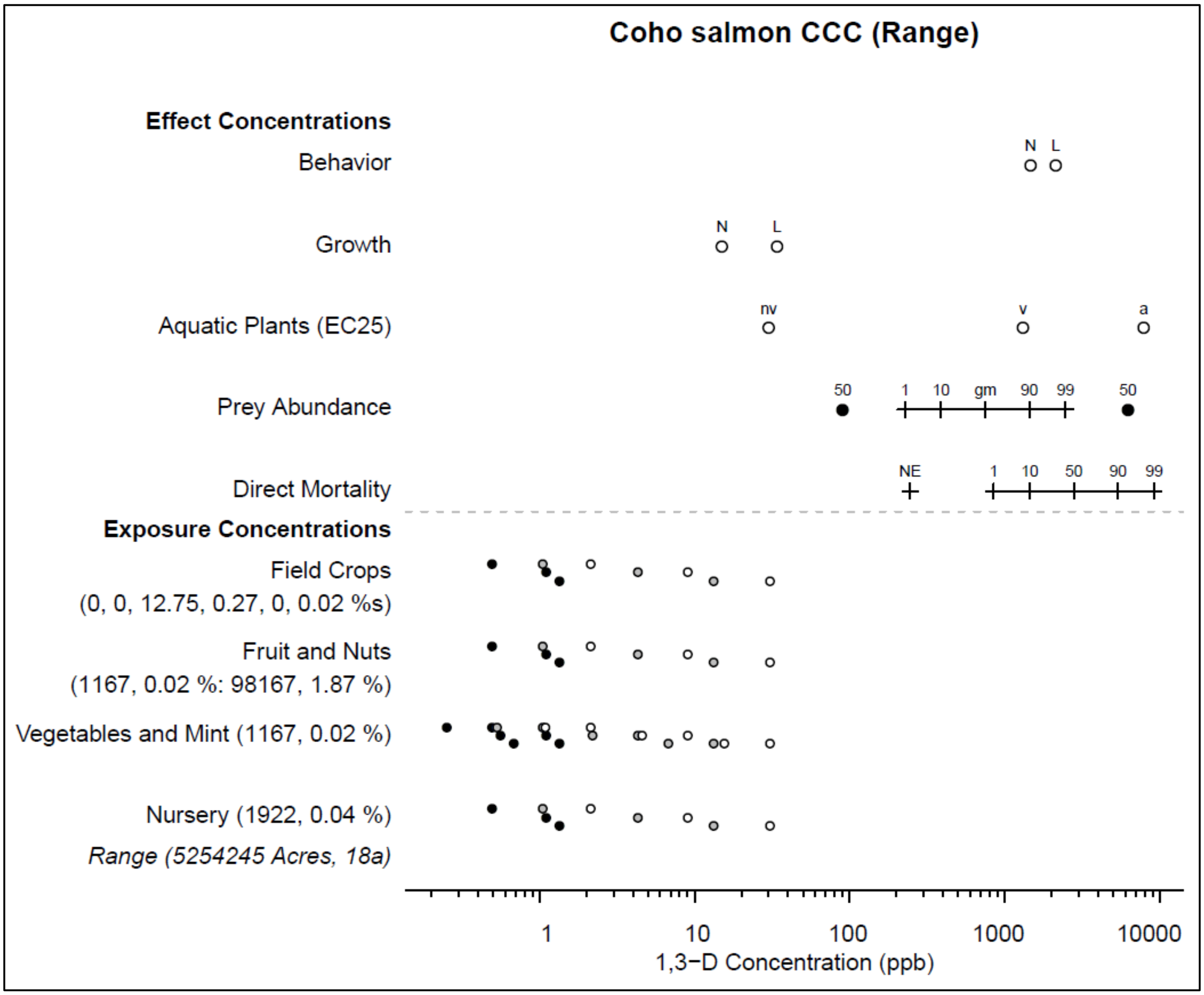


Figure 72. Effects analysis Risk-plot for Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

Table 237. Likelihood of exposure determination for Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 238. Direct mortality risk hypothesis; Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.02	None Expected	Medium	Low
Nursery	0.04	None Expected	Medium	Low
Fruit and Nuts	0.02, 1.87	None Expected	Medium	Medium
Field Crops	0, 0, 12.75, 0.27, 0, 0.02	None Expected	Medium	Medium
Vegetable Crops	0.02	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 239. Prey risk hypothesis; Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.02	None Expected	None Expected	Low
Nursery	0.04	None Expected	None Expected	Low
Fruit and Nuts	0.02, 1.87	None Expected	None Expected	Medium
Field Crops	0, 0, 12.75, 0.27, 0, 0.02	None Expected	None Expected	Medium
Vegetable Crops	0.02	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 240. Growth risk hypothesis; Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.02	None Expected	Low
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.02, 1.87	None Expected	Medium
Field Crops	0, 0, 12.75, 0.27, 0, 0.02	None Expected	Medium
Vegetable Crops	0.02	None Expected	Low

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).		
Risk	**Confidence**	
Low	**High**	

Table 241. Behavior risk hypothesis; Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

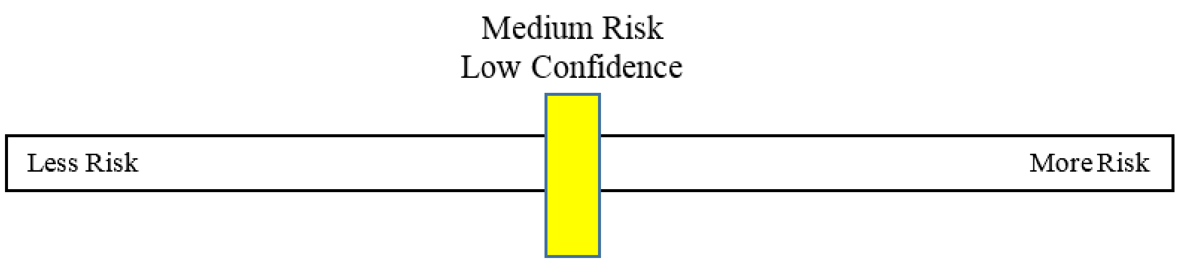
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.02	None Expected	Low
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.02, 1.87	None Expected	Medium
Field Crops	0, 0, 12.75, 0.27, 0, 0.02	None Expected	Medium
Vegetable Crops	0.02	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 242. Effects analysis summary table: Coho salmon, Central California Coast ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is	Medium	Low	No impact for 1,3-D; some associated with	No

sufficient to reduce abundance via acute lethality.			chloropicrin (See chapter 11.5).	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Coho salmon, Central California Coast ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.13 Coho Salmon, Lower Columbia River ESU (*Oncorhynchus kisutch*)

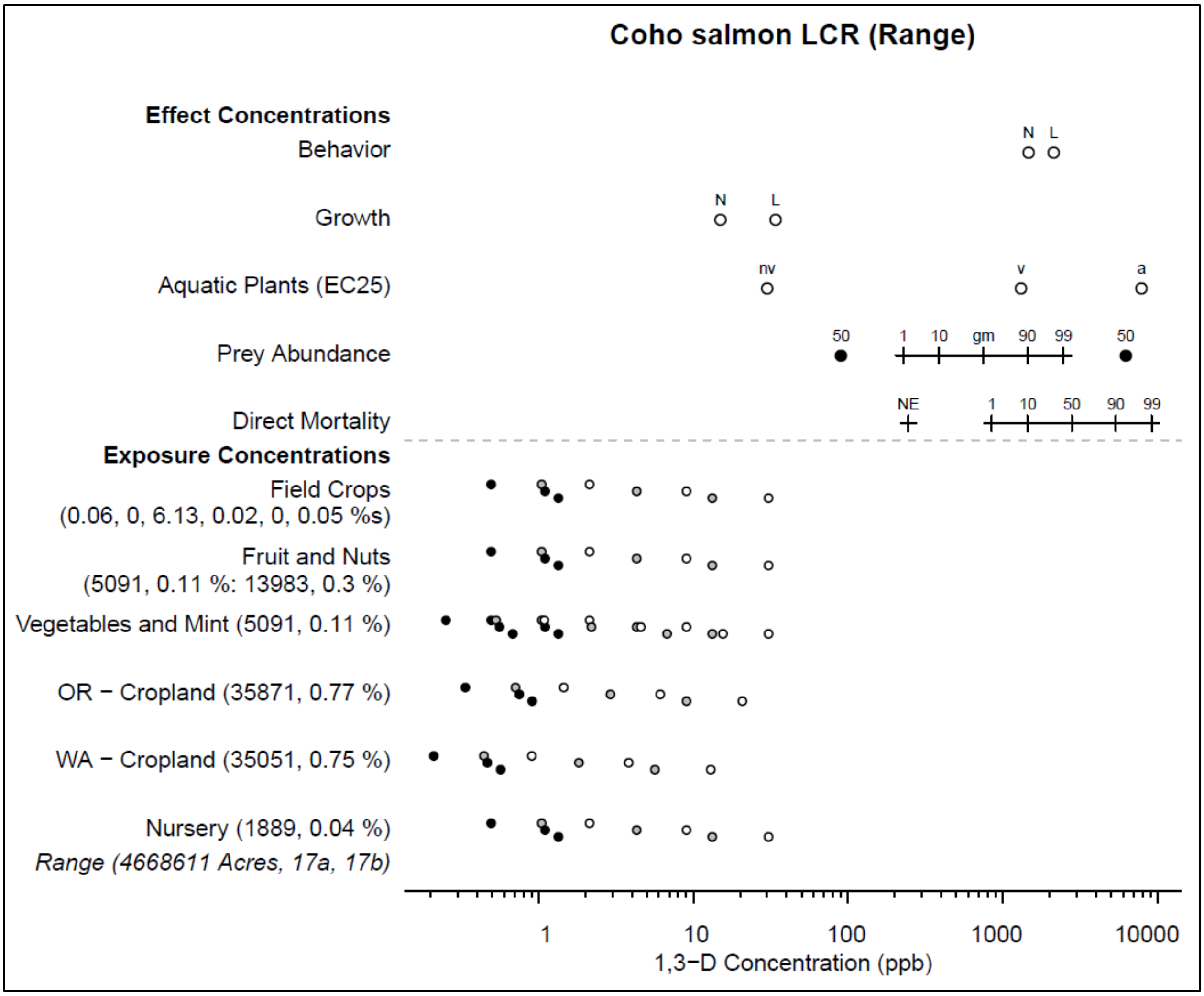


Figure 73. Effects analysis Risk-plot for Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Table 243. Likelihood of exposure determination for Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	1	yes	no	yes	yes	3	**High**
WA Cropland	1	yes	no	yes	yes	3	**High**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 244. Direct mortality risk hypothesis; Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.77	None Expected	Medium	High
WA Cropland	0.75	None Expected	Medium	High
Mint	0.11	None Expected	Medium	Medium
Nursery	0.04	None Expected	Medium	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium	Medium
Field Crops	0.06, 0, 6.13, 0.02, 0, 0.05	None Expected	Medium	Medium
Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 245. Prey risk hypothesis; Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.77	None Expected	None Expected	High
WA Cropland	0.75	None Expected	None Expected	High
Mint	0.11	None Expected	None Expected	Medium
Nursery	0.04	None Expected	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	None Expected	Medium
Field Crops	0.06, 0, 6.13, 0.02, 0, 0.05	None Expected	None Expected	Medium
Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 246. Growth risk hypothesis; Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
OR Cropland	0.77	None Expected	High
WA Cropland	0.75		High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium
Field Crops	0.06, 0, 6.13, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 247. Behavior risk hypothesis; Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.77	None Expected	High
WA Cropland	0.75		High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.3	None Expected	Medium
Field Crops	0.06, 0, 6.13, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium

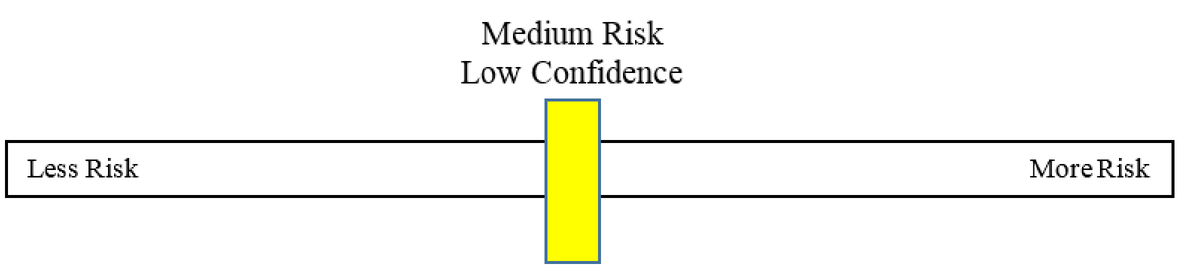
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 248. Effects analysis summary table: Coho salmon, Lower Columbia River ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and	Low	High	Not modelled	No

adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Coho salmon, Lower Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.14 Coho Salmon, Oregon Coast ESU (*Oncorhynchus kisutch*)

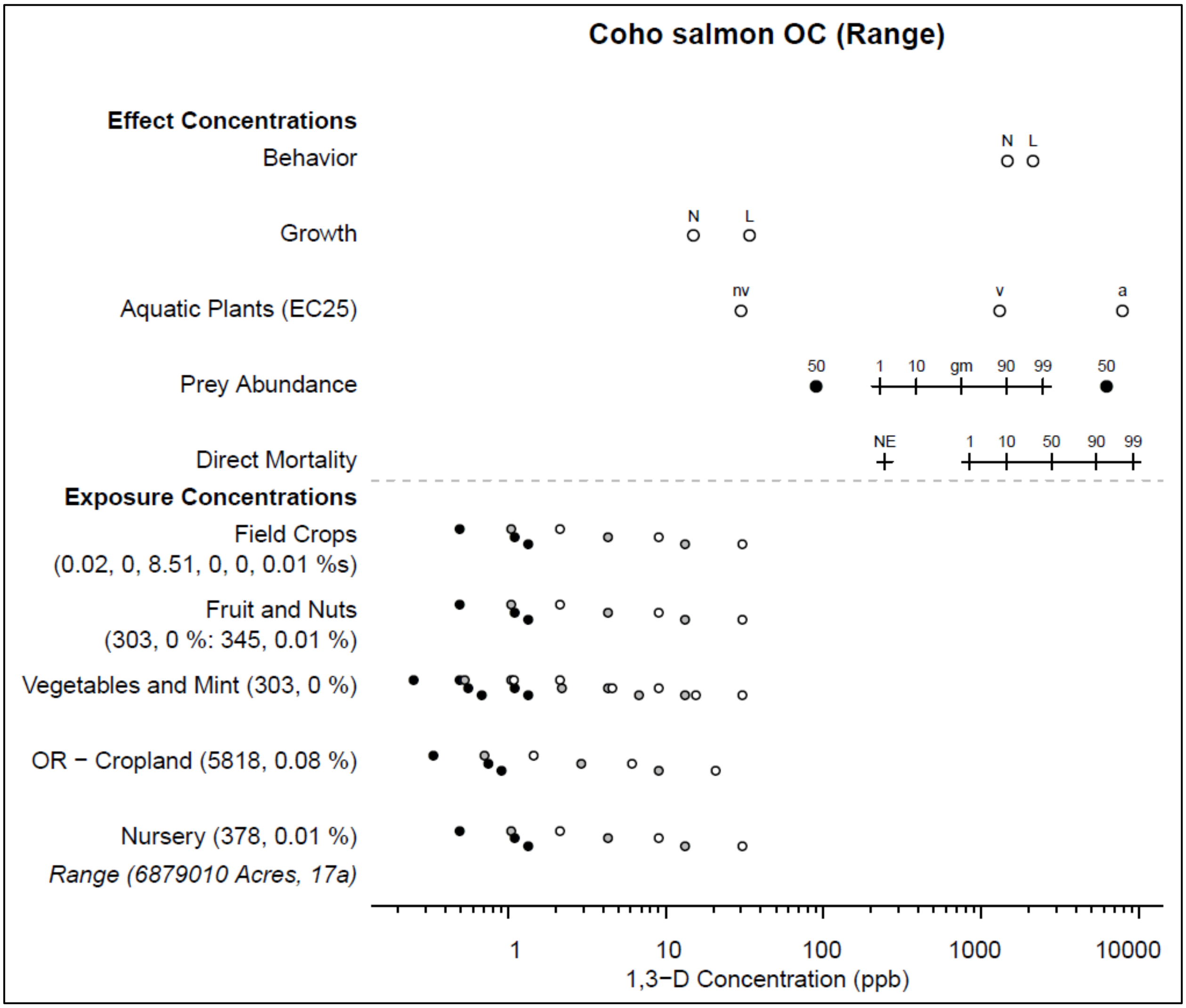


Figure 74. Effects analysis Risk-plot for Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

Table 249. Likelihood of exposure determination for Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	1	yes	no	yes	no	3	**Low**
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	no	3	**Low**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 250. Direct mortality risk hypothesis; Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.08	None Expected	Medium	Low
Mint	0	None Expected	Medium	Low
Nursery	0.01	None Expected	Medium	Low
Fruit and Nuts	0, 0.01	None Expected	Medium	Low
Field Crops	0.02, 0, 8.51, 0, 0, 0.01	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Low	**High**			

Table 251. Prey risk hypothesis; Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.08	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	0, 0.01	None Expected	None Expected	Low
Field Crops	0.02, 0, 8.51, 0, 0, 0.01	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 252. Growth risk hypothesis; Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.08	None Expected	Low
Mint	0.01	None Expected	Low
Nursery	0, 0.01	None Expected	Low

Fruit and Nuts	0.02, 0, 8.51, 0, 0, 0.01	None Expected	Medium
Field Crops	0	None Expected	Low
Vegetable Crops	0.08	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 253. Behavior risk hypothesis; Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

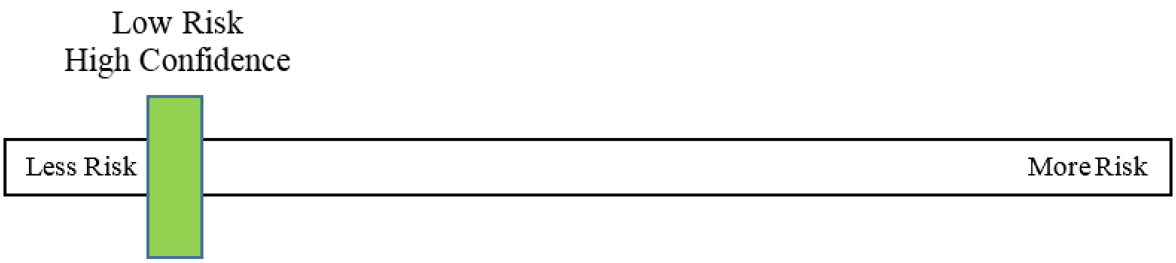
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.08	None Expected	Low
Mint	0.01	None Expected	Low
Nursery	0, 0.01	None Expected	Low
Fruit and Nuts	0.02, 0, 8.51, 0, 0, 0.01	None Expected	Medium
Field Crops	0	None Expected	Low
Vegetable Crops	0.08	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 254. Effects analysis summary table: Coho salmon, Oregon Coast ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		

	Risk **1,3-D** **Chloropicrin**	**Confidence** **1,3-D** **Chloropicrin**	**Population Model Results**	**Risk Hypothesis Supported?** **Yes/No**
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Low	High	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Coho salmon, Oregon Coast ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to 1,3-D or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Where formulated products and tank mixtures containing 1,3-D occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.



12.2.15 Coho Salmon, Southern Oregon/Northern California Coast ESU (*Oncorhynchus kisutch*)

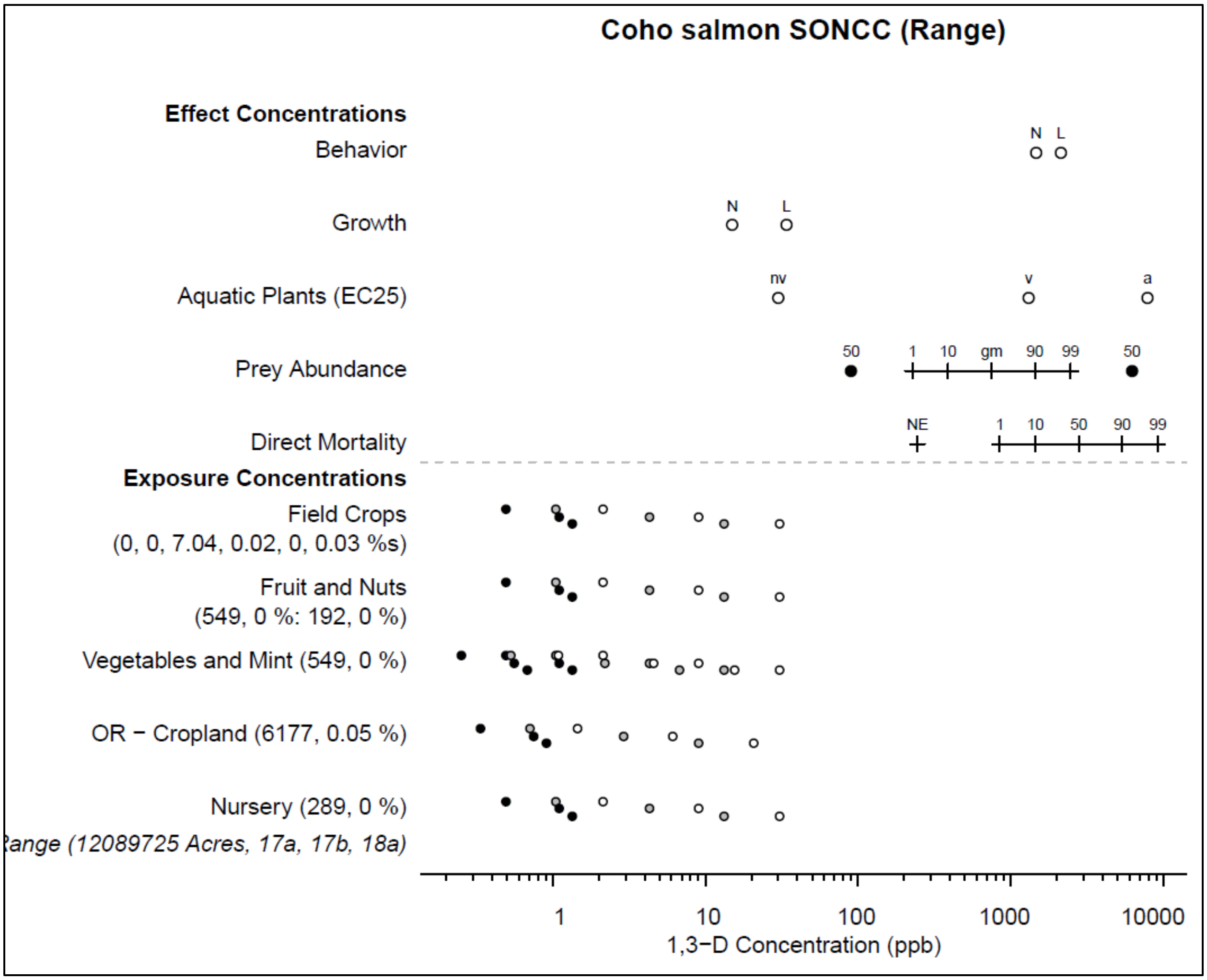


Figure 75. Effects analysis Risk-plot for Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Table 255. Likelihood of exposure determination for Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
OR Cropland	1	yes	no	yes	yes	3	High
Mint	1	yes	no	no	no	3	Low
Nursery	1	yes	no	no	no	3	Low
Fruit and Nuts	1	yes	no	no	no	3	Low
Field Crops	3	yes	no	no	NA	3	Medium
Vegetable Crops	1	yes	no	no	no	3	Low

Table 256. Direct mortality risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.05	None Expected	Medium	High
Mint	0	None Expected	Medium	Low
Nursery	0	None Expected	Medium	Low
Fruit and Nuts	0,0	None Expected	Medium	Low
Field Crops	0, 0, 7.04, 0.02, 0, 0.03	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 257. Prey risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.05	None Expected	None Expected	High
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0,0	None Expected	None Expected	Low
Field Crops	0, 0, 7.04, 0.02, 0, 0.03	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 258. Growth risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.05	None Expected	High

Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0, 0, 7.04, 0.02, 0, 0.03	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

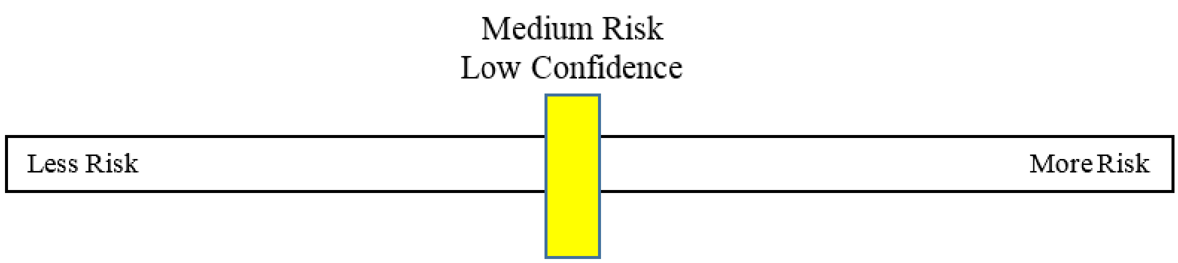
Table 259. Behavior risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
OR Cropland	0.05	None Expected	High
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0, 0, 7.04, 0.02, 0, 0.03	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 260. Effects analysis summary table: Coho salmon, Southern Oregon Northern California Coast ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Coho salmon, Southern Oregon Northern California Coast ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.16 Sockeye Salmon, Ozette Lake ESU (*Oncorhynchus nerka*)

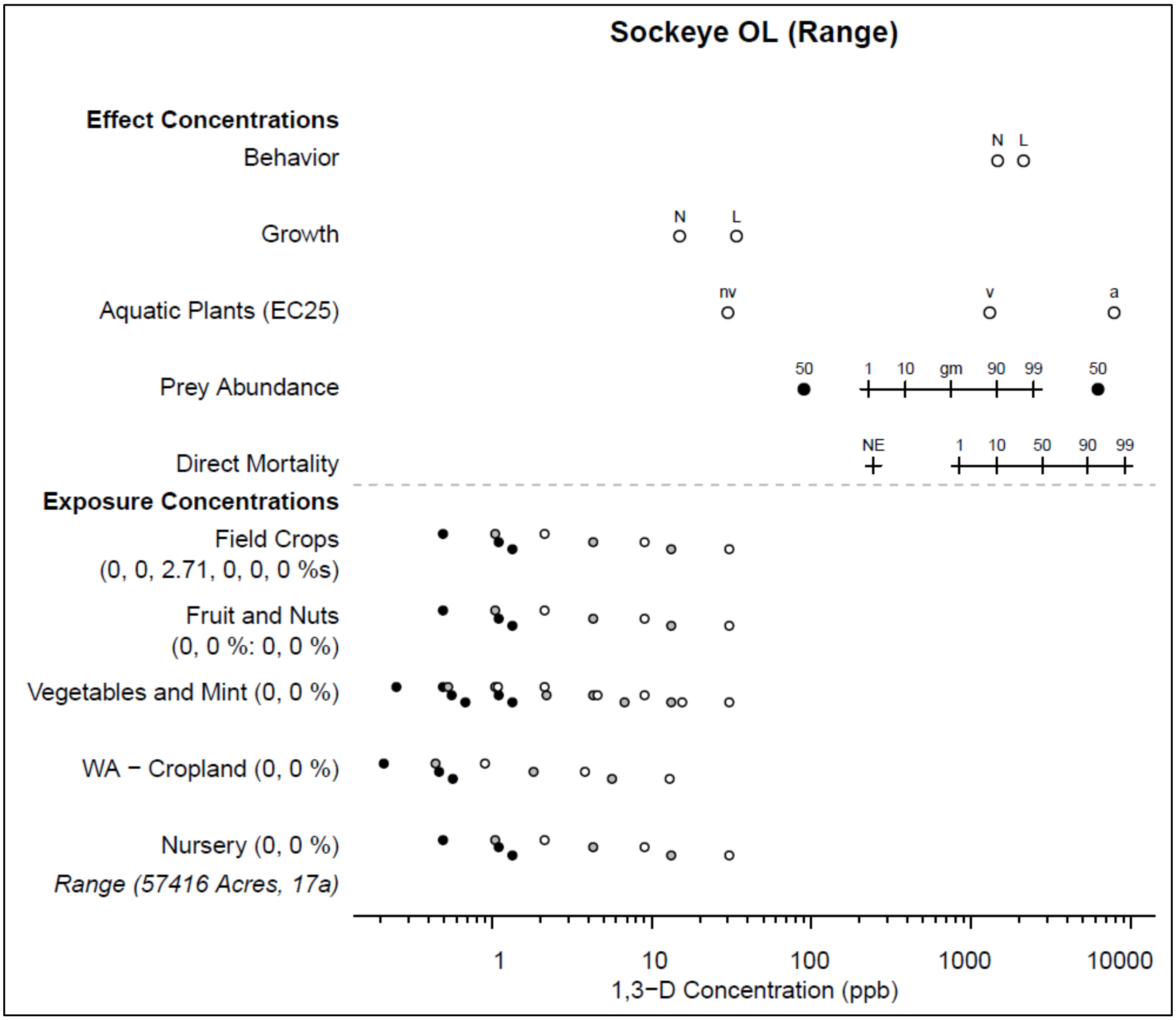


Figure 76. Effects analysis Risk-plot for Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

Table 261. Likelihood of exposure determination for Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	1	yes	no	yes	no	3	**Low**
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	no	3	**Low**
Field Crops	2	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 262. Direct mortality risk hypothesis; Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0	None Expected	Medium	Low
Mint	0	None Expected	Medium	Low
Nursery	0	None Expected	Medium	Low
Fruit and Nuts	0,0	None Expected	Medium	Low
Field Crops	0, 0, 2.71, 0, 0, 0	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Low	**High**			

Table 263. Prey risk hypothesis; Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0,0	None Expected	None Expected	Low
Field Crops	0, 0, 2.71, 0, 0, 0	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 264. Growth risk hypothesis; Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	0	None Expected	Low
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low

Field Crops	0, 0, 2.71, 0, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 265. Behavior risk hypothesis; Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

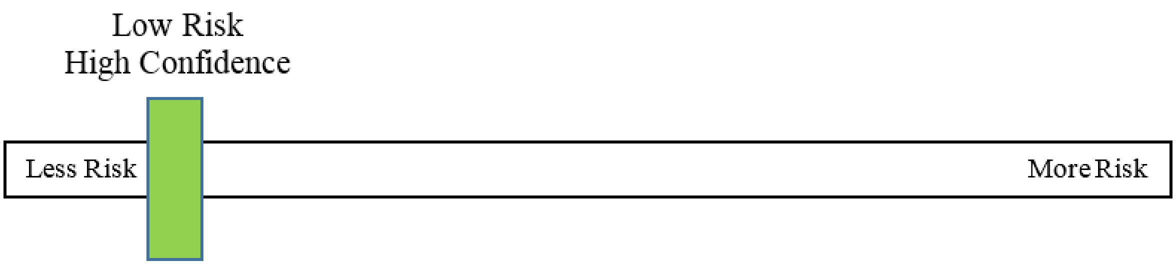
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	0	None Expected	Low
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0, 0, 2.71, 0, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 266. Effects analysis summary table: Sockeye salmon, Ozette Lake ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		

Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Low	High	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Sockeye salmon, Ozette Lake ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to 1,3-D or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Where formulated products and tank mixtures containing 1,3-D occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.2.17 Sockeye Salmon, Snake River ESU (*Oncorhynchus nerka*)

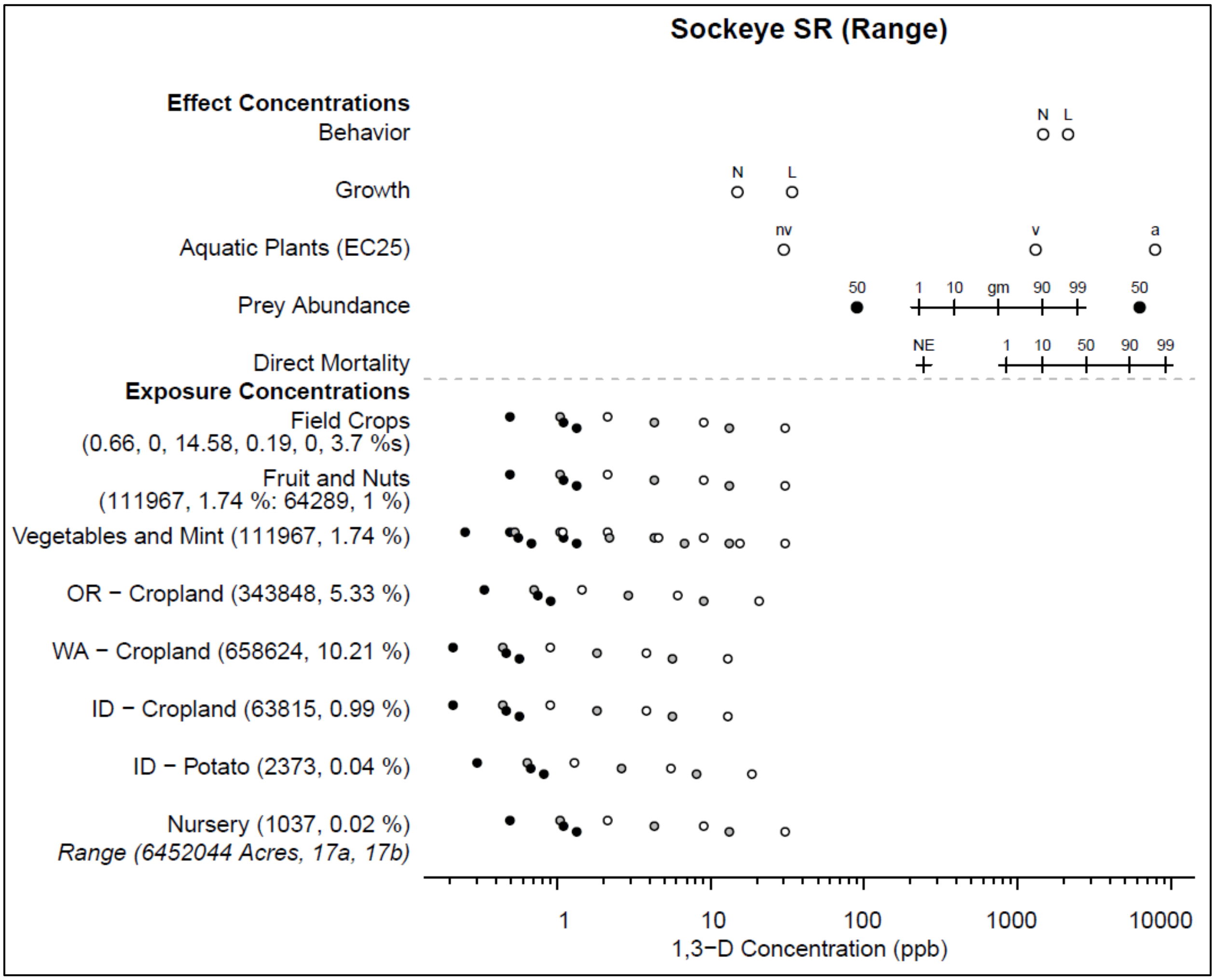


Figure 77. Effects analysis Risk-plot for Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Table 267. Likelihood of exposure determination for Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	3	yes	no	yes	NA	3	**High**
OR Cropland	3	yes	no	yes	NA	3	**High**
ID Cropland	1	yes	no	yes	no	3	**Low**
ID Potato	1	yes	no	yes	no	3	**Low**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 268. Direct mortality risk hypothesis; Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	10.21	None Expected	Medium	High
OR Cropland	5.33	None Expected	Medium	High
ID Cropland	0.99	None Expected	Medium	Low
ID Potato	0.04	None Expected	Medium	Low
Mint	1.74	None Expected	Medium	Medium
Nursery	0.02	None Expected	Medium	Low
Fruit and Nuts	1.74, 1	None Expected	Medium	Medium

Field Crops	0.66, 0, 14.58, 0.19, 0, 3.7	None Expected	Medium	Medium
Vegetable Crops	1.74	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 269. Prey risk hypothesis; Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	10.21	None Expected	None Expected	High
OR Cropland	5.33	None Expected	None Expected	High
ID Cropland	0.99	None Expected	None Expected	Low
ID Potato	0.04	None Expected	None Expected	Low
Mint	1.74	None Expected	None Expected	Medium
Nursery	0.02	None Expected	None Expected	Low
Fruit and Nuts	1.74, 1	None Expected	None Expected	Medium
Field Crops	0.66, 0, 14.58, 0.19, 0, 3.7	None Expected	None Expected	Medium
Vegetable Crops	1.74	None Expected	None Expected	Medium

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.		
Risk	**Confidence**	
Low	**Medium**	

Table 270. Growth risk hypothesis; Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	10.21	None Expected	High
OR Cropland	5.33	None Expected	High
ID Cropland	0.99	None Expected	Low
ID Potato	0.04	None Expected	Low
Mint	1.74	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.74, 1	None Expected	Medium
Field Crops	0.66, 0, 14.58, 0.19, 0, 3.7	None Expected	Medium
Vegetable Crops	1.74	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 271. Behavior risk hypothesis; Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**

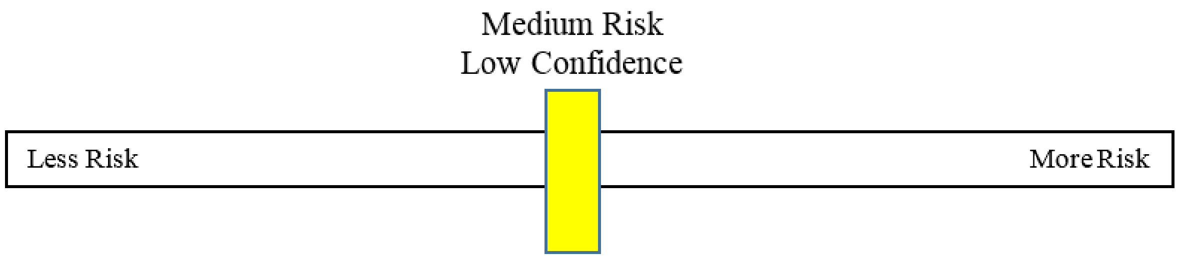
WA Cropland	10.21	None Expected	High
OR Cropland	5.33	None Expected	High
ID Cropland	0.99	None Expected	Low
ID Potato	0.04	None Expected	Low
Mint	1.74	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.74, 1	None Expected	Medium
Field Crops	0.66, 0, 14.58, 0.19, 0, 3.7	None Expected	Medium
Vegetable Crops	1.74	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 272. Effects analysis summary table: Sockeye salmon, Snake River ESU and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	No impact for 1,3-D; some associated with chloropicrin (See chapter 11.5).	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce	Low	Medium	Not modelled	No

abundance via reduction in prey availability.				
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High	Not modelled	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High	Not modelled	No

Effects analysis summary: Sockeye salmon, Snake River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to 1,3-D. Slight shifts in population growth rate occurred at the mortality levels anticipated for some formulated products containing chloropicrin, and increased with the percentage of the population exposed. Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.2.18 Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*)

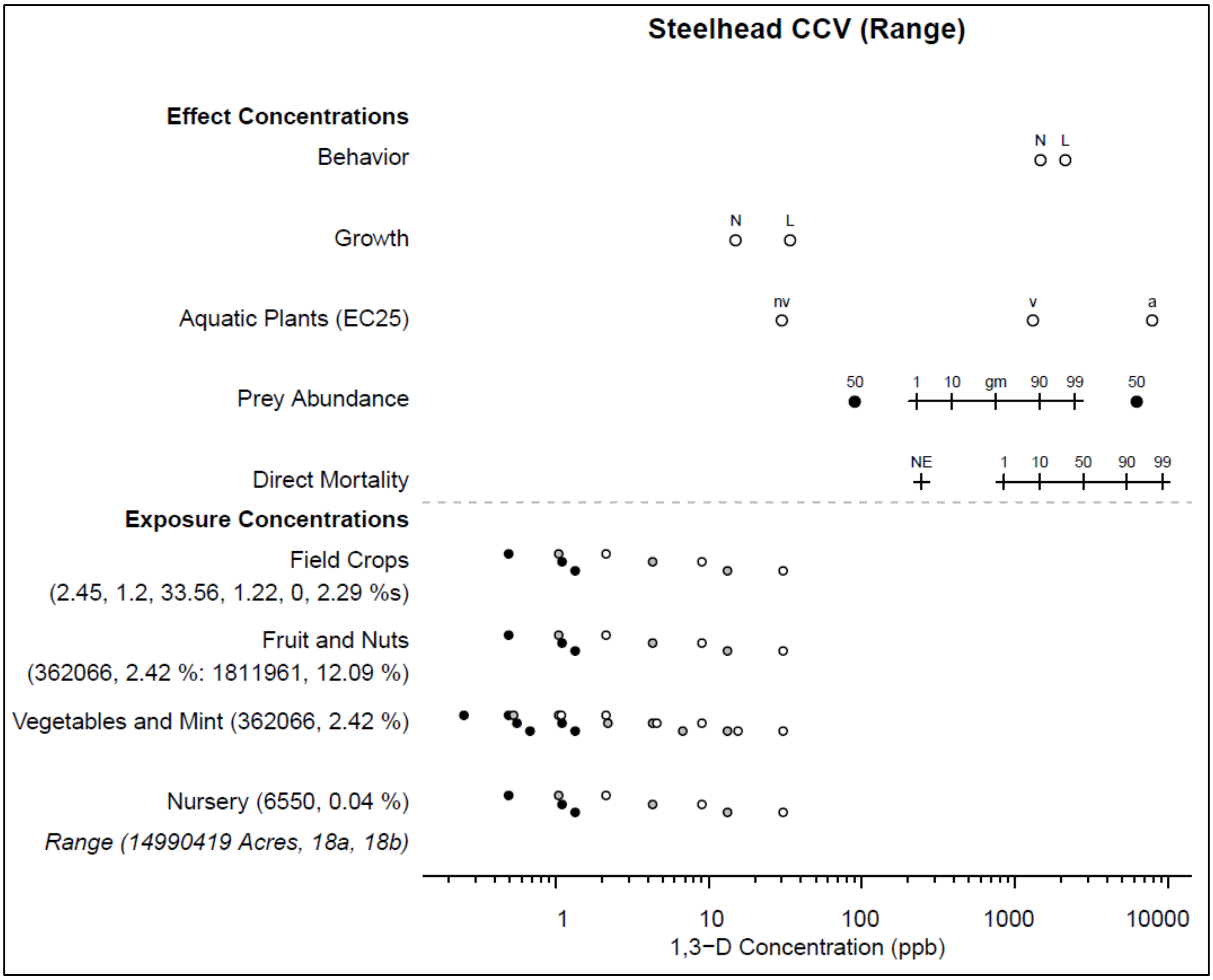


Figure 78. Effects analysis Risk-plot for Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Table 273. Likelihood of exposure determination for Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	3	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 274. Direct mortality risk hypothesis; Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	2.42	None Expected	Medium	Medium
Nursery	0.04	None Expected	Medium	Low
Fruit and Nuts	2.42, 12.09	None Expected	Medium	Medium
Field Crops	2.45, 1.2, 33.56, 1.22, 0, 2.29	None Expected	Medium	Medium
Vegetable Crops	2.42	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 275. Prey risk hypothesis; Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates/Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	2.42	None Expected	None Expected / Medium	Medium
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	2.42, 12.09	None Expected	None Expected / Medium	Medium
Field Crops	2.45, 1.2, 33.56, 1.22, 0, 2.29	None Expected	None Expected / Medium	Medium
Vegetable Crops	2.42	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 276. Growth risk hypothesis; Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	2.42	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	2.42, 12.09	None Expected	Medium
Field Crops	2.45, 1.2, 33.56, 1.22, 0, 2.29	None Expected	Medium

Vegetable Crops	2.42	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 277. Behavior risk hypothesis; Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	2.42	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	2.42, 12.09	None Expected	Medium
Field Crops	2.45, 1.2, 33.56, 1.22, 0, 2.29	None Expected	Medium
Vegetable Crops	2.42	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

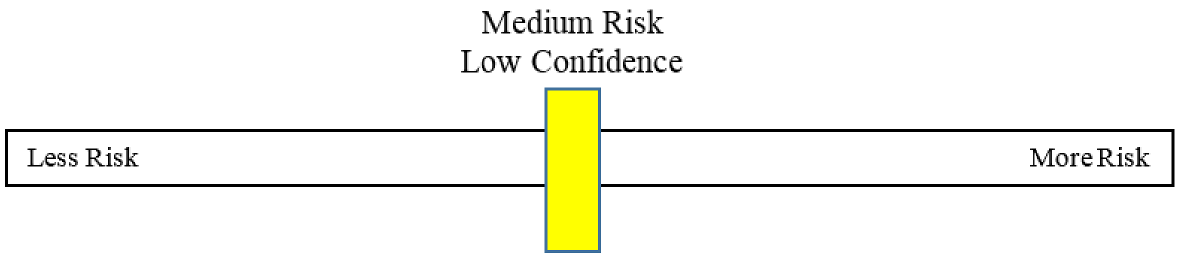
Table 278. Effects analysis summary table: Steelhead, California Central Valley DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-	Medium	Low		No

Dichloropropene is sufficient to reduce abundance via acute lethality.			Not Applicable	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary:

Steelhead, California Central Valley DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. We did not find support for the risk hypotheses for prey abundance, growth, or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.19 Steelhead, Central California Coast DPS (*Oncorhynchus mykiss*)

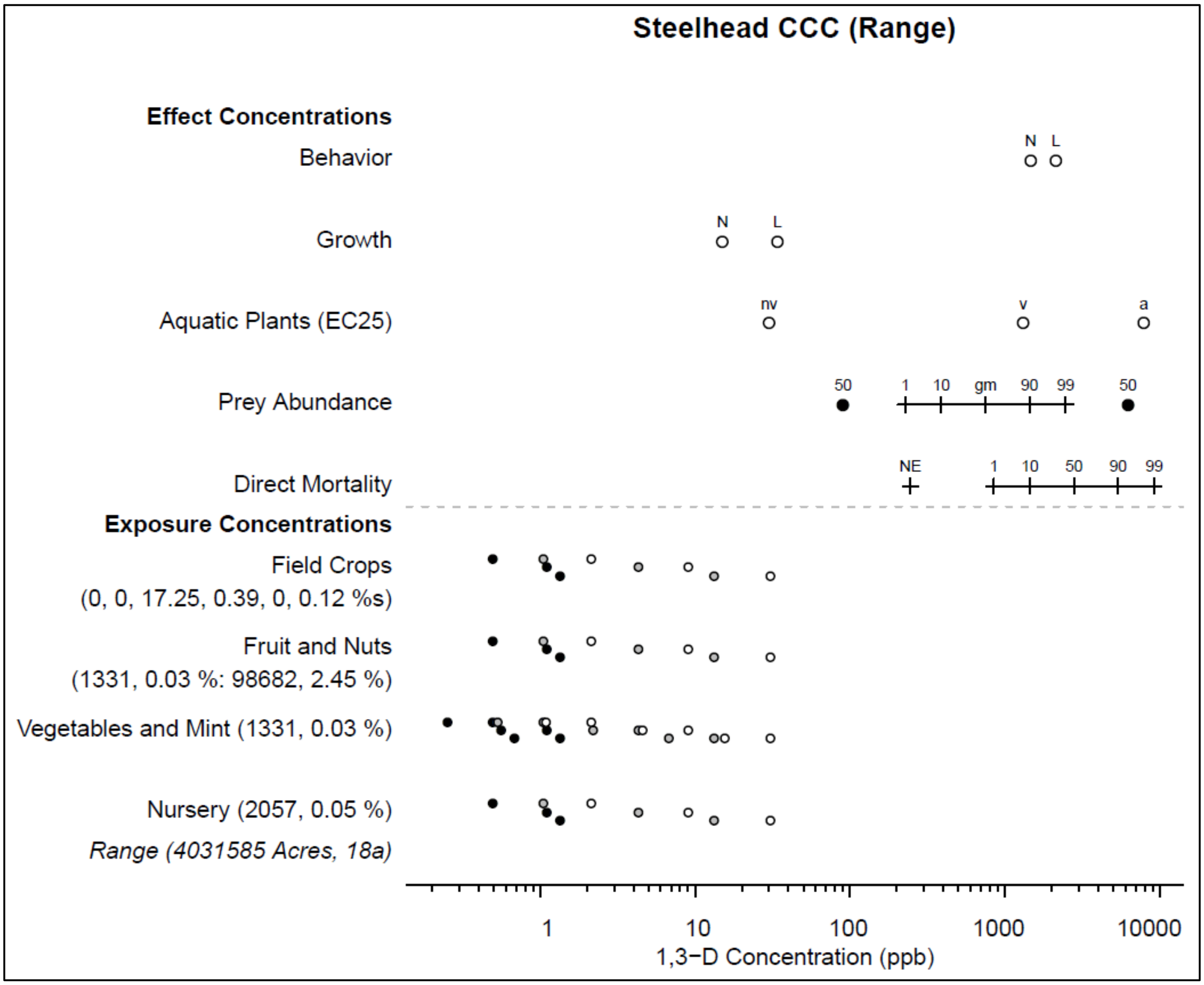


Figure 79. Effects analysis Risk-plot for Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Table 279. Likelihood of exposure determination for Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 280. Direct mortality risk hypothesis; Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.03	None Expected	Medium	Low
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	0.03, 2.45	None Expected	Medium	Medium
Field Crops	0, 0, 17.25, 0.39, 0, 0.12	None Expected	Medium	Medium
Vegetable Crops	0.03	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 281. Prey risk hypothesis; Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates/Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.03	None Expected	None Expected / Medium	Low
Nursery	0.05	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.03, 2.45	None Expected	None Expected / Medium	Medium
Field Crops	0, 0, 17.25, 0.39, 0, 0.12	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.03	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 282. Growth risk hypothesis; Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.03	None Expected	Low
Nursery	0.05	None Expected	Low
Fruit and Nuts	0.03, 2.45	None Expected	Medium
Field Crops	0, 0, 17.25, 0.39, 0, 0.12	None Expected	Medium

Vegetable Crops	0.03	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 283. Behavior risk hypothesis; Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.03	None Expected	Low
Nursery	0.05	None Expected	Low
Fruit and Nuts	0.03, 2.45	None Expected	Medium
Field Crops	0, 0, 17.25, 0.39, 0, 0.12	None Expected	Medium
Vegetable Crops	0.03	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

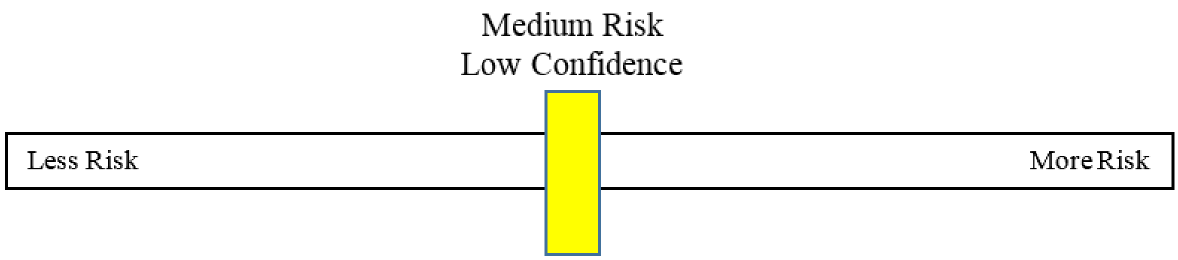
Table 284. Effects analysis summary table: Steelhead, California Coastal DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-	Medium	Low		No

Dichloropropene is sufficient to reduce abundance via acute lethality.			Not Applicable	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, California Coastal DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-

D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-D may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.20 Steelhead, Lower Columbia River DPS (*Oncorhynchus mykiss*)

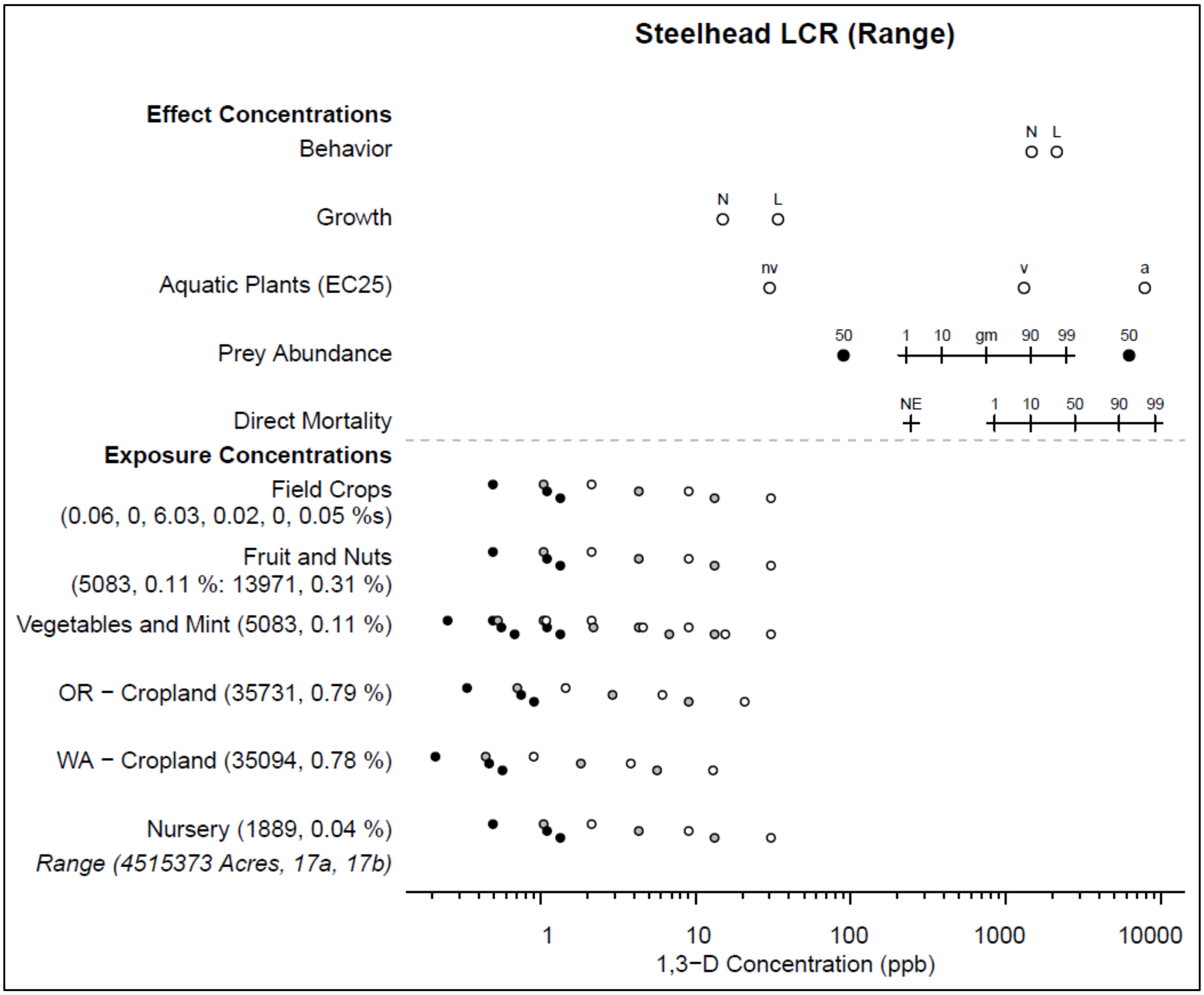


Figure 80. Effects analysis Risk-plot for Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Table 285. Likelihood of exposure determination for Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	1	yes	no	yes	yes	3	**High**
OR Cropland	1	yes	no	yes	yes	3	**High**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 286. Direct mortality risk hypothesis; Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0.78	None Expected	Medium	High
OR Cropland	0.79	None Expected	Medium	High
Mint	0.11	None Expected	Medium	Medium
Nursery	0.04	None Expected	Medium	Low
Fruit and Nuts	0.11, 0.31	None Expected	Medium	Medium
Field Crops	0.06, 0, 6.03, 0.02, 0, 0.05	None Expected	Medium	Medium
Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 287. Prey risk hypothesis; Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0.78	None Expected	None Expected / Medium	High
OR Cropland	0.79	None Expected	None Expected / Medium	High
Mint	0.11	None Expected	None Expected / Medium	Medium
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.11, 0.31	None Expected	None Expected / Medium	Medium
Field Crops	0.06, 0, 6.03, 0.02, 0, 0.05	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.11	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 288. Growth risk hypothesis; Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA Cropland	0.78	None Expected	High
OR Cropland	0.79	None Expected	High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.31	None Expected	Medium
Field Crops	0.06, 0, 6.03, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 289. Behavior risk hypothesis; Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	0.78	None Expected	High
OR Cropland	0.79	None Expected	High
Mint	0.11	None Expected	Medium
Nursery	0.04	None Expected	Low
Fruit and Nuts	0.11, 0.31	None Expected	Medium
Field Crops	0.06, 0, 6.03, 0.02, 0, 0.05	None Expected	Medium
Vegetable Crops	0.11	None Expected	Medium

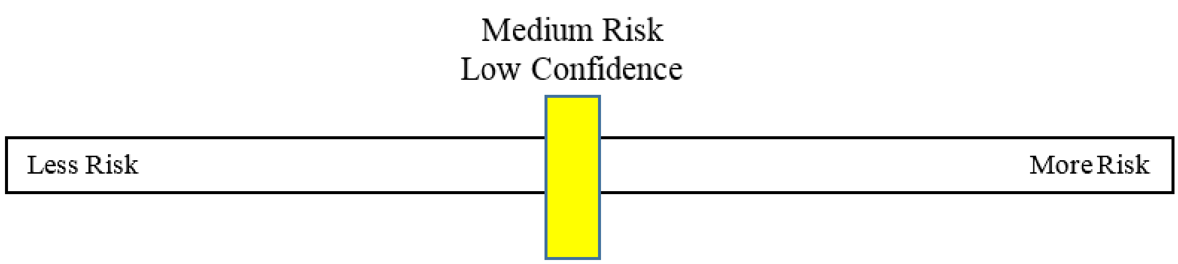
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 290. Effects analysis summary table: Steelhead, Lower Columbia River DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments	Low	High		No

to ecologically significant behaviors.				

Effects analysis summary: Steelhead, Lower Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.21 Steelhead, Middle Columbia River DPS (*Oncorhynchus mykiss*)

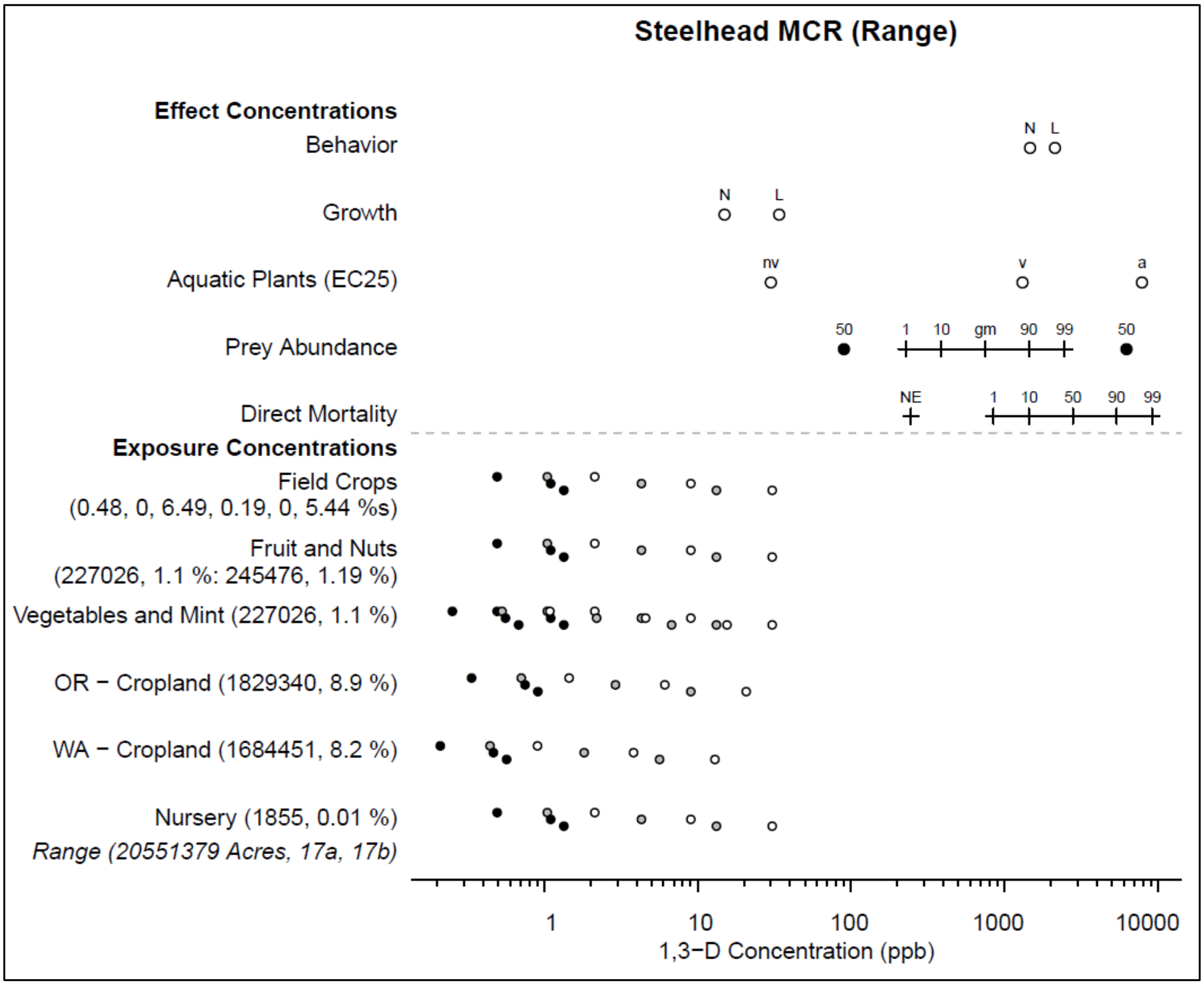


Figure 81. Effects analysis Risk-plot for Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Table 291. Likelihood of exposure determination for Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	3	yes	no	yes	NA	3	High
OR Cropland	3	yes	no	yes	NA	3	High
Mint	2	yes	no	no	NA	3	Medium
Nursery	1	yes	no	no	no	3	Low
Fruit and Nuts	2	yes	no	no	NA	3	Medium
Field Crops	3	yes	no	no	NA	3	Medium
Vegetable Crops	2	yes	no	no	NA	3	Medium

Table 292. Direct mortality risk hypothesis; Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	8.2	None Expected	Medium	High
OR Cropland	8.9	None Expected	Medium	High
Mint	1.1	None Expected	Medium	Medium
Nursery	0.01	None Expected	Medium	Low
Fruit and Nuts	1.1, 1.19	None Expected	Medium	Medium
Field Crops	0.48, 0, 6.49, 0.19, 0, 5.44	None Expected	Medium	Medium
Vegetable Crops	1.1	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 293. Prey risk hypothesis; Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	8.2	None Expected	None Expected / Medium	High
OR Cropland	8.9	None Expected	None Expected / Medium	High
Mint	1.1	None Expected	None Expected / Medium	Medium
Nursery	0.01	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.1, 1.19	None Expected	None Expected / Medium	Medium
Field Crops	0.48, 0, 6.49, 0.19, 0, 5.44	None Expected	None Expected / Medium	Medium
Vegetable Crops	1.1	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 294. Growth risk hypothesis; Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA Cropland	8.2	None Expected	High
OR Cropland	8.9	None Expected	High
Mint	1.1	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	1.1, 1.19	None Expected	Medium
Field Crops	0.48, 0, 6.49, 0.19, 0, 5.44	None Expected	Medium
Vegetable Crops	1.1	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 295. Behavior risk hypothesis; Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	8.2	None Expected	High
OR Cropland	8.9	None Expected	High
Mint	1.1	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	1.1, 1.19	None Expected	Medium
Field Crops	0.48, 0, 6.49, 0.19, 0, 5.44	None Expected	Medium
Vegetable Crops	1.1	None Expected	Medium

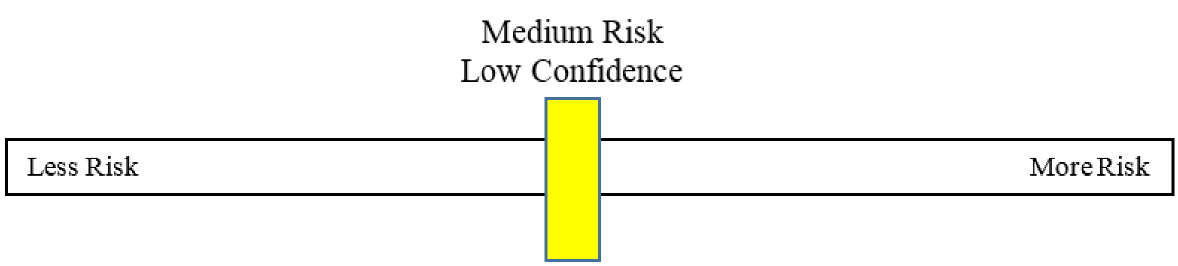
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 296. Effects analysis summary table: Steelhead, Middle Columbia River DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments	Low	High		No

to ecologically significant behaviors.				

Effects analysis summary: Steelhead, Middle Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.22 Steelhead, Northern California DPS (*Oncorhynchus mykiss*)

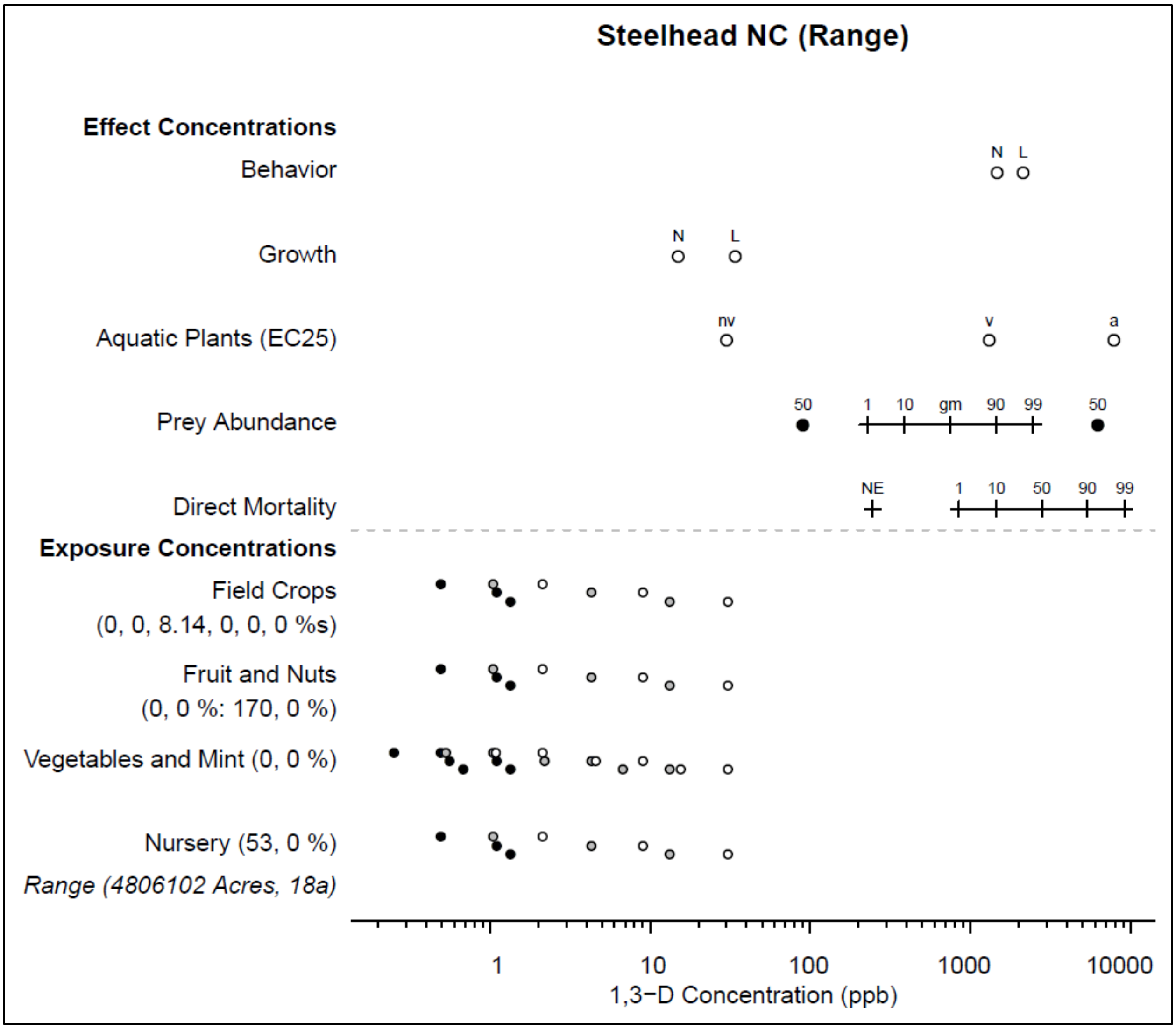


Figure 82. Effects analysis Risk-plot for Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

Table 297. Likelihood of exposure determination for Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	no	3	**Low**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	no	3	**Low**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	no	3	**Low**

Table 298. Direct mortality risk hypothesis; Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	Medium	Low
Nursery	0	None Expected	Medium	Low
Fruit and Nuts	0,0	None Expected	Medium	Low
Field Crops	0, 0, 8.14, 0, 0, 0	None Expected	Medium	Medium
Vegetable Crops	0	None Expected	Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Low	**High**			

Table 299. Prey risk hypothesis; Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	None Expected / Medium	Low
Nursery	0	None Expected	None Expected / Medium	Low
Fruit and Nuts	0,0	None Expected	None Expected / Medium	Low
Field Crops	0, 0, 8.14, 0, 0, 0	None Expected	None Expected / Medium	Medium
Vegetable Crops	0	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 300. Growth risk hypothesis; Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0, 0, 8.14, 0, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).		
Risk	**Confidence**	
Low	**High**	

Table 301. Behavior risk hypothesis; Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

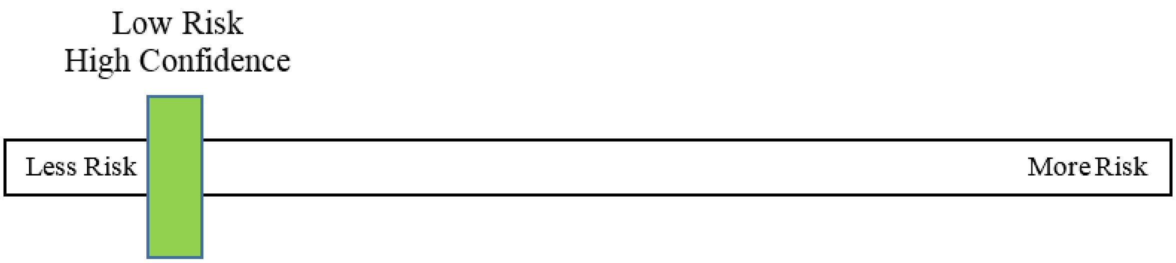
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0	None Expected	Low
Nursery	0	None Expected	Low
Fruit and Nuts	0,0	None Expected	Low
Field Crops	0, 0, 8.14, 0, 0, 0	None Expected	Medium
Vegetable Crops	0	None Expected	Low
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 302. Effects analysis summary table: Steelhead, Northern California DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is sufficient	Low	High	Not Applicable	No

to reduce abundance via acute lethality.				
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Northern California DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to 1,3-D or associated degradates. Where formulated products and tank mixtures containing 1,3-Dichloropropene occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.2.23 Steelhead, Puget Sound DPS (*Oncorhynchus mykiss*)

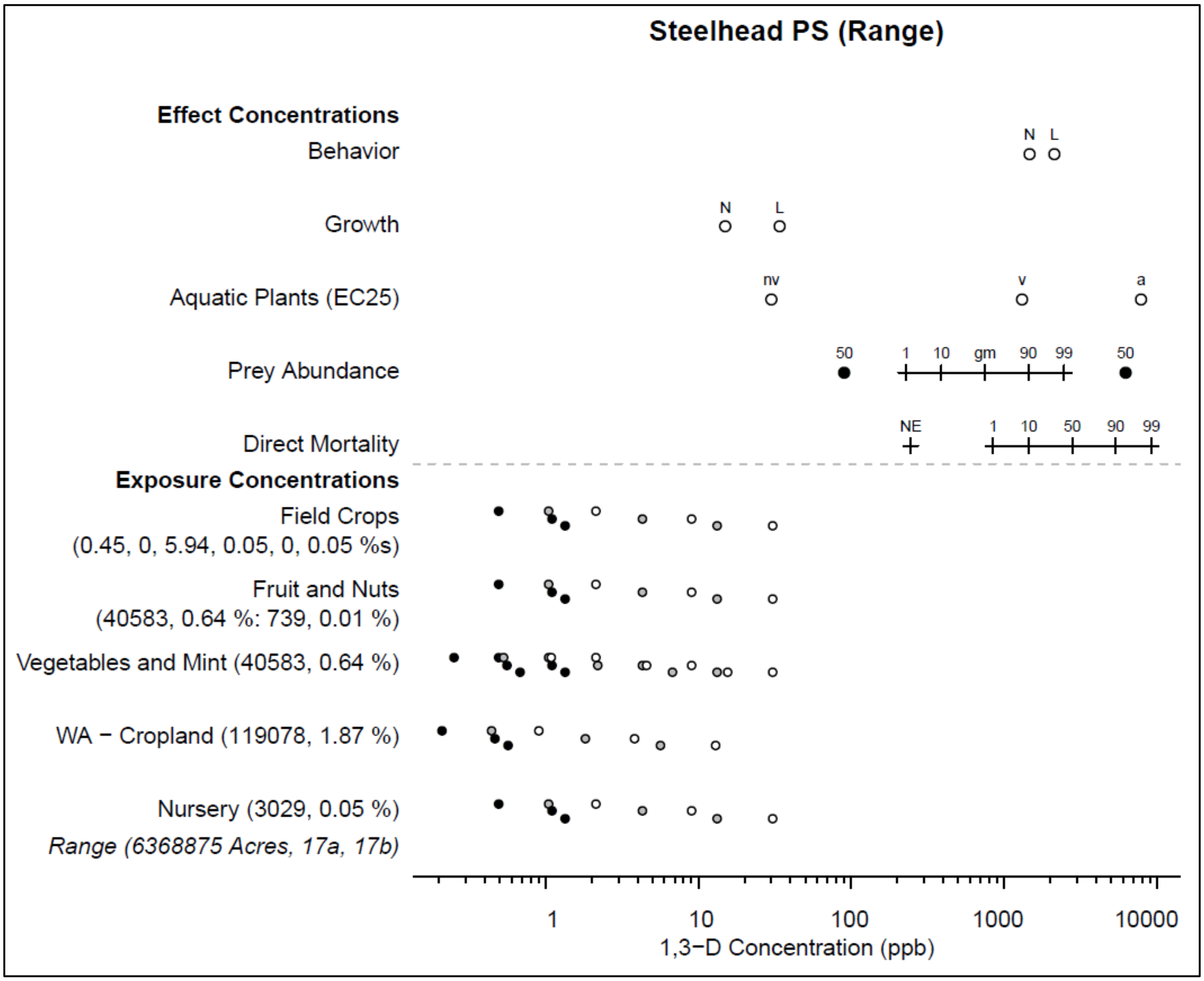


Figure 83. Effects analysis Risk-plot for Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

Table 303. Likelihood of exposure determination for Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	2	yes	no	yes	NA	3	**Medium**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 304. Direct mortality risk hypothesis; Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	1.87	None Expected	Medium	Medium
Mint	0.64	None Expected	Medium	Medium
Nursery	0.05	None Expected	Medium	Low
Fruit and Nuts	0.64, 0.01	None Expected	Medium	Medium
Field Crops	0.45, 0, 5.94, 0.05, 0, 0.05	None Expected	Medium	Medium
Vegetable Crops	0.64	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 305. Prey risk hypothesis; Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	1.87	None Expected	None Expected / Medium	Medium
Mint	0.64	None Expected	None Expected / Medium	Medium
Nursery	0.05	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.64, 0.01	None Expected	None Expected / Medium	Medium
Field Crops	0.45, 0, 5.94, 0.05, 0, 0.05	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.64	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 306. Growth risk hypothesis; Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	1.87	None Expected	Medium
Mint	0.64	None Expected	Medium
Nursery	0.05	None Expected	Low

Fruit and Nuts	0.64, 0.01	None Expected	Medium
Field Crops	0.45, 0, 5.94, 0.05, 0, 0.05	None Expected	Medium
Vegetable Crops	0.64	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 307. Behavior risk hypothesis; Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

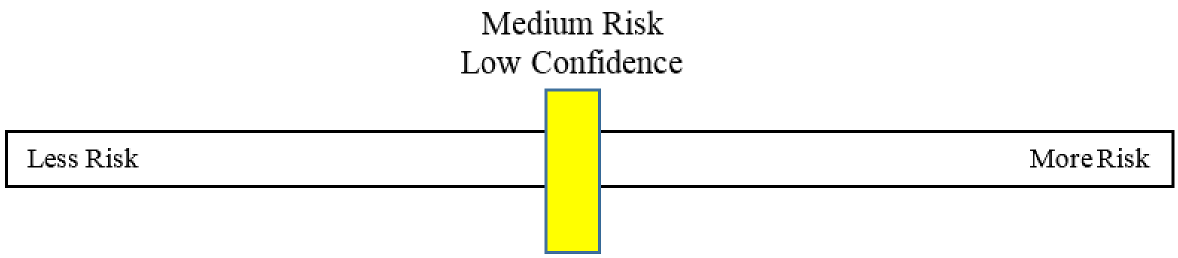
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	1.87	None Expected	Medium
Mint	0.64	None Expected	Medium
Nursery	0.05	None Expected	Low
Fruit and Nuts	0.64, 0.01	None Expected	Medium
Field Crops	0.45, 0, 5.94, 0.05, 0, 0.05	None Expected	Medium
Vegetable Crops	0.64	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 308. Effects analysis summary table: Steelhead, Puget Sound DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		

	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Puget Sound DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.24 Steelhead, Snake River Basin DPS (*Oncorhynchus mykiss*)

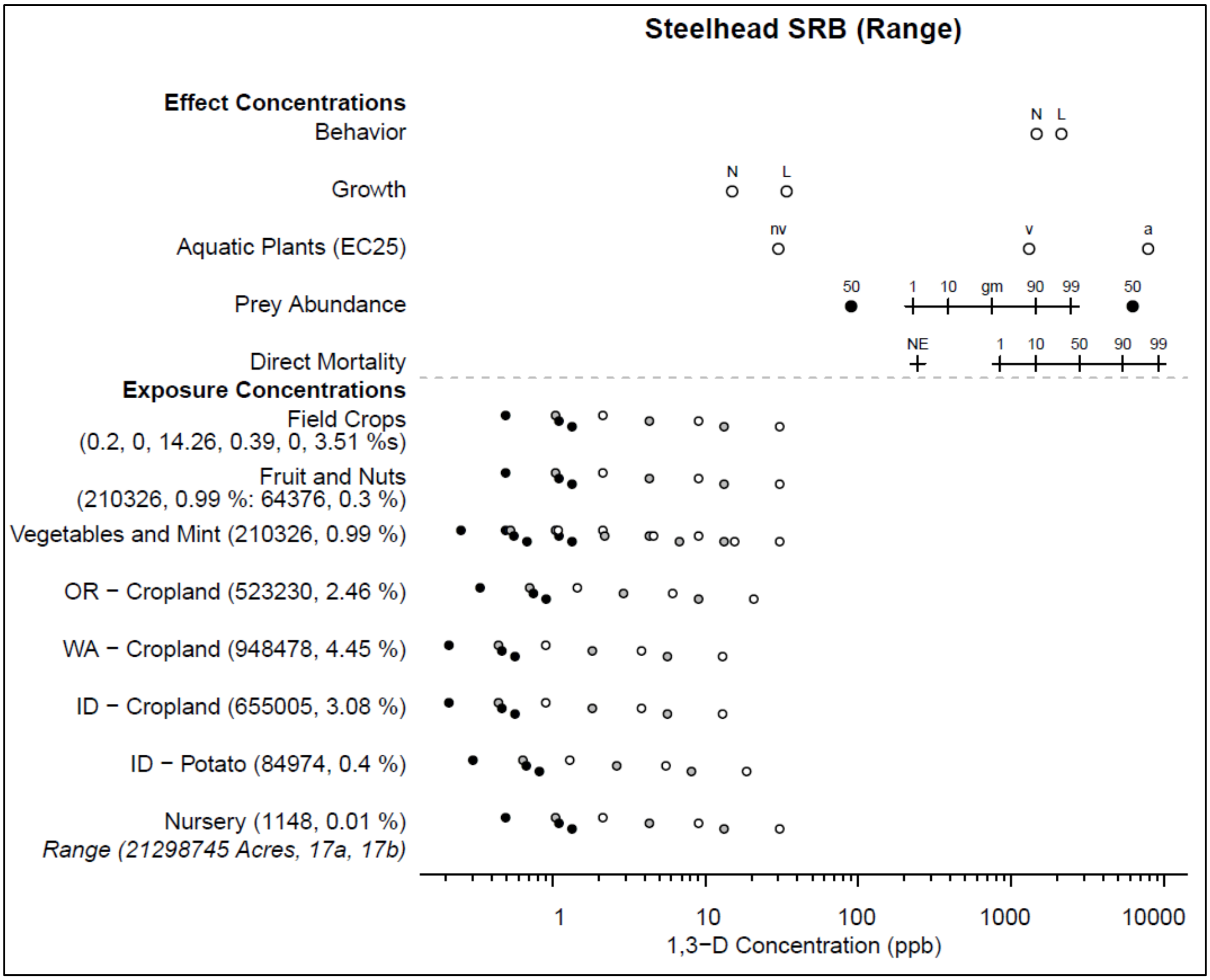


Figure 84. Effects analysis Risk-plot for Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Table 309. Likelihood of exposure determination for Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	2	yes	no	yes	NA	3	**Medium**
OR Cropland	2	yes	no	yes	NA	3	**Medium**
ID Cropland	2	yes	no	yes	NA	3	**Medium**
ID Potato	1	yes	no	yes	no	3	**Low**
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	1	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 310. Direct mortality risk hypothesis; Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	4.45	None Expected	Medium	Medium
OR Cropland	2.46	None Expected	Medium	Medium
ID Cropland	3.08	None Expected	Medium	Medium
ID Potato	0.4	None Expected	Medium	Low
Mint	0.99	None Expected	Medium	Medium
Nursery	0.01	None Expected	Medium	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium	Medium

Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium	Medium
Vegetable Crops	0.99	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 311. Prey risk hypothesis; Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	4.45	None Expected	None Expected / Medium	Medium
WA Cropland	2.46	None Expected	None Expected / Medium	Medium
ID Cropland	3.08	None Expected	None Expected / Medium	Medium
ID Potato	0.4	None Expected	None Expected / Medium	Low
Mint	0.99	None Expected	None Expected / Medium	Medium
Nursery	0.01	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.99, 0.3	None Expected	None Expected / Medium	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	None Expected / Medium	Medium

Vegetable Crops	0.99	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 312. Growth risk hypothesis; Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	4.45	None Expected	Medium
OR Cropland	2.46	None Expected	Medium
ID Cropland	3.08	None Expected	Medium
ID Potato	0.4	None Expected	Low
Mint	0.99	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium
Vegetable Crops	0.99	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 313. Behavior risk hypothesis; Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior

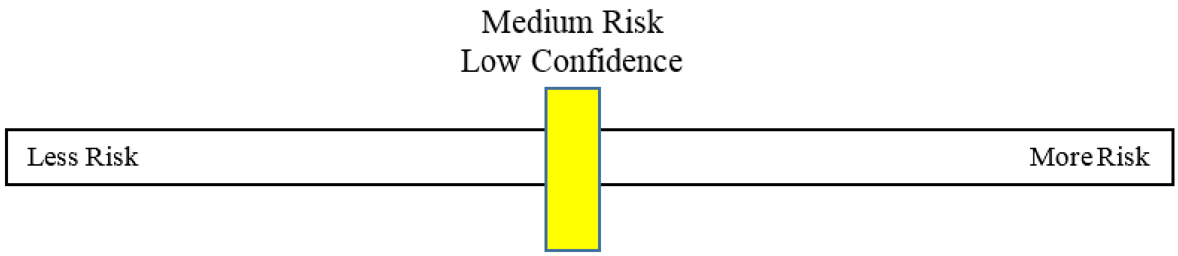
Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA Cropland	4.45	None Expected	Medium
OR Cropland	2.46	None Expected	Medium
ID Cropland	3.08	None Expected	Medium
ID Potato	0.4	None Expected	Low
Mint	0.99	None Expected	Medium
Nursery	0.01	None Expected	Low
Fruit and Nuts	0.99, 0.3	None Expected	Medium
Field Crops	0.2, 0, 14.26, 0.39, 0, 3.51	None Expected	Medium
Vegetable Crops	0.99	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 314. Effects analysis summary table: Steelhead, Snake River Basin DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient	Low	Medium		No

to reduce abundance via reduction in prey availability.				
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Snake River Basin DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.2.25 Steelhead, South-Central California Coast DPS (*Oncorhynchus mykiss*)

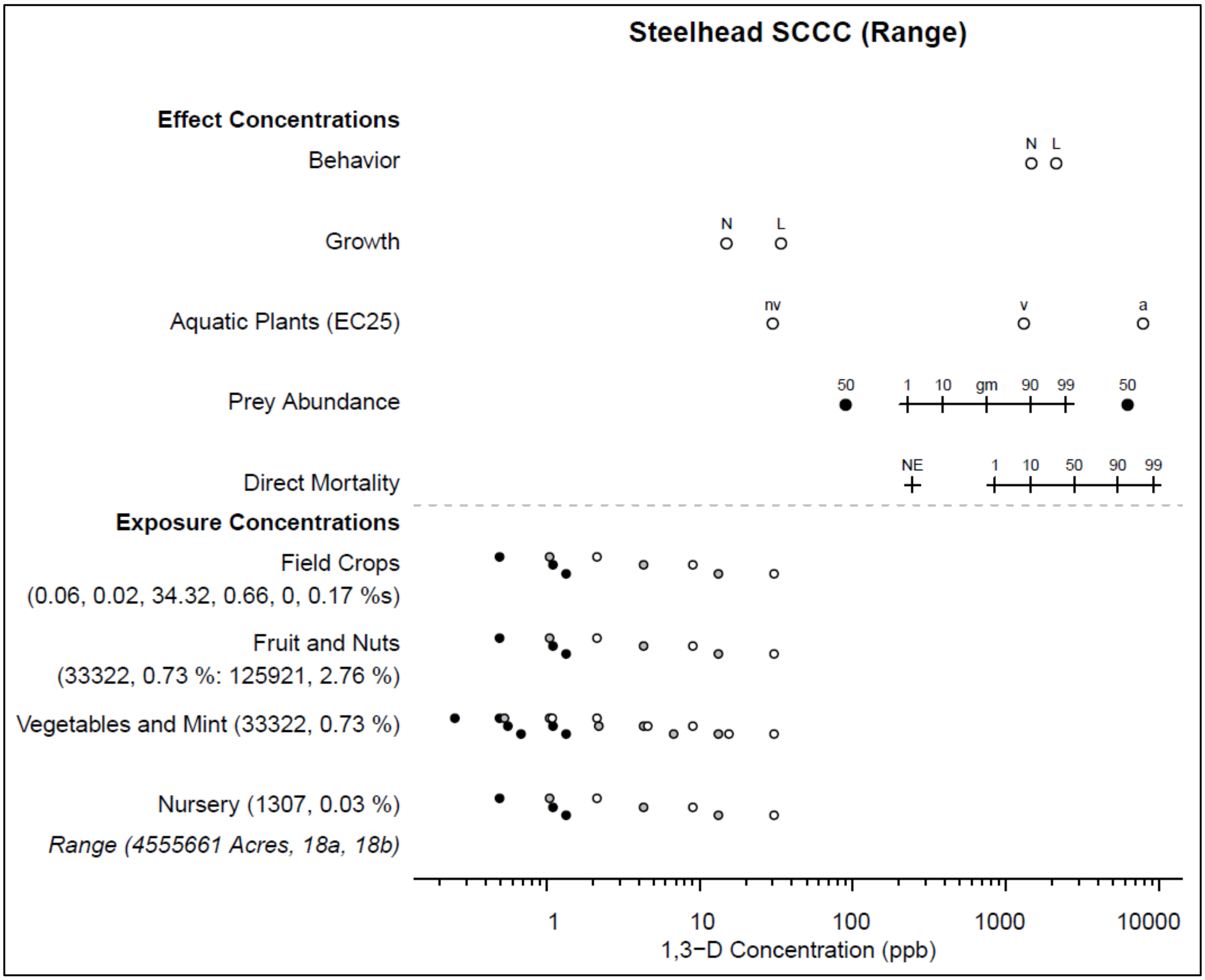


Figure 85. Effects analysis Risk-plot for Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

Table 315. Likelihood of exposure determination for Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	yes	3	**Medium**
Field Crops	3	yes	no	no	yes	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 316. Direct mortality risk hypothesis; Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.73	None Expected	Medium	Medium
Nursery	0.03	None Expected	Medium	Low
Fruit and Nuts	0.73, 2.76	None Expected	Medium	Medium
Field Crops	0.06, 0.02, 34.32, 0.66, 0, 0.17	None Expected	Medium	Medium
Vegetable Crops	0.73	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 317. Prey risk hypothesis; Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.73	None Expected	None Expected / Medium	Medium
Nursery	0.03	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.73, 2.76	None Expected	None Expected / Medium	Medium
Field Crops	0.06, 0.02, 34.32, 0.66, 0, 0.17	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.73	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 318. Growth risk hypothesis; Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.73	None Expected	Medium
Nursery	0.03	None Expected	Low
Fruit and Nuts	0.73, 2.76	None Expected	Medium

Field Crops	0.06, 0.02, 34.32, 0.66, 0, 0.17	None Expected	Medium
Vegetable Crops	0.73	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 319. Behavior risk hypothesis; Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

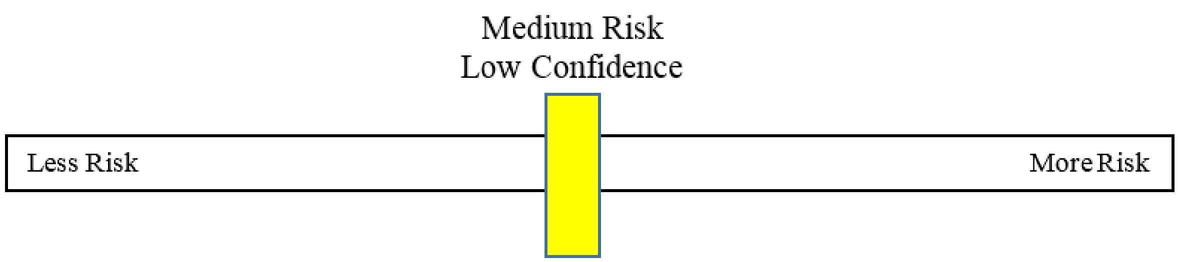
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.73	None Expected	Medium
Nursery	0.03	None Expected	Low
Fruit and Nuts	0.73, 2.76	None Expected	Medium
Field Crops	0.06, 0.02, 34.32, 0.66, 0, 0.17	None Expected	Medium
Vegetable Crops	0.73	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 320. Effects analysis summary table: Steelhead, South-Central California Coast DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		

Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, South-Central California Coast DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.26 Steelhead, Southern California DPS (*Oncorhynchus mykiss*)

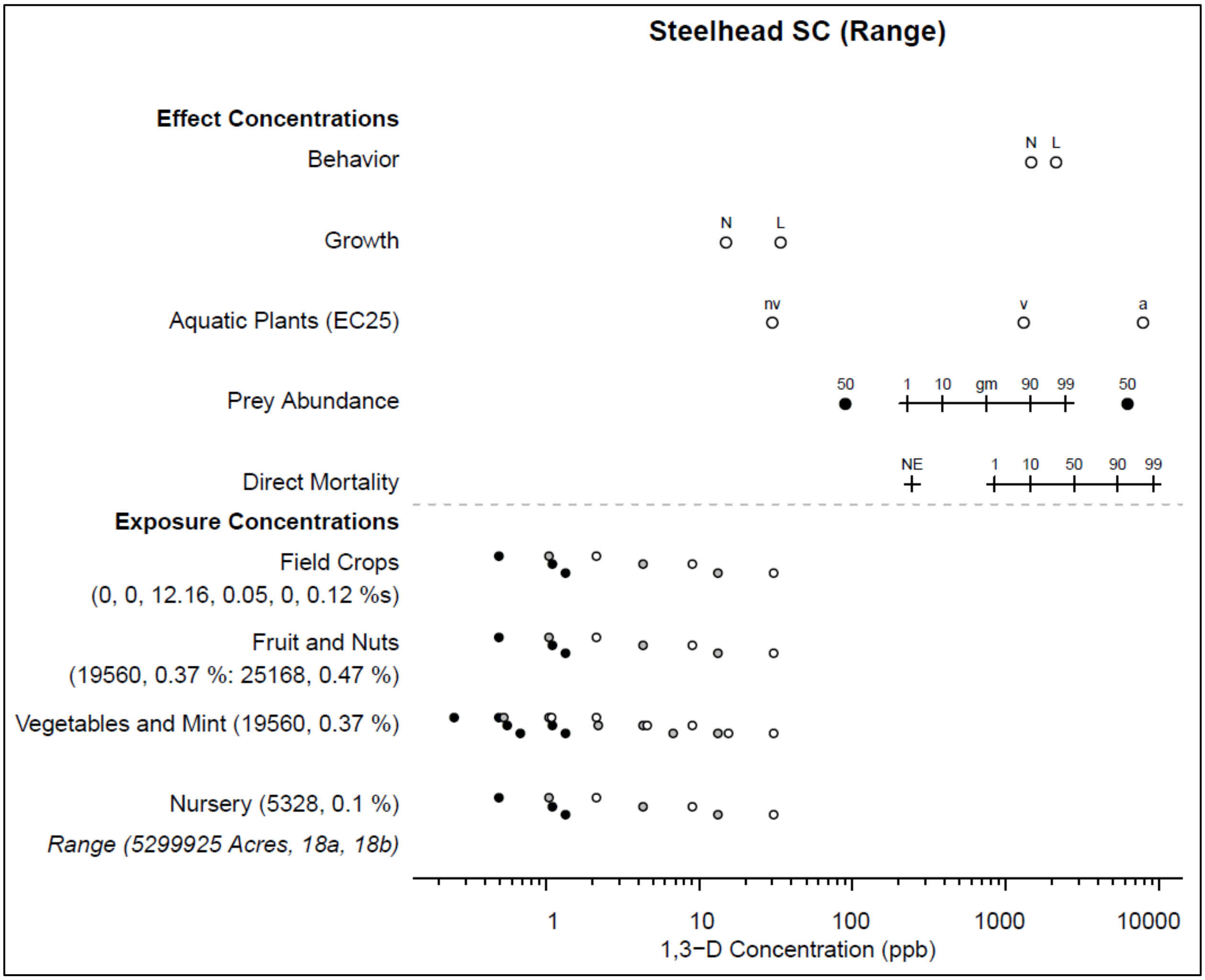


Figure 86. Effects analysis Risk-plot for Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Table 321. Likelihood of exposure determination for Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Mint	1	yes	no	no	yes	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	1	yes	no	no	yes	3	**Medium**

Table 322. Direct mortality risk hypothesis; Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.37	None Expected	Medium	Medium
Nursery	0.1	None Expected	Medium	Low
Fruit and Nuts	0.37, 0.47	None Expected	Medium	Medium
Field Crops	0, 0, 12.16, 0.05, 0, 0.12	None Expected	Medium	Medium
Vegetable Crops	0.37	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				
Risk	**Confidence**			
Medium	**Low**			

Table 323. Prey risk hypothesis; Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.37	None Expected	None Expected / Medium	Medium
Nursery	0.1	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.37, 0.47	None Expected	None Expected / Medium	Medium
Field Crops	0, 0, 12.16, 0.05, 0, 0.12	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.37	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 324. Growth risk hypothesis; Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.37	None Expected	Medium
Nursery	0.1	None Expected	Low
Fruit and Nuts	0.37, 0.47	None Expected	Medium
Field Crops	0, 0, 12.16, 0.05, 0, 0.12	None Expected	Medium

Vegetable Crops	0.37	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 325. Behavior risk hypothesis; Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Mint	0.37	None Expected	Medium
Nursery	0.1	None Expected	Low
Fruit and Nuts	0.37, 0.47	None Expected	Medium
Field Crops	0, 0, 12.16, 0.05, 0, 0.12	None Expected	Medium
Vegetable Crops	0.37	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

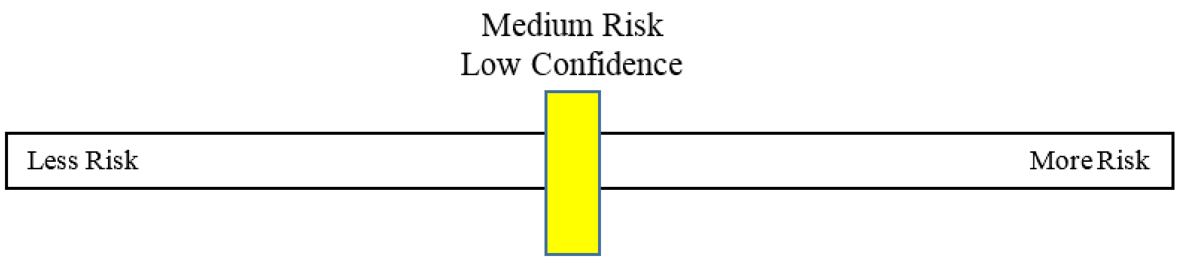
Table 326. Effects analysis summary table: Steelhead, Southern California DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk 1,3-D Chloropicrin	**Confidence 1,3-D Chloropicrin**		
Exposure to products containing 1,3-	Medium	Low		No

Dichloropropene is sufficient to reduce abundance via acute lethality.			Not Applicable	
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Southern California DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-

D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.27 Steelhead, Upper Columbia River DPS (*Oncorhynchus mykiss*)

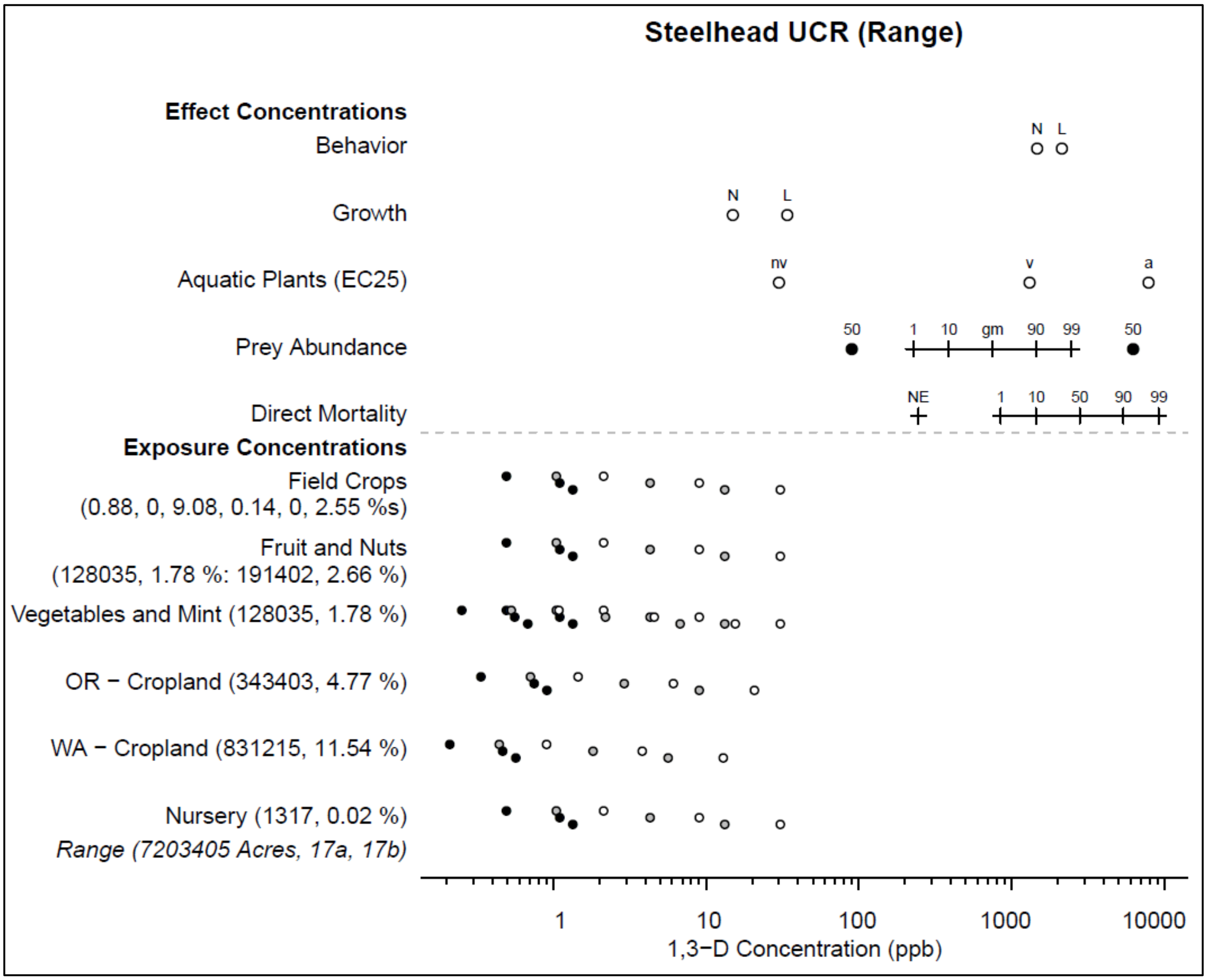


Figure 87. Effects analysis Risk-plot for Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Table 327. Likelihood of exposure determination for Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	3	yes	no	yes	NA	3	**High**
OR Cropland	2	yes	no	yes	NA	3	**Medium**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 328. Direct mortality risk hypothesis; Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	11.54	None Expected	Medium	High
OR Cropland	4.77	None Expected	Medium	Medium
Mint	1.78	None Expected	Medium	Medium
Nursery	0.02	None Expected	Medium	Low
Fruit and Nuts	1.78, 2.66	None Expected	Medium	Medium
Field Crops	0.88, 0, 9.08, 0.14, 0, 2.55	None Expected	Medium	Medium
Vegetable Crops	1.78	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 329. Prey risk hypothesis; Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	11.54	None Expected	None Expected / Medium	High
OR Cropland	4.77	None Expected	None Expected / Medium	Medium
Mint	1.78	None Expected	None Expected / Medium	Medium
Nursery	0.02	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.78, 2.66	None Expected	None Expected / Medium	Medium
Field Crops	0.88, 0, 9.08, 0.14, 0, 2.55	None Expected	None Expected / Medium	Medium
Vegetable Crops	1.78	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 330. Growth risk hypothesis; Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA Cropland	11.54	None Expected	High
OR Cropland	4.77	None Expected	Medium
Mint	1.78	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.78, 2.66	None Expected	Medium
Field Crops	0.88, 0, 9.08, 0.14, 0, 2.55	None Expected	Medium
Vegetable Crops	1.78	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 331. Behavior risk hypothesis; Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	11.54	None Expected	High
OR Cropland	4.77	None Expected	Medium
Mint	1.78	None Expected	Medium
Nursery	0.02	None Expected	Low
Fruit and Nuts	1.78, 2.66	None Expected	Medium
Field Crops	0.88, 0, 9.08, 0.14, 0, 2.55	None Expected	Medium
Vegetable Crops	1.78	None Expected	Medium

Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

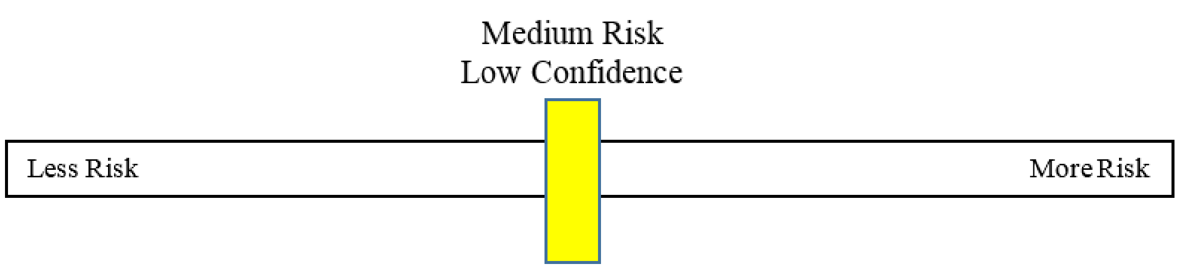
Table 332. Effects analysis summary table: Steelhead, Upper Columbia River DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?** **Yes/No**
	Risk **1,3-D** **Chloropicrin**	**Confidence** **1,3-D** **Chloropicrin**		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments	Low	High		No

to ecologically significant behaviors.				

Effects analysis summary:

Steelhead, Upper Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.2.28 Steelhead, Upper Willamette River DPS (*Oncorhynchus mykiss*)

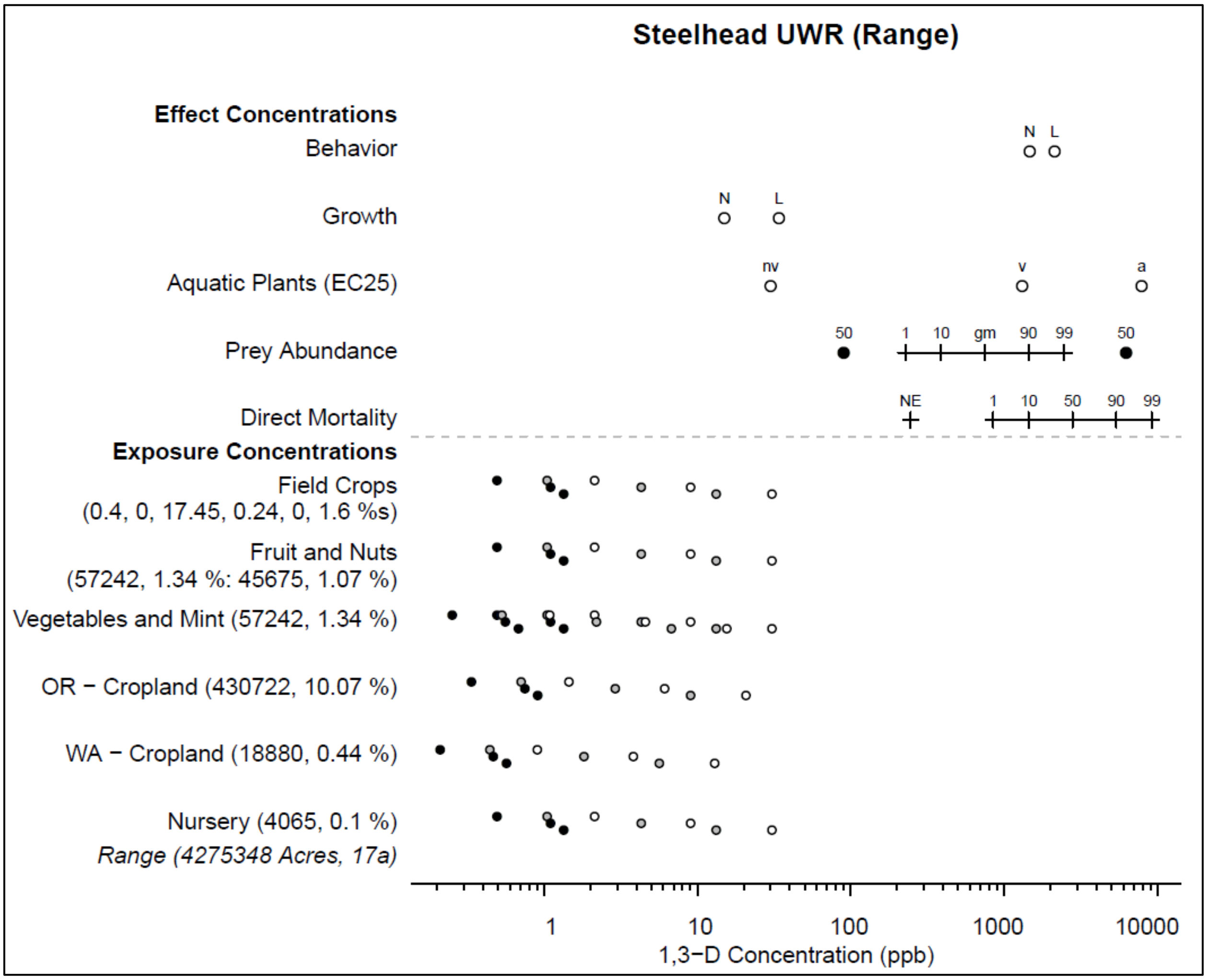


Figure 88. Effects analysis Risk-plot for Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Table 333. Likelihood of exposure determination for Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
WA Cropland	1	yes	no	yes	yes	3	**High**
OR Cropland	3	yes	no	yes	NA	3	**High**
Mint	2	yes	no	no	NA	3	**Medium**
Nursery	1	yes	no	no	no	3	**Low**
Fruit and Nuts	2	yes	no	no	NA	3	**Medium**
Field Crops	3	yes	no	no	NA	3	**Medium**
Vegetable Crops	2	yes	no	no	NA	3	**Medium**

Table 334. Direct mortality risk hypothesis; Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Endpoint: Mortality				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0.44	None Expected	Medium	High
OR Cropland	10.07	None Expected	Medium	High
Mint	1.34	None Expected	Medium	Medium
Nursery	0.1	None Expected	Medium	Low
Fruit and Nuts	1.34, 1.07	None Expected	Medium	Medium
Field Crops	0.4, 0, 17.45, 0.24, 0, 1.6	None Expected	Medium	Medium
Vegetable Crops	1.34	None Expected	Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.				

Risk	Confidence	
Medium	**Low**	

Table 335. Prey risk hypothesis; Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA Cropland	0.44	None Expected	None Expected / Medium	High
OR Cropland	10.07	None Expected	None Expected / Medium	High
Mint	1.34	None Expected	None Expected / Medium	Medium
Nursery	0.1	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.34, 1.07	None Expected	None Expected / Medium	Medium
Field Crops	0.4, 0, 17.45, 0.24, 0, 1.6	None Expected	None Expected / Medium	Medium
Vegetable Crops	1.34	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.				
Risk	**Confidence**			
Low	**Medium**			

Table 336. Growth risk hypothesis; Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Endpoint: Growth

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
WA Cropland	0.44	None Expected	High
OR Cropland	10.07	None Expected	High
Mint	1.34	None Expected	Medium
Nursery	0.1	None Expected	Low
Fruit and Nuts	1.34, 1.07	None Expected	Medium
Field Crops	0.4, 0, 17.45, 0.24, 0, 1.6	None Expected	Medium
Vegetable Crops	1.34	None Expected	Medium
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 337. Behavior risk hypothesis; Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
WA Cropland	0.44	None Expected	High
OR Cropland	10.07	None Expected	High
Mint	1.34	None Expected	Medium
Nursery	0.1	None Expected	Low
Fruit and Nuts	1.34, 1.07	None Expected	Medium
Field Crops	0.4, 0, 17.45, 0.24, 0, 1.6	None Expected	Medium
Vegetable Crops	1.34	None Expected	Medium

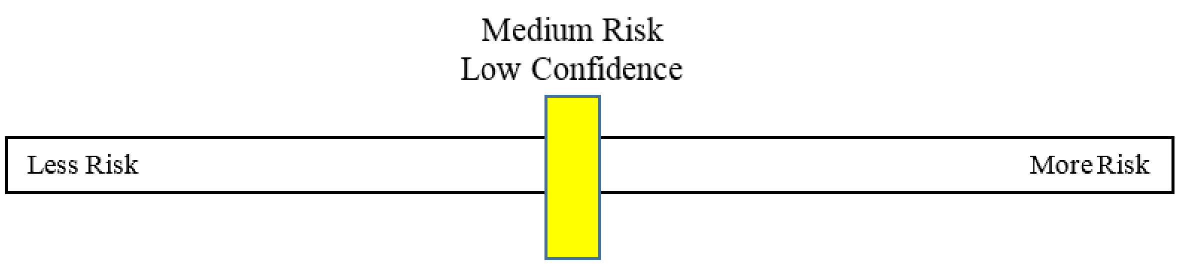
Risk Hypothesis: Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.		
Risk	**Confidence**	
Low	**High**	

Table 338. Effects analysis summary table: Steelhead, Upper Willamette River DPS and products containing 1,3-Dichloropropene

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk 1,3-D Chloropicrin	Confidence 1,3-D Chloropicrin		
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via reduction in prey availability.	Low	Medium		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to products containing 1,3-Dichloropropene is sufficient to reduce adult and juvenile abundance and adult productivity via impairments	Low	High		No

to ecologically significant behaviors.				

Effects analysis summary: Steelhead, Upper Willamette River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to products containing 1,3-D or associated degradates. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats. The anticipated levels of products containing 1,3-D within the species range are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We did not find support for the risk hypotheses for growth or behavior. Although risk associated with acute mortality is medium, we have low confidence in this determination because only a subset of product labels containing chloropicrin produced EECs which exceeded this determination threshold. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). Exposure to multiple ingredients from formulated products and tank mixtures containing 1,3-Dichloropropene may result in increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3 Metolachlor Effects Analysis

The response endpoints displayed in the metolachlor risk plots that follow are provided in Table 339. See the introduction to the effects analysis chapter for more information regarding the available relevant toxicological data for these compounds.

Table 339. Effects endpoints displayed in risk plots for metolachlor

Endpoint: Behavior

Test species: Bluegill sunfish; Rainbow Trout; Sheepshead minnow
Duration: 96-hr
Toxicity value (ppb): NOAEC (N) / LOAEC (L) = 2590/3290; 2500/5300; 6040/12100
Citation/MRID: 43928910; 43928911; 46829506

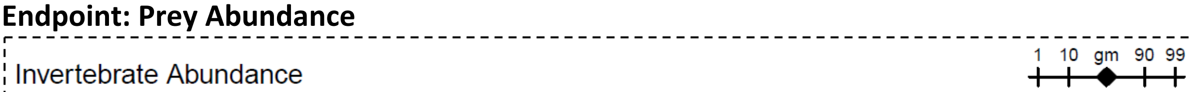
Endpoint: Growth

Test species: Fathead Minnow
Duration: 30-day
Toxicity value (ppb): NOAEC (N) = 30; LOAEC (L) = 56
Citation/MRID: 44995903

Endpoint: Aquatic Plants

Test species: Green algae (a); Duckweed (v); Freshwater diatom (nv)
Duration: 5-day; 14-day; 5-day
Toxicity value (ppb): EC25= 4.8; 13; 42
Citation/MRID: 43928929; 43928931; 43541302

Endpoint: Prey Abundance



Test species: Water flea
Duration: 96-hr
Toxicity value (ppb): LC50 (black diamond) = 23,500; 25,100; geometric mean* (gm) = 24,287; slope = 4.5 (assumed)
Citation/MRID: 40098001; 00015546

Endpoint: Direct Mortality

Test species: Rainbow Trout; Rainbow Trout Duration: 96-hr Toxicity value (ppb): LC50 (black diamond) = 3,900; 11,900; geometric mean* (gm) = 6,840 slope = 4.5 (assumed); None Expected (NE) = 600 Citation/MRID: 00018722; 43928911
**The calculation and reference to the geometric mean of the two different LC50s was determined appropriate as the studies were otherwise comparable in regards to species tested, exposure duration, and overall data quality.*

12.3.1 Chum Salmon, Columbia River ESU (*Oncorhynchus keta*)

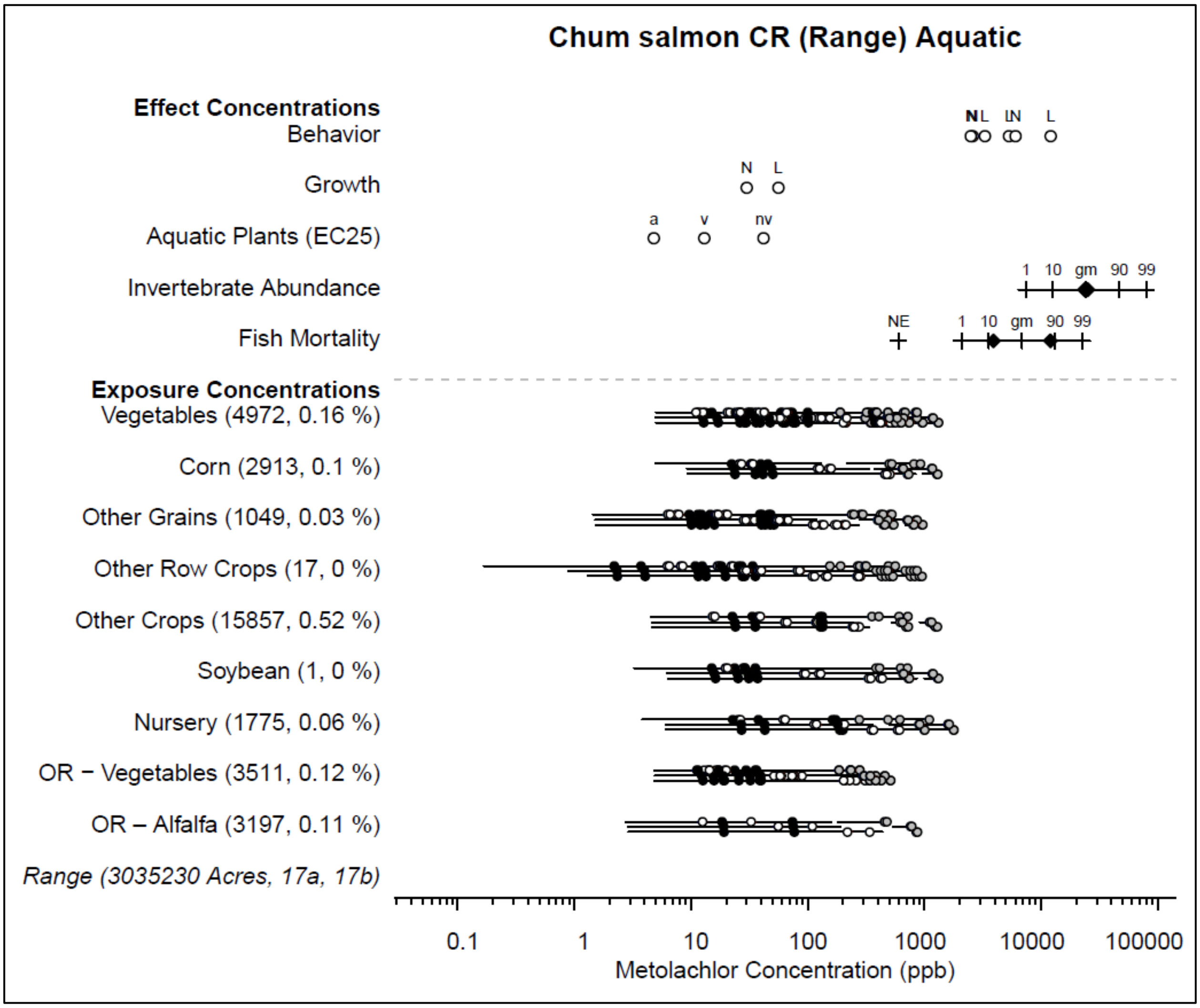


Figure 89. Effects analysis Risk-plot for Chum salmon, Columbia River ESU and Metolachlor

Table 340. Likelihood of exposure determination for Chum salmon, Columbia River ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	2	**Medium**
Corn	1	yes	no	yes	yes	2	**Medium**
Other Grains	1	yes	no	yes	no	2	**Low**
Other Row Crops	1	yes	no	yes	no	2	**Low**
Other Crops	1	yes	no	yes	yes	2	**Medium**
Soybean	1	yes	no	yes	no	2	**Low**
Nursery	1	yes	no	yes	no	2	**Low**
OR - Vegetables	1	yes	no	yes	yes	2	**Medium**
OR - Alfalfa	1	yes	no	yes	no	2	**Low**

Table 341. Direct mortality risk hypothesis; Chum salmon, Columbia River ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.16	Low	Medium
Corn	0.1	Low	Medium
Other Grains	0.03	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.52	Low	Medium
Soybean	0	Low	Low
Nursery	0.06	Low	Low
OR - Vegetables	0.12	None Expected	Medium
OR - Alfalfa	0.11	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 342. Prey risk hypothesis; Chum salmon, Columbia River ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.16	None Expected	Medium
Corn	0.1	None Expected	Medium
Other Grains	0.03	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.06	Low	Low
OR - Vegetables	0.12	None Expected	Medium
OR - Alfalfa	0.11	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 343. Growth risk hypothesis; Chum salmon, Columbia River ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.16	Medium	Medium
Corn	0.1	Medium	Medium
Other Grains	0.03	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.52	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.06	Medium	Low

OR - Vegetables	0.12	Medium	Medium
OR - Alfalfa	0.11	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 344. Behavior risk hypothesis; Chum salmon, Columbia River ESU and Metolachlor

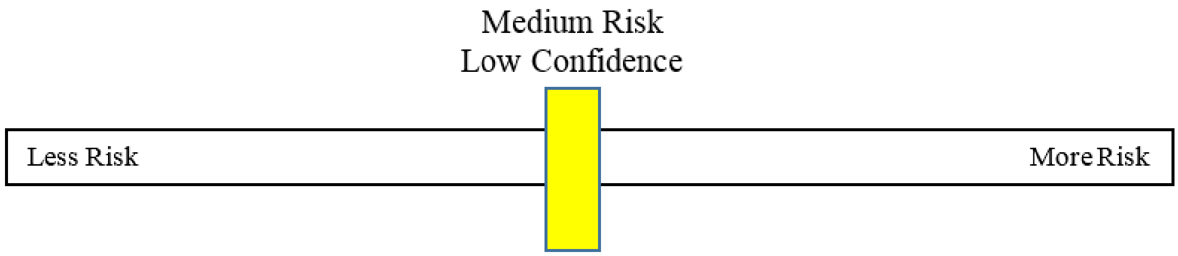
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.16	None Expected	Medium
Corn	0.1	None Expected	Medium
Other Grains	0.03	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.06	None Expected	Low
OR - Vegetables	0.12	None Expected	Medium
OR - Alfalfa	0.11	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 345. Effects analysis summary table: Chum salmon, Columbia River ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?**
	Risk	**Confidence**		

				Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chum salmon, Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.2 Chum Salmon, Hood Canal summer-run ESU (*Oncorhynchus keta*)

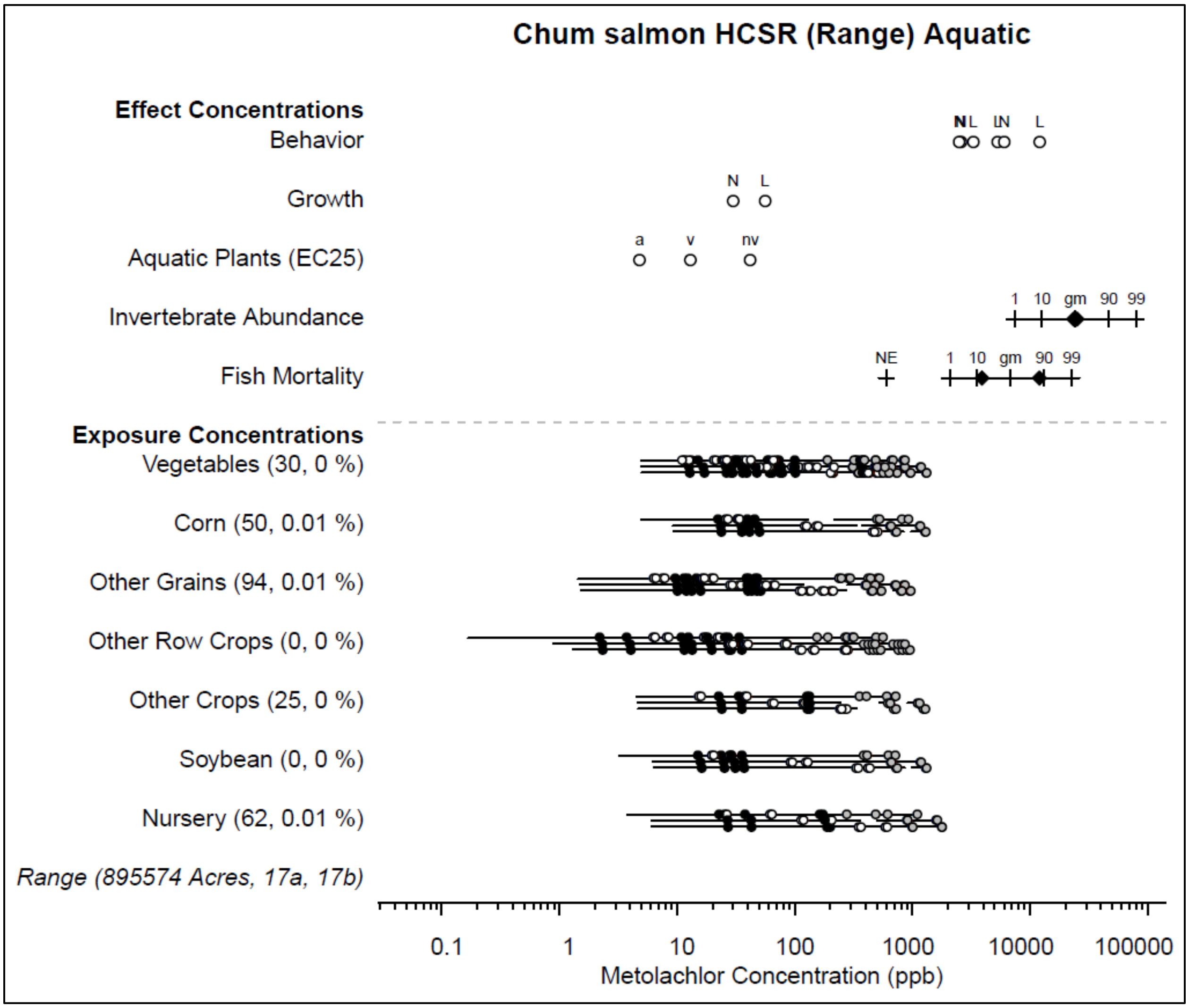


Figure 90. Effects analysis Risk-plot for Chum salmon, Hood Canal summer-run ESU and Metolachlor

Table 346. Likelihood of exposure determination for Chum salmon, Hood Canal summer-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	2	**Low**
Corn	1	yes	no	yes	no	2	**Low**
Other Grains	1	yes	no	yes	no	2	**Low**
Other Row Crops	1	yes	no	yes	no	2	**Low**
Other Crops	1	yes	no	yes	no	2	**Low**
Soybean	1	yes	no	yes	no	2	**Low**
Nursery	1	yes	no	yes	no	2	**Low**

Table 347. Direct mortality risk hypothesis; Chum salmon, Hood Canal summer-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0.01	Low	Low
Other Grains	0.01	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0	Low	Low
Soybean	0	Low	Low
Nursery	0.01	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 348. Prey risk hypothesis; Chum salmon, Hood Canal summer-run ESU and Metolachlor

Endpoint: Prey

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
Vegetables	0	None Expected	Low
Corn	0.01	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 349. Growth risk hypothesis; Chum salmon, Hood Canal summer-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0.01	Medium	Low
Other Grains	0.01	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0	Medium	Low
Soybean	0	Medium	Low
Nursery	0.01	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 350. Behavior risk hypothesis; Chum salmon, Hood Canal summer-run ESU and Metolachlor

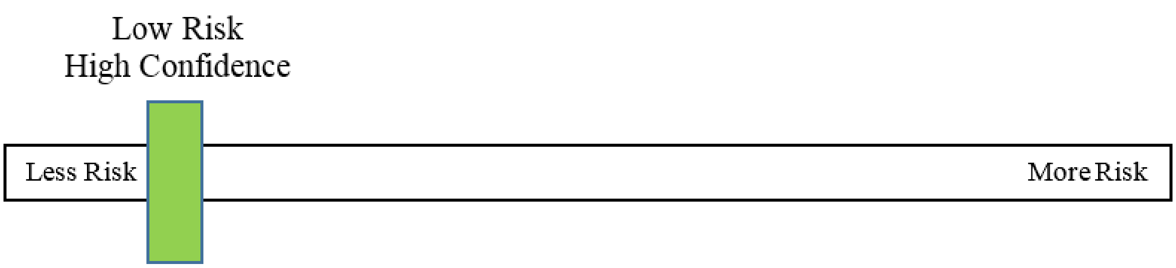
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0.01	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 351. Effects analysis summary table: Chum salmon, Hood Canal summer-run ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk	**Confidence**		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No

Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chum salmon, Hood Canal summer-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.



12.3.3 Chinook Salmon, California Coastal (*Oncorhynchus tshawytscha*)

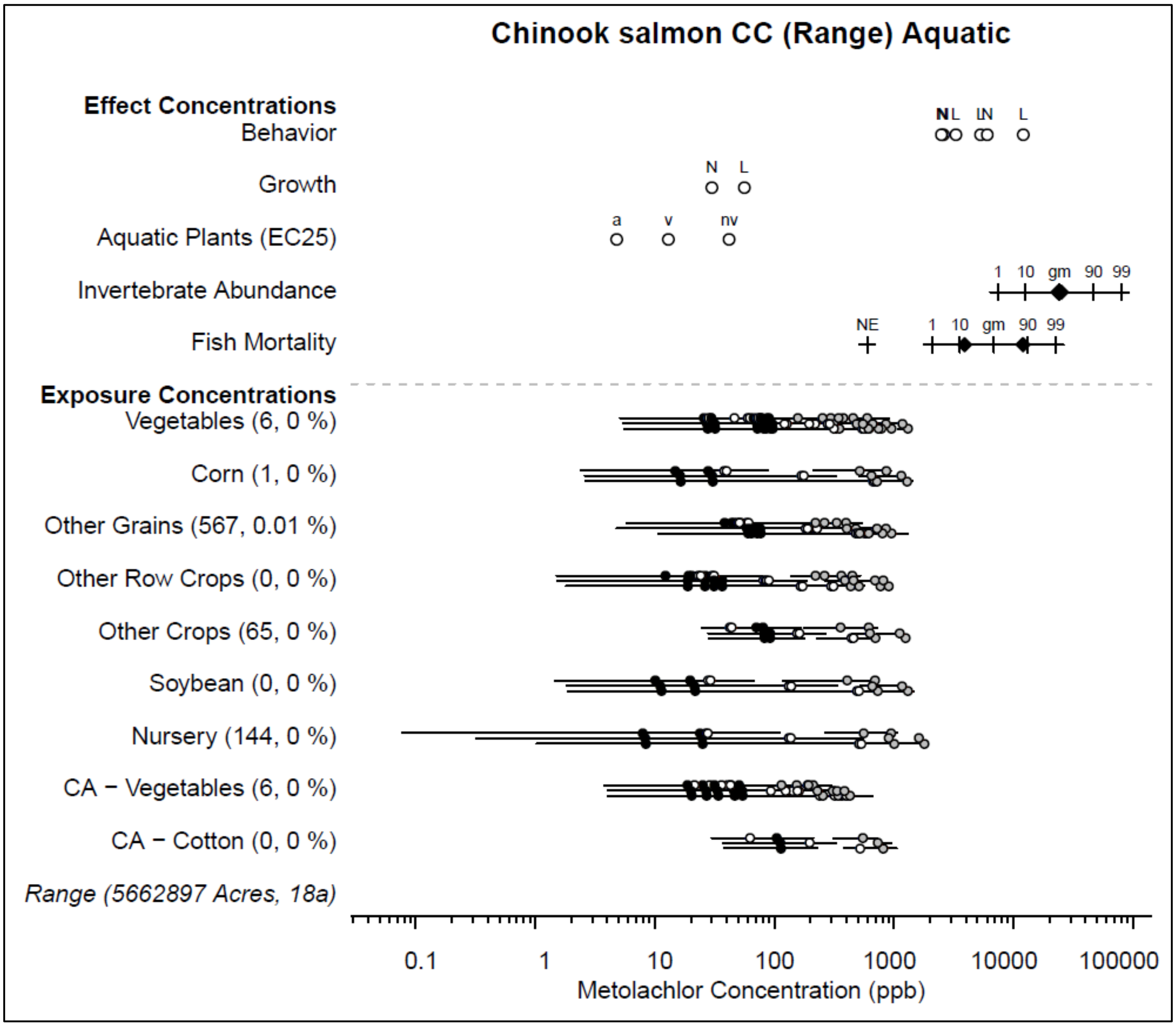


Figure 91. Effects analysis Risk-plot for Chinook salmon, California Coastal ESU and Metolachlor

Table 352. Likelihood of exposure determination for Chinook salmon, California Coastal ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	no	3	**Low**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	no	3	**Low**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	no	3	**Low**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 353. Direct mortality risk hypothesis; Chinook salmon, California Coastal ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0	Low	Low
Other Grains	0.01	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0	Low	Low
Soybean	0	Low	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 354. Prey risk hypothesis; Chinook salmon, California Coastal ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 355. Growth risk hypothesis; Chinook salmon, California Coastal ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0	Medium	Low
Other Grains	0.01	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0	Medium	Low
Soybean	0	Medium	Low

Nursery	0	Medium	Low
CA - Vegetables	0	Medium	Low
CA - Cotton	0	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 356. Behavior risk hypothesis; Chinook salmon, California Coastal ESU and Metolachlor

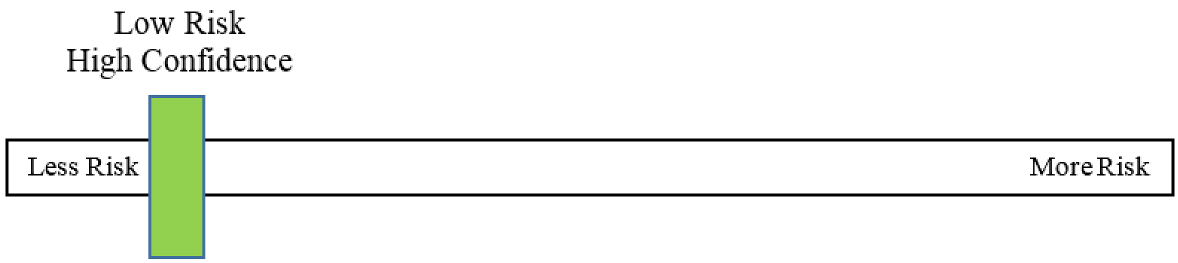
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	None Expected	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 357. Effects analysis summary table: Chinook salmon, California Coastal ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, California Coastal ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.3.4 Chinook Salmon, Central Valley spring-run ESU (*Oncorhynchus tshawytscha*)

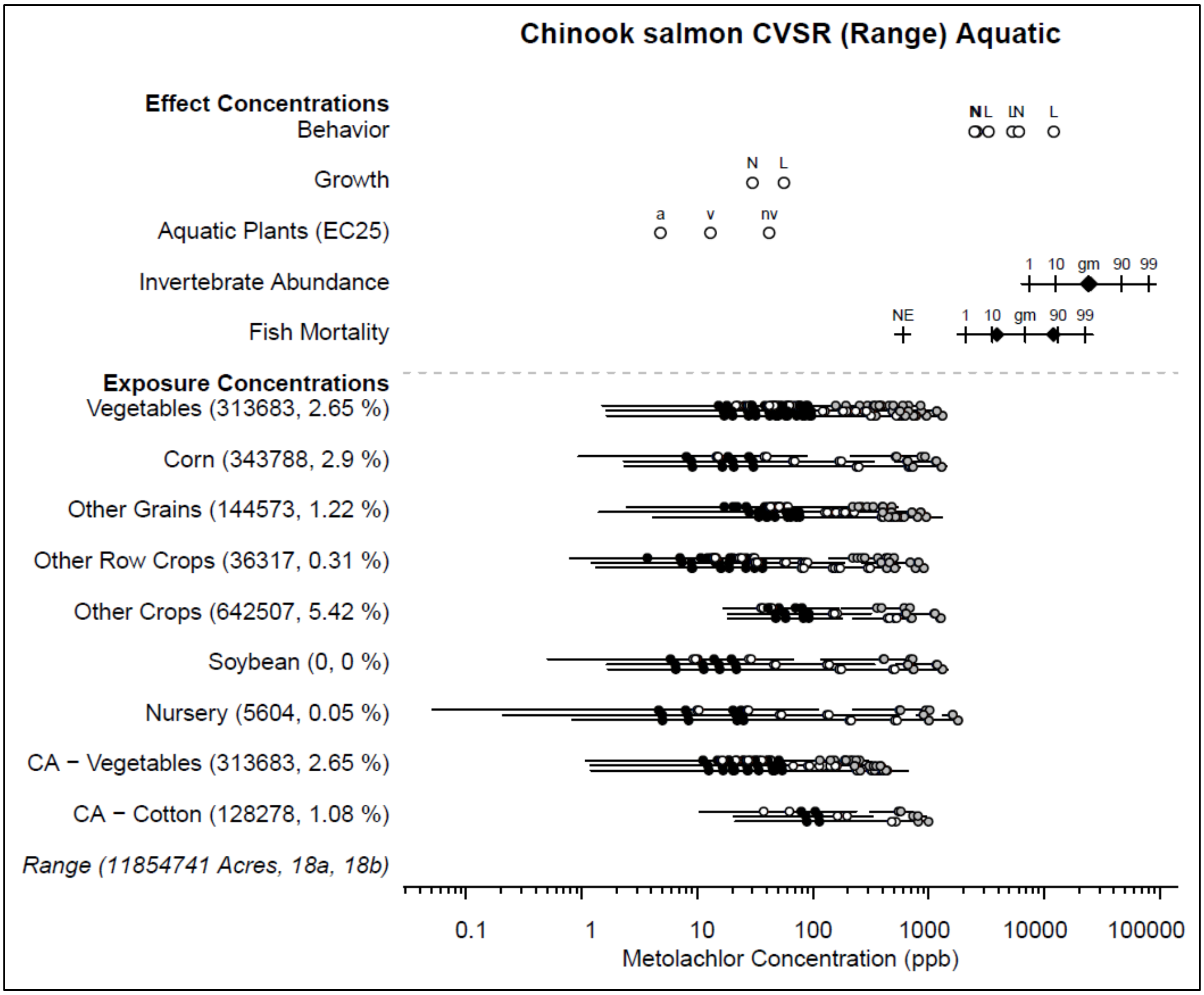


Figure 92. Effects analysis Risk-plot for Chinook salmon, Central Valley spring-run ESU and Metolachlor

Table 358. Likelihood of exposure determination for Chinook salmon, Central Valley spring-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	2	yes	no	yes	NA	3	**Medium**
Other Grains	2	yes	no	yes	NA	3	**Medium**
Other Row Crops	1	yes	no	yes	yes	3	**High**
Other Crops	3	yes	no	yes	NA	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	2	yes	no	yes	NA	3	**Medium**
CA - Cotton	2	yes	no	yes	NA	3	**Medium**

Table 359. Direct mortality risk hypothesis; Chinook salmon, Central Valley spring-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.65	Low	Medium
Corn	2.9	Low	Medium
Other Grains	1.22	Low	Medium
Other Row Crops	0.31	Low	High
Other Crops	5.42	Low	High
Soybean	0	Low	Low
Nursery	0.05	Low	Low
CA - Vegetables	2.65	None Expected	Medium
CA - Cotton	1.08	Low	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 360. Prey risk hypothesis; Chinook salmon, Central Valley spring-run ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.65	None Expected	Medium
Corn	2.9	None Expected	Medium
Other Grains	1.22	None Expected	Medium
Other Row Crops	0.31	None Expected	High
Other Crops	5.42	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
CA - Vegetables	2.65	None Expected	Medium
CA - Cotton	1.08	None Expected	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 361. Growth risk hypothesis; Chinook salmon, Central Valley spring-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.65	Medium	Medium
Corn	2.9	Medium	Medium
Other Grains	1.22	Medium	Medium
Other Row Crops	0.31	Medium	High
Other Crops	5.42	Medium	High
Soybean	0	Medium	Low

Nursery	0.05	Medium	Low
CA - Vegetables	2.65	Medium	Medium
CA - Cotton	1.08	Medium	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 362. Behavior risk hypothesis; Chinook salmon, Central Valley spring-run ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.65	None Expected	Medium
Corn	2.9	None Expected	Medium
Other Grains	1.22	None Expected	Medium
Other Row Crops	0.31	None Expected	High
Other Crops	5.42	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	None Expected	Low
CA - Vegetables	2.65	None Expected	Medium
CA - Cotton	1.08	None Expected	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

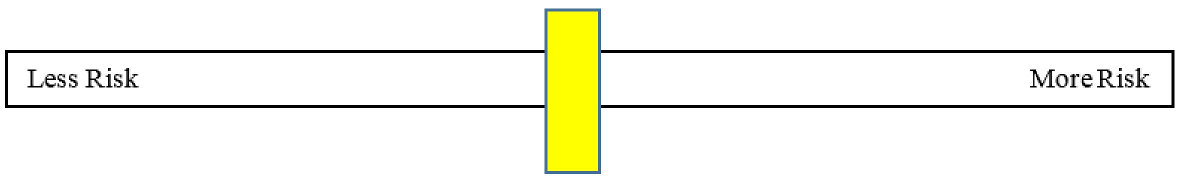
Table 363. Effects analysis summary table: Chinook salmon, Central Valley spring-run ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Central Valley spring-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.

Medium Risk
Low Confidence



12.3.5 Chinook Salmon, Lower Columbia River ESU (*Oncorhynchus tshawytscha*)

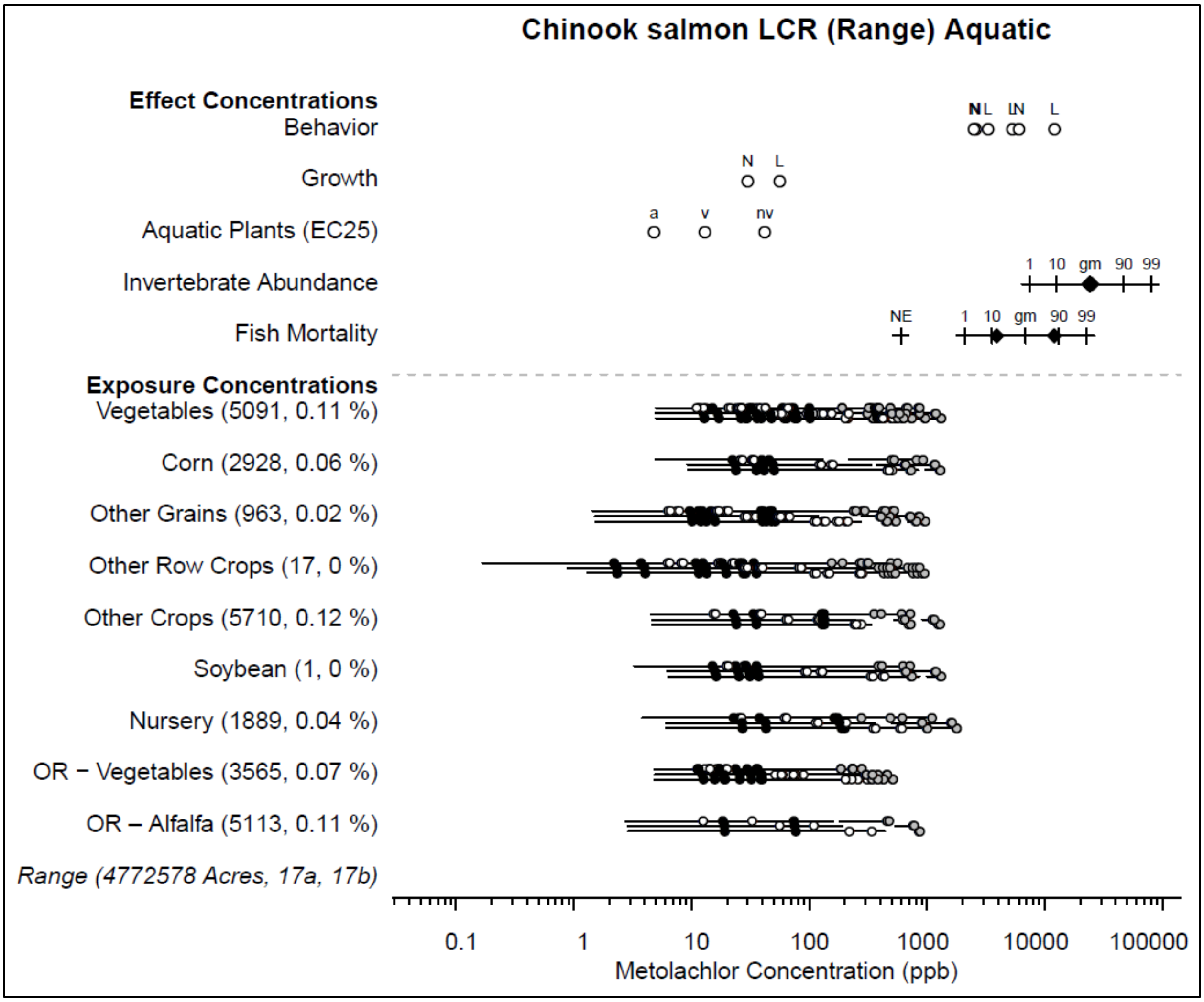


Figure 93. Effects analysis Risk-plot for Chinook salmon, Lower Columbia River ESU and Metolachlor

Table 364. Likelihood of exposure determination for Chinook salmon, Lower Columbia River ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	**High**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	yes	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 365. Direct mortality risk hypothesis; Chinook salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Low	High
Corn	0.06	Low	High
Other Grains	0.02	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.12	Low	High
Soybean	0	Low	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.07	None Expected	Low
OR - Alfalfa	0.11	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 366. Prey risk hypothesis; Chinook salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.07	None Expected	Low
OR - Alfalfa	0.11	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 367. Growth risk hypothesis; Chinook salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Medium	High
Corn	0.06	Medium	High
Other Grains	0.02	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.12	Medium	High
Soybean	0	Medium	Low

Nursery	0.04	Medium	Low
OR - Vegetables	0.07	Medium	Low
OR - Alfalfa	0.11	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 368. Behavior risk hypothesis; Chinook salmon, Lower Columbia River ESU and Metolachlor

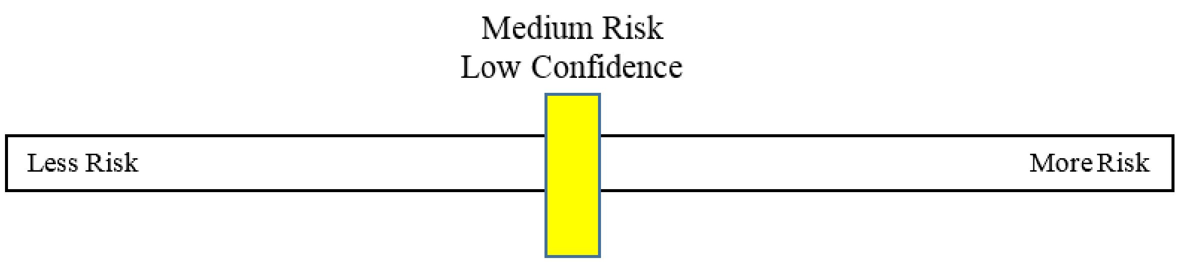
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	None Expected	Low
OR - Vegetables	0.07	None Expected	Low
OR - Alfalfa	0.11	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 369. Effects analysis summary table: Chinook salmon, Lower Columbia River ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Lower Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.6 Chinook salmon, Puget Sound ESU (*Oncorhynchus tshawytscha*)

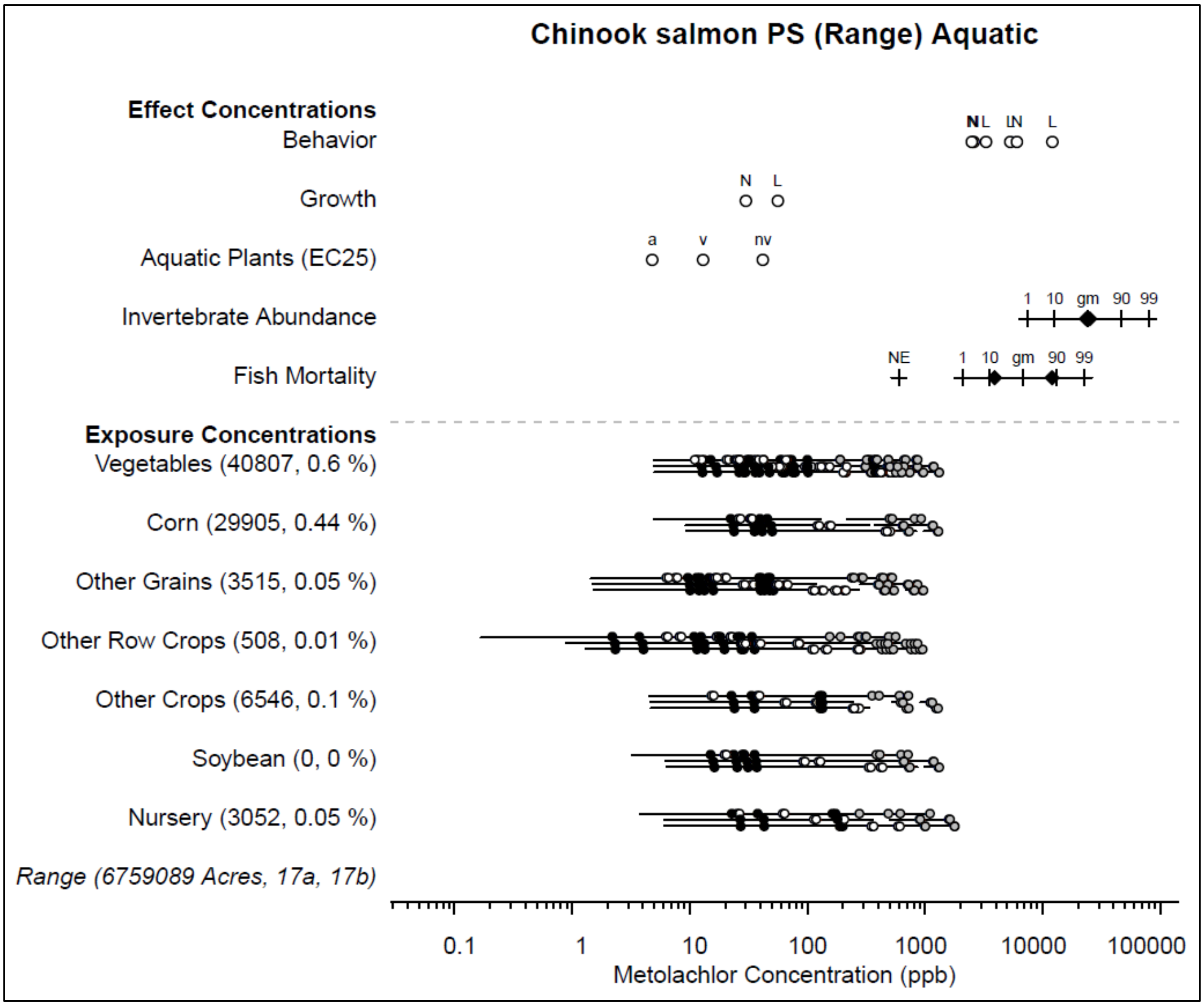


Figure 94. Effects analysis Risk-plot for Chinook salmon, Puget Sound ESU and Metolachlor

Table 370. Likelihood of exposure determination for Chinook salmon, Puget Sound ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	High
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	no	3	Low
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	1	yes	no	yes	no	3	Low
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low

Table 371. Direct mortality risk hypothesis; Chinook salmon, Puget Sound ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.6	Low	High
Corn	0.44	Low	High
Other Grains	0.05	Low	Low
Other Row Crops	0.01	Low	Low
Other Crops	0.1	Low	Low
Soybean	0	Low	Low
Nursery	0.05	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 372. Prey risk hypothesis; Chinook salmon, Puget Sound ESU and Metolachlor

Endpoint: Prey

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
Vegetables	0.6	None Expected	High
Corn	0.44	None Expected	High
Other Grains	0.05	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.1	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 373. Growth risk hypothesis; Chinook salmon, Puget Sound ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.6	Medium	High
Corn	0.44	Medium	High
Other Grains	0.05	Medium	Low
Other Row Crops	0.01	Medium	Low
Other Crops	0.1	Medium	Low
Soybean	0	Medium	Low
Nursery	0.05	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 374. Behavior risk hypothesis; Chinook salmon, Puget Sound ESU and Metolachlor

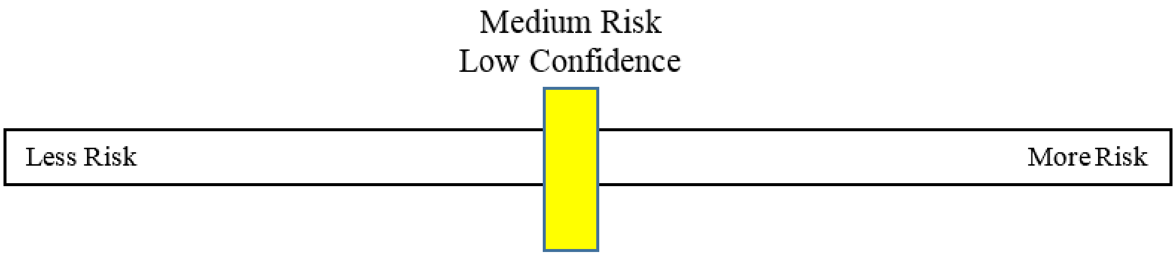
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.6	None Expected	High
Corn	0.44	None Expected	High
Other Grains	0.05	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.1	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.05	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 375. Effects analysis summary table: Chinook salmon, Puget Sound ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No

Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Puget Sound ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.7 Chinook Salmon, Sacramento River winter-run (*Oncorhynchus tshawytscha*)

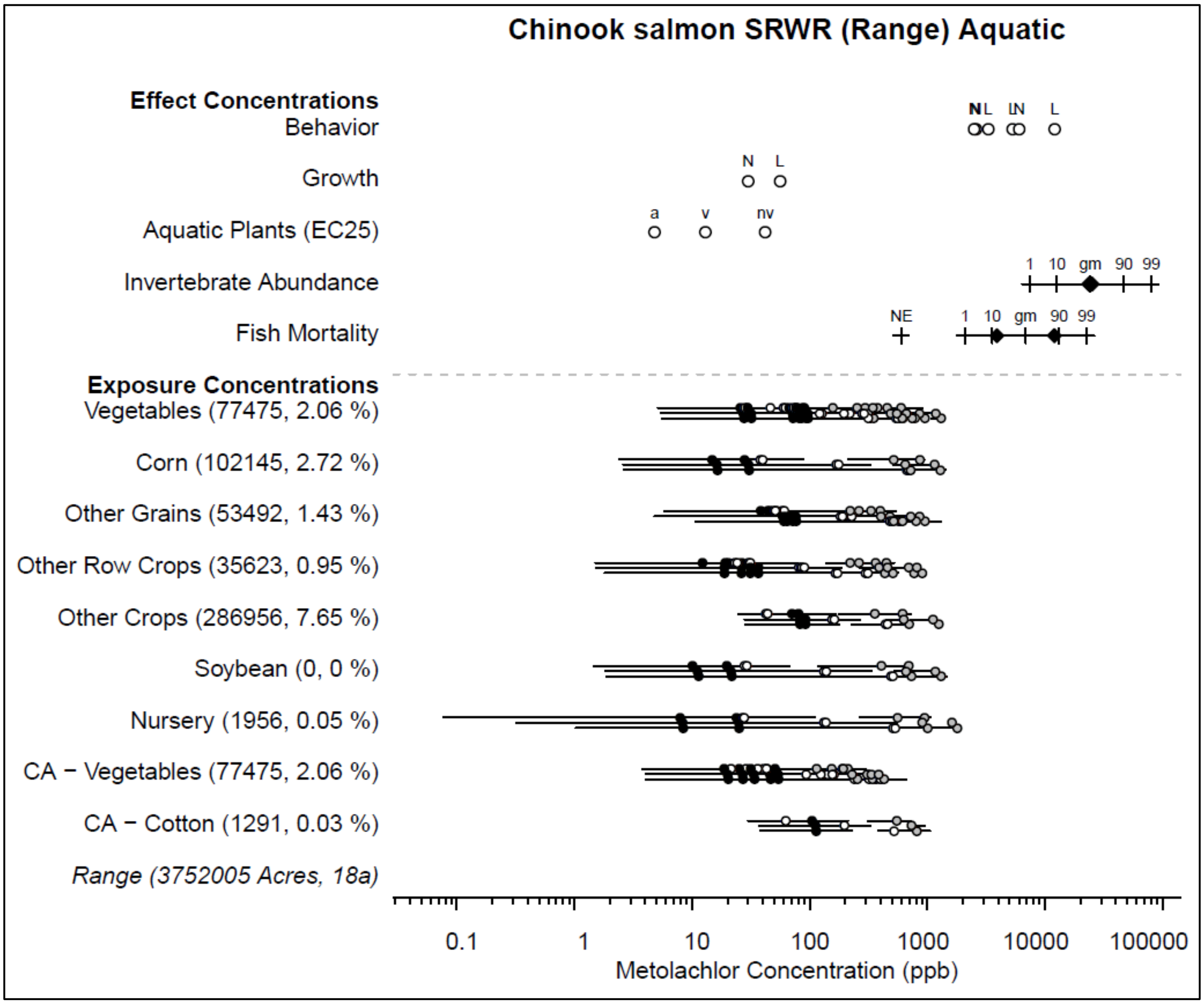


Figure 95. Effects analysis Risk-plot for Chinook salmon, Sacramento River winter-run ESU and Metolachlor

Table 376. Likelihood of exposure determination for Chinook salmon, Sacramento River winter-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	2	yes	no	yes	NA	3	**Medium**
Other Grains	2	yes	no	yes	NA	3	**Medium**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	3	yes	no	yes	NA	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	2	yes	no	yes	NA	3	**Medium**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 377. Direct mortality risk hypothesis; Chinook salmon, Sacramento River winter-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.06	Low	Medium
Corn	2.72	Low	Medium
Other Grains	1.43	Low	Medium
Other Row Crops	0.95	Low	Low
Other Crops	7.65	Low	High
Soybean	0	Low	Low
Nursery	0.05	Low	Low
CA – Vegetables	2.06	Low	Medium
CA – Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 378. Prey risk hypothesis; Chinook salmon, Sacramento River winter-run ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.06	None Expected	Medium
Corn	2.72	None Expected	Medium
Other Grains	1.43	None Expected	Medium
Other Row Crops	0.95	None Expected	Low
Other Crops	7.65	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
CA – Vegetables	2.06	None Expected	Medium
CA – Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 379. Growth risk hypothesis; Chinook salmon, Sacramento River winter-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.06	Medium	Medium
Corn	2.72	Medium	Medium
Other Grains	1.43	Medium	Medium
Other Row Crops	0.95	Medium	Low
Other Crops	7.65	Medium	High
Soybean	0	Medium	Low

Nursery	0.05	Medium	Low
CA – Vegetables	2.06	Medium	Medium
CA – Cotton	0.03	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 380. Behavior risk hypothesis; Chinook salmon, Sacramento River winter-run ESU and Metolachlor

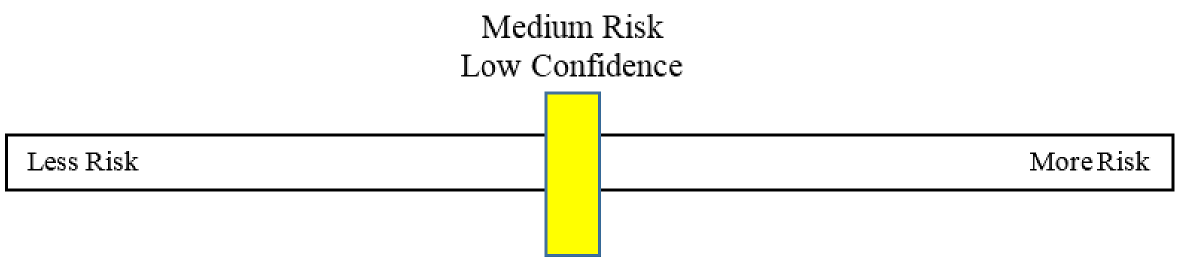
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.06	None Expected	Medium
Corn	2.72	None Expected	Medium
Other Grains	1.43	None Expected	Medium
Other Row Crops	0.95	None Expected	Low
Other Crops	7.65	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	None Expected	Low
CA – Vegetables	2.06	None Expected	Medium
CA – Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 381. Effects analysis summary table: Chinook salmon, Sacramento River winter-run ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Sacramento River winter-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.8 Chinook Salmon, Snake River fall-run ESU (*Oncorhynchus tshawytscha*)

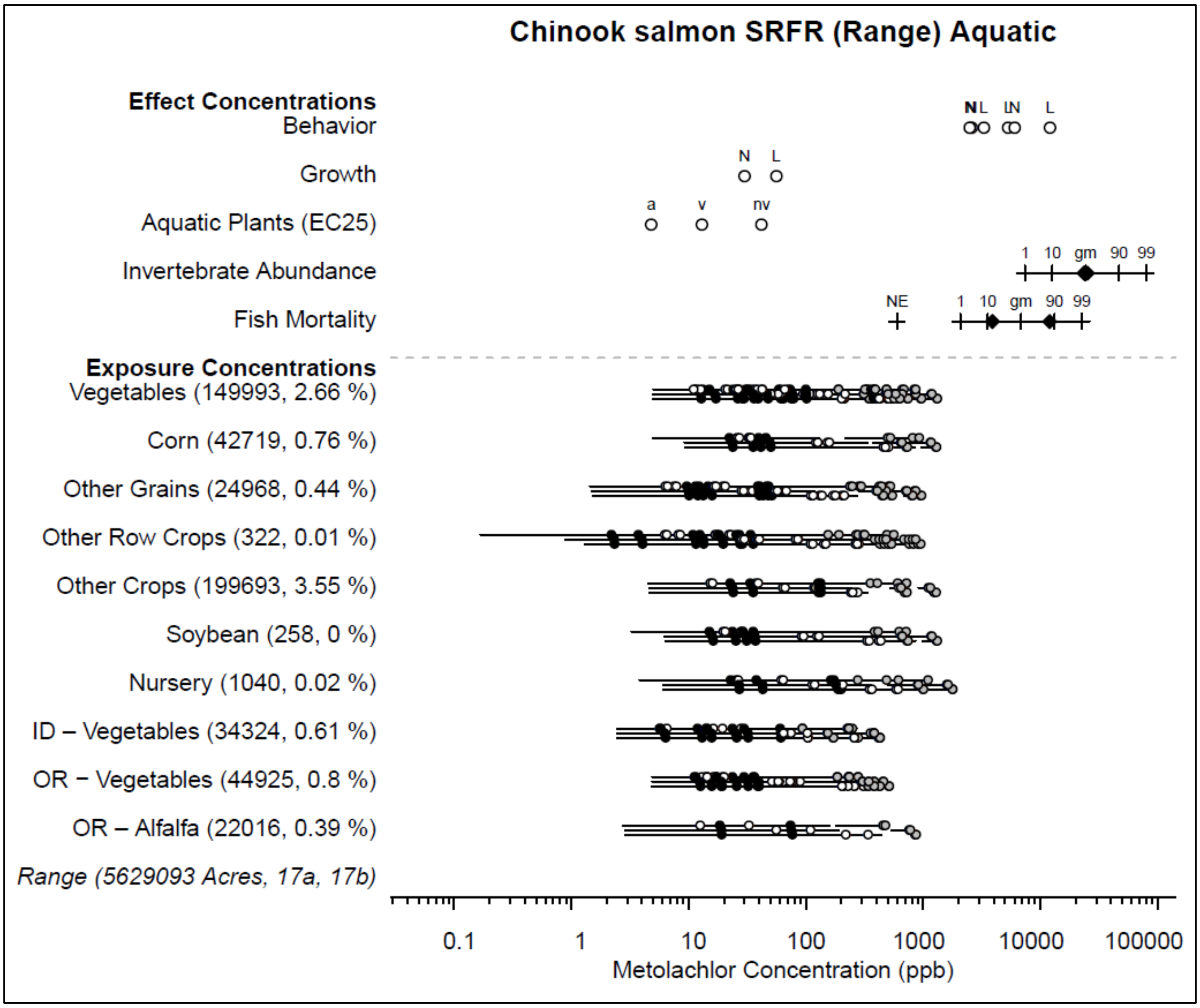


Figure 96. Effects analysis Risk-plot for Chinook salmon, Snake River fall-run ESU and Metolachlor

Table 382. Likelihood of exposure determination for Chinook salmon, Snake River fall-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	Medium
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	yes	3	High
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	2	yes	no	yes	NA	3	Medium
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low
ID - Vegetables	1	yes	no	yes	no	3	Low
OR - Vegetables	1	yes	no	yes	yes	3	High
OR - Alfalfa	1	yes	no	yes	no	3	Low

Table 383. Direct mortality risk hypothesis; Chinook salmon, Snake River fall-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.66	Low	Medium
Corn	0.76	Low	High
Other Grains	0.44	Low	High
Other Row Crops	0.01	Low	Low
Other Crops	3.55	Low	Medium
Soybean	0	Low	Low
Nursery	0.02	Low	Low
ID – Vegetables	0.61	Low	Low
OR - Vegetables	0.8	None Expected	High
OR - Alfalfa	0.39	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		

Medium	**Low**	

Table 384. Prey risk hypothesis; Chinook salmon, Snake River fall-run ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.66	None Expected	Medium
Corn	0.76	None Expected	High
Other Grains	0.44	None Expected	High
Other Row Crops	0.01	None Expected	Low
Other Crops	3.55	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	Low	Low
ID – Vegetables	0.61	None Expected	Low
OR - Vegetables	0.8	None Expected	High
OR - Alfalfa	0.39	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 385. Growth risk hypothesis; Chinook salmon, Snake River fall-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.66	Medium	Medium
Corn	0.76	Medium	High
Other Grains	0.44	Medium	High

Other Row Crops	0.01	Medium	Low
Other Crops	3.55	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.02	Medium	Low
ID – Vegetables	0.61	Medium	Low
OR - Vegetables	0.8	Medium	High
OR - Alfalfa	0.39	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 386. Behavior risk hypothesis; Chinook salmon, Snake River fall-run ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.66	None Expected	Medium
Corn	0.76	None Expected	High
Other Grains	0.44	None Expected	High
Other Row Crops	0.01	None Expected	Low
Other Crops	3.55	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	None Expected	Low
ID – Vegetables	0.61	None Expected	Low
OR - Vegetables	0.8	None Expected	High
OR - Alfalfa	0.39	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			

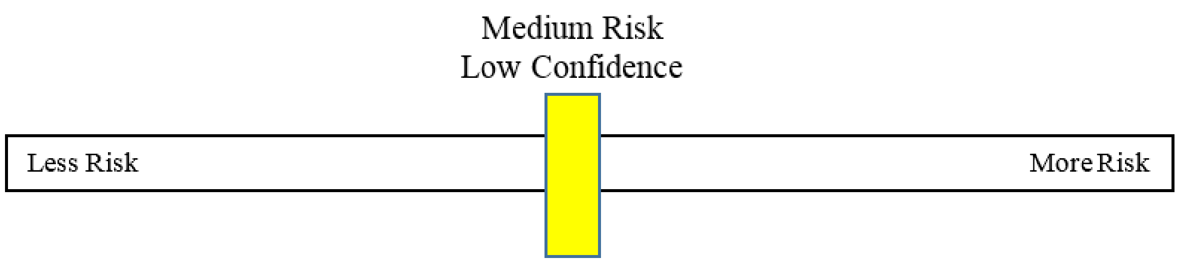
Risk	Confidence	
Low	**High**	

Table 387. Effects analysis summary table: Chinook salmon, Snake River fall-run ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Snake River fall-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis.

Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.9 Chinook Salmon, Snake River spring/summer-run ESU (*Oncorhynchus tshawytscha*

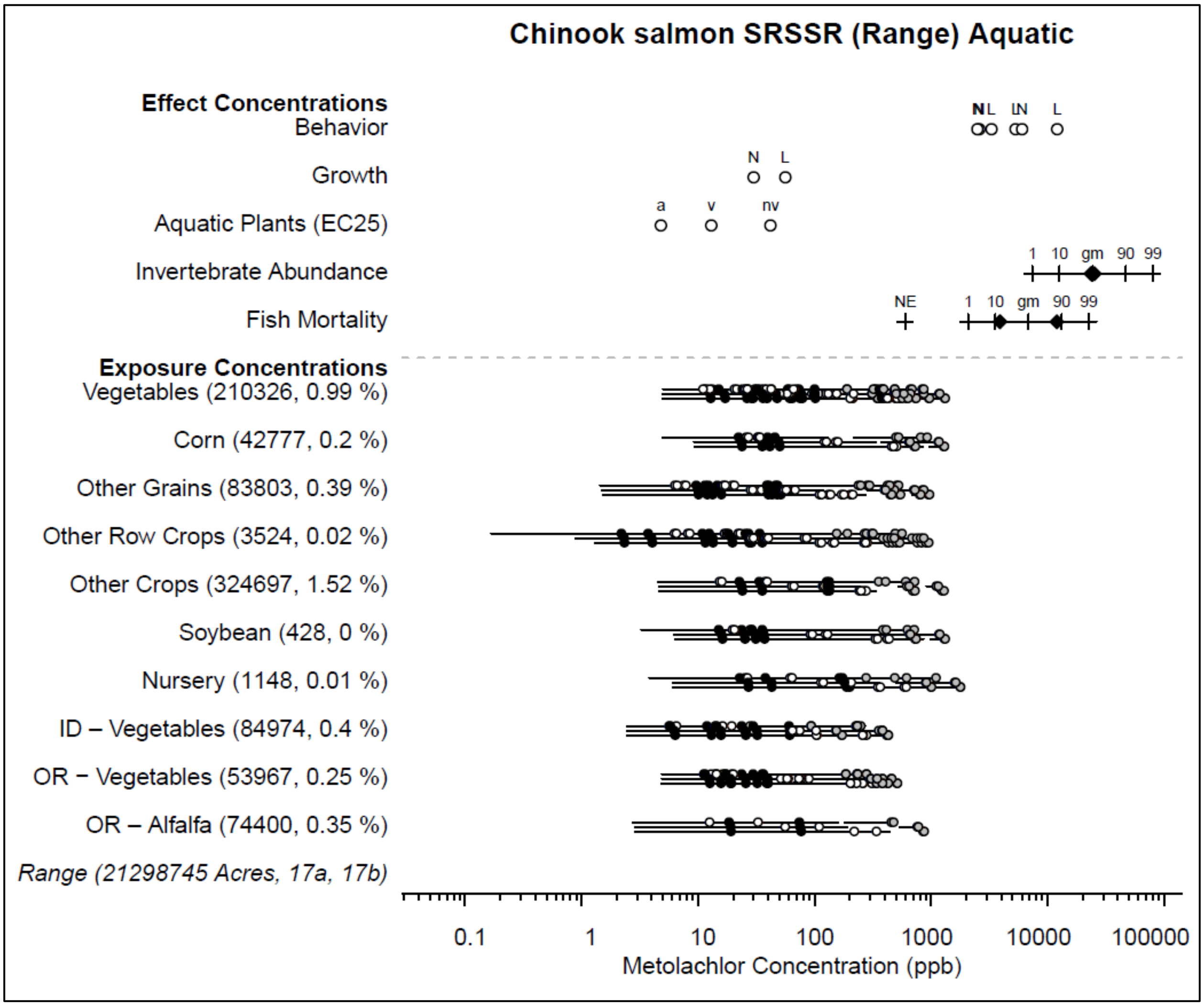


Figure 97. Effects analysis Risk-plot for Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

Table 388. Likelihood of exposure determination for Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	2	yes	no	yes	NA	3	**Medium**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
ID - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 389. Direct mortality risk hypothesis; Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	Low	Low
Corn	0.2	Low	High
Other Grains	0.39	Low	Low
Other Row Crops	0.02	Low	Low
Other Crops	1.52	Low	Medium
Soybean	0	Low	Low
Nursery	0.01	Low	Low
ID – Vegetables	0.4	Low	Low
OR - Vegetables	0.25	None Expected	Low
OR - Alfalfa	0.35	Low	Low

Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.		
Risk	**Confidence**	
Medium	**Low**	

Table 390. Prey risk hypothesis; Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	None Expected	Low
Corn	0.2	None Expected	High
Other Grains	0.39	None Expected	Low
Other Row Crops	0.02	None Expected	Low
Other Crops	1.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
ID – Vegetables	0.4	None Expected	Low
OR - Vegetables	0.25	None Expected	Low
OR - Alfalfa	0.35	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 391. Growth risk hypothesis; Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**

Vegetables	0.99	Medium	Low
Corn	0.2	Medium	High
Other Grains	0.39	Medium	Low
Other Row Crops	0.02	Medium	Low
Other Crops	1.52	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.01	Medium	Low
ID – Vegetables	0.4	Medium	Low
OR - Vegetables	0.25	Medium	Low
OR - Alfalfa	0.35	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 392. Behavior risk hypothesis; Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

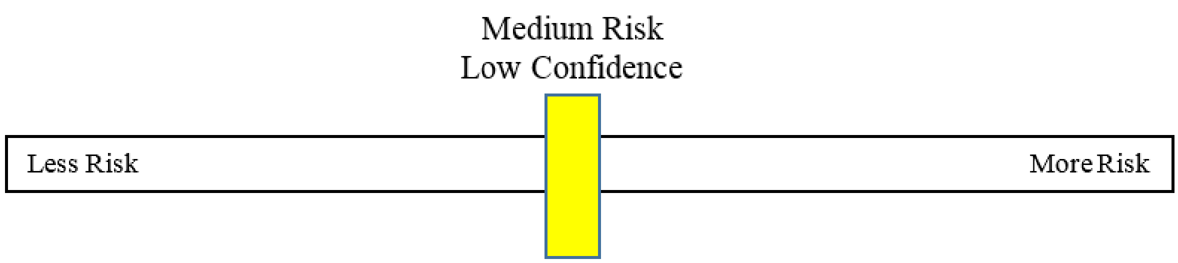
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	None Expected	Low
Corn	0.2	None Expected	High
Other Grains	0.39	None Expected	Low
Other Row Crops	0.02	None Expected	Low
Other Crops	1.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	None Expected	Low
ID – Vegetables	0.4	None Expected	Low
OR - Vegetables	0.25	None Expected	Low

OR - Alfalfa	0.35	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 393. Effects analysis summary table: Chinook salmon, Snake River spring/summer-run ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Snake River spring/summer-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.10 Chinook salmon, Upper Columbia River spring-run ESU (*Oncorhynchus tshawytscha*)

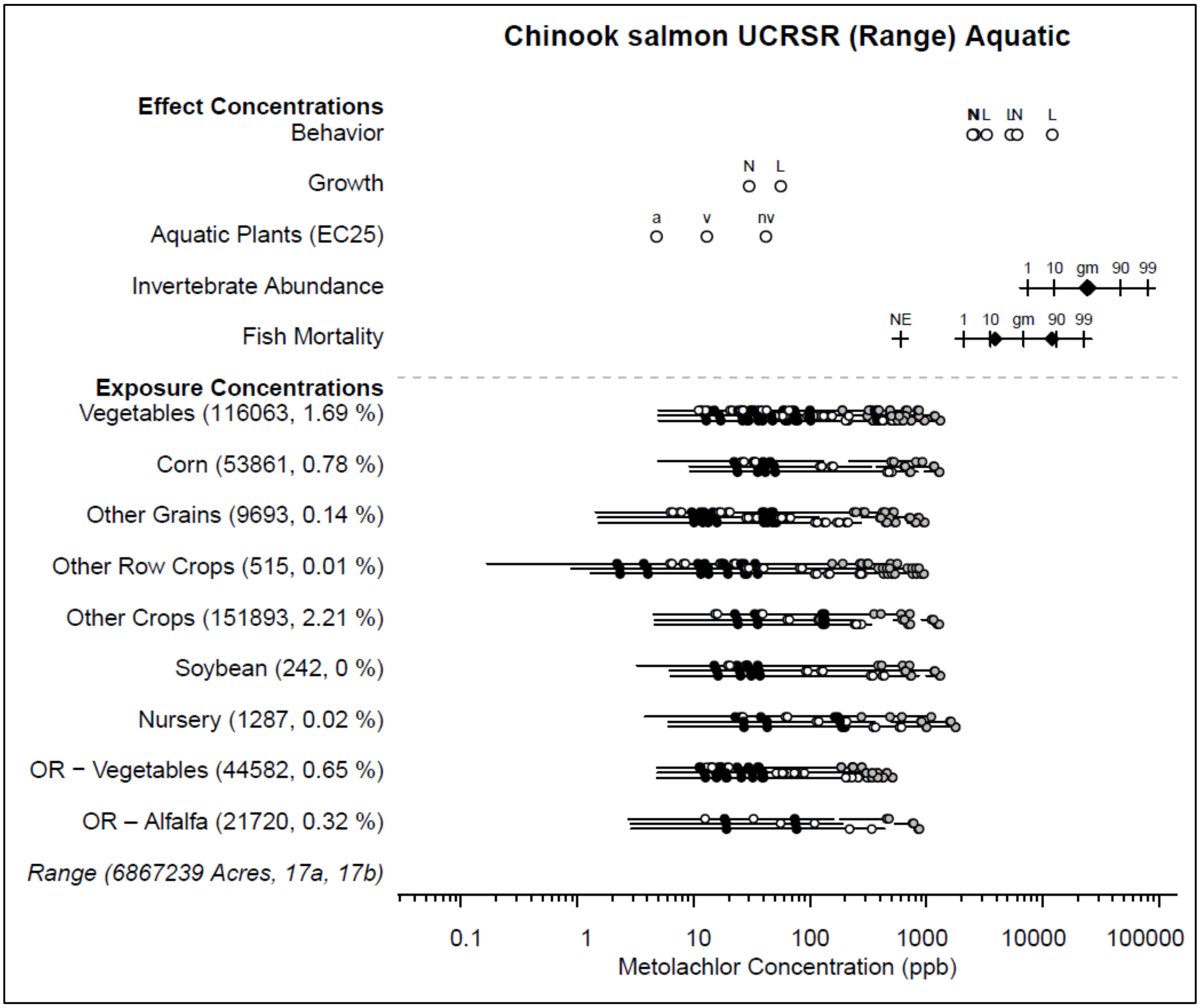


Figure 98. Effects analysis Risk-plot for Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Table 394. Likelihood of exposure determination for Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	Medium
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	no	3	Low
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	2	yes	no	yes	NA	3	Medium
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low
OR - Vegetables	1	yes	no	yes	no	3	Low
OR - Alfalfa	1	yes	no	yes	no	3	Low

Table 395. Direct mortality risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.69	Low	Medium
Corn	0.78	Low	High
Other Grains	0.14	Low	Low
Other Row Crops	0.01	Low	Low
Other Crops	2.21	Low	Medium
Soybean	0	Low	Low
Nursery	0.02	Low	Low
OR - Vegetables	0.65	None Expected	Low
OR - Alfalfa	0.32	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			

Risk	Confidence	
Medium	**Low**	

Table 396. Prey risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.69	None Expected	Medium
Corn	0.78	None Expected	High
Other Grains	0.14	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	2.21	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	Low	Low
OR - Vegetables	0.65	None Expected	Low
OR - Alfalfa	0.32	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 397. Growth risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.69	Medium	Medium
Corn	0.78	Medium	High
Other Grains	0.14	Medium	Low

Other Row Crops	0.01	Medium	Low
Other Crops	2.21	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.02	Medium	Low
OR - Vegetables	0.65	Medium	Low
OR - Alfalfa	0.32	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

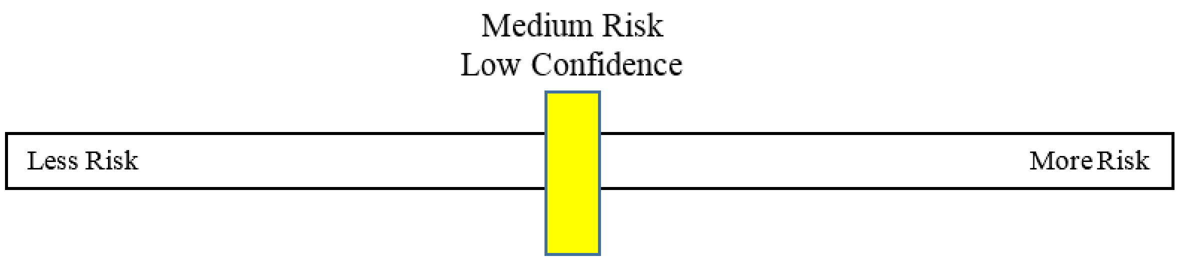
Table 398. Behavior risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.69	None Expected	Medium
Corn	0.78	None Expected	High
Other Grains	0.14	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	2.21	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	None Expected	Low
OR - Vegetables	0.65	None Expected	Low
OR - Alfalfa	0.32	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 399. Effects analysis summary table: Chinook salmon, Upper Columbia River spring-run ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Upper Columbia River spring-run ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.11 Chinook Salmon, Upper Willamette River ESU (*Oncorhynchus tshawytscha*)

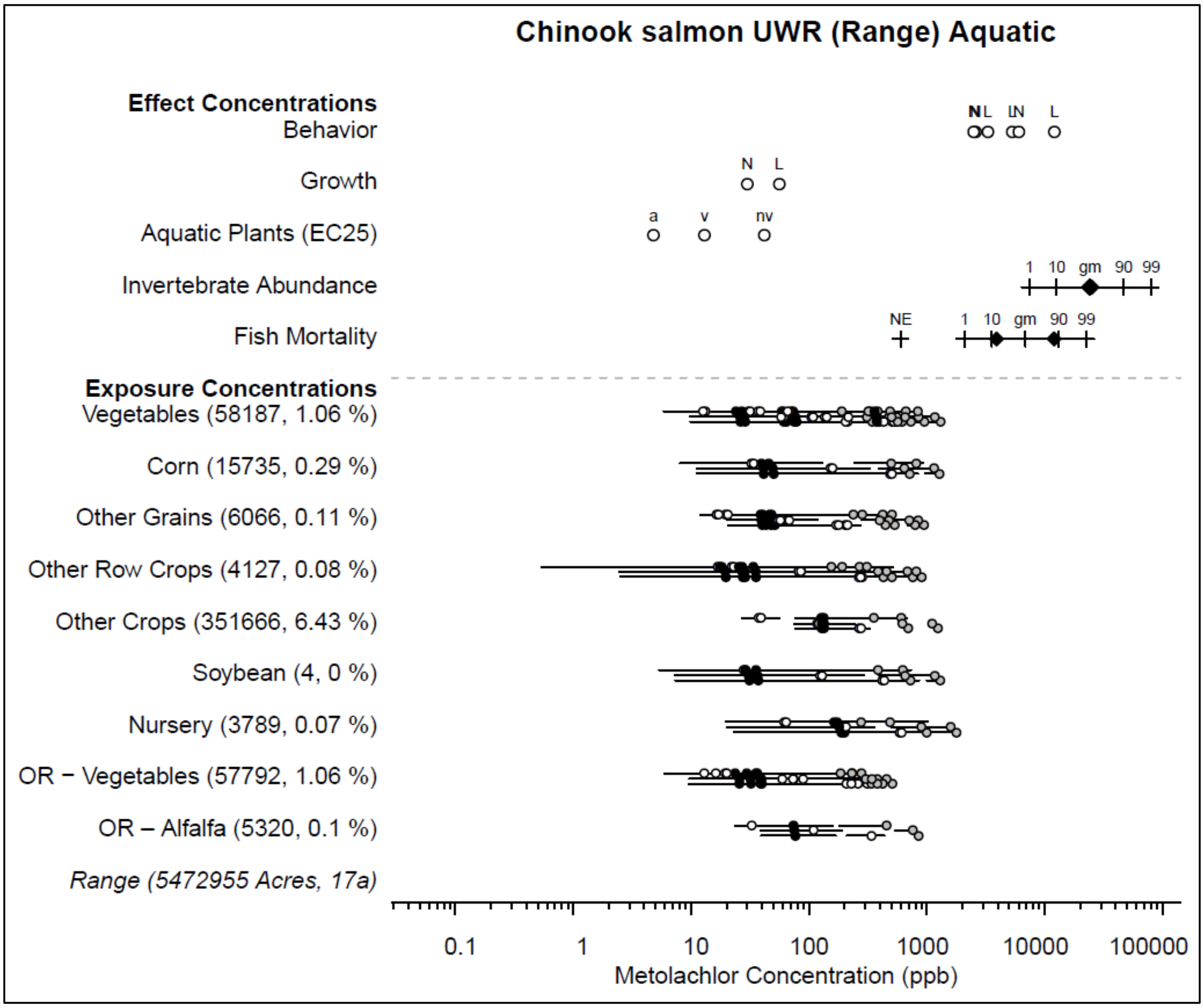


Figure 99. Effects analysis Risk-plot for Chinook salmon, Upper Willamette River ESU and Metolachlor

Table 400. Likelihood of exposure determination for Chinook salmon, Upper Willamette River ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	yes	3	**High**
Other Crops	3	yes	no	yes	NA	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	2	yes	no	yes	NA	3	**Medium**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 401. Direct mortality risk hypothesis; Chinook salmon, Upper Willamette River ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.06	Low	Medium
Corn	0.29	Low	High
Other Grains	0.11	Low	High
Other Row Crops	0.08	Low	High
Other Crops	6.43	Low	High
Soybean	0	Low	Low
Nursery	0.07	Low	Low
OR - Vegetables	1.06	None Expected	Medium
OR - Alfalfa	0.1	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 402. Prey risk hypothesis; Chinook salmon, Upper Willamette River ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.06	None Expected	Medium
Corn	0.29	None Expected	High
Other Grains	0.11	None Expected	High
Other Row Crops	0.08	None Expected	High
Other Crops	6.43	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.07	Low	Low
OR - Vegetables	1.06	None Expected	Medium
OR - Alfalfa	0.1	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 403. Growth risk hypothesis; Chinook salmon, Upper Willamette River ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.06	Medium	Medium
Corn	0.29	Medium	High
Other Grains	0.11	Medium	High
Other Row Crops	0.08	Medium	High
Other Crops	6.43	Medium	High

Soybean	0	Medium	Low
Nursery	0.07	Medium	Low
OR - Vegetables	1.06	Medium	Medium
OR - Alfalfa	0.1	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

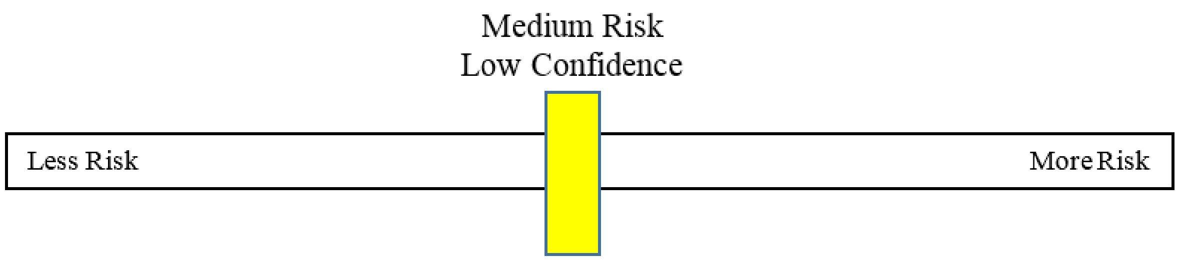
Table 404. Behavior risk hypothesis; Chinook salmon, Upper Willamette River ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.06	None Expected	Medium
Corn	0.29	None Expected	High
Other Grains	0.11	None Expected	High
Other Row Crops	0.08	None Expected	High
Other Crops	6.43	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.07	None Expected	Low
OR - Vegetables	1.06	None Expected	Medium
OR - Alfalfa	0.1	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 405. Effects analysis summary table: Chinook salmon, Upper Willamette River ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Chinook salmon, Upper Willamette River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.12 Coho Salmon, Central California Coast ESU (*Oncorhynchus kisutch*)

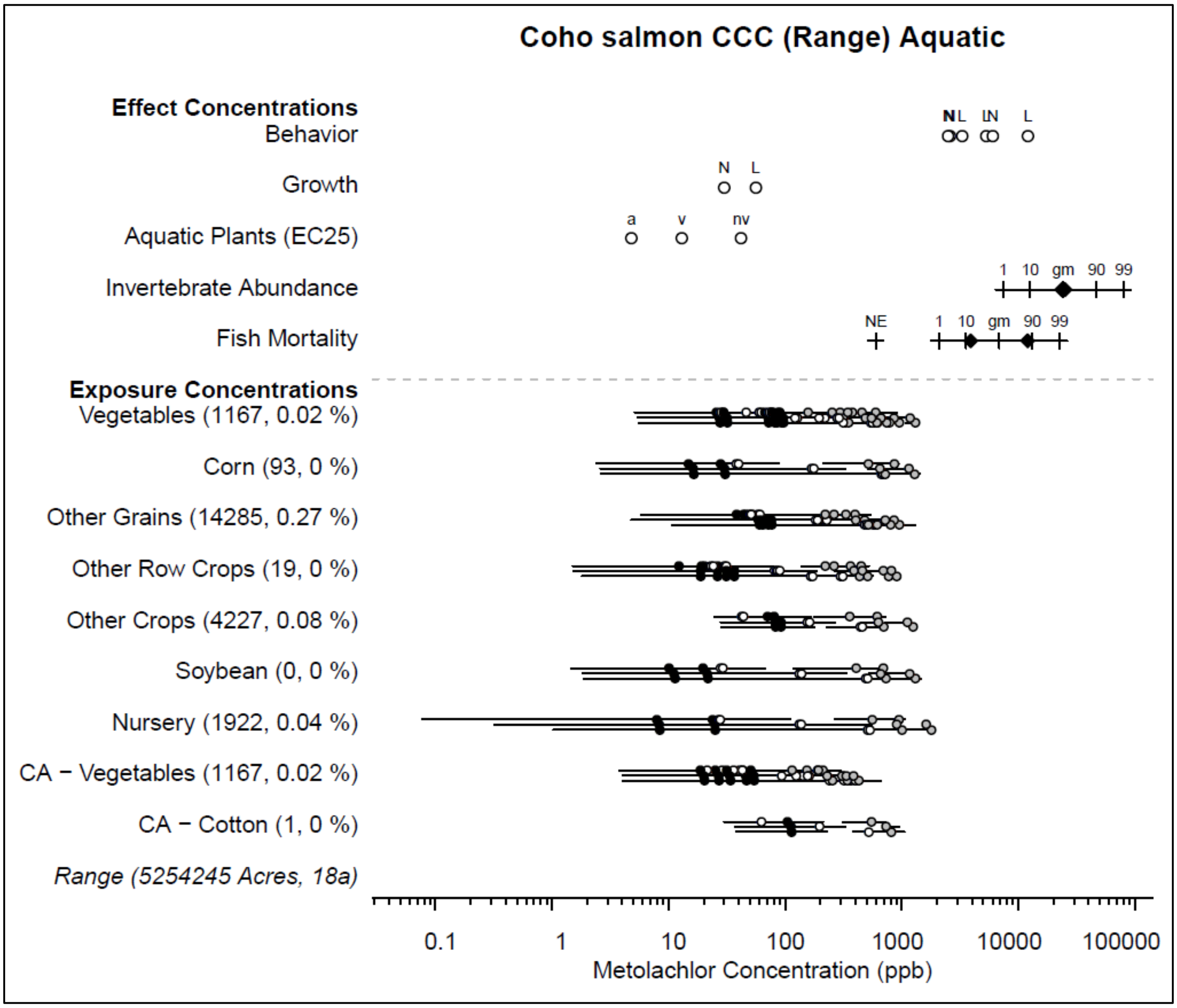


Figure 100. Effects analysis Risk-plot for Coho salmon, Central California Coast ESU and Metolachlor

Table 406. Likelihood of exposure determination for Coho salmon, Central California Coast ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	no	3	**Low**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	no	3	**Low**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	no	3	**Low**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 407. Direct mortality risk hypothesis; Coho salmon, Central California Coast ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.02	Low	Low
Corn	0	Low	Low
Other Grains	0.27	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.08	Low	Low
Soybean	0	Low	Low
Nursery	0.04	Low	Low
CA - Vegetables	0.02	None Expected	Low
CA - Cotton	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 408. Prey risk hypothesis; Coho salmon, Central California Coast ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.02	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.27	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.08	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
CA - Vegetables	0.02	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 409. Growth risk hypothesis; Coho salmon, Central California Coast ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.02	Medium	Low
Corn	0	Medium	Low
Other Grains	0.27	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.08	Medium	Low
Soybean	0	Medium	Low

Nursery	0.04	Medium	Low
CA - Vegetables	0.02	Medium	Low
CA - Cotton	0	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 410. Behavior risk hypothesis; Coho salmon, Central California Coast ESU and Metolachlor

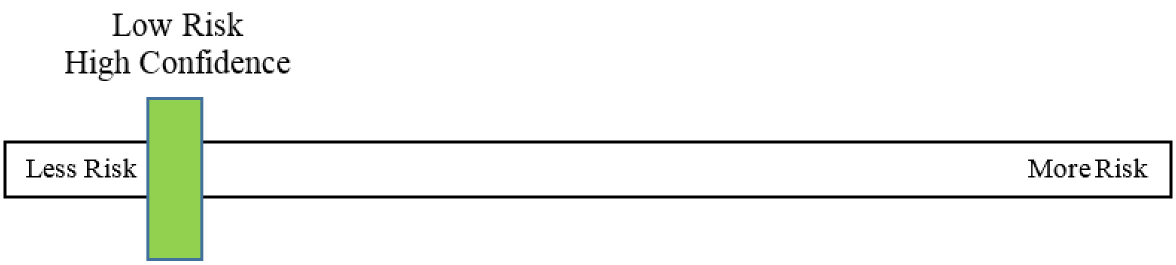
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.02	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.27	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.08	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.04	None Expected	Low
CA - Vegetables	0.02	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 411. Effects analysis summary table: Coho salmon, Central California Coast ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Coho salmon, Central California Coast ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.3.13 Coho Salmon, Lower Columbia River ESU (*Oncorhynchus kisutch*)

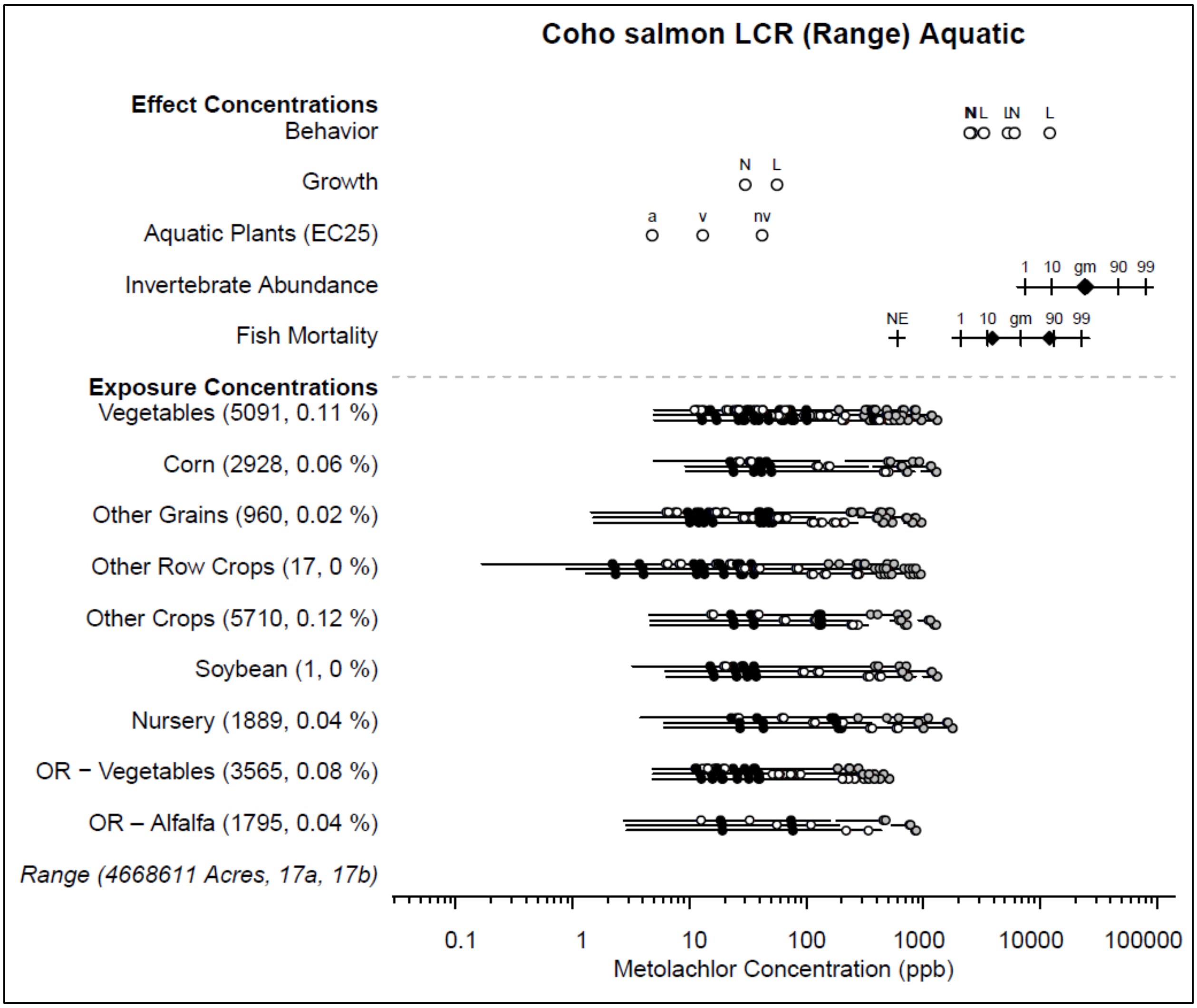


Figure 101. Effects analysis Risk-plot for Coho salmon, Lower Columbia River ESU and Metolachlor

Table 412. Likelihood of exposure determination for Coho salmon, Lower Columbia River ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	**High**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	yes	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	yes	3	**High**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 413. Direct mortality risk hypothesis; Coho salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Low	High
Corn	0.06	Low	High
Other Grains	0.02	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.12	Low	High
Soybean	0	Low	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.08	None Expected	High
OR - Alfalfa	0.04	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 414. Prey risk hypothesis; Coho salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.08	None Expected	High
OR - Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 415. Growth risk hypothesis; Coho salmon, Lower Columbia River ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Medium	High
Corn	0.06	Medium	High
Other Grains	0.02	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.12	Medium	High
Soybean	0	Medium	Low

Nursery	0.04	Medium	Low
OR - Vegetables	0.08	Medium	High
OR - Alfalfa	0.04	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 416. Behavior risk hypothesis; Coho salmon, Lower Columbia River ESU and Metolachlor

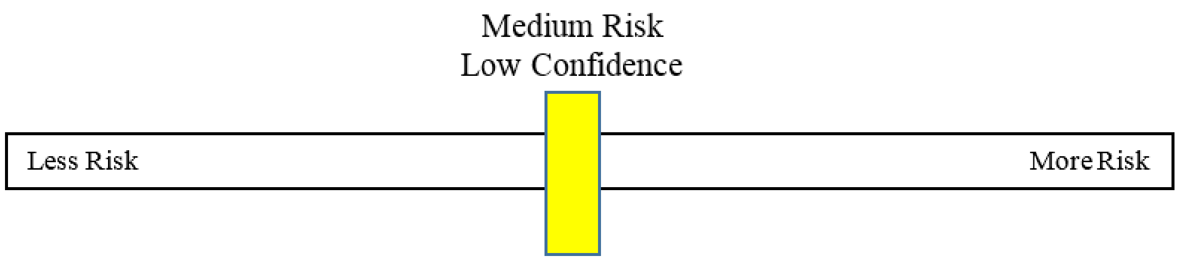
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	None Expected	Low
OR - Vegetables	0.08	None Expected	High
OR - Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 417. Effects analysis summary table: Coho salmon, Lower Columbia River ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Coho salmon, Lower Columbia River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.14 Coho Salmon, Oregon Coast ESU (*Oncorhynchus kisutch*)

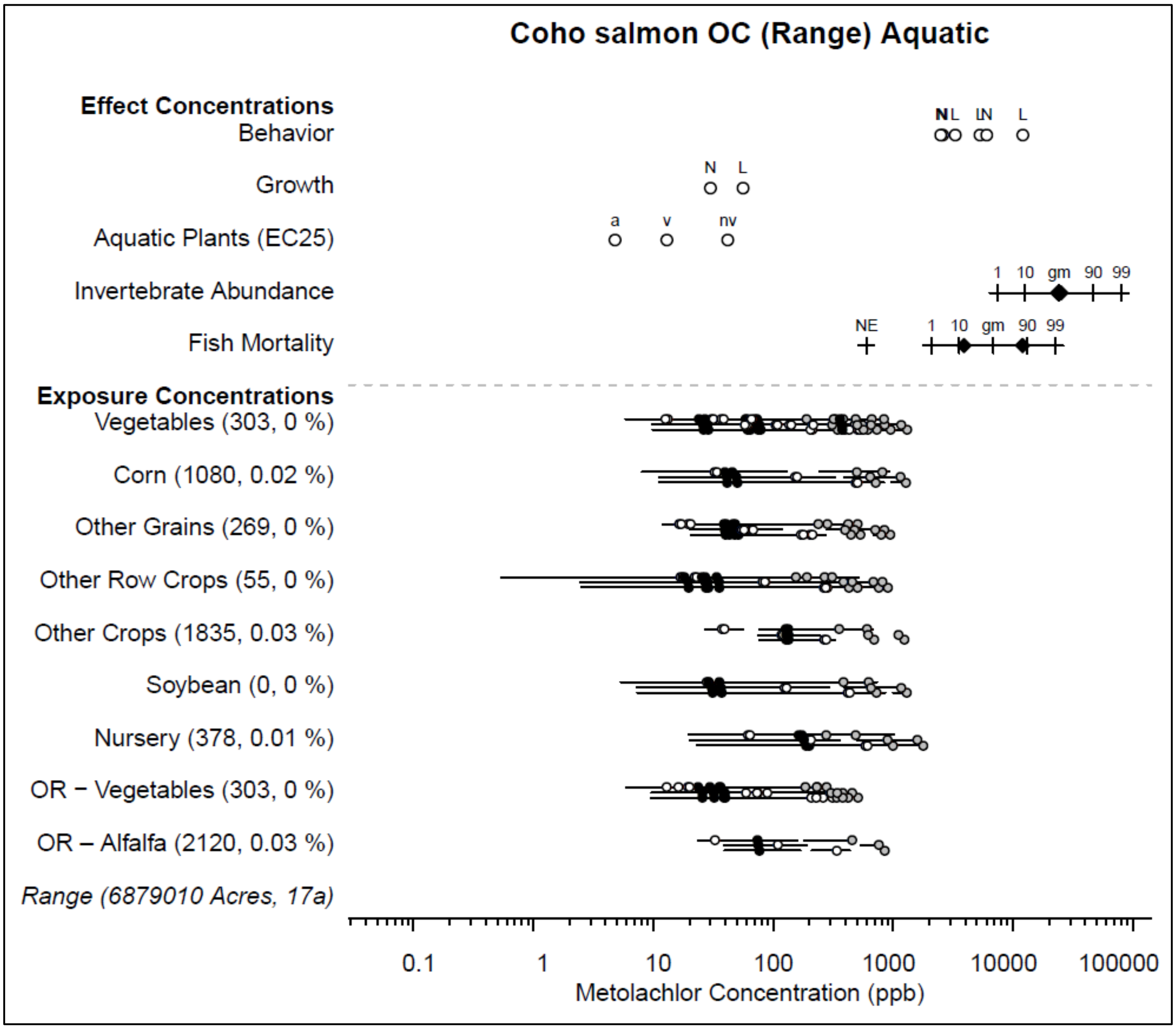


Figure 102. Effects analysis Risk-plot for Coho salmon, Oregon Coast ESU and Metolachlor

Table 418. Likelihood of exposure determination for Coho salmon, Oregon Coast ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	no	3	**Low**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	no	3	**Low**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 419. Direct mortality risk hypothesis; Coho salmon, Oregon Coast ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0.02	Low	Low
Other Grains	0	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.03	Low	Low
Soybean	0	Low	Low
Nursery	0.01	Low	Low
OR- Vegetables	0	None Expected	Low
OR - Cotton	0.03	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 420. Prey risk hypothesis; Coho salmon, Oregon Coast ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0.02	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.03	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
OR- Vegetables	0	None Expected	Low
OR - Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 421. Growth risk hypothesis; Coho salmon, Oregon Coast ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0.02	Medium	Low
Other Grains	0	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.03	Medium	Low
Soybean	0	Medium	Low
Nursery	0.01	Medium	Low

OR- Vegetables	0	Medium	Low
OR - Cotton	0.03	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 422. Behavior risk hypothesis; Coho salmon, Oregon Coast ESU and Metolachlor

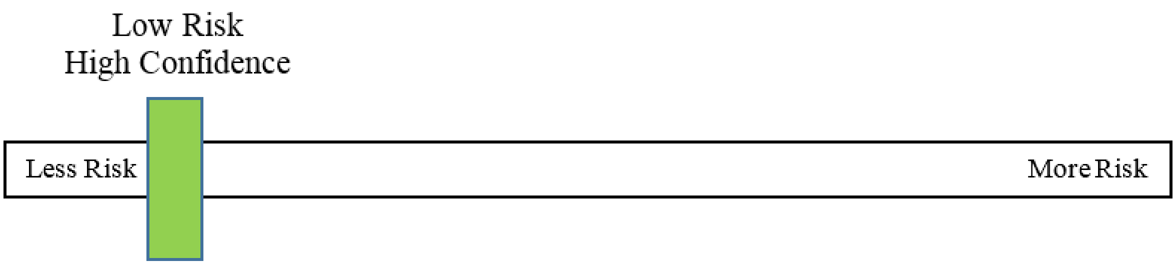
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0.02	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.03	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	None Expected	Low
OR- Vegetables	0	None Expected	Low
OR - Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 423. Effects analysis summary table: Coho salmon, Oregon Coast ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?**
	Risk	**Confidence**		

				Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Coho salmon, Oregon Coast ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.


Low Risk
High Confidence
Less Risk
More Risk

12.3.15 Coho Salmon, Southern Oregon/Northern California Coast ESU (*Oncorhynchus kisutch*)

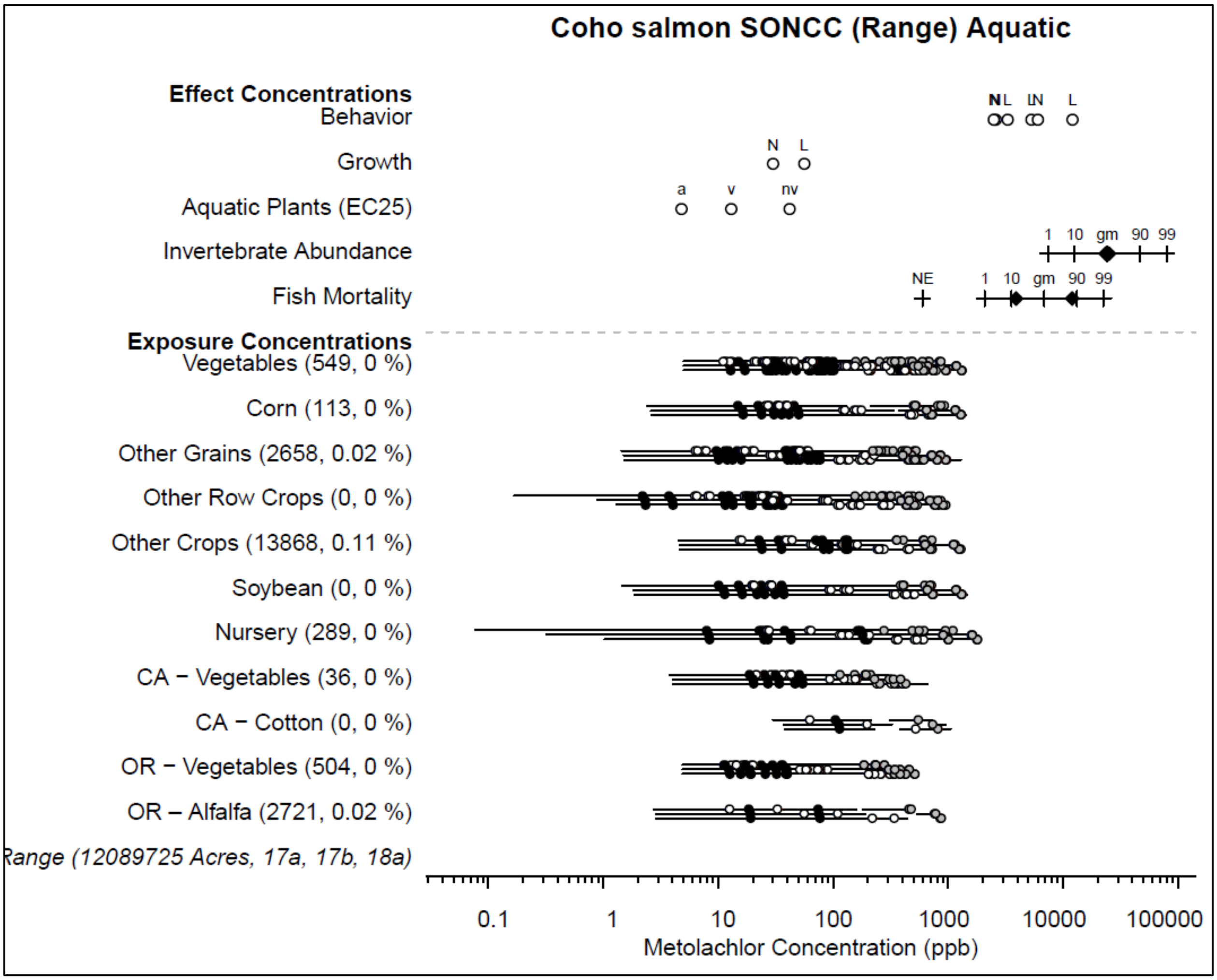


Figure 103. Effects analysis Risk-plot for Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Table 424. Likelihood of exposure determination for Coho salmon, Southern Oregon Northern California ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	Low
Corn	1	yes	no	yes	no	3	Low
Other Grains	1	yes	no	yes	no	3	Low
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	1	yes	no	yes	yes	3	High
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low
CA - Vegetables	1	yes	no	yes	no	3	Low
CA - Cotton	1	yes	no	yes	no	3	Low
OR - Vegetables	1	yes	no	yes	no	3	Low
OR - Alfalfa	1	yes	no	yes	no	3	Low

Table 425. Direct mortality risk hypothesis; Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0	Low	Low
Other Grains	0.02	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.11	Low	High
Soybean	0	Low	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	Low	Low

OR – Vegetables	0	Low	Low
OR – Alfalfa	0.02	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 426. Prey risk hypothesis; Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.11	None Expected	High
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
OR – Vegetables	0	None Expected	Low
OR – Alfalfa	0.02	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 427. Growth risk hypothesis; Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0	Medium	Low
Other Grains	0.02	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.11	Medium	High
Soybean	0	Medium	Low
Nursery	0	Medium	Low
CA - Vegetables	0	Medium	Low
CA - Cotton	0	Medium	Low
OR – Vegetables	0	Medium	Low
OR – Alfalfa	0.02	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Medium	**Low**		

Table 428. Behavior risk hypothesis; Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low

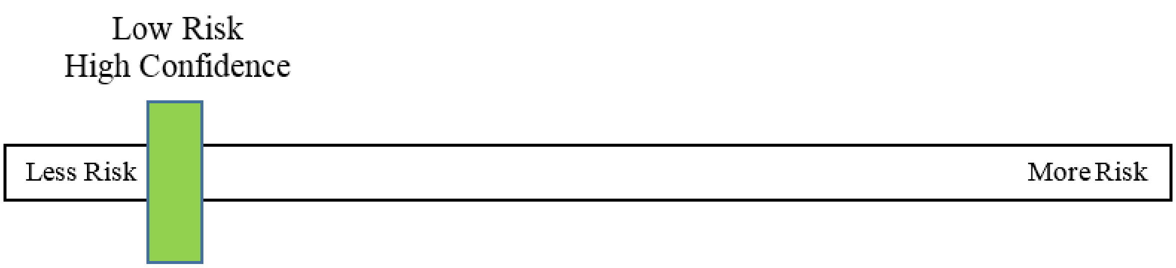
Other Crops	0.11	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	None Expected	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
OR – Vegetables	0	None Expected	Low
OR – Alfalfa	0.02	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 429. Effects analysis summary table: Coho salmon, Southern Oregon Northern California ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?** **Yes/No**
	Risk	**Confidence**		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Medium	Low		No
Exposure to metolachlor is sufficient to reduce adult and	Low	High		No

juvenile abundance and adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Coho salmon, Southern Oregon Northern California ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as medium, our confidence in this risk is low because of the lack of environmental relevance of the available study to the species in these habitats. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is low and the confidence associated with that risk is high given the low risk associated with all risk hypotheses evaluated.



12.3.16 Sockeye Salmon, Ozette Lake ESU (*Oncorhynchus nerka*)

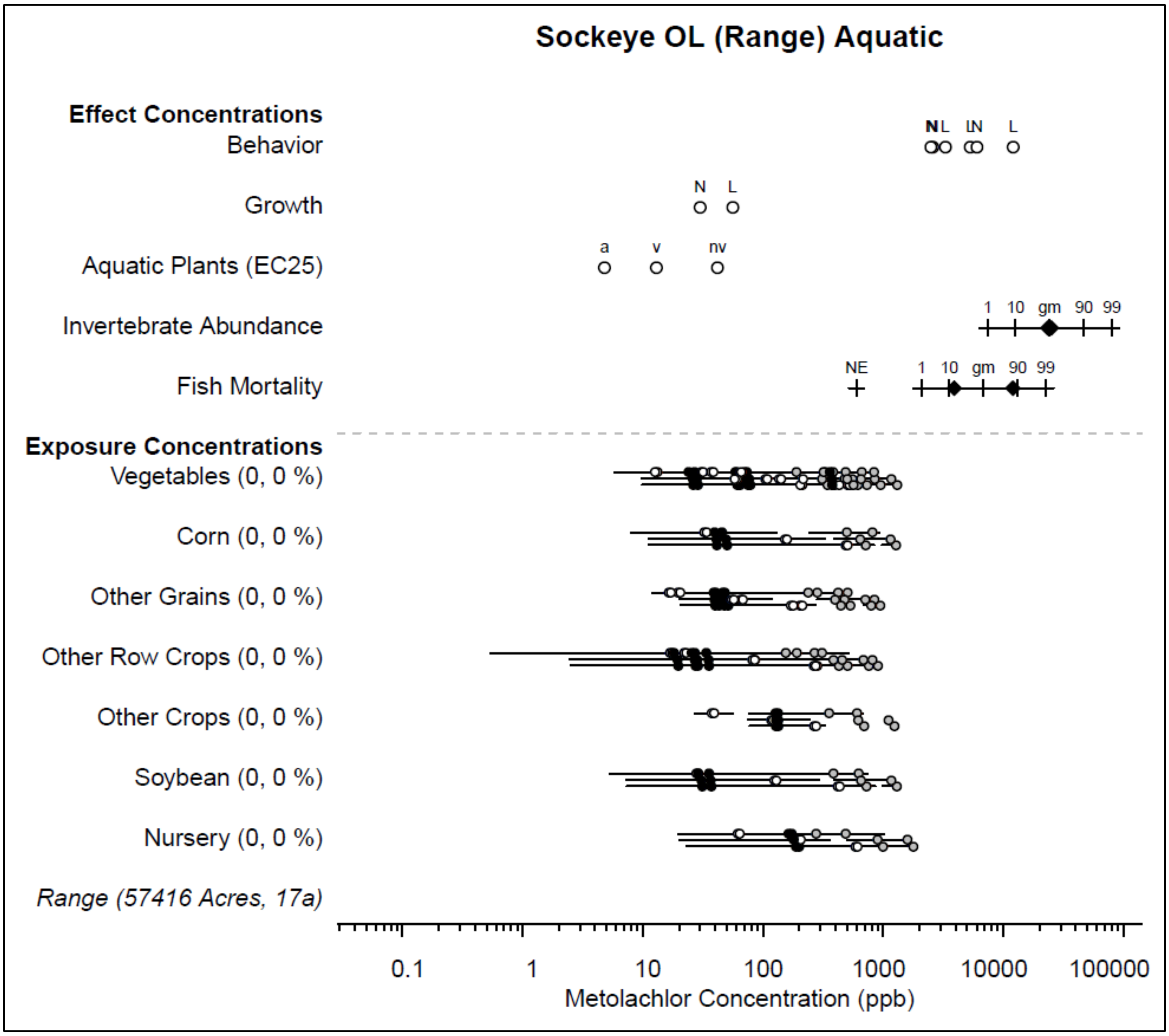


Figure 104. Effects analysis Risk-plot for Sockeye salmon, Lake Ozette ESU and Metolachlor

Table 430. Likelihood of exposure determination for Sockeye salmon, Lake Ozette ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	2	**Low**
Corn	1	yes	no	yes	no	2	**Low**
Other Grains	1	yes	no	yes	no	2	**Low**
Other Row Crops	1	yes	no	yes	no	2	**Low**
Other Crops	1	yes	no	yes	no	2	**Low**
Soybean	1	yes	no	yes	no	2	**Low**
Nursery	1	yes	no	yes	no	2	**Low**

Table 431. Direct mortality risk hypothesis; Sockeye salmon, Lake Ozette ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0	Low	Low
Other Grains	0	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0	Low	Low
Soybean	0	Low	Low
Nursery	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 432. Prey risk hypothesis; Sockeye salmon, Lake Ozette ESU and Metolachlor

Endpoint: Prey

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 433. Growth risk hypothesis; Sockeye salmon, Lake Ozette ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0	Medium	Low
Other Grains	0	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0	Medium	Low
Soybean	0	Medium	Low
Nursery	0	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 434. Behavior risk hypothesis; Sockeye salmon, Lake Ozette ESU and Metolachlor

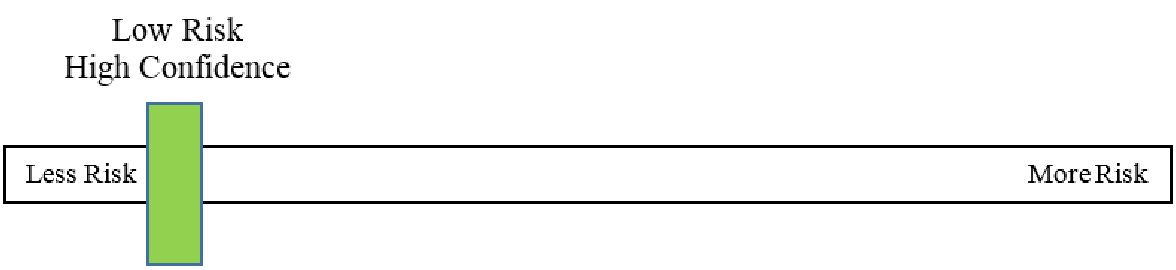
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 435. Effects analysis summary table: Sockeye salmon, Lake Ozette ESU and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?** **Yes/No**
	Risk	**Confidence**		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance	Low	High		No

via impacts to growth (direct toxicity).				
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Sockeye salmon, Lake Ozette ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. We found no overlap of approved use sites within this species range. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. NMFS has determined there is no risk to the species from the effects of the action and the confidence associated with our risk determination is high given the low risk associated with all risk hypotheses evaluated.



12.3.17 Sockeye Salmon, Snake River ESU (Oncorhynchus nerka)

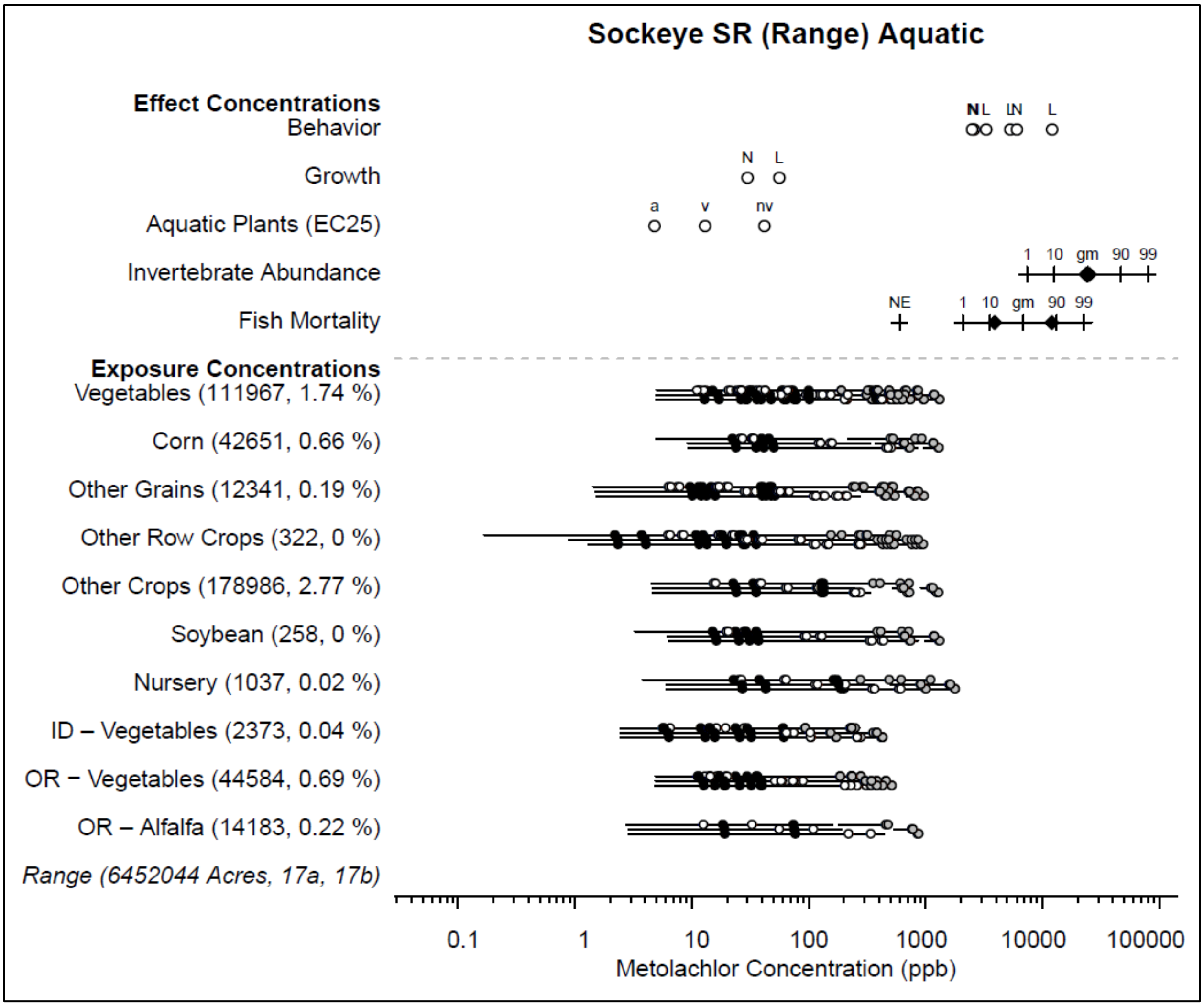


Figure 105. Effects analysis Risk-plot for Sockeye Salmon, Snake River ESU and Metolachlor

Table 436. Likelihood of exposure determination for Sockeye Salmon, Snake River ESU and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	Medium
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	yes	3	High
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	2	yes	no	yes	NA	3	Medium
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low
ID - Vegetables	1	yes	no	yes	no	3	Low
OR - Vegetables	1	yes	no	yes	no	3	Low
OR - Alfalfa	1	yes	no	yes	no	3	Low

Table 437. Direct mortality risk hypothesis; Sockeye Salmon, Snake River ESU and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.74	Low	Medium
Corn	0.66	Low	High
Other Grains	0.19	Low	High
Other Row Crops	0	Low	Low
Other Crops	2.77	Low	Medium
Soybean	0	Low	Low
Nursery	0.02	Low	Low
ID – Vegetables	0.04	Low	Low
OR - Vegetables	0.69	None Expected	Low
OR - Alfalfa	0.22	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		

Medium	**Low**	

Table 438. Prey risk hypothesis; Sockeye Salmon, Snake River ESU and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.74	None Expected	Medium
Corn	0.66	None Expected	High
Other Grains	0.19	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	2.77	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	Low	Low
ID – Vegetables	0.04	None Expected	Low
OR - Vegetables	0.69	None Expected	Low
OR - Alfalfa	0.22	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 439. Growth risk hypothesis; Sockeye Salmon, Snake River ESU and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.74	Medium	Medium
Corn	0.66	Medium	High
Other Grains	0.19	Medium	High
Other Row Crops	0	Medium	Low

Other Crops	2.77	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.02	Medium	Low
ID – Vegetables	0.04	Medium	Low
OR - Vegetables	0.69	Medium	Low
OR - Alfalfa	0.22	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

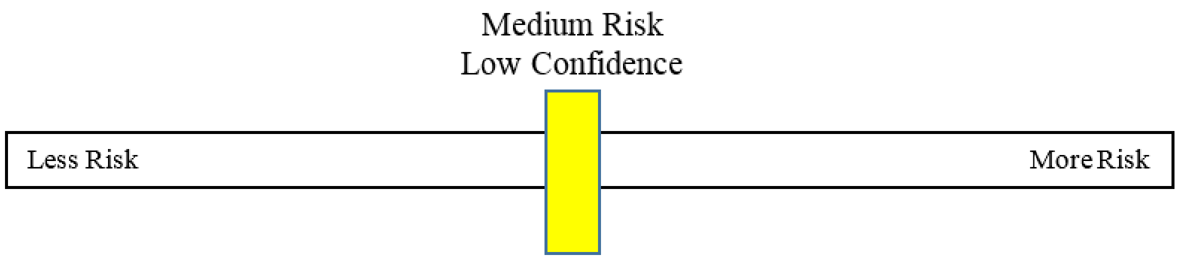
Table 440. Behavior risk hypothesis; Sockeye Salmon, Snake River ESU and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.74	None Expected	Medium
Corn	0.66	None Expected	High
Other Grains	0.19	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	2.77	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	None Expected	Low
ID – Vegetables	0.04	None Expected	Low
OR - Vegetables	0.69	None Expected	Low
OR - Alfalfa	0.22	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 441. Effects analysis summary table: Sockeye Salmon, Snake River ESU and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	No significant reductions in population growth rate. (See chapter 11.5).	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Sockeye Salmon, Snake River ESU are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. No changes in population growth rate occurred at the one percent mortality level for any model runs. This suggests that no changes in population growth would occur at the percent mortalities anticipated (less than one percent) with exposures to metolachlor. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.18 Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*)

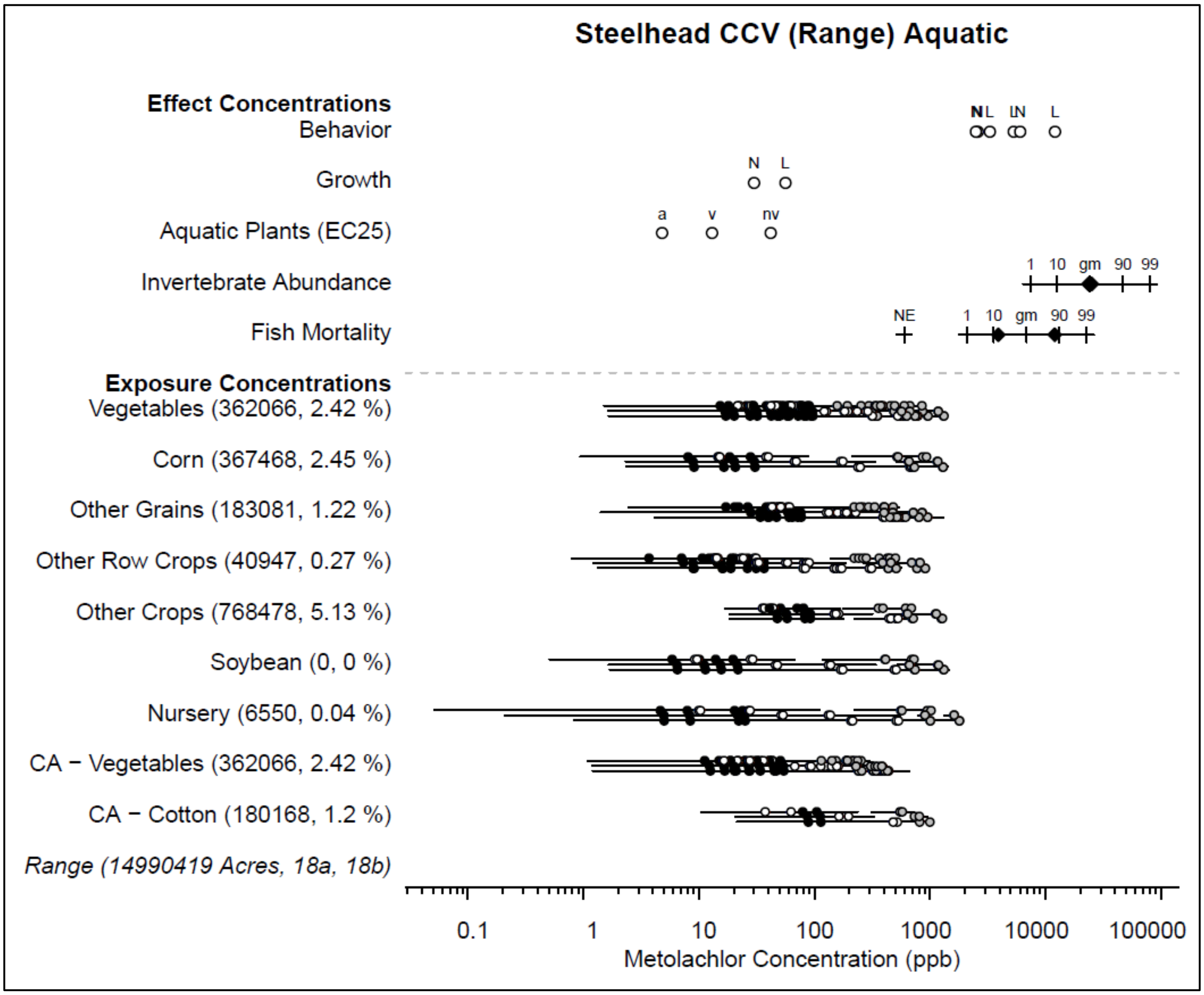


Figure 106. Effects analysis Risk-plot for Steelhead, California Central-Valley DPS and Metolachlor

Table 442. Likelihood of exposure determination for Steelhead, California Central-Valley DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	2	yes	no	yes	NA	3	**Medium**
Other Grains	2	yes	no	yes	NA	3	**Medium**
Other Row Crops	1	yes	no	yes	yes	3	**High**
Other Crops	3	yes	no	yes	NA	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	2	yes	no	yes	NA	3	**Medium**
CA - Cotton	2	yes	no	yes	NA	3	**Medium**

Table 443. Direct mortality risk hypothesis; Steelhead, California Central-Valley DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.42	Low	Medium
Corn	2.45	Low	Medium
Other Grains	1.22	Low	Medium
Other Row Crops	0.27	Low	High
Other Crops	5.13	Low	High
Soybean	0	Low	Low
Nursery	0.04	Low	Low
CA - Vegetables	2.42	None Expected	Medium
CA - Cotton	1.2	Low	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 444. Prey risk hypothesis; Steelhead, California Central-Valley DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.42	None Expected	Medium
Corn	2.45	None Expected	Medium
Other Grains	1.22	None Expected	Medium
Other Row Crops	0.27	None Expected	High
Other Crops	5.13	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
CA - Vegetables	2.42	None Expected	Medium
CA - Cotton	1.2	None Expected	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 445. Growth risk hypothesis; Steelhead, California Central-Valley DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.42	Medium	Medium
Corn	2.45	Medium	Medium
Other Grains	1.22	Medium	Medium
Other Row Crops	0.27	Medium	High
Other Crops	5.13	Medium	High
Soybean	0	Medium	Low

Nursery	0.04	Medium	Low
CA - Vegetables	2.42	Medium	Medium
CA - Cotton	1.2	Medium	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 446. Behavior risk hypothesis; Steelhead, California Central-Valley DPS and Metolachlor

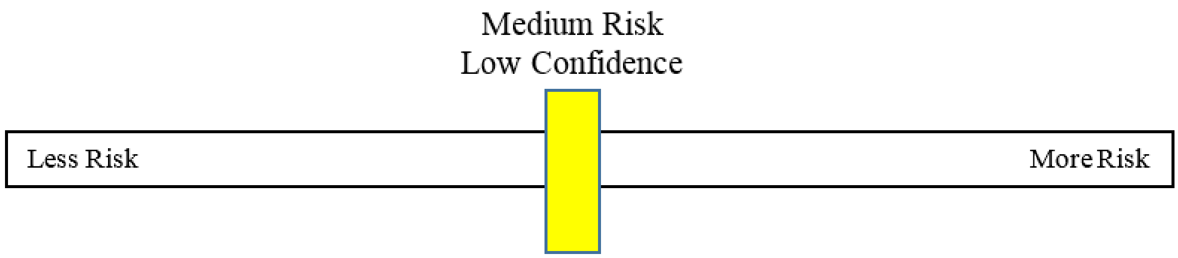
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.42	None Expected	Medium
Corn	2.45	None Expected	Medium
Other Grains	1.22	None Expected	Medium
Other Row Crops	0.27	None Expected	High
Other Crops	5.13	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	None Expected	Low
CA - Vegetables	2.42	None Expected	Medium
CA - Cotton	1.2	None Expected	Medium
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 447. Effects analysis summary table: Steelhead, California Central-Valley DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, California Central-Valley DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.19 Steelhead, Central California Coast DPS (*Oncorhynchus mykiss*)

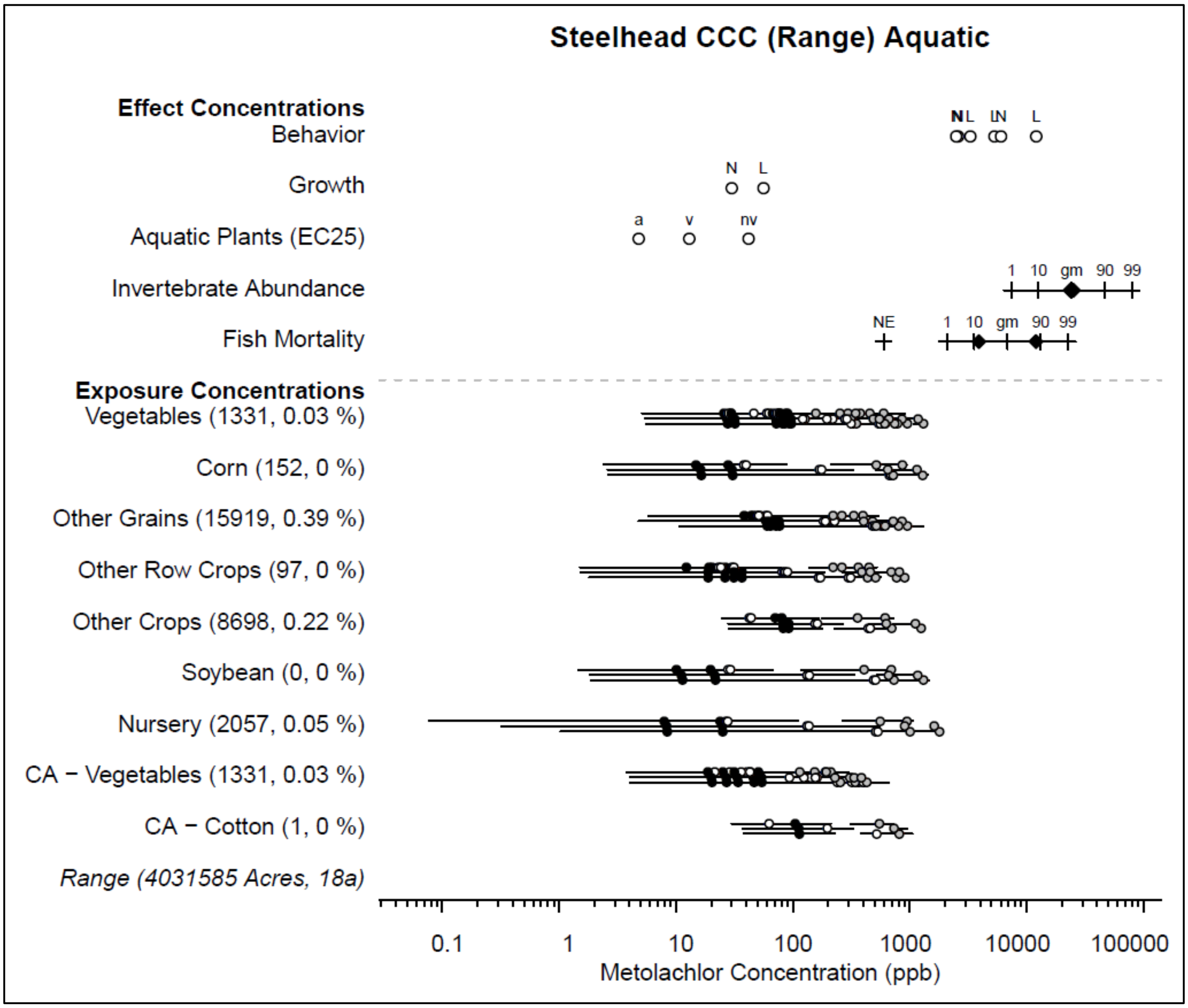


Figure 107. Effects analysis Risk-plot for Steelhead, Central California Coast DPS and Metolachlor

Table 448. Likelihood of exposure determination for Steelhead, Central California Coast DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	no	3	**Low**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	yes	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	no	3	**Low**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 449. Direct mortality risk hypothesis; Steelhead, Central California Coast DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.03	Low	Low
Corn	0	Low	Low
Other Grains	0.39	Low	High
Other Row Crops	0	Low	Low
Other Crops	0.22	Low	High
Soybean	0	Low	Low
Nursery	0.05	Low	Low
CA - Vegetables	0.03	None Expected	Low
CA - Cotton	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 450. Prey risk hypothesis; Steelhead, Central California Coast DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.03	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.39	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.22	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
CA - Vegetables	0.03	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 451. Growth risk hypothesis; Steelhead, Central California Coast DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.03	Medium	Low
Corn	0	Medium	Low
Other Grains	0.39	Medium	High
Other Row Crops	0	Medium	Low
Other Crops	0.22	Medium	High
Soybean	0	Medium	Low

Nursery	0.05	Medium	Low
CA - Vegetables	0.03	Medium	Low
CA - Cotton	0	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 452. Behavior risk hypothesis; Steelhead, Central California Coast DPS and Metolachlor

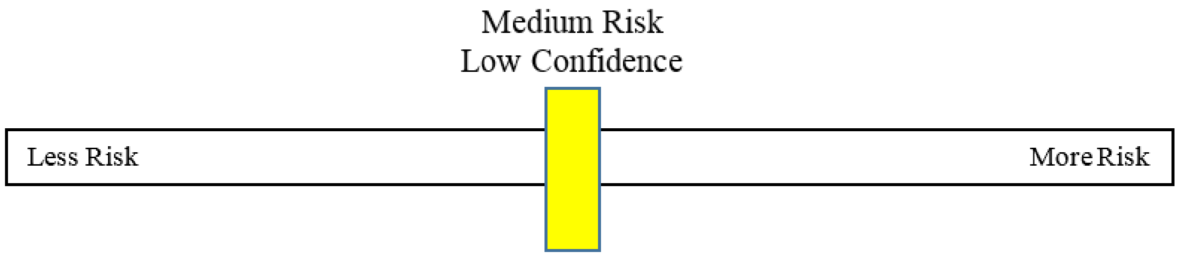
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.03	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.39	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.22	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	None Expected	Low
CA - Vegetables	0.03	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 453. Effects analysis summary table: Steelhead, Central California Coast DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Central California Coast DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.20 Steelhead, Lower Columbia River DPS (*Oncorhynchus mykiss*)

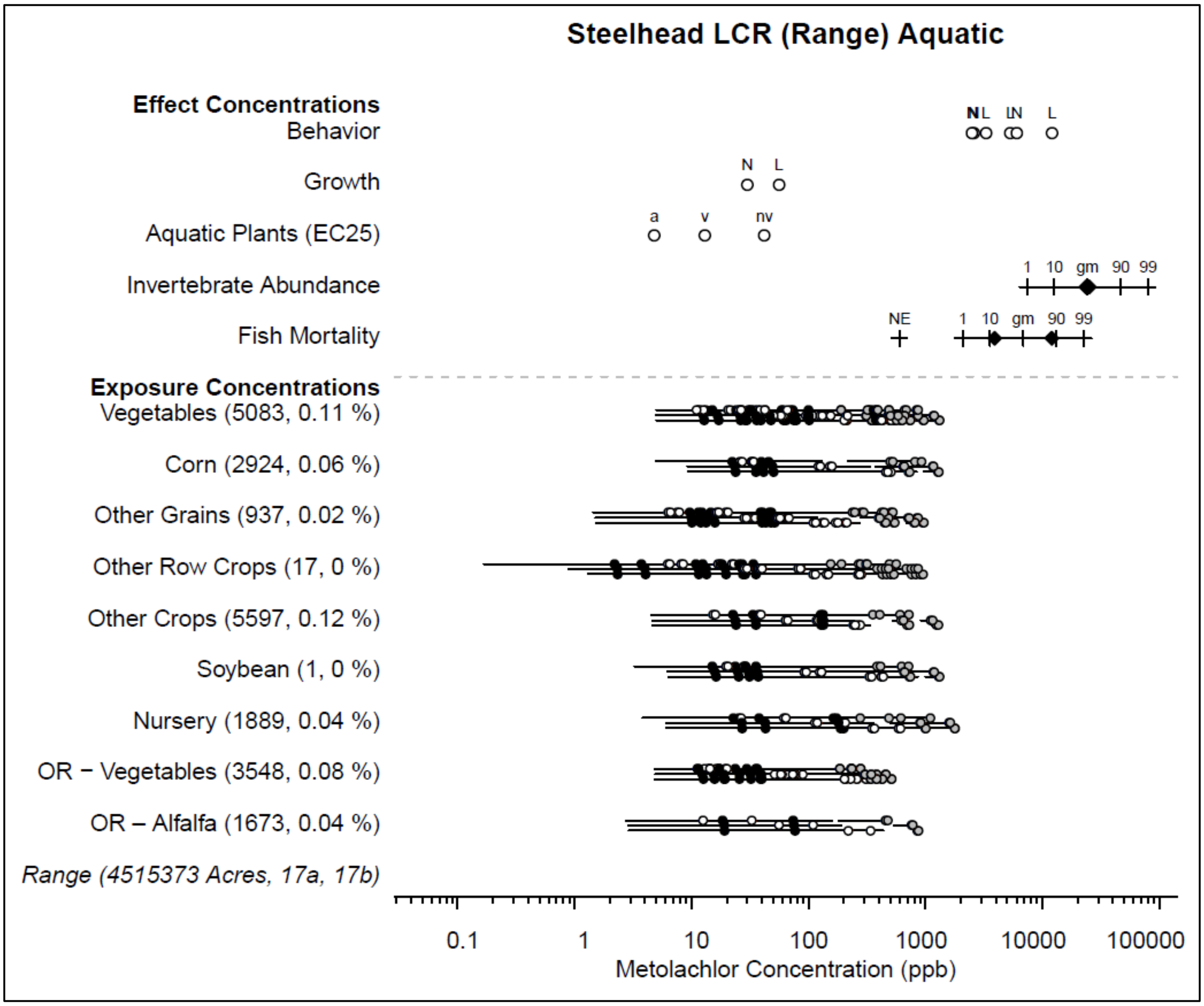


Figure 108. Effects analysis Risk-plot for Steelhead, Lower Columbia River DPS and Metolachlor

Table 454. Likelihood of exposure determination for Steelhead, Lower Columbia River DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	High
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	no	3	Low
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	1	yes	no	yes	yes	3	High
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low
OR - Vegetables	1	yes	no	yes	no	3	Low
OR - Alfalfa	1	yes	no	yes	no	3	Low

Table 455. Direct mortality risk hypothesis; Steelhead, Lower Columbia River DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Low	High
Corn	0.06	Low	High
Other Grains	0.02	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0.12	Low	High
Soybean	0	Low	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.08	None Expected	Low
OR - Alfalfa	0.04	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 456. Prey risk hypothesis; Steelhead, Lower Columbia River DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
OR - Vegetables	0.08	None Expected	Low
OR - Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 457. Growth risk hypothesis; Steelhead, Lower Columbia River DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	Medium	High
Corn	0.06	Medium	High
Other Grains	0.02	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0.12	Medium	High
Soybean	0	Medium	Low

Nursery	0.04	Medium	Low
OR - Vegetables	0.08	Medium	Low
OR - Alfalfa	0.04	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 458. Behavior risk hypothesis; Steelhead, Lower Columbia River DPS and Metolachlor

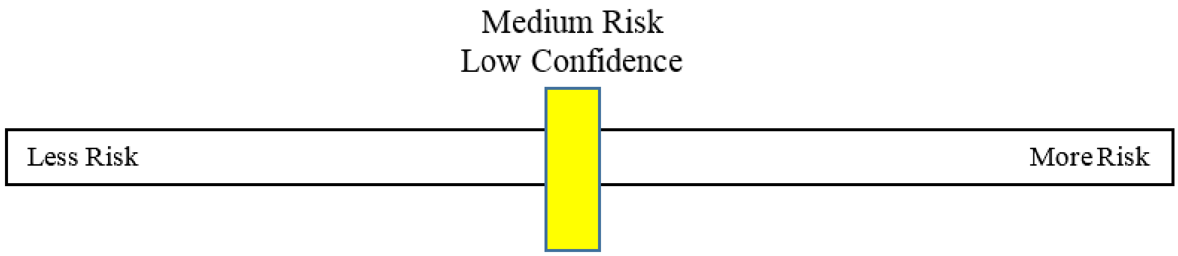
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.12	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	None Expected	Low
OR - Vegetables	0.08	None Expected	Low
OR - Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 459. Effects analysis summary table: Steelhead, Lower Columbia River DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Lower Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.21 Steelhead, Middle Columbia River DPS (*Oncorhynchus mykiss*)

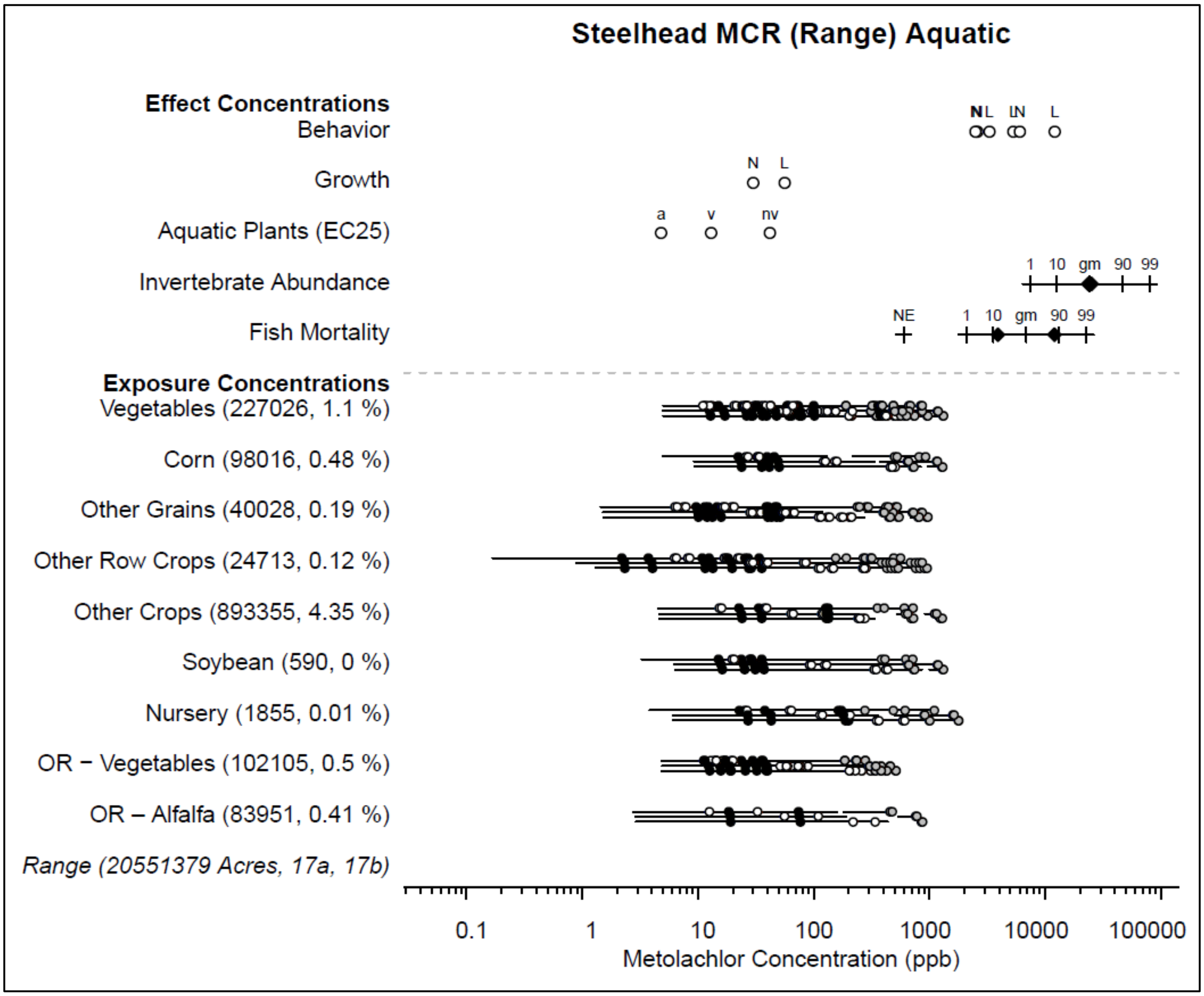


Figure 109. Effects analysis Risk-plot for Steelhead, Middle Columbia River DPS and Metolachlor

Table 460. Likelihood of exposure determination for Steelhead, Middle Columbia River DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	yes	3	**High**
Other Crops	2	yes	no	yes	NA	3	**Medium**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 461. Direct mortality risk hypothesis; Steelhead, Middle Columbia River DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.1	Low	Medium
Corn	0.48	Low	High
Other Grains	0.19	Low	Low
Other Row Crops	0.12	Low	High
Other Crops	4.35	Low	Medium
Soybean	0	Low	Low
Nursery	0.01	Low	Low
OR - Vegetables	0.5	None Expected	Low
OR - Alfalfa	0.41	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 462. Prey risk hypothesis; Steelhead, Middle Columbia River DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.1	None Expected	Medium
Corn	0.48	None Expected	High
Other Grains	0.19	None Expected	Low
Other Row Crops	0.12	None Expected	High
Other Crops	4.35	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
OR - Vegetables	0.5	None Expected	Low
OR - Alfalfa	0.41	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 463. Growth risk hypothesis; Steelhead, Middle Columbia River DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.1	Medium	Medium
Corn	0.48	Medium	High
Other Grains	0.19	Medium	Low
Other Row Crops	0.12	Medium	High
Other Crops	4.35	Medium	Medium
Soybean	0	Medium	Low

Nursery	0.01	Medium	Low
OR - Vegetables	0.5	Medium	Low
OR - Alfalfa	0.41	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 464. Behavior risk hypothesis; Steelhead, Middle Columbia River DPS and Metolachlor

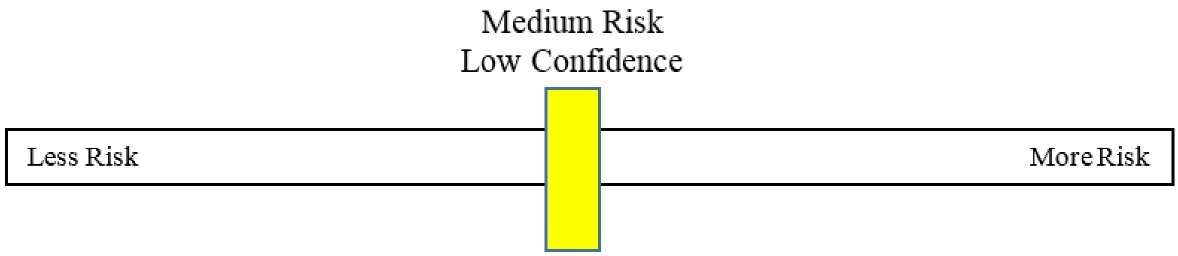
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.1	None Expected	Medium
Corn	0.48	None Expected	High
Other Grains	0.19	None Expected	Low
Other Row Crops	0.12	None Expected	High
Other Crops	4.35	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	None Expected	Low
OR - Vegetables	0.5	None Expected	Low
OR - Alfalfa	0.41	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 465. Effects analysis summary table: Steelhead, Middle Columbia River DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Middle Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.22 Steelhead, Northern California DPS (*Oncorhynchus mykiss*)

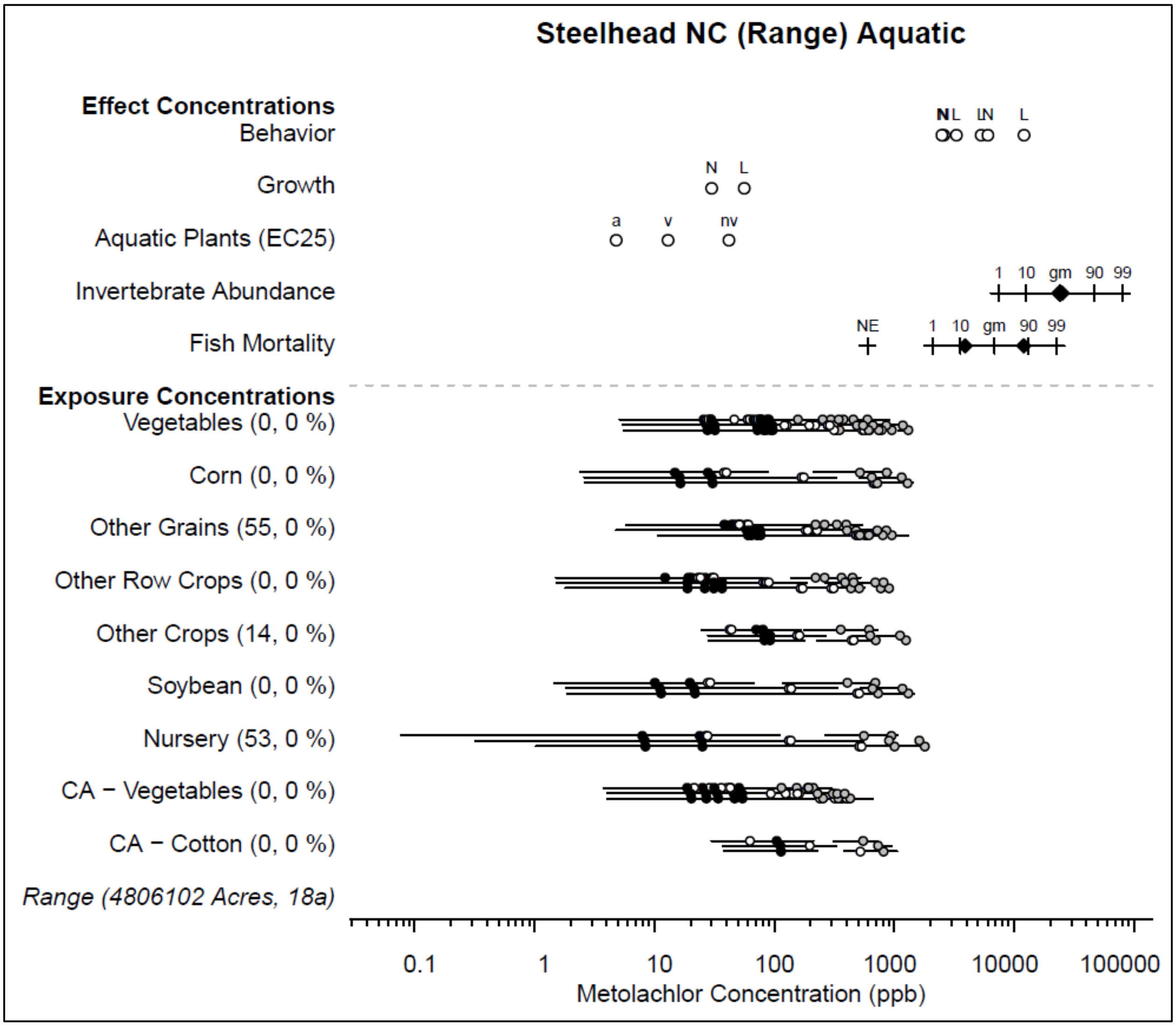


Figure 110. Effects analysis Risk-plot for Steelhead, Northern California DPS and Metolachlor

Table 466. Likelihood of exposure determination for Steelhead, Northern California DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	no	3	**Low**
Corn	1	yes	no	yes	no	3	**Low**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	no	3	**Low**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	no	3	**Low**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 467. Direct mortality risk hypothesis; Steelhead, Northern California DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Low	Low
Corn	0	Low	Low
Other Grains	0	Low	Low
Other Row Crops	0	Low	Low
Other Crops	0	Low	Low
Soybean	0	Low	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Low	**High**		

Table 468. Prey risk hypothesis; Steelhead, Northern California DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 469. Growth risk hypothesis; Steelhead, Northern California DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	Medium	Low
Corn	0	Medium	Low
Other Grains	0	Medium	Low
Other Row Crops	0	Medium	Low
Other Crops	0	Medium	Low
Soybean	0	Medium	Low
Nursery	0	Medium	Low

CA - Vegetables	0	Medium	Low
CA - Cotton	0	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
Low	**High**		

Table 470. Behavior risk hypothesis; Steelhead, Northern California DPS and Metolachlor

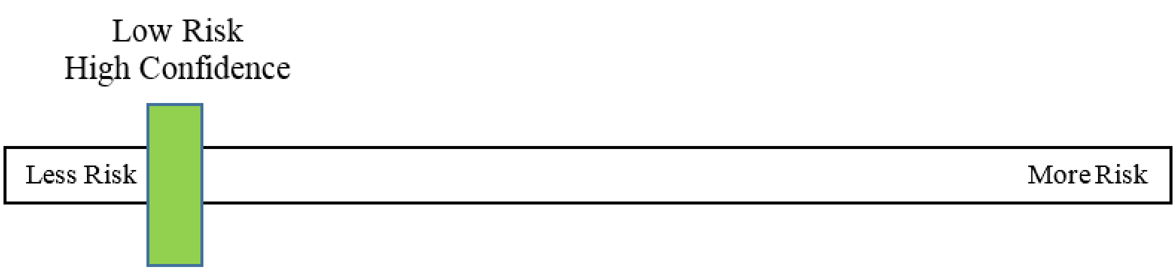
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	None Expected	Low
CA - Vegetables	0	None Expected	Low
CA - Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 471. Effects analysis summary table: Steelhead, Northern California DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?**
	Risk	**Confidence**		

				Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	High	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	High		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Northern California DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. We found no significant overlap of approved use sites within this species range. NMFS has determined that the risk to the species is insignificant from the effects of the action and the confidence associated with our risk determination is high given the low risk associated with all risk hypotheses evaluated.



12.3.23 Steelhead, Puget Sound DPS (*Oncorhynchus mykiss*)

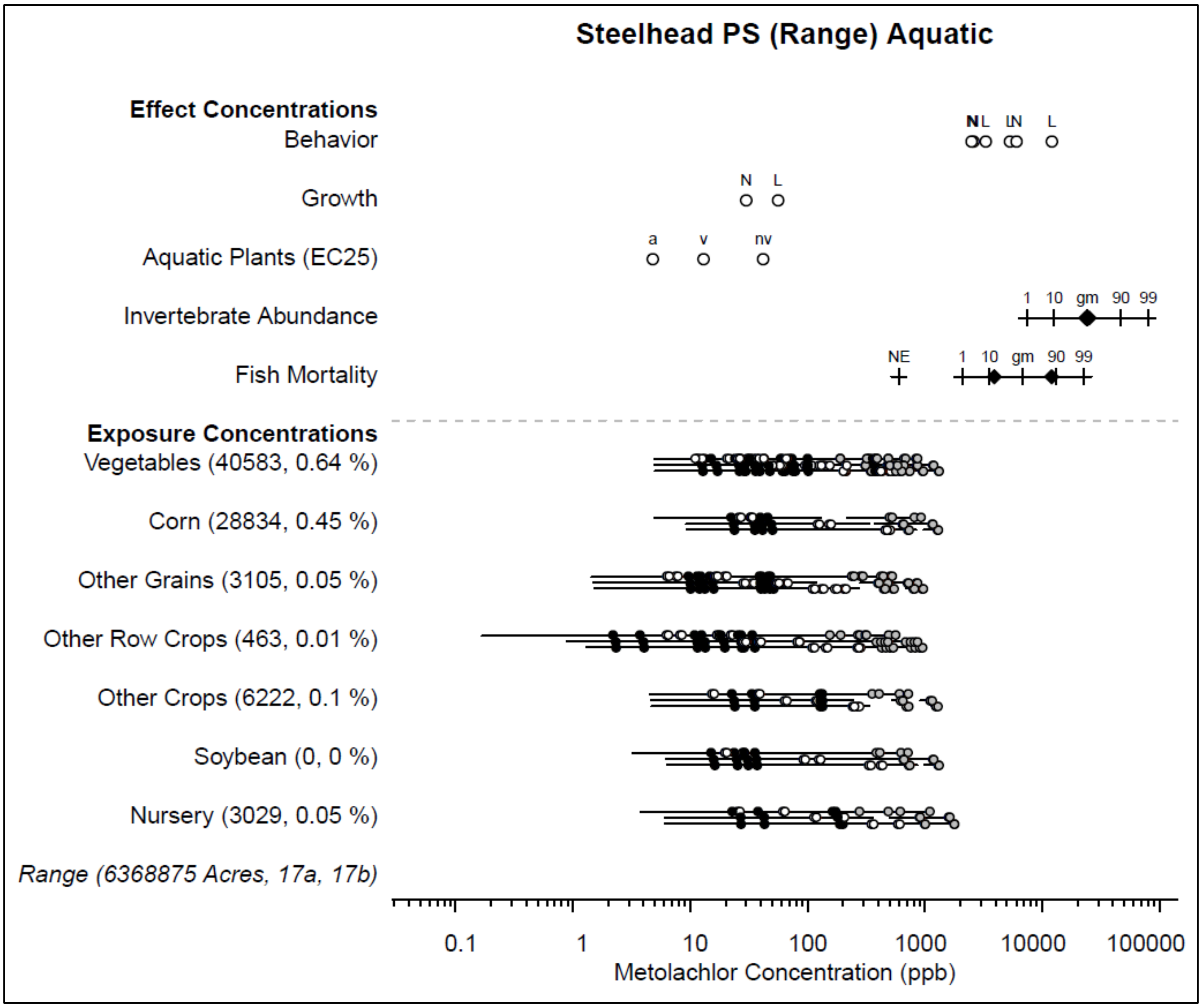


Figure 111. Effects analysis Risk-plot for Steelhead, Puget Sound DPS and Metolachlor

Table 472. Likelihood of exposure determination for Steelhead, Puget Sound DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	High
Corn	1	yes	no	yes	yes	3	High
Other Grains	1	yes	no	yes	no	3	Low
Other Row Crops	1	yes	no	yes	no	3	Low
Other Crops	1	yes	no	yes	no	3	Low
Soybean	1	yes	no	yes	no	3	Low
Nursery	1	yes	no	yes	no	3	Low

Table 473. Direct mortality risk hypothesis; Steelhead, Puget Sound DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.64	Low	High
Corn	0.45	Low	High
Other Grains	0.05	Low	Low
Other Row Crops	0.01	Low	Low
Other Crops	0.1	Low	Low
Soybean	0	Low	Low
Nursery	0.05	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 474. Prey risk hypothesis; Steelhead, Puget Sound DPS and Metolachlor

Endpoint: Prey

Use Category	% Overlap	Effect of Exposure	Likelihood of Exposure
Vegetables	0.64	None Expected	High
Corn	0.45	None Expected	High
Other Grains	0.05	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.1	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 475. Growth risk hypothesis; Steelhead, Puget Sound DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.64	Medium	High
Corn	0.45	Medium	High
Other Grains	0.05	Medium	Low
Other Row Crops	0.01	Medium	Low
Other Crops	0.1	Medium	Low
Soybean	0	Medium	Low
Nursery	0.05	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 476. Behavior risk hypothesis; Steelhead, Puget Sound DPS and Metolachlor

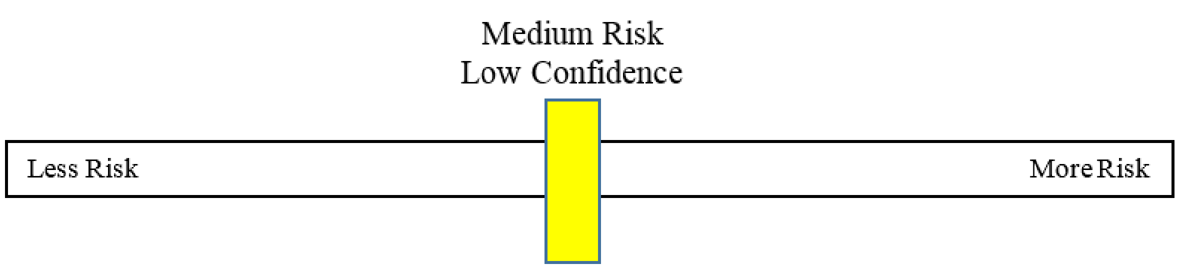
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.64	None Expected	High
Corn	0.45	None Expected	High
Other Grains	0.05	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.1	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.05	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 477. Effects analysis summary table: Steelhead, Puget Sound DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported? Yes/No**
	Risk	**Confidence**		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and	Low	High		No

juvenile abundance and adult productivity via impairments to ecologically significant behaviors.				

Effects analysis summary: Steelhead, Puget Sound DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.24 Steelhead, Snake River Basin DPS (*Oncorhynchus mykiss*)

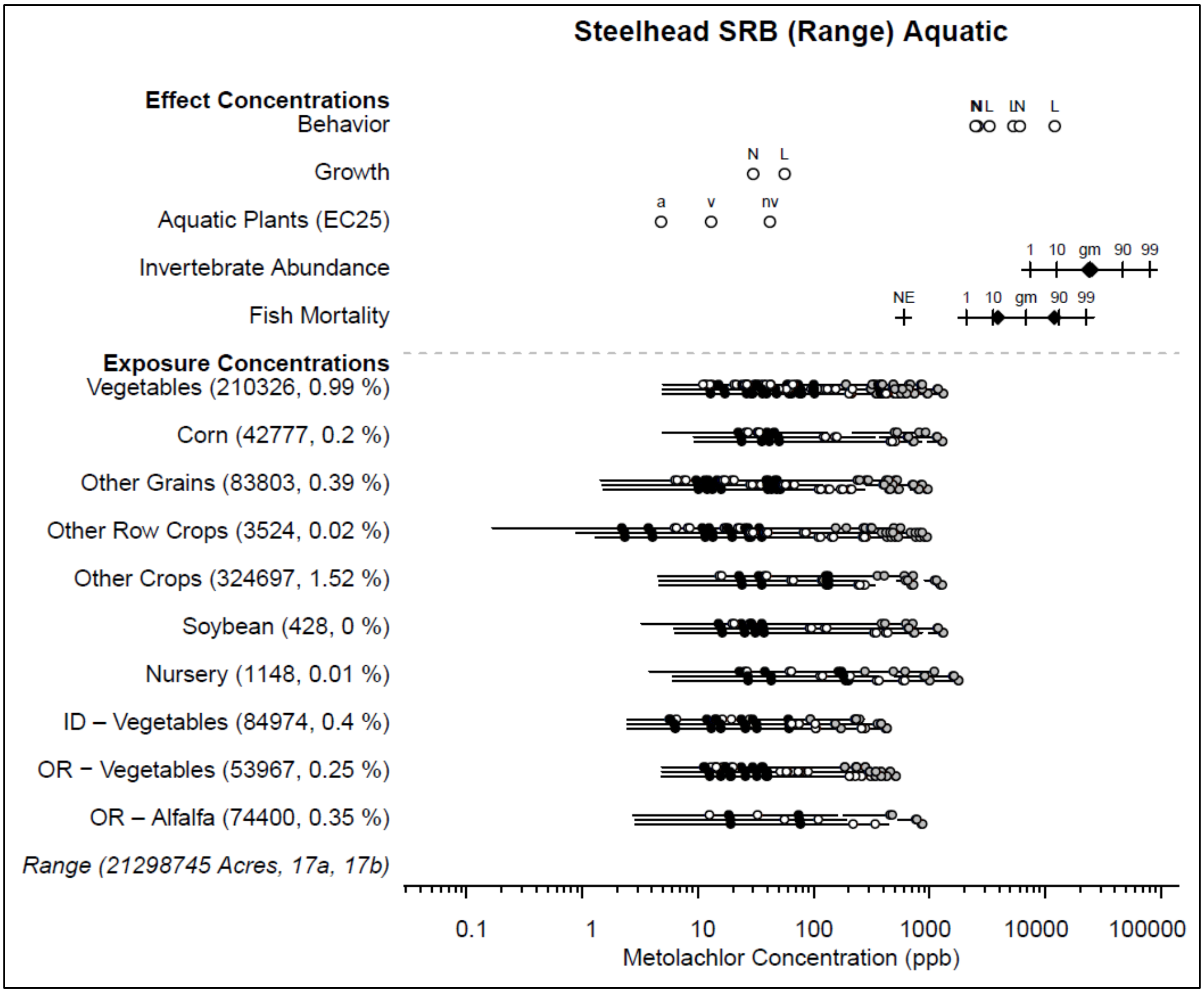


Figure 112. Effects analysis Risk-plot for Steelhead, Snake River Basin DPS and Metolachlor

Table 478. Likelihood of exposure determination for Steelhead, Snake River Basin DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	2	yes	no	yes	NA	3	**Medium**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
ID - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 479. Direct mortality risk hypothesis; Steelhead, Snake River Basin DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	Low	Medium
Corn	0.2	Low	High
Other Grains	0.39	Low	High
Other Row Crops	0.02	Low	Low
Other Crops	1.52	Low	Medium
Soybean	0	Low	Low
Nursery	0.01	Low	Low
ID – Vegetables	0.4	Low	Low
OR - Vegetables	0.25	None Expected	Low
OR - Alfalfa	0.35	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		

Medium	**Low**	

Table 480. Prey risk hypothesis; Steelhead, Snake River Basin DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	None Expected	Medium
Corn	0.2	None Expected	High
Other Grains	0.39	None Expected	High
Other Row Crops	0.02	None Expected	Low
Other Crops	1.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
ID – Vegetables	0.4	None Expected	Low
OR - Vegetables	0.25	None Expected	Low
OR - Alfalfa	0.35	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 481. Growth risk hypothesis; Steelhead, Snake River Basin DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	Medium	Medium
Corn	0.2	Medium	High
Other Grains	0.39	Medium	High
Other Row Crops	0.02	Medium	Low

Other Crops	1.52	Medium	Medium
Soybean	0	Medium	Low
Nursery	0.01	Medium	Low
ID – Vegetables	0.4	Medium	Low
OR - Vegetables	0.25	Medium	Low
OR - Alfalfa	0.35	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

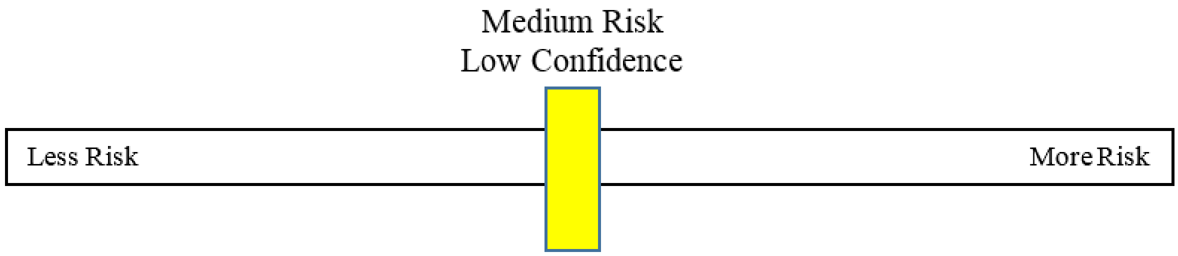
Table 482. Behavior risk hypothesis; Steelhead, Snake River Basin DPS and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.99	None Expected	Medium
Corn	0.2	None Expected	High
Other Grains	0.39	None Expected	High
Other Row Crops	0.02	None Expected	Low
Other Crops	1.52	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	None Expected	Low
ID – Vegetables	0.4	None Expected	Low
OR - Vegetables	0.25	None Expected	Low
OR - Alfalfa	0.35	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 483. Effects analysis summary table: Steelhead, Snake River Basin DPS and Metolachlor

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Snake River Basin DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.25 Steelhead, South-Central California Coast DPS (*Oncorhynchus mykiss*)

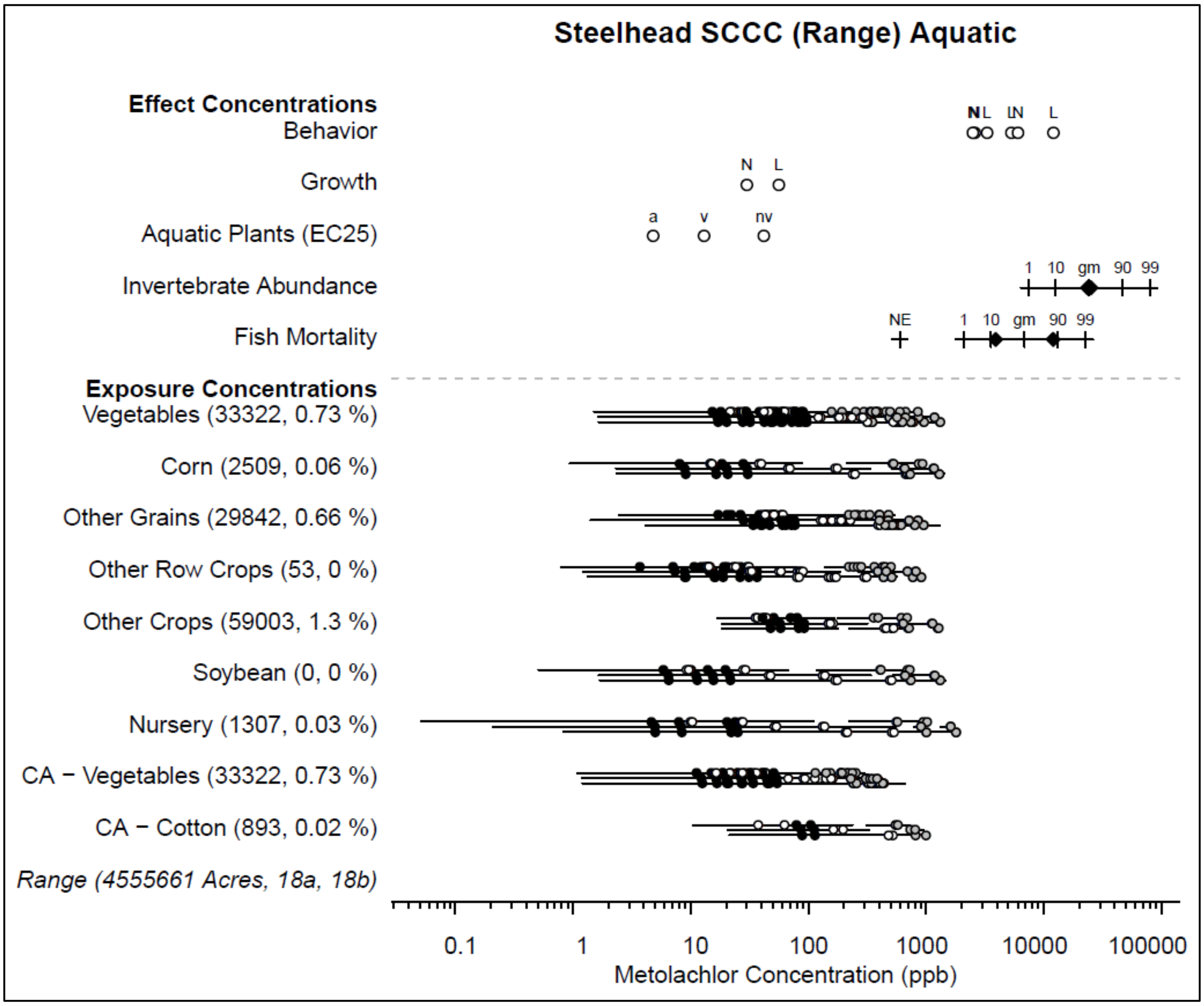


Figure 113. Effects analysis Risk-plot for Steelhead, South-Central California Coast DPS and Metolachlor

Table 484. Likelihood of exposure determination for Steelhead, South-Central California Coast DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	**High**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	2	yes	no	yes	NA	3	**Medium**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	yes	3	**High**
CA - Cotton	1	yes	no	yes	no	3	**Low**

Table 485. Direct mortality risk hypothesis; Steelhead, South-Central California Coast DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.73	Low	High
Corn	0.06	Low	High
Other Grains	0.66	Low	High
Other Row Crops	0	Low	Low
Other Crops	1.3	Low	Medium
Soybean	0	Low	Low
Nursery	0.03	Low	Low
CA - Vegetables	0.73	None Expected	High
CA - Cotton	0.02	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 486. Prey risk hypothesis; Steelhead, South-Central California Coast DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.73	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.66	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	1.3	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.03	Low	Low
CA - Vegetables	0.73	None Expected	High
CA - Cotton	0.02	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 487. Growth risk hypothesis; Steelhead, South-Central California Coast DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.73	Medium	High
Corn	0.06	Medium	High
Other Grains	0.66	Medium	High
Other Row Crops	0	Medium	Low
Other Crops	1.3	Medium	Medium
Soybean	0	Medium	Low

Nursery	0.03	Medium	Low
CA - Vegetables	0.73	Medium	High
CA - Cotton	0.02	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 488. Behavior risk hypothesis; Steelhead, South-Central California Coast DPS and Metolachlor

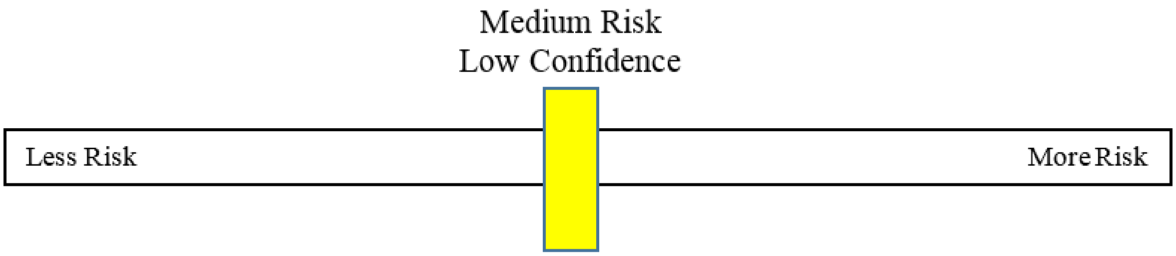
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.73	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.66	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	1.3	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.03	None Expected	Low
CA - Vegetables	0.73	None Expected	High
CA - Cotton	0.02	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 489. Effects analysis summary table: Steelhead, South-Central California Coast DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, South-Central California Coast DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.26 Steelhead, Southern California DPS (*Oncorhynchus mykiss*)

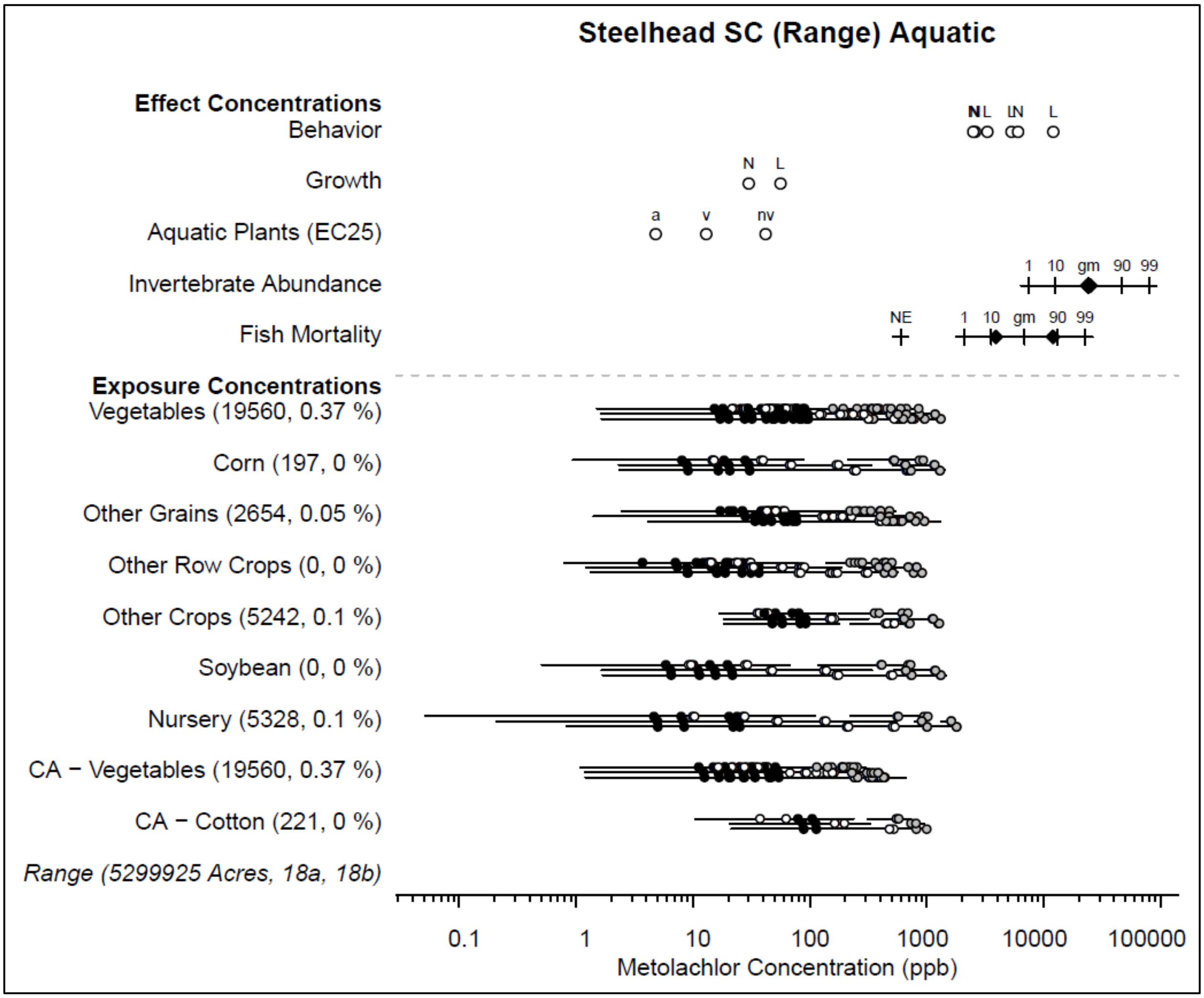


Figure 114. Effects analysis Risk-plot for Steelhead, Southern California DPS and Metolachlor

Table 490. Likelihood of exposure determination for Steelhead, Southern California DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	1	yes	no	yes	yes	3	**High**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	1	yes	no	yes	yes	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
CA - Vegetables	1	yes	no	yes	yes	3	**High**
CA - Cotton	1	yes	no	yes	yes	3	**High**

Table 491. Direct mortality risk hypothesis; Steelhead, Southern California DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.37	Low	High
Corn	0	Low	High
Other Grains	0.05	Low	High
Other Row Crops	0	Low	Low
Other Crops	0.1	Low	High
Soybean	0	Low	Low
Nursery	0.1	Low	Low
CA - Vegetables	0.37	None Expected	High
CA - Cotton	0	Low	High
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 492. Prey risk hypothesis; Steelhead, Southern California DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.37	None Expected	High
Corn	0	None Expected	High
Other Grains	0.05	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.1	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.1	Low	Low
CA - Vegetables	0.37	None Expected	High
CA - Cotton	0	None Expected	High
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 493. Growth risk hypothesis; Steelhead, Southern California DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.37	Medium	High
Corn	0	Medium	High
Other Grains	0.05	Medium	High
Other Row Crops	0	Medium	Low
Other Crops	0.1	Medium	High
Soybean	0	Medium	Low
Nursery	0.1	Medium	Low

CA - Vegetables	0.37	Medium	High
CA - Cotton	0	Medium	High
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 494. Behavior risk hypothesis; Steelhead, Southern California DPS and Metolachlor

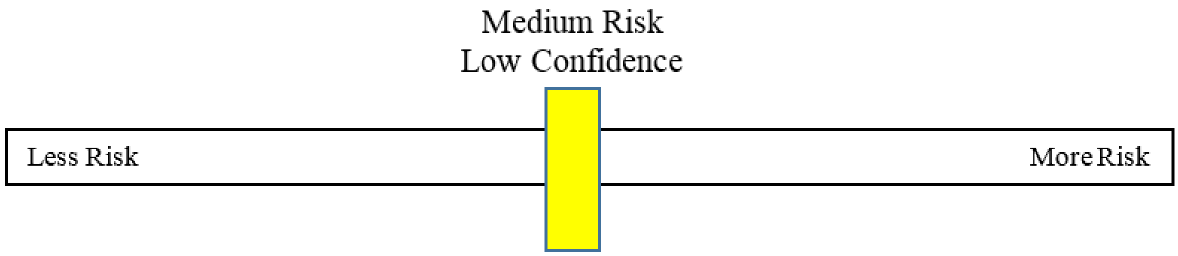
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.37	None Expected	High
Corn	0	None Expected	High
Other Grains	0.05	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.1	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.1	None Expected	Low
CA - Vegetables	0.37	None Expected	High
CA - Cotton	0	None Expected	High
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 495. Effects analysis summary table: Steelhead, Southern California DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		**Population Model Results**	**Risk Hypothesis Supported?**
	Risk	**Confidence**		

				Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Southern California DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.


Medium Risk
Low Confidence
Less Risk
More Risk

12.3.27 Steelhead, Upper Columbia River DPS (*Oncorhynchus mykiss*)

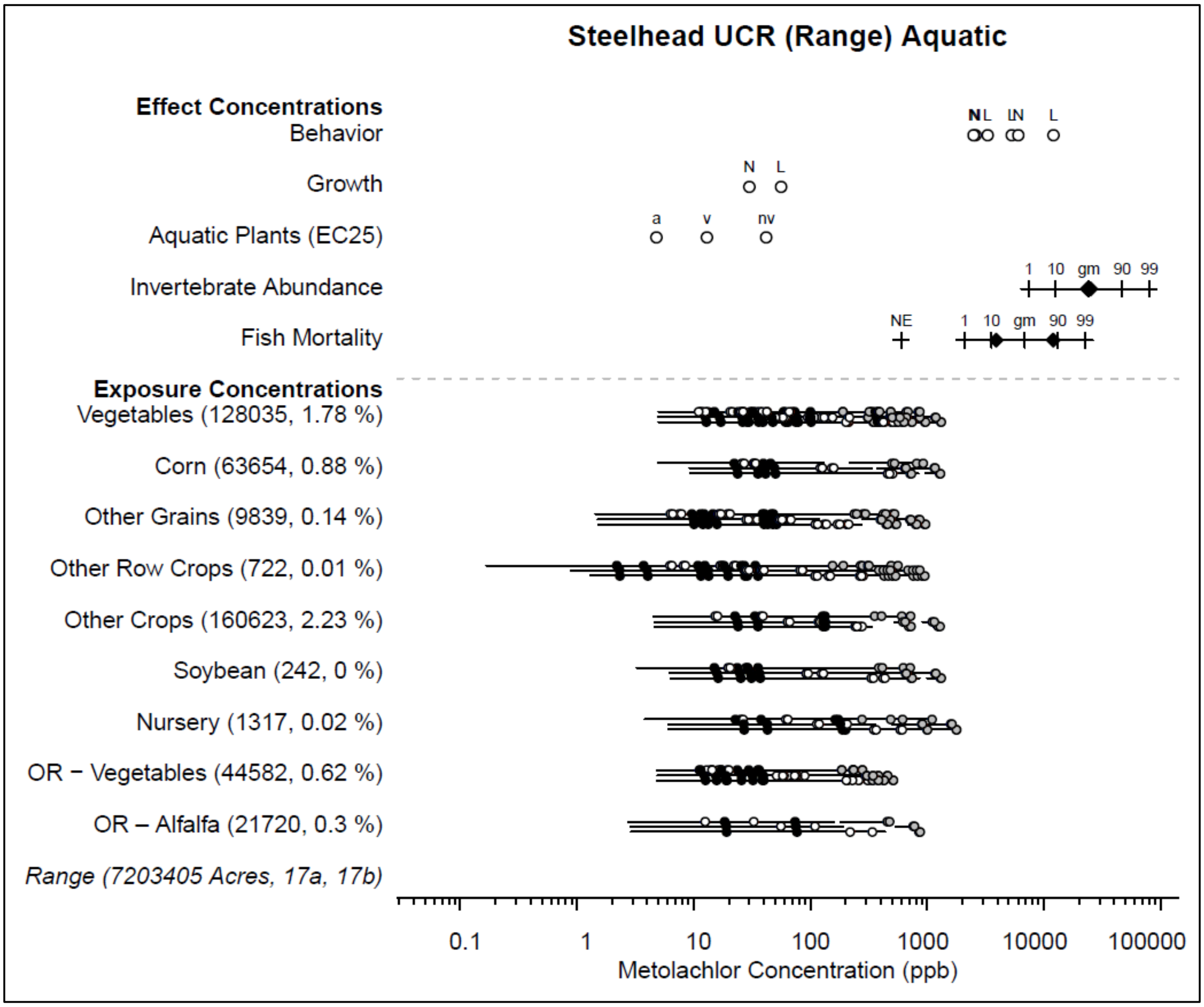


Figure 115. Effects analysis Risk-plot for Steelhead, Upper Columbia River DPS and Metolachlor

Table 496. Likelihood of exposure determination for Steelhead, Upper Columbia River DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	no	3	**Low**
Other Row Crops	1	yes	no	yes	no	3	**Low**
Other Crops	2	yes	no	yes	NA	3	**Medium**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	1	yes	no	yes	no	3	**Low**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 497. Direct mortality risk hypothesis; Steelhead, Upper Columbia River DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.78	Low	Medium
Corn	0.88	Low	High
Other Grains	0.14	Low	Low
Other Row Crops	0.01	Low	Low
Other Crops	2.23	Low	Medium
Soybean	0	Low	Low
Nursery	0.02	Low	Low
OR - Vegetables	0.62	None Expected	Low
OR - Alfalfa	0.3	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 498. Prey risk hypothesis; Steelhead, Upper Columbia River DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.78	None Expected	Medium
Corn	0.88	None Expected	High
Other Grains	0.14	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	2.23	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	Low	Low
OR - Vegetables	0.62	None Expected	Low
OR - Alfalfa	0.3	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 499. Growth risk hypothesis; Steelhead, Upper Columbia River DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.78	Medium	Medium
Corn	0.88	Medium	High
Other Grains	0.14	Medium	Low
Other Row Crops	0.01	Medium	Low
Other Crops	2.23	Medium	Medium
Soybean	0	Medium	Low

Nursery	0.02	Medium	Low
OR - Vegetables	0.62	Medium	Low
OR - Alfalfa	0.3	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 500. Behavior risk hypothesis; Steelhead, Upper Columbia River DPS and Metolachlor

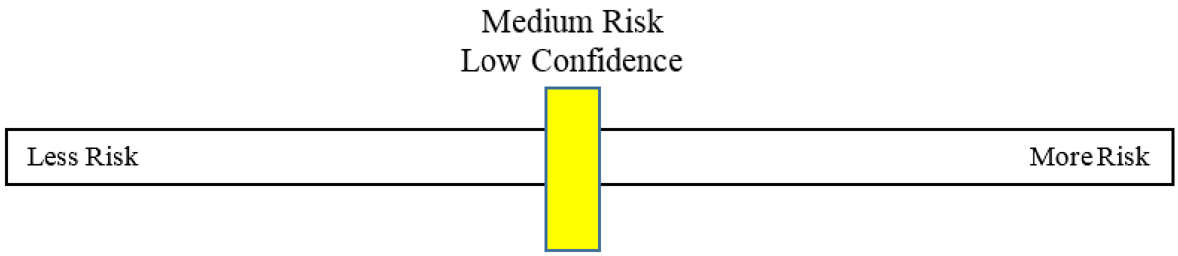
Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.78	None Expected	Medium
Corn	0.88	None Expected	High
Other Grains	0.14	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	2.23	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.02	None Expected	Low
OR - Vegetables	0.62	None Expected	Low
OR - Alfalfa	0.3	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 501. Effects analysis summary table: Steelhead, Upper Columbia River DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Upper Columbia River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.



12.3.28 Steelhead, Upper Willamette River DPS (*Oncorhynchus mykiss*)

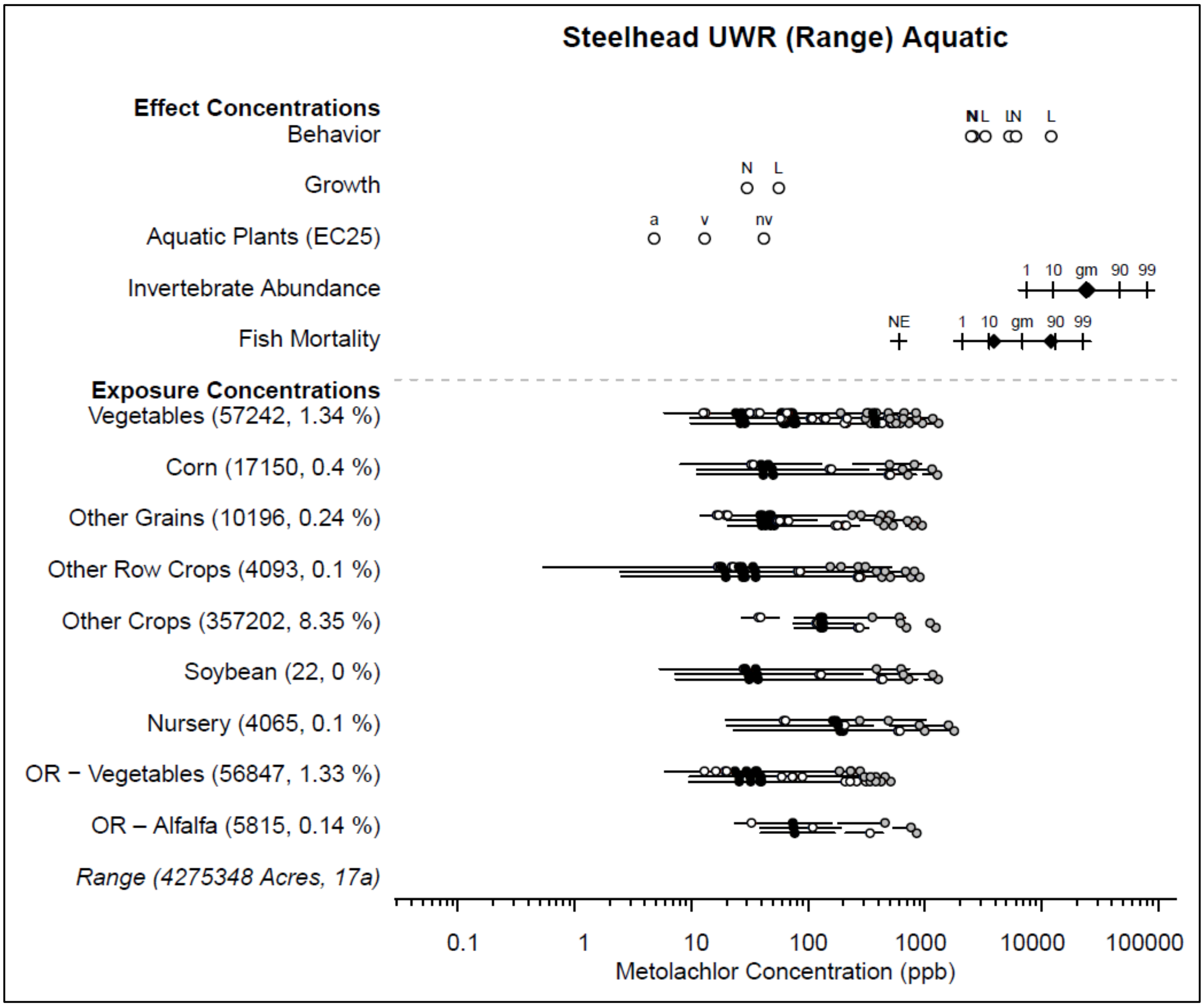


Figure 116. Effects analysis Risk-plot for Steelhead, Upper Willamette River DPS and Metolachlor

Table 502. Likelihood of exposure determination for Steelhead, Upper Willamette River DPS and Metolachlor

	Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
Vegetables	2	yes	no	yes	NA	3	**Medium**
Corn	1	yes	no	yes	yes	3	**High**
Other Grains	1	yes	no	yes	yes	3	**High**
Other Row Crops	1	yes	no	yes	yes	3	**High**
Other Crops	3	yes	no	yes	NA	3	**High**
Soybean	1	yes	no	yes	no	3	**Low**
Nursery	1	yes	no	yes	no	3	**Low**
OR - Vegetables	2	yes	no	yes	NA	3	**Medium**
OR - Alfalfa	1	yes	no	yes	no	3	**Low**

Table 503. Direct mortality risk hypothesis; Steelhead, Upper Willamette River DPS and Metolachlor

Endpoint: Mortality			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.34	Low	Medium
Corn	0.4	Low	High
Other Grains	0.24	Low	High
Other Row Crops	0.1	Low	High
Other Crops	8.35	Low	High
Soybean	0	Low	Low
Nursery	0.1	Low	Low
OR - Vegetables	1.33	None Expected	Medium
OR - Alfalfa	0.14	Low	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via acute lethality.			
Risk	**Confidence**		
Medium	**Low**		

Table 504. Prey risk hypothesis; Steelhead, Upper Willamette River DPS and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.34	None Expected	Medium
Corn	0.4	None Expected	High
Other Grains	0.24	None Expected	High
Other Row Crops	0.1	None Expected	High
Other Crops	8.35	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.1	Low	Low
OR - Vegetables	1.33	None Expected	Medium
OR - Alfalfa	0.14	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.			
Risk	**Confidence**		
Low	**High**		

Table 505. Growth risk hypothesis; Steelhead, Upper Willamette River DPS and Metolachlor

Endpoint: Growth			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.34	Medium	Medium
Corn	0.4	Medium	High
Other Grains	0.24	Medium	High
Other Row Crops	0.1	Medium	High
Other Crops	8.35	Medium	High
Soybean	0	Medium	Low

Nursery	0.1	Medium	Low
OR - Vegetables	1.33	Medium	Medium
OR - Alfalfa	0.14	Medium	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).			
Risk	**Confidence**		
High	**Low**		

Table 506. Behavior risk hypothesis; Steelhead, Upper Willamette River DPS and Metolachlor

Endpoint: Behavior			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.34	None Expected	Medium
Corn	0.4	None Expected	High
Other Grains	0.24	None Expected	High
Other Row Crops	0.1	None Expected	High
Other Crops	8.35	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.1	None Expected	Low
OR - Vegetables	1.33	None Expected	Medium
OR - Alfalfa	0.14	None Expected	Low
Risk Hypothesis: Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.			
Risk	**Confidence**		
Low	**High**		

Table 507. Effects analysis summary table: Steelhead, Upper Willamette River DPS and Metolachlor

Risk Hypothesis	**Risk-plot Derived**		

	Risk	Confidence	Population Model Results	Risk Hypothesis Supported? Yes/No
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Medium	Low	Not Applicable	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Low	High		No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	High	Low		No
Exposure to metolachlor is sufficient to reduce adult and juvenile abundance and adult productivity via impairments to ecologically significant behaviors.	Low	High		No

Effects analysis summary: Steelhead, Upper Willamette River DPS are not anticipated to experience reductions in abundance through any of the risk hypotheses assessed from exposure to metolachlor or associated degradates. For metolachlor, some of the use categories have the potential to overestimate the spatial footprint of authorized use. We did not find support for the direct mortality risk hypothesis. Although risk associated with acute mortality is medium, we have low confidence in this determination because the likelihood of exposure characterizations are greater than would be anticipated. We did not find support for the prey risk hypothesis. Direct impacts to aquatic invertebrates are anticipated to be minimal. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species, the scale of these effects are not anticipated to have a significant impact on overall prey availability. We did not find support for the growth risk hypothesis. Although we characterized risk associated with effects to growth as high, our confidence in this risk is low given the uncertain chronic exposure to metolachlor at the duration evaluated under this study is not expected. Where formulated products and tank mixtures containing metolachlor occur in aquatic habitats, individuals may experience increased toxicity. NMFS has determined the overall risk to the species from the effects of the action is medium and the confidence associated with that risk is low.

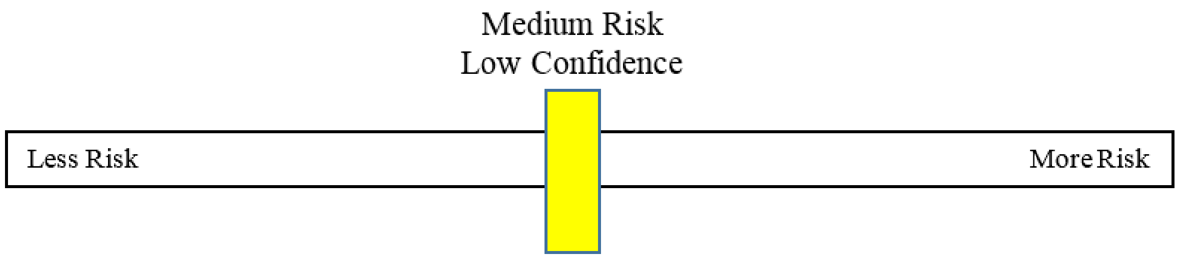

Medium Risk
Low Confidence
Less Risk
More Risk

Table 508. Summary of risk and confidence determinations for products containing 1,3-Dichloropropene and Pacific Salmonids.

Salmon Type	ESU/DPS	Risk	Confidence
Chum	Columbia River	Medium	Low
Chum	Hood Canal summer-run	Medium	Low
Chinook	California Coastal	Low	High
Chinook	CA Central Valley spring-run	Medium	Low
Chinook	Lower Columbia River	Medium	Low
Chinook	Puget Sound	Medium	Low
Chinook	Sacramento River winter-run	Medium	Low
Chinook	Snake River fall-run	Medium	Low
Chinook	Snake River spring/summer-run	Medium	Low
Chinook	Upper Columbia River spring-run	Medium	Low
Chinook	Upper Willamette River	Medium	Low
Coho	Central California Coast	Medium	Low
Coho	Lower Columbia River	Medium	Low
Coho	Oregon Coast	Low	High
Coho	S. Oregon N. California Coast	Medium	Low
Sockeye	Ozette Lake	Low	High
Sockeye	Snake River	Medium	Low
Steelhead	CA Central Valley	Medium	Low
Steelhead	Central California Coast	Medium	Low
Steelhead	Lower Columbia River	Medium	Low
Steelhead	Middle Columbia River	Medium	Low
Steelhead	Northern California	Low	High
Steelhead	Puget Sound	Medium	Low
Steelhead	Snake River Basin	Medium	Low
Steelhead	South-Central California Coast	Medium	Low

Steelhead	Southern California	Medium	Low
Steelhead	Upper Columbia River	Medium	Low
Steelhead	Upper Willamette River	Medium	Low

Table 509. Summary of risk and confidence determinations for metolachlor and Pacific Salmonids.

Salmon Type	ESU/DPS	Risk	Confidence
Chum	Columbia River	Medium	Low
Chum	Hood Canal summer-run	Low	High
Chinook	California Coastal	Low	High
Chinook	CA Central Valley spring-run	Medium	Low
Chinook	Lower Columbia River	Medium	Low
Chinook	Puget Sound	Medium	Low
Chinook	Sacramento River winter-run	Medium	Low
Chinook	Snake River fall-run	Medium	Low
Chinook	Snake River spring/summer-run	Medium	Low
Chinook	Upper Columbia River spring-run	Medium	Low
Chinook	Upper Willamette River	Medium	Low
Coho	Central California Coast	Low	High
Coho	Lower Columbia River	Medium	Low
Coho	Oregon Coast	Low	High
Coho	S. Oregon N. California Coast	Low	High
Sockeye	Ozette Lake	Low	High
Sockeye	Snake River	Medium	Low
Steelhead	CA Central Valley	Medium	Low
Steelhead	Central California Coast	Medium	Low
Steelhead	Lower Columbia River	Medium	Low

Steelhead	Middle Columbia River	Medium	Low
Steelhead	Northern California	Low	High
Steelhead	Puget Sound	Medium	Low
Steelhead	Snake River Basin	Medium	Low
Steelhead	South-Central California Coast	Medium	Low
Steelhead	Southern California	Medium	Low
Steelhead	Upper Columbia River	Medium	Low
Steelhead	Upper Willamette River	Medium	Low

13 Integration and Synthesis: Species

13.1 Introduction

The integration and synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Chapter 12) to the environmental baseline (Chapter 9) and the cumulative effects (Chapter 10) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species. These assessments are made in full consideration of the Status of the Species (Chapter 9).

We treat the information from the status of the species, environmental baseline, and cumulative effects, as "risk modifiers," in that the effects described in the Effects Analysis section may be modified by the condition of the species; the condition of environmental baseline, and the anticipated cumulative effects. To help guide our risk assessors in making transparent and consistent determinations, we developed several key-questions which were examined for each species and critical habitat (see Chapters 8, 9, 10). However, the ultimate consideration of increased or decreased risk attributable to the status of the species, environmental baseline, or cumulative effects is not restricted to the consideration of the key questions alone. Additional relevant factors were considered depending on the species or critical habitat being assessed.

Once each of the above sections is evaluated, the effects of the action and the risk modifiers are depicted graphically on a "scorecard." The influence of each modifier on the effects of the action is represented by an arrow (Figure 117). The magnitude of influence (low or high) is represented by the length of the arrow (short or long). The direction an arrow is pointed indicates the directionality of the risk modifier, increasing or decreasing risk. For example, an environmental baseline arrow pointing towards more risk may indicate that environmental mixtures and elevated temperatures occur in the Environmental Baseline, which further stresses the species in question. The level of confidence in the magnitude of modification is indicated by bolding (high confidence) or unbolding (low confidence) the arrow.

An additional arrow representing the influence on risk by the proposed action is graphically depicted on each species' scorecard. The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar ("Effects Analysis") of the scorecard, using the analytical process described in Chapter 4. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the species, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard (Figure 118), the bar labeled Conclusion shows the overall risk and jeopardy determination (the colored bar beginning with green (less risk) to red (more risk). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The No Jeopardy/ Jeopardy determination for each species is ultimately an informed best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles (see Chapters 3 and 11).

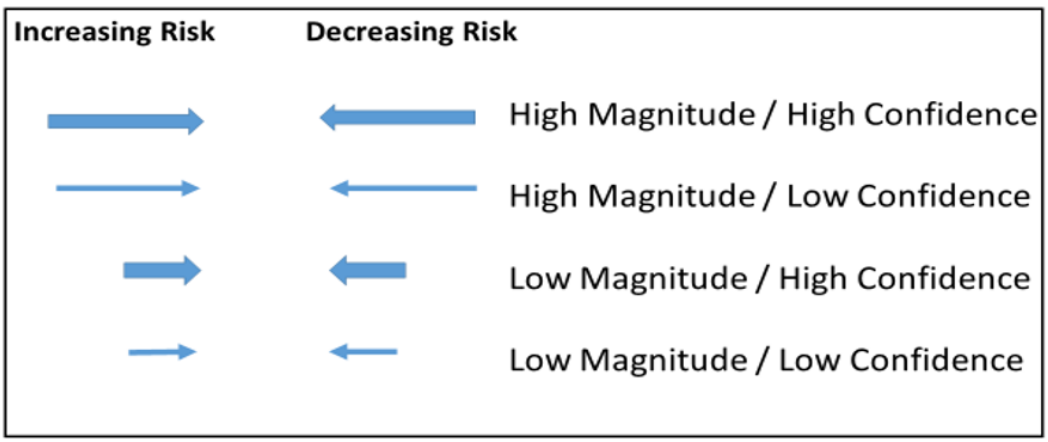


Figure 117. Example of arrows to represent direction, magnitude, and confidence of risk modifiers

Conclusion Section:

With full consideration of the status of the species and the designated critical habitat, we construct a description of the effects of the action within the action area on populations or subpopulations, when added to the environmental baseline and the cumulative effects, to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or

- Appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

A scorecard is generated for each species and designated critical habitat. The effects of the proposed action are considered, as modified by the magnitude and confidence of the three arrows. Next, a no-jeopardy or jeopardy bar is placed on the risk bar i.e., the colored bar beginning with green (less risk) to red (more risk) (***Figure 118)***.

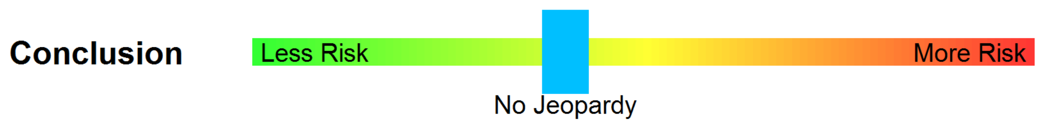


Figure 118: Example conclusion graphic

13.2 Species Scorecards – Products containing 1,3-D

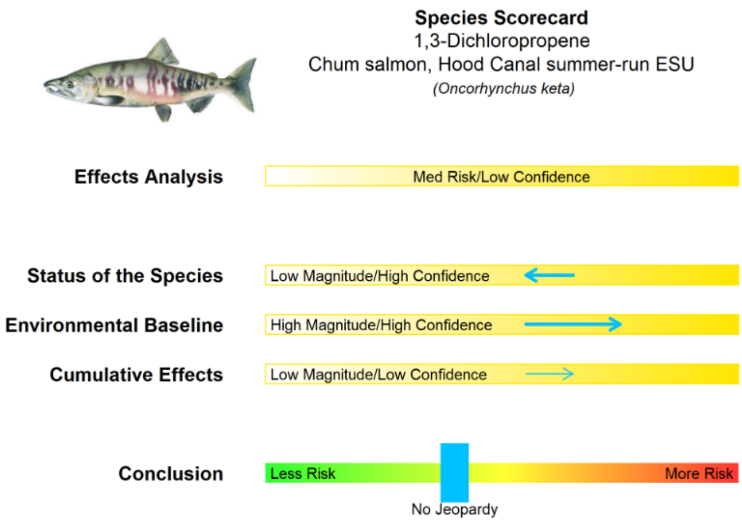


Figure 119. Species Scorecard; Chum salmon, Hood Canal summer-run ESU; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Decreased risk of jeopardy; Low magnitude/ High confidence</u>

- Stable to increasing abundance trend, increasing population productivity
- Proposed action may hinder attainment of some recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures likely
- Anticipated hydrologic effects in freshwater areas may affect species

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

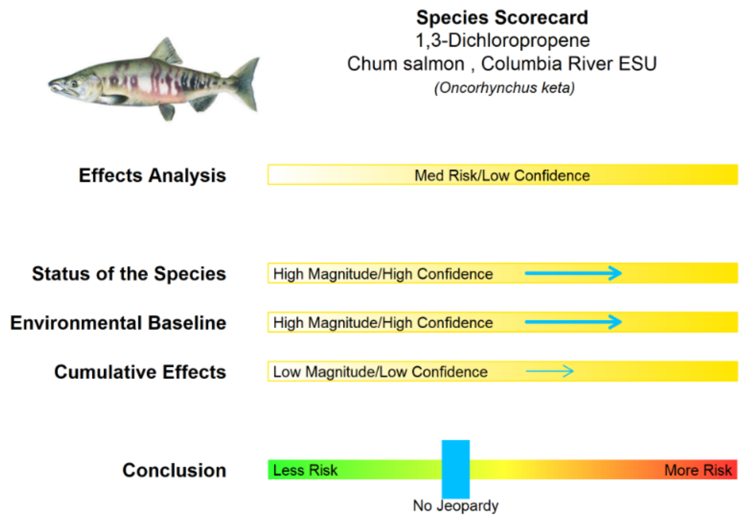


Figure 120. Species Scorecard; Chum salmon, Columbia River ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Declining abundance trends, high risk of extinction
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas that may affect species

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

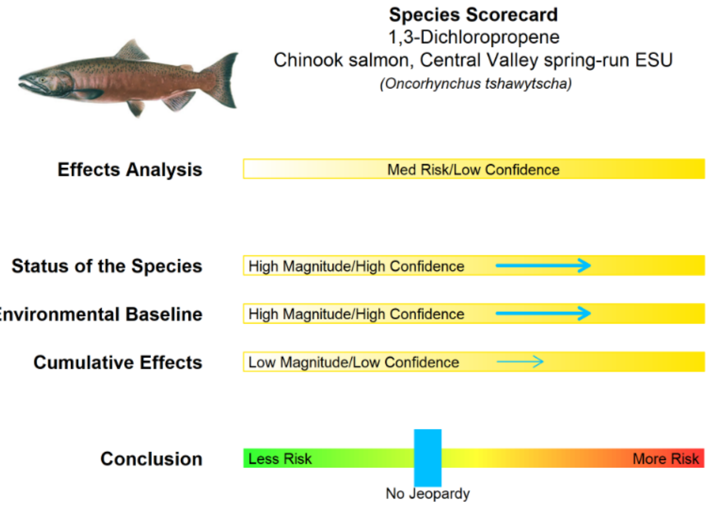


Figure 121. Species Scorecard; Chinook salmon, Central Valley spring-run ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Stable to declining abundance trends, low abundances and fragmented populations
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

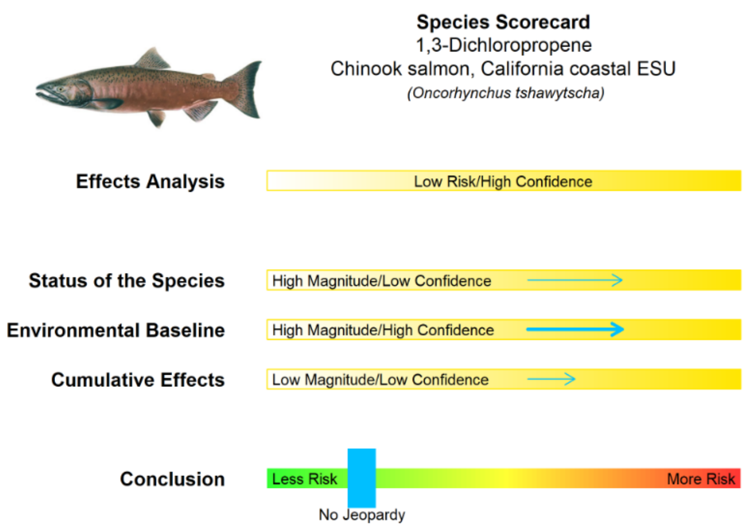


Figure 122. Species Scorecard; Chinook salmon, California coastal ESU; Products containing 1,3-D

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; High magnitude/ Low confidence

- One population with greater than 1000 spawners, declining trends in abundance
- Threatened
- Some recovery criteria not met, yet reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the California Coastal Chinook ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

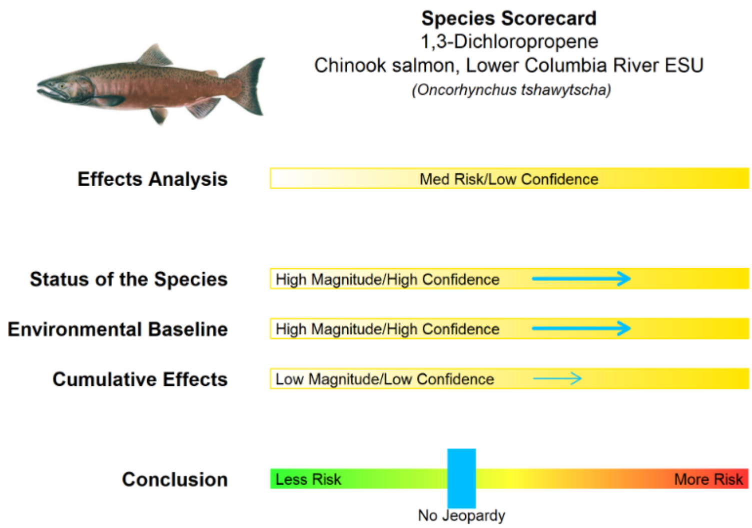


Figure 123. Species Scorecard; Chinook salmon, Lower Columbia River ESU; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Declining trends in abundance, one self-sustaining population, low genetic diversity
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy</u>

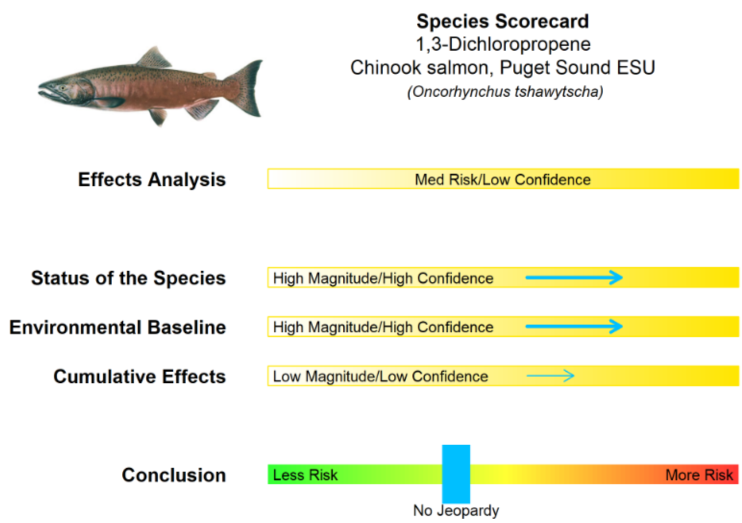


Figure 124. Species Scorecard; Chinook salmon, Puget Sound ESU; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Half of the populations declining and half increasing in abundance
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

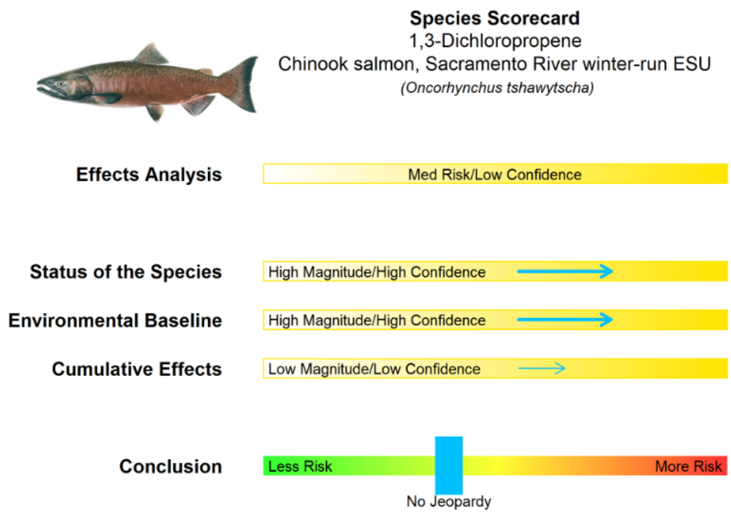


Figure 125. Species Scorecard; Chinook salmon, Sacramento River winter-run ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- One extant population, declining abundance trends, hatchery-supported
- Endangered species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

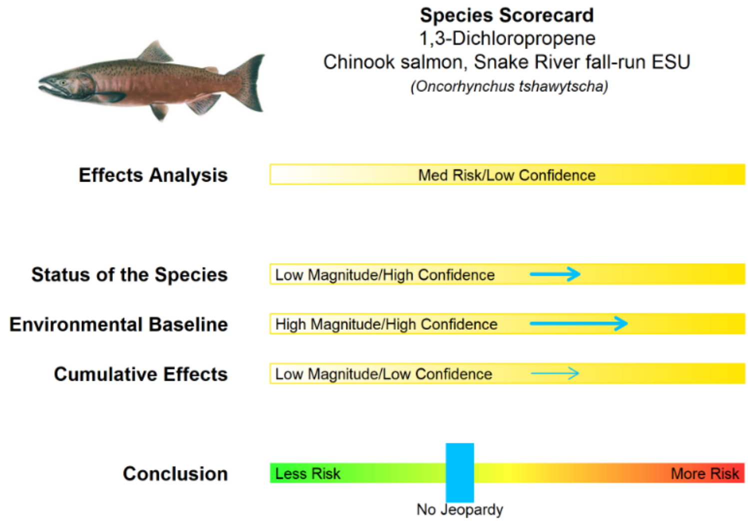


Figure 126. Species Scorecard; Chinook salmon, Snake River fall-run ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; Low magnitude/ High confidence

- Stable to increasing abundance trends, moderate extinction risk, hatchery supported
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

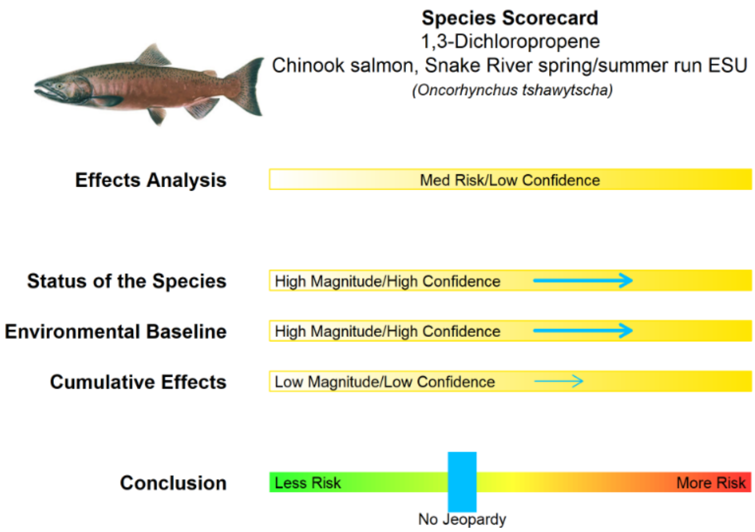


Figure 127. Species Scorecard; Chinook salmon, Snake River spring/summer run ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Decreasing abundance trends, high extinction risk, moderate genetic diversity
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

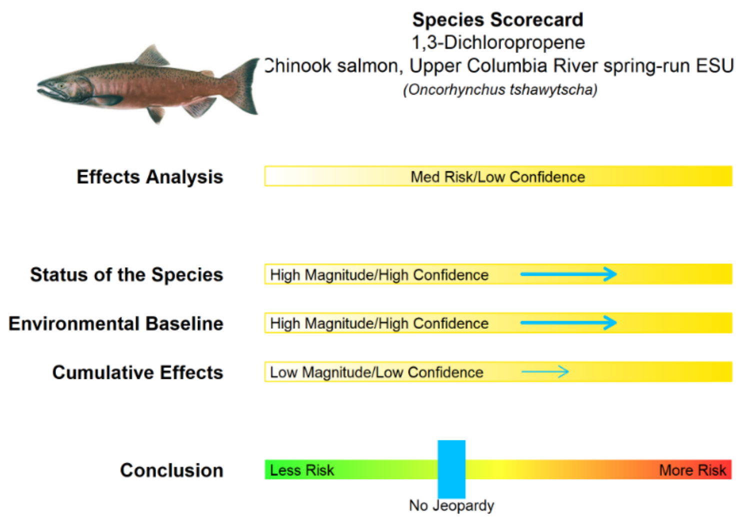


Figure 128. Species Scorecard; Chinook salmon, Upper Columbia River spring-run ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Decreasing abundance trends, independent populations not replacing themselves
- Endangered species (all independent population experiencing low abundance)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

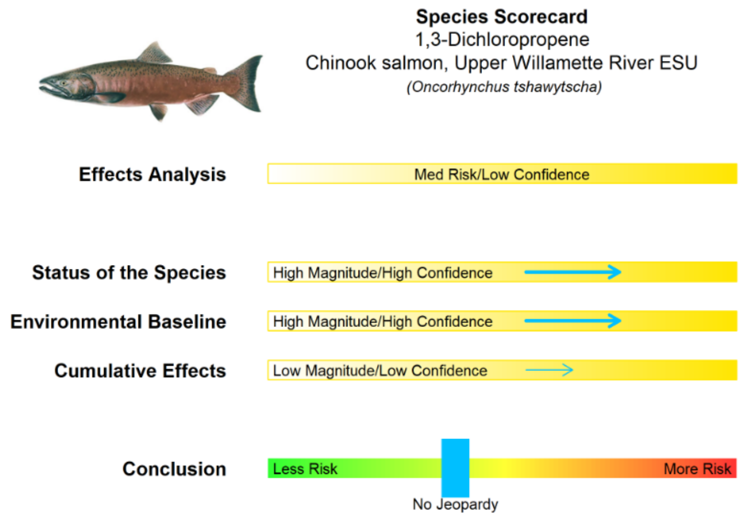


Figure 129. Species Scorecard; Chinook salmon, Upper Willamette River ESU; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Decreasing abundance trends, 1 of 7 remaining naturally reproducing populations
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D is no likely to jeopardize the continued existence of this species: No Jeopardy</u>

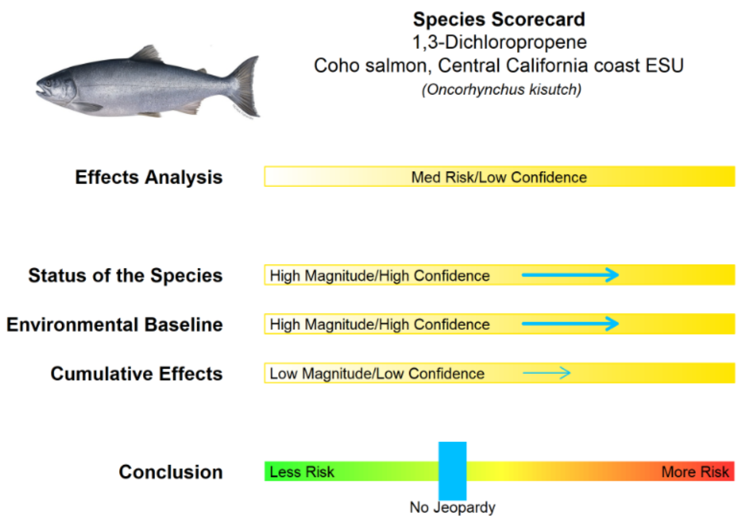


Figure 130. Species Scorecard; Coho salmon, Central California coast ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Stable population trend, fragmented populations, supported by hatchery propagation
- Endangered species (low abundances)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

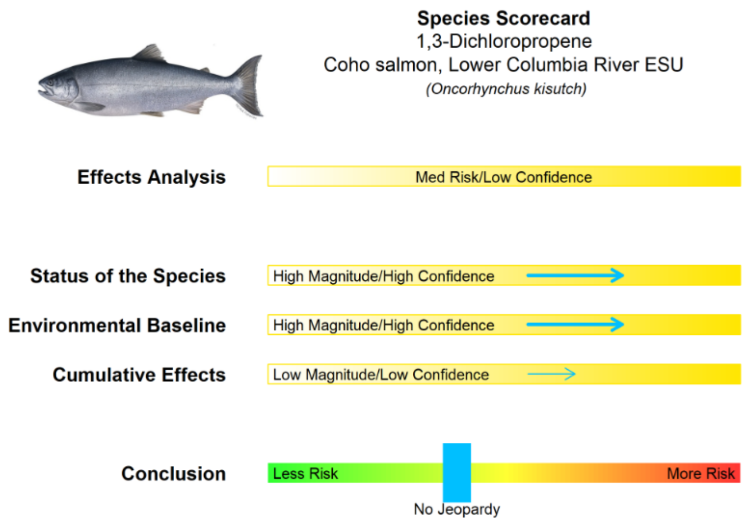


Figure 131. Species Scorecard; Coho salmon, Lower Columbia River ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Negative long/short term lambda projections. Only 2 of 25 populations exhibit natural production. Diversity in "high risk" category.
- Endangered species (90% reduction in abundance of all independent populations)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

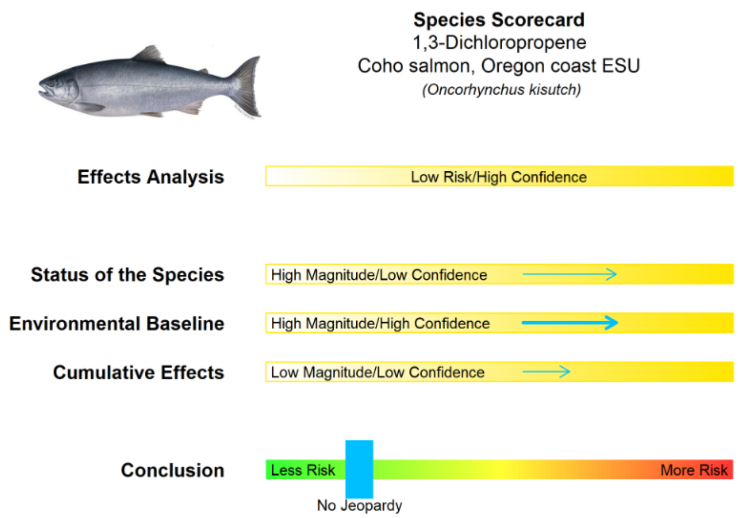


Figure 132. Species Scorecard; Coho salmon, Oregon coast ESU; Products containing 1,3-D

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ Low confidence</u>

- Variable abundances with periods of severe declines. Negative long term trends negative
- Threatened (Severe reductions in ESU abundance compared to historical estimates)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to the Oregon Coast Coho ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy</u>

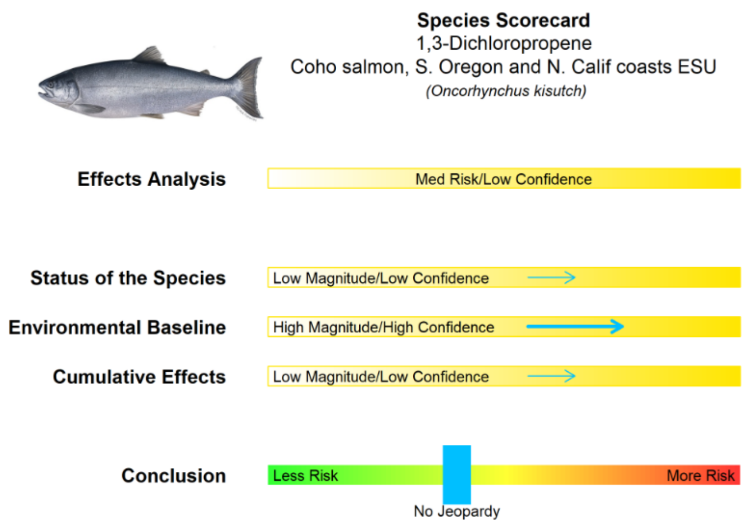


Figure 133. Species Scorecard; Coho salmon, S. Oregon and N. Calif coasts ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Limited data on population abundance, thus trend data unavailable
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

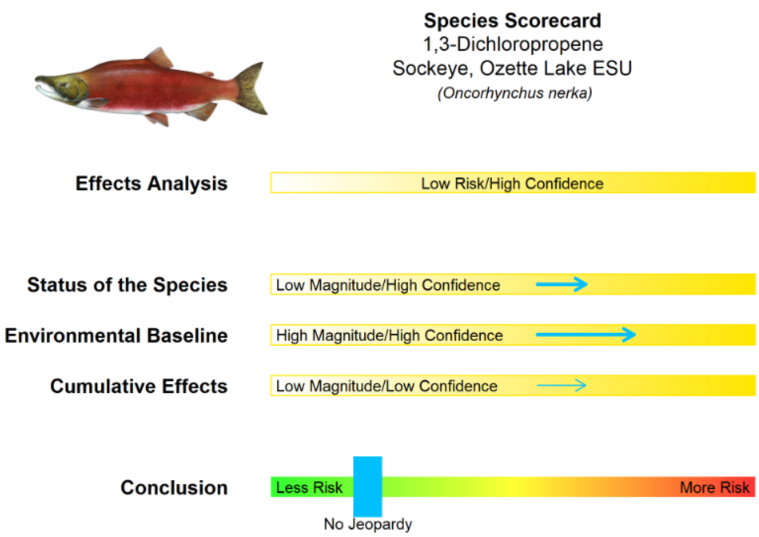


Figure 134. Species Scorecard; Sockeye, Ozette Lake ESU; Products containing 1,3-D

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence

- Stable productivity rates; low genetic diversity and low resilience to future perturbations
- Threatened (abundance only 1% of historical levels)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the Ozette Lake Sockeye ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

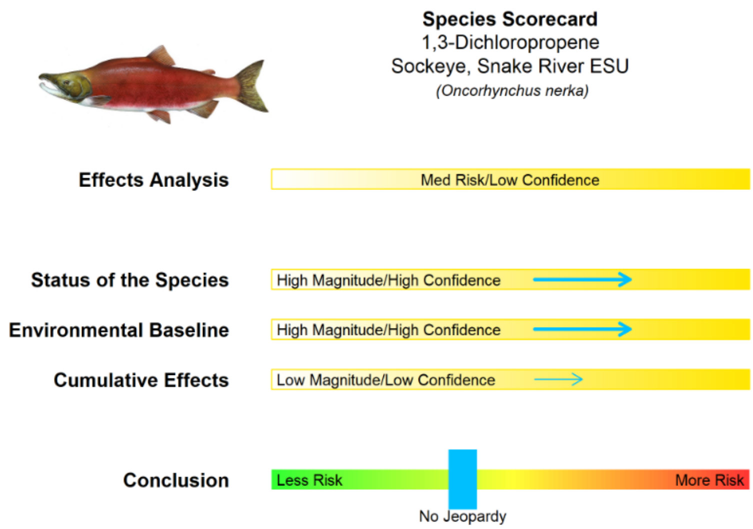


Figure 135. Species Scorecard; Sockeye, Snake River ESU; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- One population remaining supported by hatchery propagation. Increasing abundance, well below sustainable natural production. Low resilience to perturbations.
- Endangered (abundance only 1% of historical levels)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

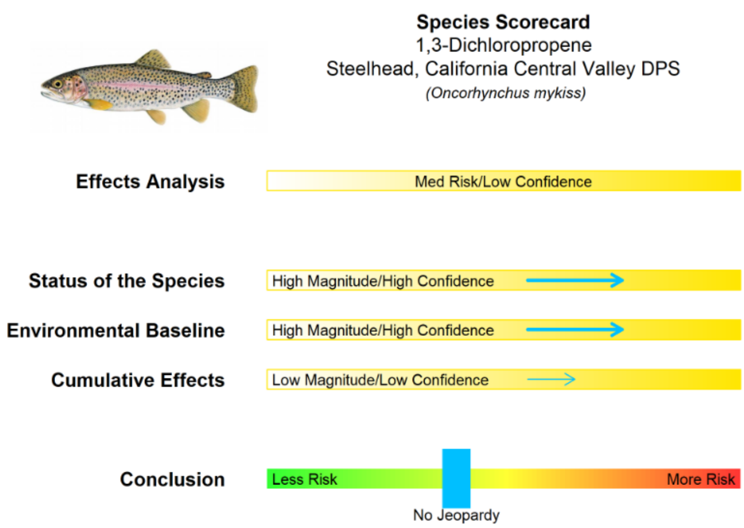


Figure 136. Species Scorecard; Steelhead, California Central Valley Distinct Population Segment (DPS); Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Long-term trend of declining abundances and reduced genetic diversity. Populations supplemented by hatchery propagation.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

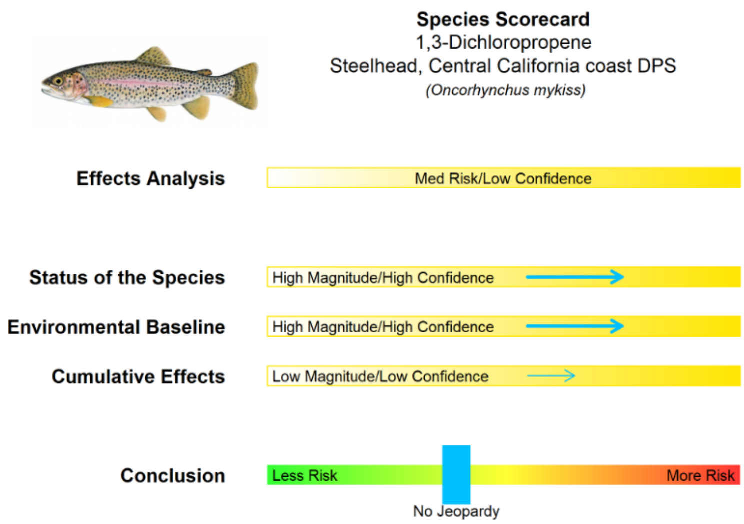


Figure 137. Species Scorecard; Steelhead, Central California coast DPS; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend uncertain. Population abundance supplemented by hatchery propagation. Populations likely not viable, and have lost spatial structure.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

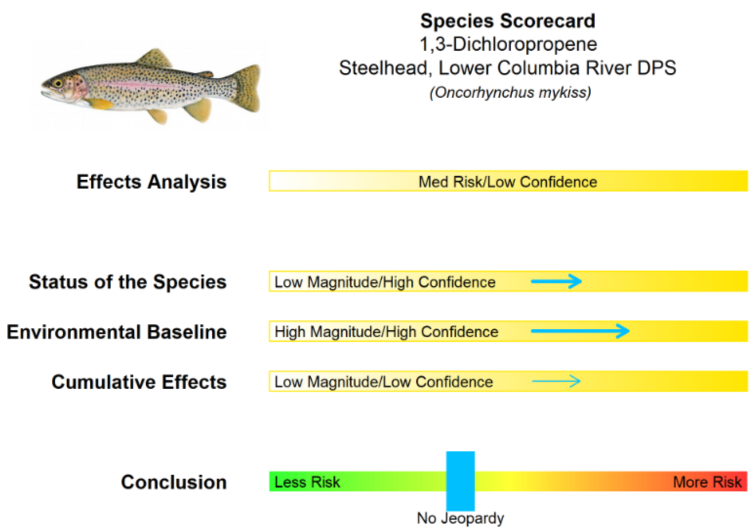


Figure 138. Species Scorecard; Steelhead, Lower Columbia River DPS; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence

- 5-year population trend stable. Populations exhibit low genetic diversity and impacted by a loss of available habitat.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

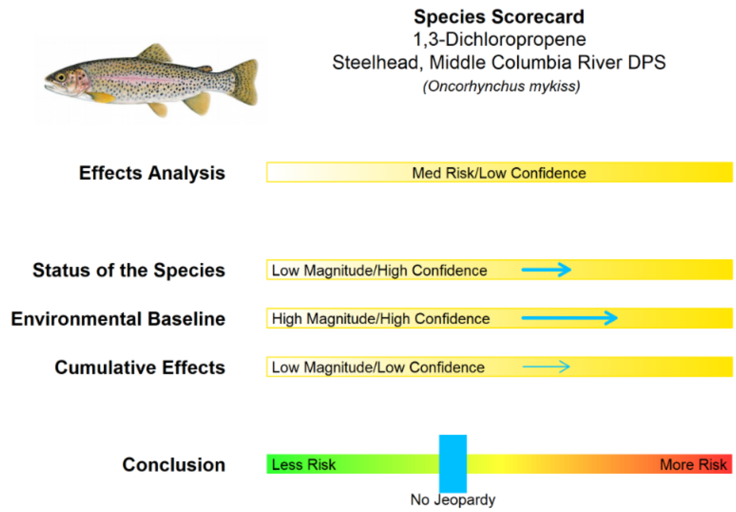


Figure 139. Species Scorecard; Steelhead, Middle Columbia River DPS; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence

- 5-year population trend stable to improving; abundances remain low compared to historical numbers
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

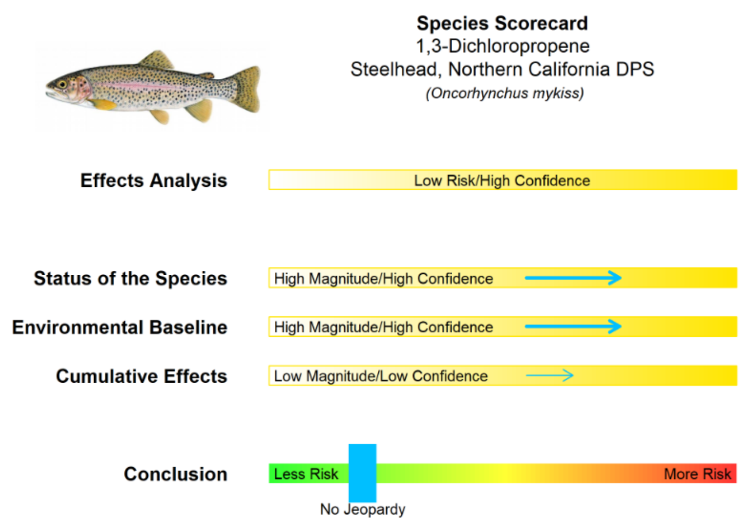


Figure 140. Species Scorecard; Steelhead, Northern California DPS; Products containing 1,3-D

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Icreased risk of jeopardy; High magnitude/ High confidence

- Variable 5-year population abundance trends; Population supplemented by hatchery propagation. Populations exhibit low abundances and productivity.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the Northern California Steelhead DPS is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

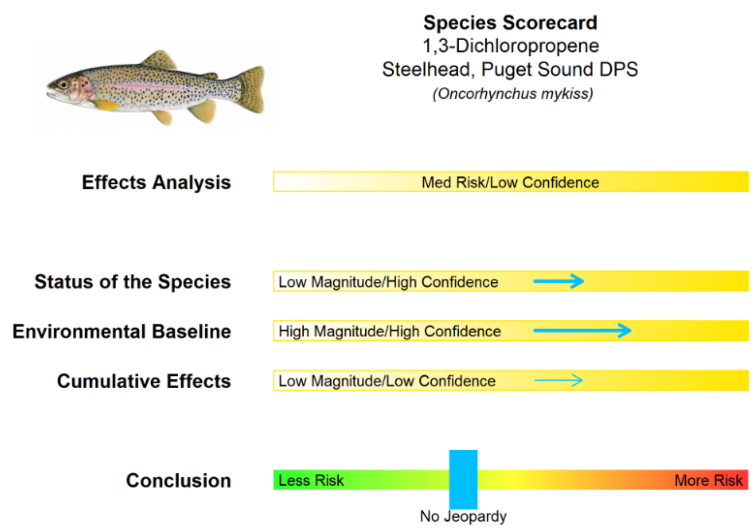


Figure 141. Species Scorecard; Steelhead, Puget Sound DPS; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence</u>

- 5-year population trend stable, but populations have reduced genetic diversity
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

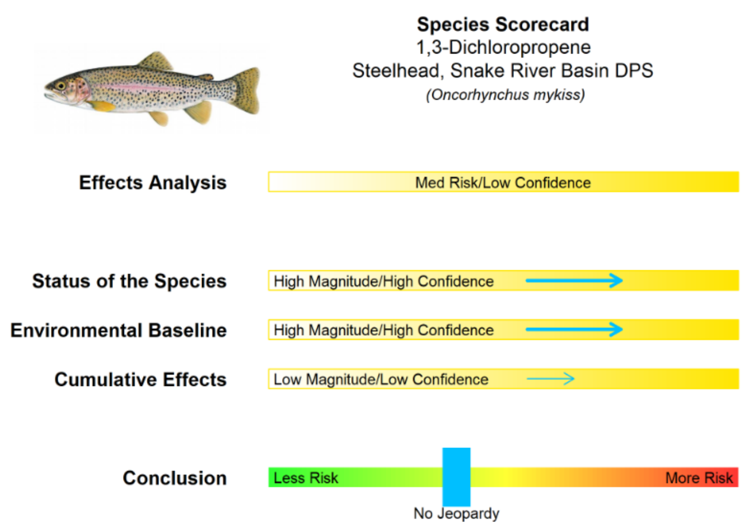


Figure 142. Species Scorecard; Steelhead, Snake River Basin DPS; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- 5-year population trend stable to improving, but still in moderate danger of extinction. Overall abundances remain below thresholds necessary for recovery.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

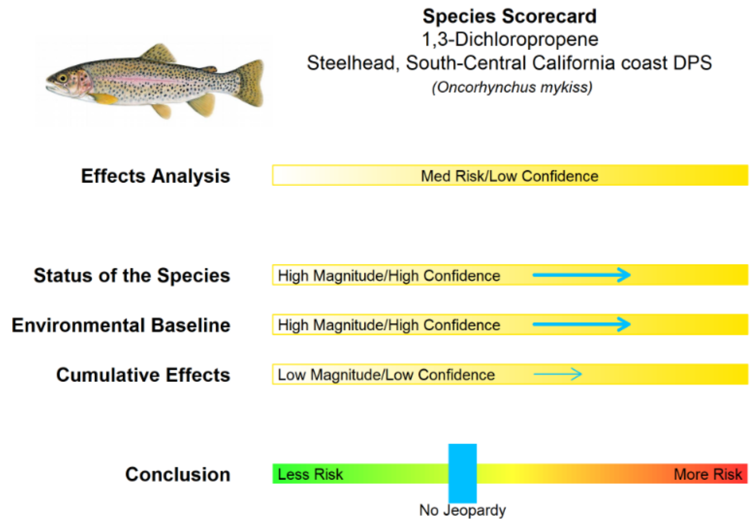


Figure 143. Species Scorecard; Steelhead, South-Central California coast DPS; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend declining, depressed abundances.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

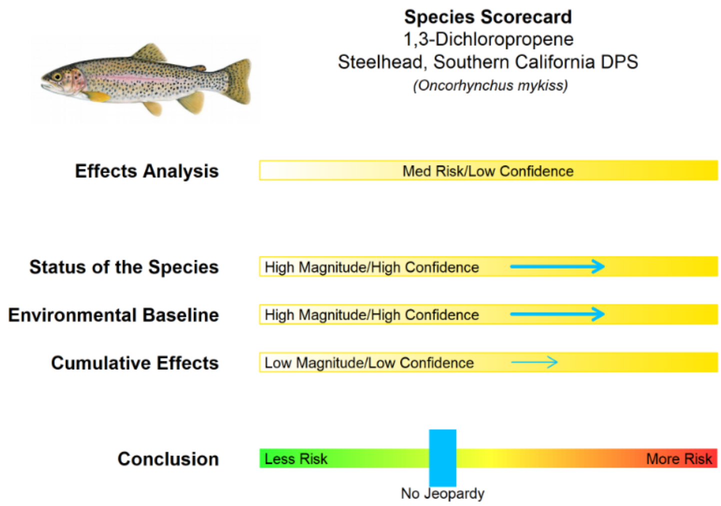


Figure 144. Species Scorecard; Steelhead, Southern California DPS; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend uncertain (large annual variations); supplemented by hatchery propagation; fragmented distributions.
- Endangered; Populations at extreme southern end of species' range
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy</u>

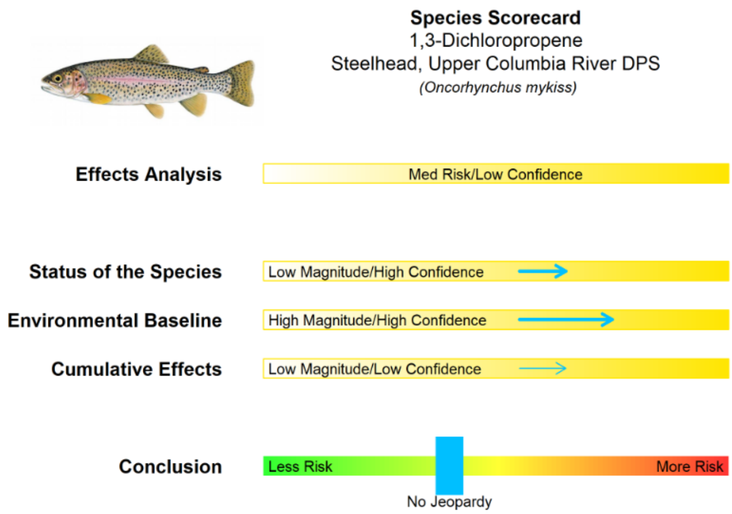


Figure 145. Species Scorecard; Steelhead, Upper Columbia River DPS; Products containing 1,3-D

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

<u>Status of the Species: Increased risk of jeopardy; Low magnitude/ High confidence</u>

- 5-year population trend improving, but low genetic diversity.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy</u>

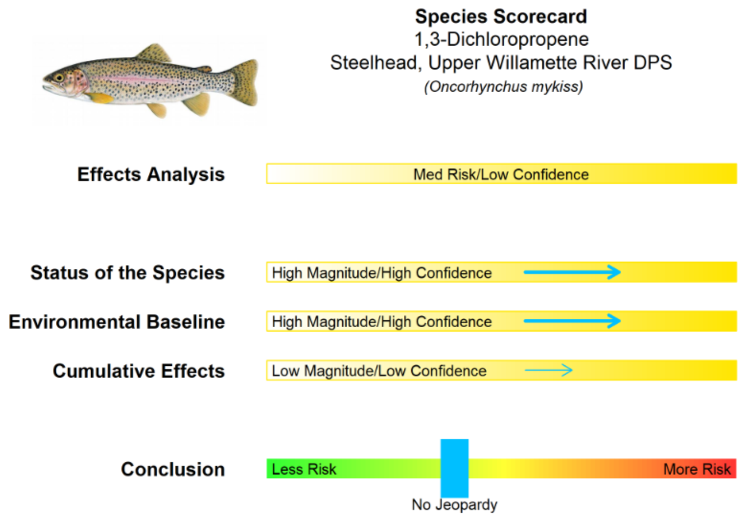


Figure 146. Species Scorecard; Steelhead, Upper Willamette River DPS; Products containing 1,3-D

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability, impairments to fish growth and/or ecologically significant behaviors are not anticipated.
- Some take is anticipated when formulated products containing chloropicrin are used in proximity to low flow, low volume species habitats.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- 5-year population trend declining, large fluctuations in abundances.
- Threatened;
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability are not expected. Impairments to fish growth and/or ecologically significant behaviors are also not anticipated. Use of 1,3-D products containing chloropicrin in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Products containing 1,3-D are not likely to jeopardize the continued existence of this species: No Jeopardy

13.3 Species Scorecards – Metolachlor

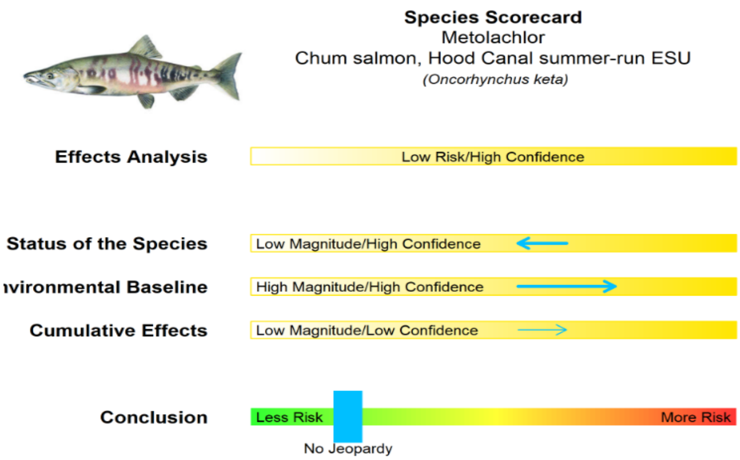


Figure 147. Species Scorecard; Chum salmon, Hood Canal summer-run ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Decreased risk of jeopardy; Low magnitude/ High confidence</u>

- Stable to increasing abundance trend, increasing population productivity
- Proposed action may hinder attainment of some recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures likely
- Anticipated hydrologic effects in freshwater areas may affect species

<u>Conclusion:</u> We find the overall risk to the Hood Canal summer-run Chum ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

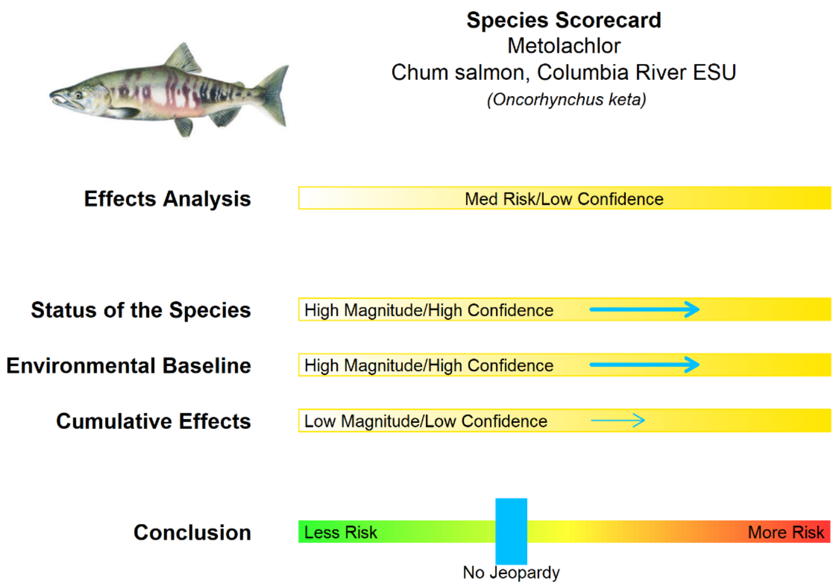


Figure 148. Species Scorecard; Chum salmon, Columbia River ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- Declining abundance trends, high risk of extinction
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas that may affect species

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

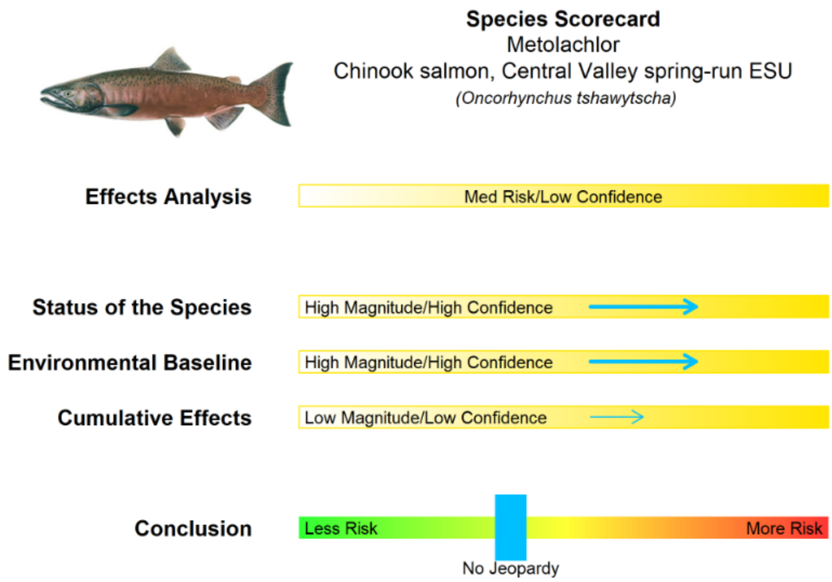


Figure 149. Species Scorecard; Chinook salmon, Central Valley spring-run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Stable to declining abundance trends, low abundances and fragmented populations
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

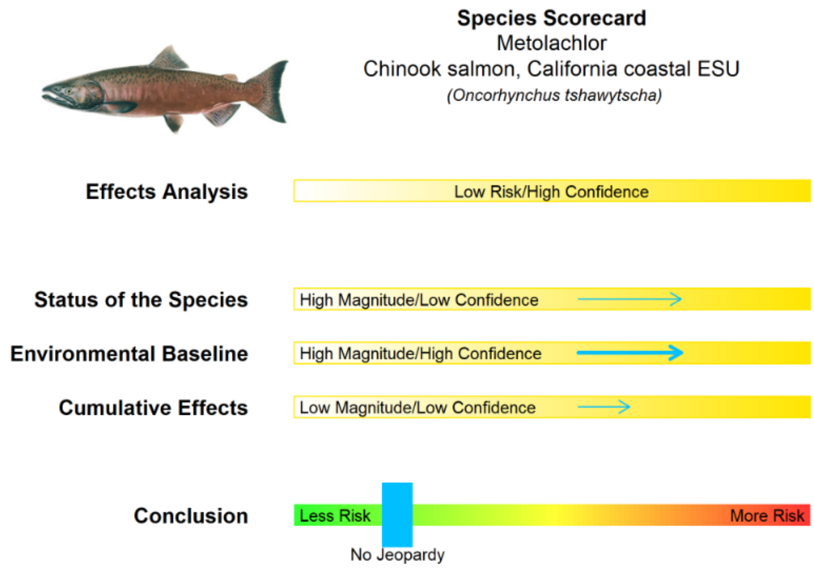


Figure 150. Species Scorecard; Chinook salmon, California coastal ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; High magnitude/ Low confidence

- One population with greater than 1000 spawners, declining trends in abundance
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the California Coastal Chinook ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

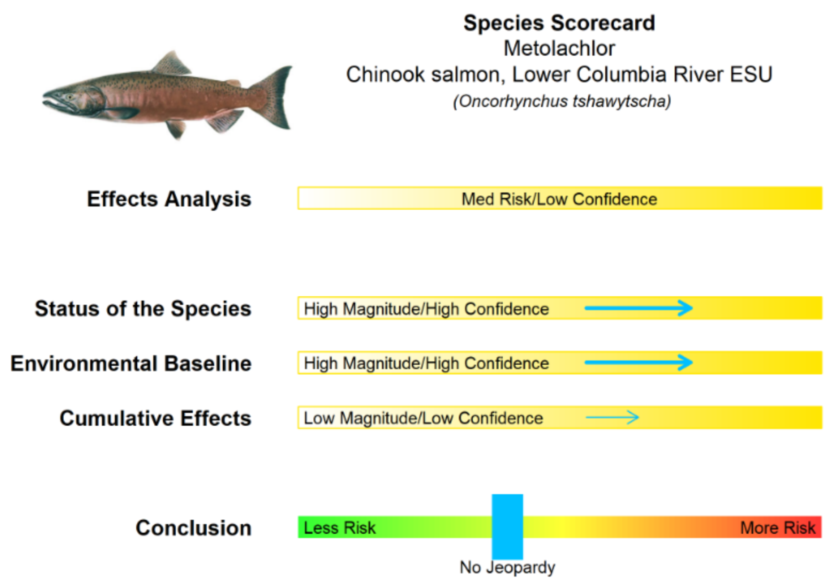


Figure 151. Species Scorecard; Chinook salmon, Lower Columbia River ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Declining trends in abundance, one self-sustaining population, low genetic diversity
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

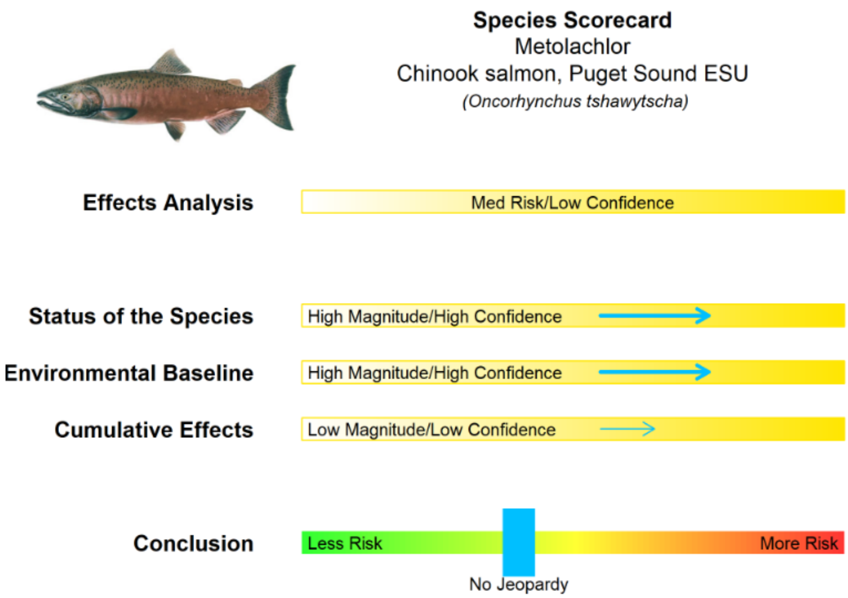


Figure 152. Species Scorecard; Chinook salmon, Puget Sound ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Half of the populations declining and half increasing in abundance
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

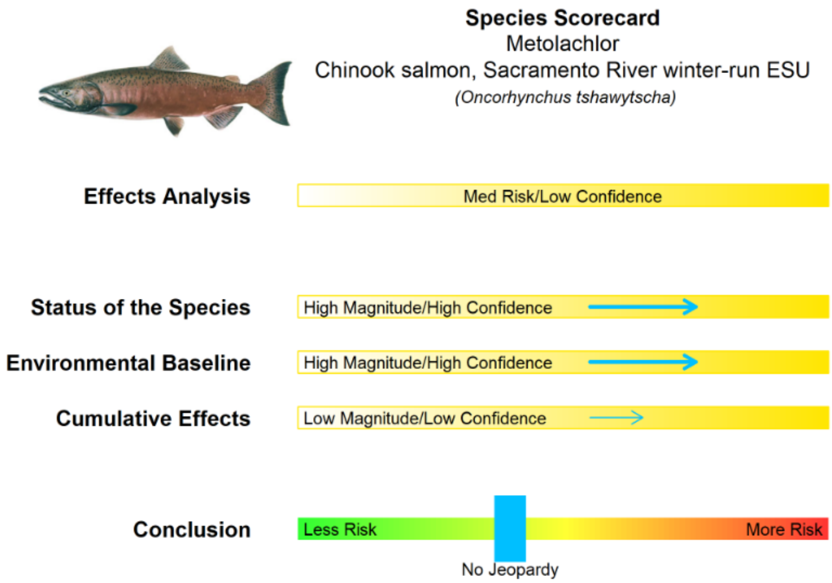


Figure 153. Species Scorecard; Chinook salmon, Sacramento River winter-run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- One extant population, declining abundance trends, hatchery-supported
- Endangered species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

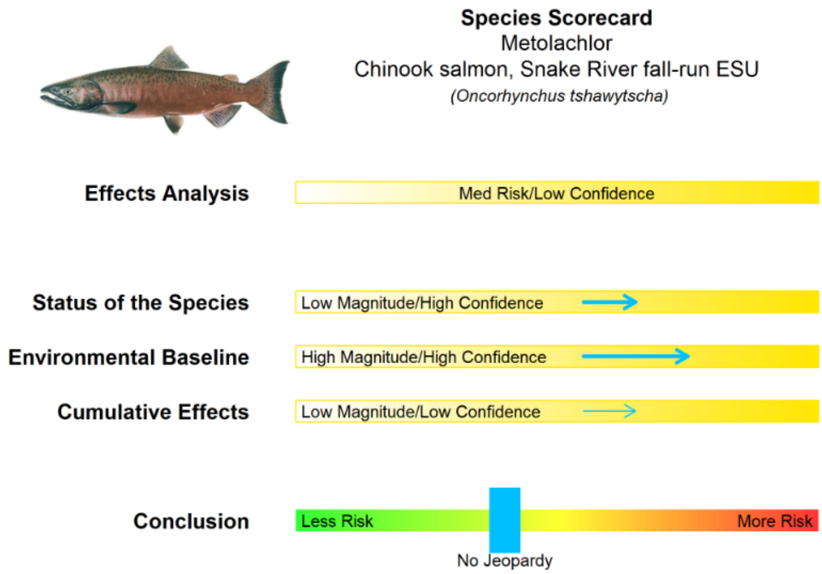


Figure 154. Species Scorecard; Chinook salmon, Snake River fall-run ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; Low magnitude/ High confidence

- Stable to increasing abundance trends, moderate extinction risk, hatchery supported
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

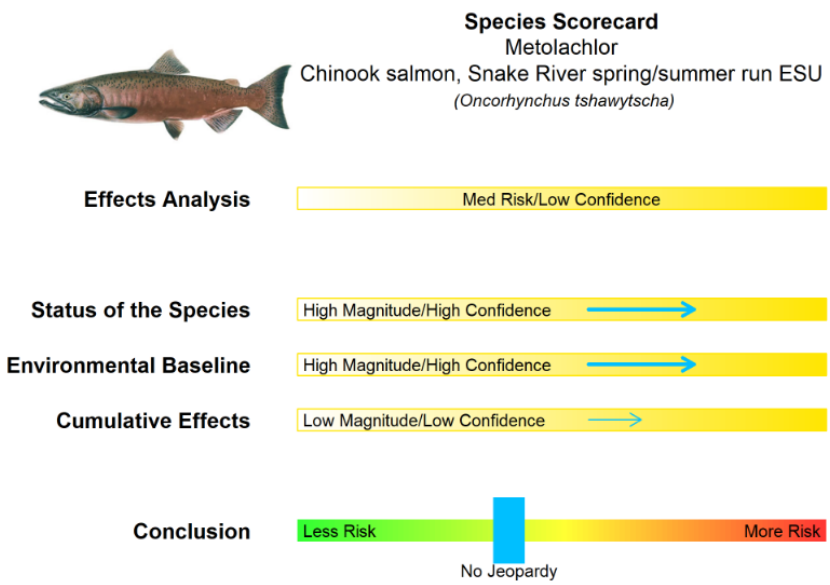


Figure 155. Species Scorecard; Chinook salmon, Snake River spring/summer run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Decreasing abundance trends, high extinction risk, moderate genetic diversity
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

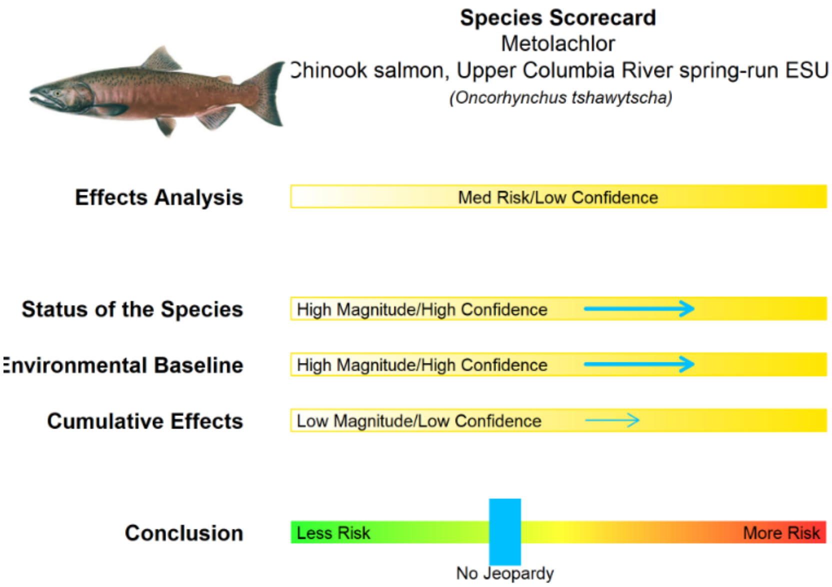


Figure 156. Species Scorecard; Chinook salmon, Upper Columbia River spring-run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Decreasing abundance trends, independent populations not replacing themselves
- Endangered species (all independent population experiencing low abundance)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

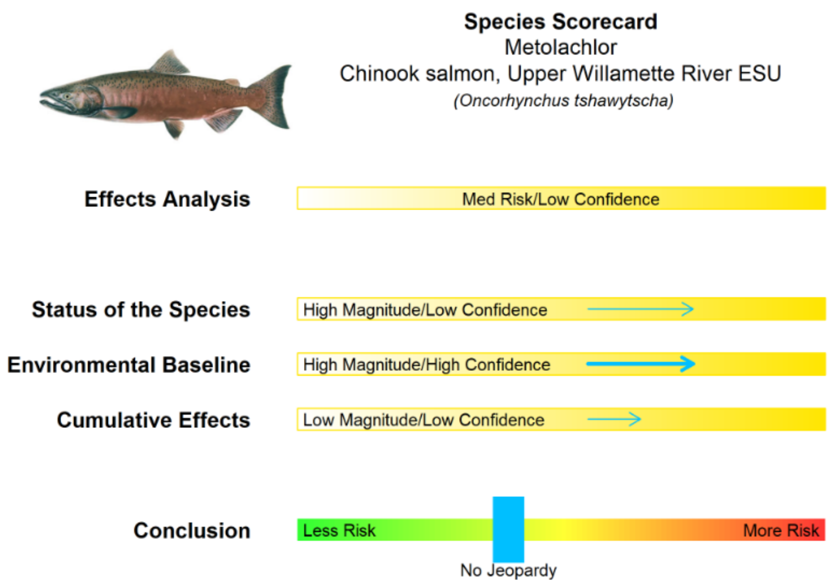


Figure 157. Species Scorecard; Chinook salmon, Upper Willamette River ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/Low confidence</u>

- Decreasing abundance trends, 1 of 7 remaining naturally reproducing populations
- Threatened species
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

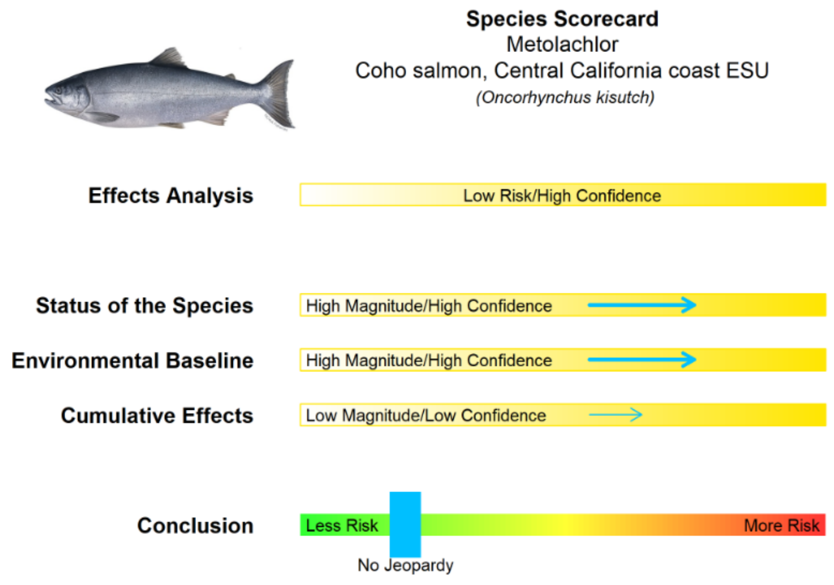


Figure 158. Species Scorecard; Coho salmon, Central California coast ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Stable population trend, fragmented populations, supported by hatchery propagation
- Endangered species (low abundances)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to the Central California Coast Coho ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

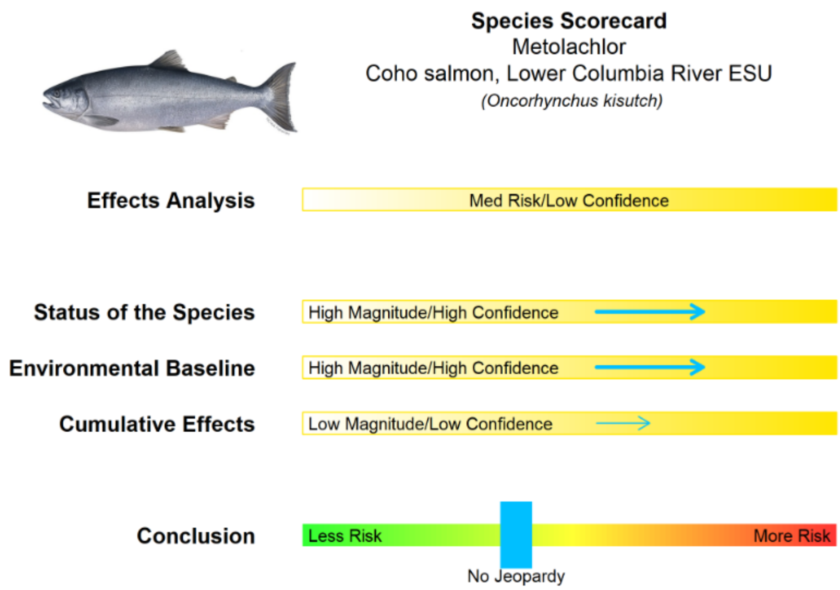


Figure 159. Species Scorecard; Coho salmon, Lower Columbia River ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Negative long/short term lambda projections. Only 2 of 25 populations exhibit natural production. Diversity in "high risk" category.
- Endangered species (90% reduction in abundance of all independent populations)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

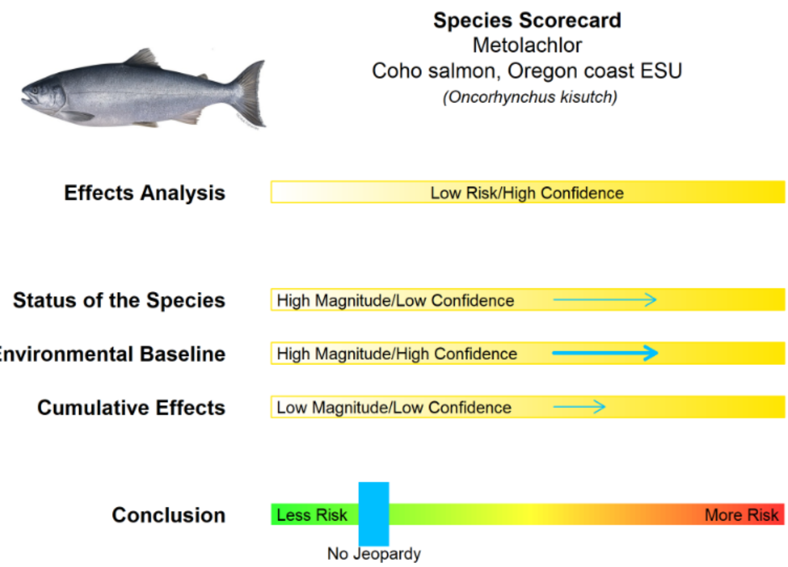


Figure 160. Species Scorecard; Coho salmon, Oregon coast ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ Low confidence</u>

- Variable abundances with periods of severe declines. Negative long term trends negative
- Threatened (Severe reductions in ESU abundance compared to historical estimates)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to the Oregon Coast Coho ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

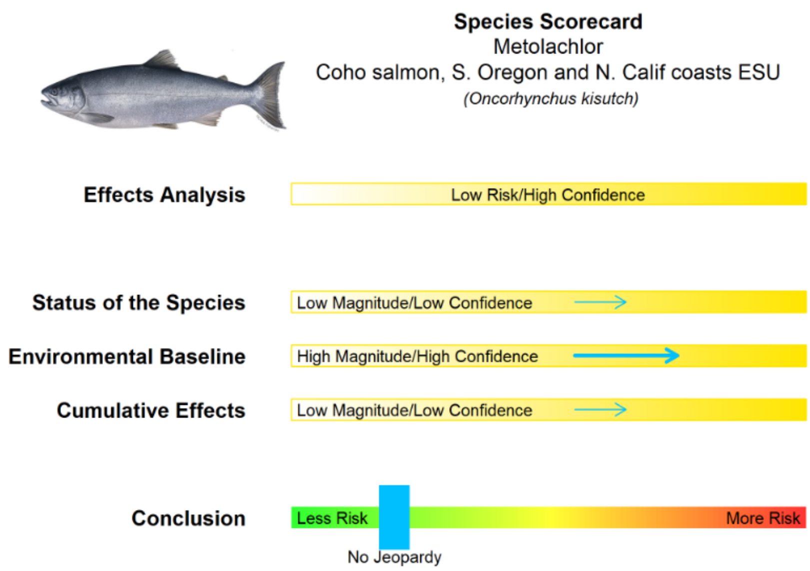


Figure 161. Species Scorecard; Coho salmon, S. Oregon and N. Calif coasts ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Limited data on population abundance, thus trend data unavailable
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the SONCC Coho ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

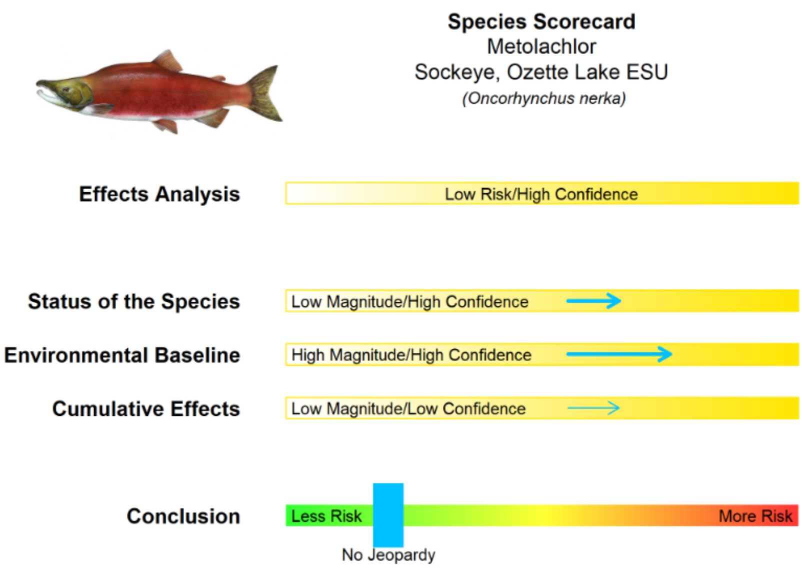


Figure 162. Species Scorecard; Sockeye, Ozette Lake ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence

- Stable productivity rates; low genetic diversity and low resilience to future perturbations
- Threatened (abundance only 1% of historical levels)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to the Ozette Lake Sockeye ESU is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

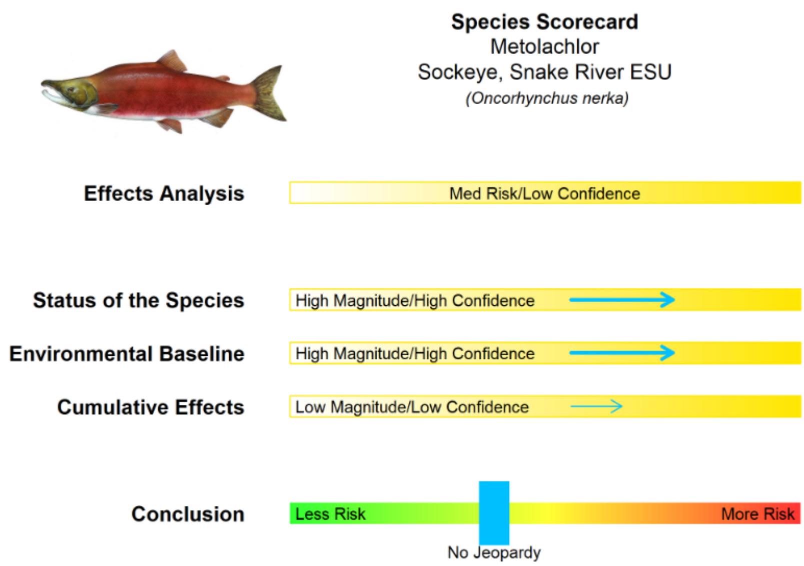


Figure 163. Species Scorecard; Sockeye, Snake River ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- One population remaining supported by hatchery propagation. Increasing abundance, well below sustainable natural production. Low resilience to perturbations.
- Endangered (abundance only 1% of historical levels)
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' ESU is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

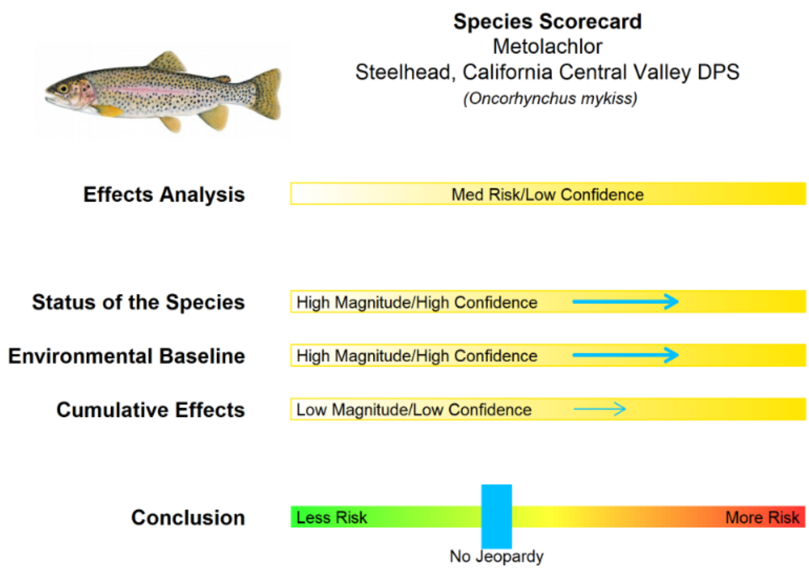


Figure 164. Species Scorecard; Steelhead, California Central Valley Distinct Population Segment (DPS); Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Long-term trend of declining abundances and reduced genetic diversity. Populations supplemented by hatchery propagation.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

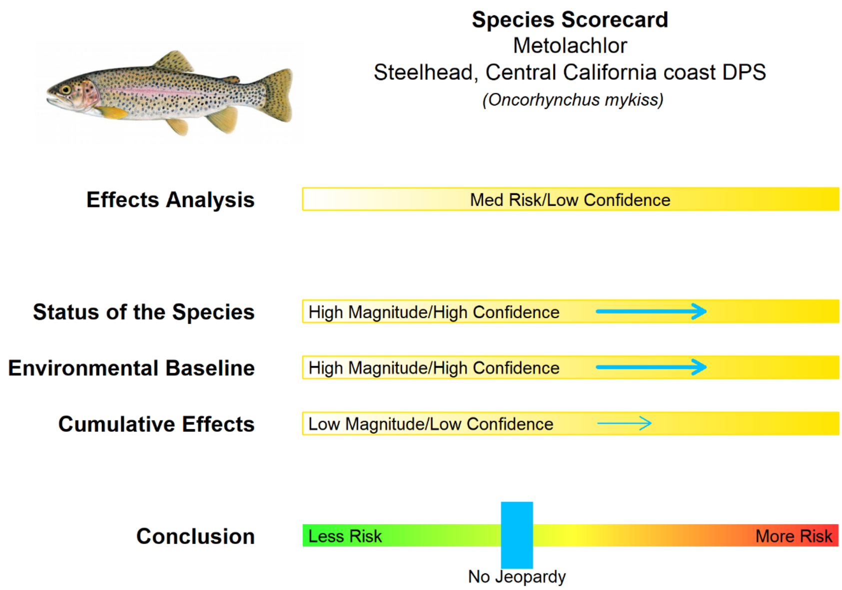


Figure 165. Species Scorecard; Steelhead, Central California coast DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend uncertain. Population abundance supplemented by hatchery propagation. Populations likely not viable, and have lost spatial structure.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

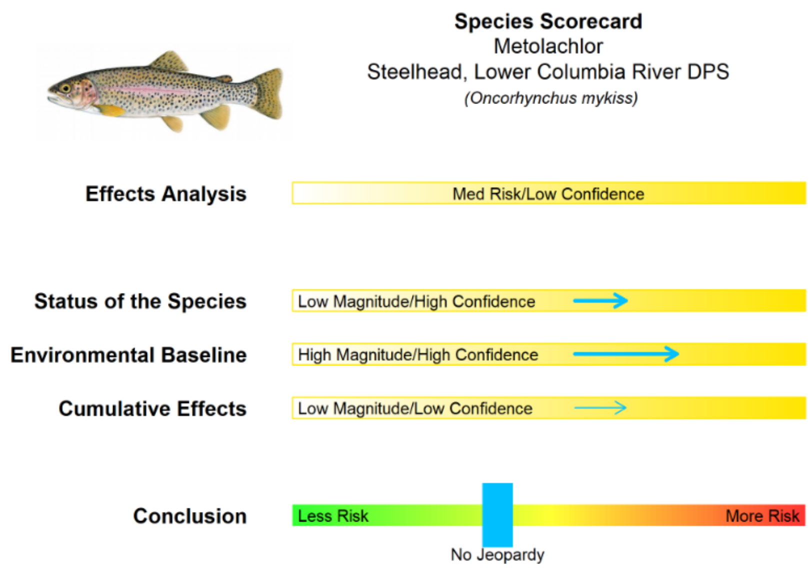


Figure 166. Species Scorecard; Steelhead, Lower Columbia River DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence</u>

- 5-year population trend stable. Populations exhibit low genetic diversity and impacted by a loss of available habitat.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

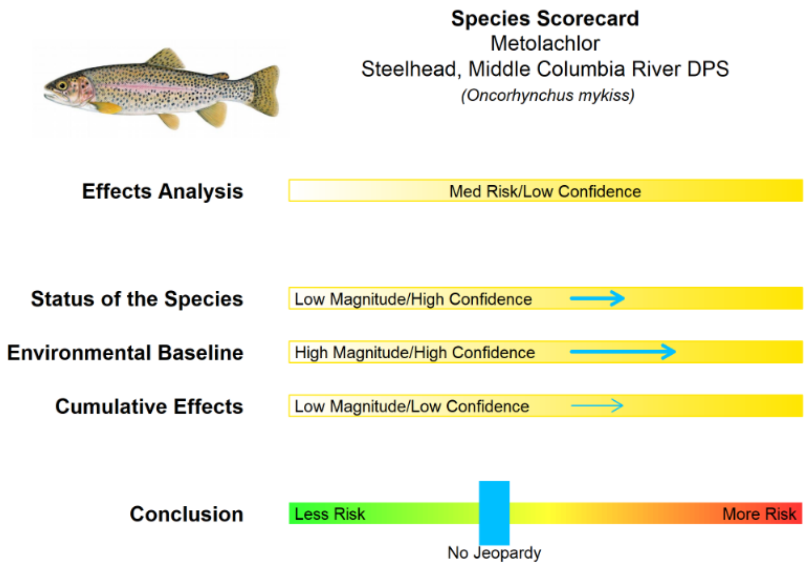


Figure 167. Species Scorecard; Steelhead, Middle Columbia River DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Minimal increased risk of jeopardy; Low magnitude/ High confidence</u>

- 5-year population trend stable to improving; abundances remain low compared to historical numbers
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>**Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy**</u>

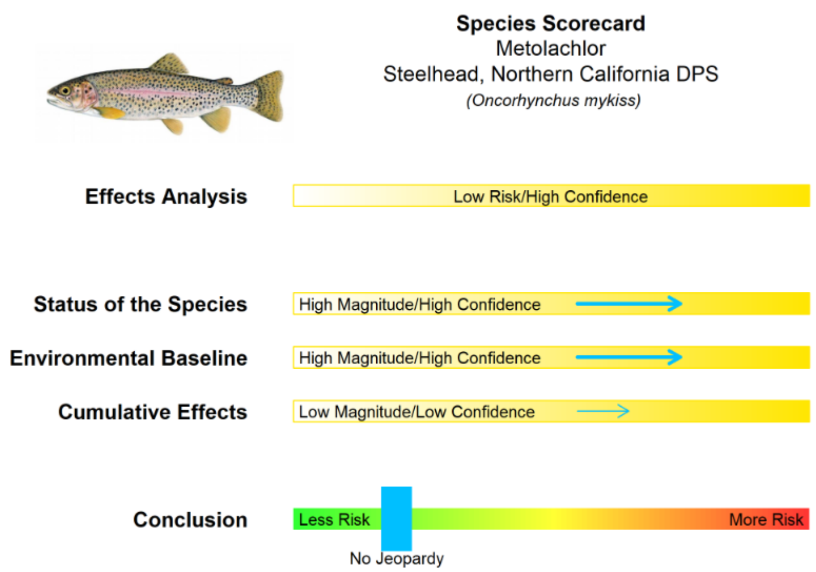


Figure 168. Species Scorecard; Steelhead, Northern California DPS; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Variable 5-year population abundance trends; Population supplemented by hatchery propagation. Populations exhibit low abundances and productivity.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to the Northern California Steelhead DPS is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

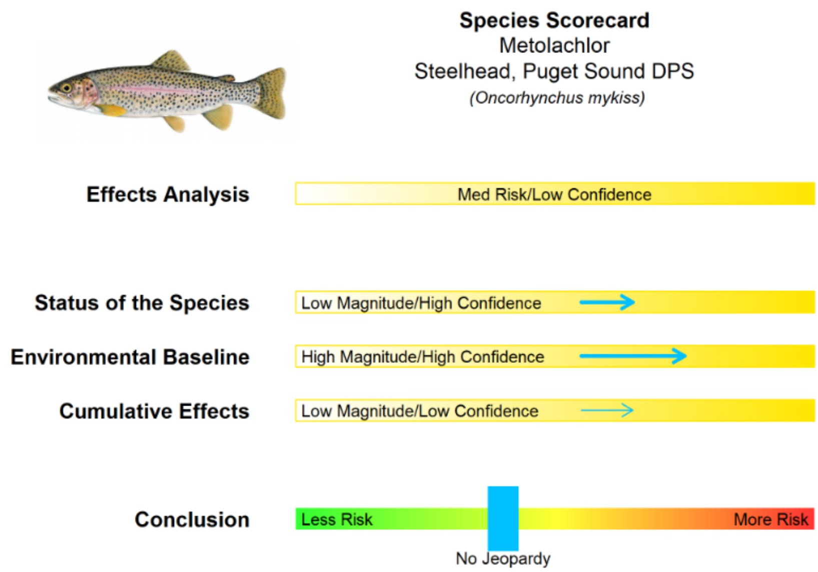


Figure 169. Species Scorecard; Steelhead, Puget Sound DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Minimal risk of jeopardy; Low magnitude/ High confidence</u>

- 5-year population trend stable, but populations have reduced genetic diversity
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

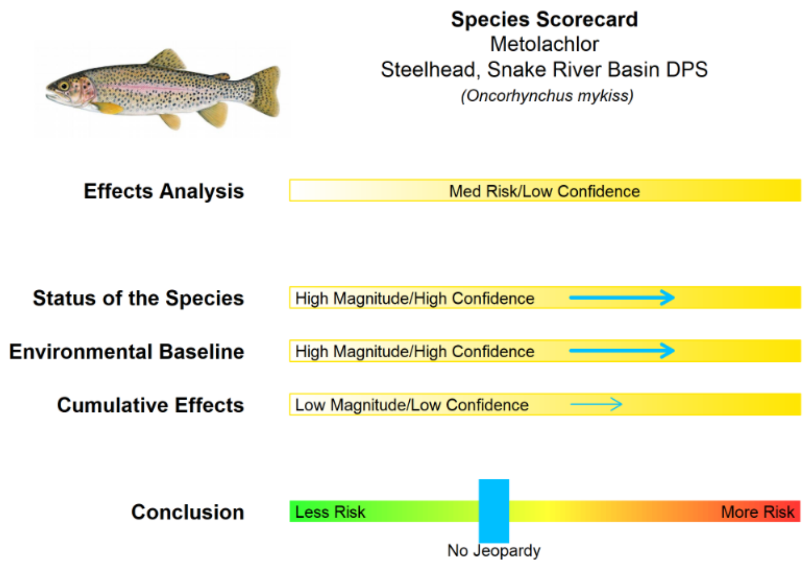


Figure 170. Species Scorecard; Steelhead, Snake River Basin DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend stable to improving, but still in moderate danger of extinction. Overall abundances remain below thresholds necessary for recovery.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

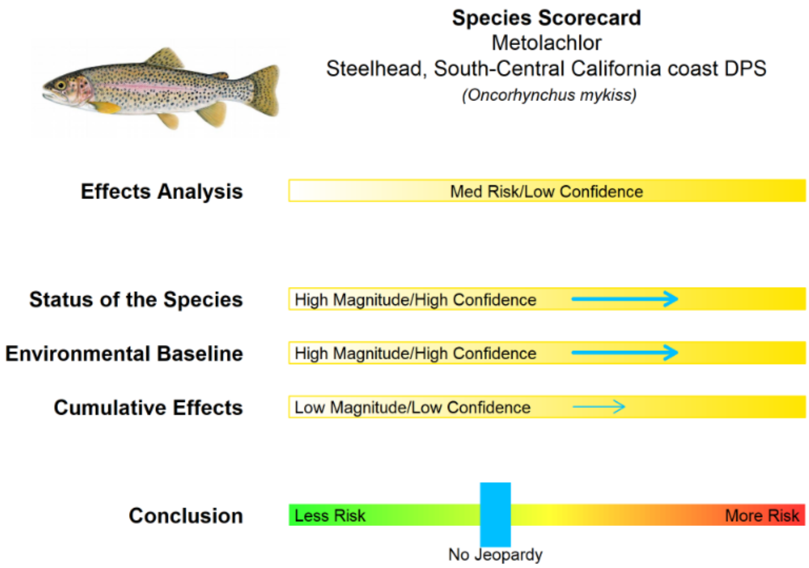


Figure 171. Species Scorecard; Steelhead, South-Central California coast DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- 5-year population trend declining, depressed abundances.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

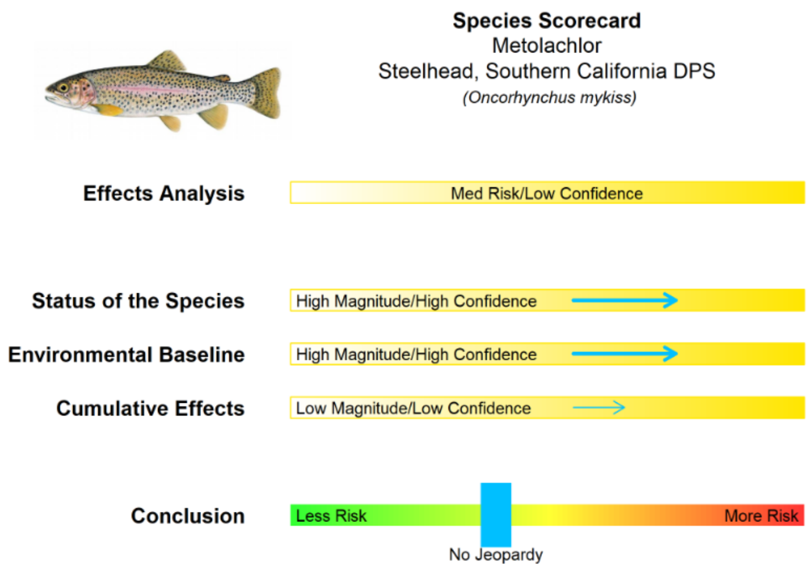


Figure 172. Species Scorecard; Steelhead, Southern California DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

<u>Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence</u>

- 5-year population trend uncertain (large annual variations); supplemented by hatchery propagation; fragmented distributions.
- Endangered; Populations at extreme southern end of species' range
- Recovery criteria not met and reduced likelihood of attaining recovery goals

<u>Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence</u>

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

<u>Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence</u>

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

<u>Conclusion:</u> We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

<u>Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy</u>

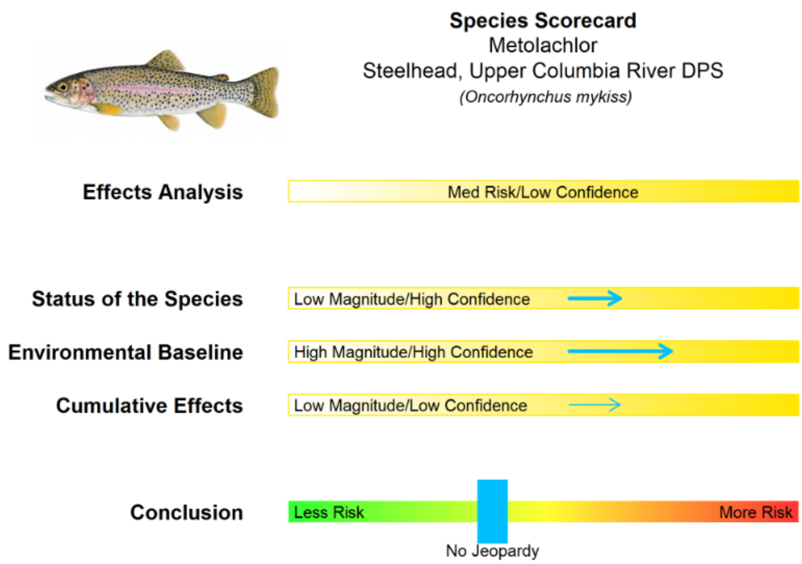


Figure 173. Species Scorecard; Steelhead, Upper Columbia River DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; Low magnitude/ High confidence

- 5-year population trend improving, but low genetic diversity.
- Threatened
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

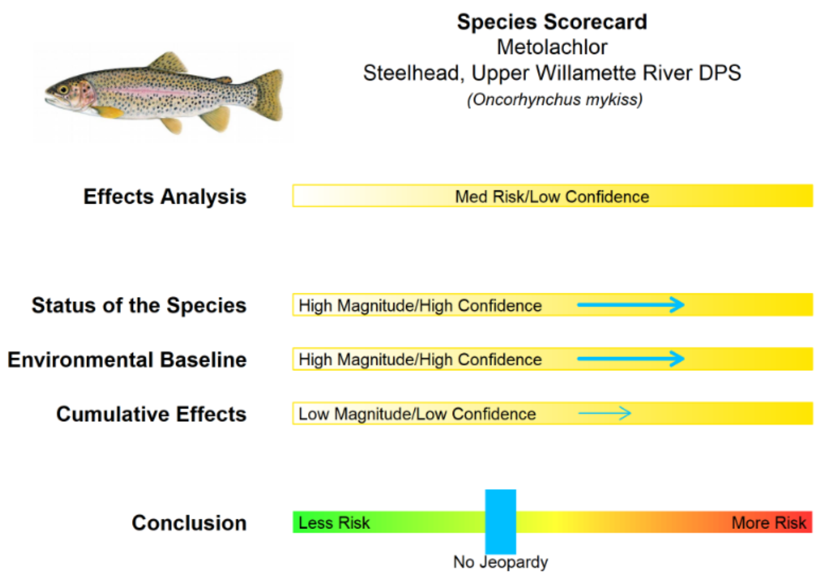


Figure 174. Species Scorecard; Steelhead, Upper Willamette River DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in abundance via acute lethality and/or prey availability are not expected.
- Impairments to growth and/or ecologically significant behaviors are not anticipated.

Status of the Species: Increased risk of jeopardy; High magnitude/ High confidence

- 5-year population trend declining, large fluctuations in abundances.
- Threatened;
- Recovery criteria not met and reduced likelihood of attaining recovery goals

Environmental Baseline: Increased risk of jeopardy; High magnitude/ High confidence

- Elevated temperatures occur in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats that affect species

Cumulative Effects: Minimal increased risk of jeopardy; Low magnitude/ Low confidence

- Future elevated temperatures anticipated
- Anticipated hydrologic effects in freshwater areas

Conclusion: We find the overall risk to this species' DPS is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Use of metolachlor products in proximity to low flow, low volume habitats may result in exposures which could result in direct take. Overall, reductions of species' abundance, reproduction, or distribution are not anticipated over the 15-year action.

Metolachlor is not likely to jeopardize the continued existence of this species: No Jeopardy

Table 510 Summary of species determinations for 1,3-D and Metolachlor

Salmon Type	ESU/DPS	1,3-D (Telone)		Metolachlor	
		Jeopardy	No Jeopardy	Jeopardy	No Jeopardy
Chum	Columbia River		X		X
Chum	Hood Canal summer-run		X		X
Chinook	California Coastal		X		X
Chinook	CA Central Valley spring-run		X		X
Chinook	Lower Columbia River		X		X
Chinook	Puget Sound		X		X
Chinook	Sacramento River winter-run		X		X
Chinook	Snake River fall-run		X		X
Chinook	Snake River spring/summer-run		X		X
Chinook	Upper Columbia River spring-run		X		X
Chinook	Upper Willamette River		X		X
Coho	Central California Coast		X		X
Coho	Lower Columbia River		X		X
Coho	Oregon Coast		X		X
Coho	S. Oregon N. California Coast		X		X
Sockeye	Ozette Lake		X		X
Sockeye	Snake River		X		X
Steelhead	CA Central Valley		X		X
Steelhead	Central California Coast		X		X
Steelhead	Lower Columbia River		X		X
Steelhead	Middle Columbia River		X		X

Steelhead	Northern California		X		X
Steelhead	Puget Sound		X		X
Steelhead	Snake River Basin		X		X
Steelhead	South-Central California Coast		X		X
Steelhead	Southern California		X		X
Steelhead	Upper Columbia River		X		X
Steelhead	Upper Willamette River		X		X

14 Effects of the Action: Introduction to Critical Habitat

The NMFS critical habitat analysis determines whether the proposed action is likely to destroy or adversely modify critical habitat for ESA-listed species by examining potential reductions in the conservation value of the essential features of designated critical habitat. "Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat as a whole for the conservation of an ESA-listed species (50 C.F.R. §402.02).

In this section, NMFS evaluates the potential consequences to designated critical habitat from exposure to the stressors of the proposed action. Each risk hypothesis is based on PBF and is evaluated across the entire species critical habitat. The critical habitat effects analysis concludes with our determination of the risk posed to all the PBFs taken together. In the integration and synthesis section (Chapter 16) we combine the effects analysis with the baseline status of the habitat and the cumulative effects to evaluate the potential consequences to designated critical habitat as a whole.

As described in the preamble to the updated regulations: "Consistent with longstanding practice and guidance, the Services must place impacts to critical habitat into the context of the overall designation to determine if the overall value of the critical habitat is likely to be appreciably reduced. The Services agree that it would not be appropriate to mask the significance of localized effects of the action by only considering the larger scale of the whole designation and not considering the significance of any effects that are occurring at smaller scales (see, e.g., Gifford Pinchot, 378 F.3d at 1075). The revision to the definition does not imply, require, or recommend discounting or ignoring the potential significance of more local impacts. Such local impacts could be significant, for instance, where a smaller affected area of the overall habitat is important in its ability to support the conservation of a species (e.g., a primary breeding site). Thus, the size or proportion of the affected area is not determinative; impacts to a smaller area may in some cases result in a determination of destruction or adverse modification, while impacts to a large geographic area will not always result in such a finding" 84 Fed. Reg. 44976, 44983 (Aug. 27, 2019).

A diagram of our analysis framework is shown in **Figure 175**. It is similar in structure to the jeopardy analysis, but focuses on whether the proposed action is likely to destroy or adversely modify designated critical habitat for listed species. NMFS reviews the status of designated and proposed critical habitat affected by the proposed action separate from species effects by examining the condition and trends of the designated essential physical and biological features (PBFs) of critical habitat throughout the action area.

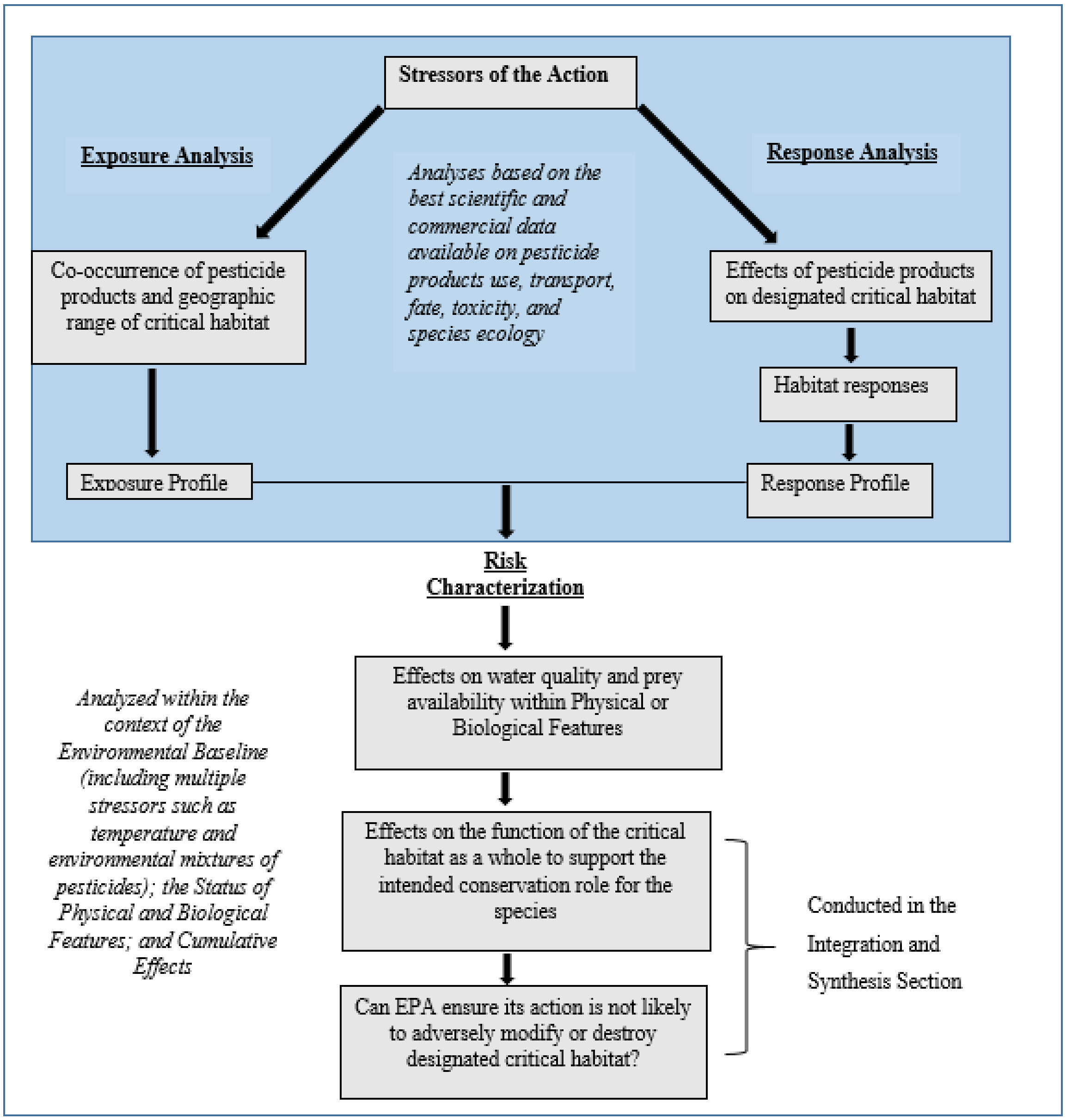


Figure 175. Assessment Framework for Designated Critical Habitat

We first determine whether critical habitat is likely to be exposed to the stressors of the proposed action (exposure profile). To conduct this analysis, we relied on R-plots showing expected pesticide concentrations in the species' designated critical habitat. If we find that critical habitat is likely to be exposed, we determine the relevant PBFs for each species' designated critical habitat that would be at risk from this proposed action and assess the consequences of that exposure on the quality, quantity, or availability of those PBFs (response profile). We relied on Environmental Protection Agency (EPA)-provided contractions of United States Department of Agriculture's (USDA) Crop Land Data Layers of crop uses and conducted an overlap of critical habitat analysis to determine exposure potential to designated critical habitat.

Salmonid designated critical habitat PBFs for many species[21] may include:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

(4) Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation;

[21] See Status of the Species – Chapter 8.

and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(7) Spawning and juvenile rearing areas which include cover/shelter, food availability, riparian vegetation, space, spawning gravel, water quality, water temperature, and water quantity.

(8) Adult and juvenile migration corridors which include essential site attributes such as cover/shelter, food (juveniles) riparian vegetation, safe passage, space, substrate, water quality, water quantity, water temperature, and water velocity.

(9) Areas for growth and development to adulthood in ocean areas including nearshore marine areas for juvenile rearing and migration.

In all of the critical habitat designations that may be exposed to the stressors of this action, water quality, prey availability, and aquatic vegetation are key attributes that are either designated as PBFs of the critical habitat, or are relevant to the PBFs. Water quality encompasses a range of typically measured parameters, including dissolved oxygen, temperature, turbidity, and presence of contaminants. Insects and phytoplankton development is critical for the aquatic ecosystem, in particular as prey for juvenile salmonids which are essential to their growth and survival. Aquatic vegetation provides substrate for insect production, and also cover to juvenile salmonids, which is important for their avoidance of predators (i.e., survival). Here, we use the presence of chemical contaminants as an indicator of degraded water quality. The proposed action could degrade water quality by introducing metolachlor, 1,3-D (and chloropicrin) and other associated chemicals into designated critical habitats. Therefore, we use the pesticide concentrations likely to adversely affect listed species, prey (e.g. juvenile fish and invertebrates), or aquatic vegetation as measures of degraded water quality.

We translated each PBF into a risk hypothesis (Table 511) to assess potential impacts on designated critical habitat. The assessment first considers the "effect of exposure", and then considers whether that effect may occur at a larger scale by evaluating the "likelihood of exposure". By combining the effect of exposure and likelihood of exposure we arrive at an overall determination of risk and confidence for each of the risk hypotheses.

Table 511 Example summary of designated critical habitat risk hypotheses

	Risk-plot Derived	

Designated Critical Habitat; Risk Hypotheses	Risk	Confidence	Risk Hypothesis Supported? Yes/No
1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration and rearing sites.	low, medium, high	low, medium, high	Yes/no
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no

To determine the effect of exposure, we used Risk-plots, when available, to evaluate the support for effects to species' PBFs. As with the species assessment, each use site is evaluated to determine whether the effect of exposure is low, medium, or high based on the EECs and the toxicity information. Consideration was given to the duration of exposure when determining which EECs were relevant for comparison.

To determine the likelihood of exposure, we evaluated four factors to arrive at a low, medium, or high finding. Unique combinations of the four likelihood factors result directly in the likelihood of exposure being characterized as either low, medium, or high according to the decision key in Table 5. The likelihood of exposure assessment allows us to consider whether effects may occur across the critical habitat by taking into consideration the extent of exposure, the chemical properties (e.g. persistence), as well as the proximity of use sites to PBFs (when spatial data are available). The four factors considered are:

5. Percent overlap of a designated critical habitat range with a pesticide's approved uses. Each use is assigned a category of 1, 2, or 3 depending on the degree of geographic overlap of use acreage with the species' U.S. range acreage (aggregation of HUC-12s that delineate the species range). Use acreage comes from EPA-derived GIS layers and is presented on the left Y-axis of the Risk-plot. Designated critical habitat range comes from NMFS listing documents.

6. Persistence of the pesticide based on environmental fate issues. We evaluated the environmental fate information provided in the BE to determine whether the pesticide is

considered persistent. As a rule of thumb, we answered yes to persistence if the pesticide has a half-life greater than 100 days.

7. Number of applications allowed. We reviewed EPA approved labels to determine whether multiple applications were allowed on each use site.

8. Proximity analysis: for use sites with less than 1 percent overlap within designated critical habitat. NMFS used GIS mapping and critical habitat information to determine whether sites were aggregated in proximity to sensitive areas (e.g., known spawning areas). When evaluating a map, we classified use sites as "in proximity" when they were either: 1) within 300 meters of the sensitive habitat and exposure was deemed likely due to runoff or drift; or 2) chemical fate, hydrologic properties, and the proximity of use sites upstream from sensitive habitat suggested exposure was likely through the downstream transport pathway.

Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
3	yes	yes	NA	**High**
3	no	yes	NA	**High**
2	yes	yes	NA	**High**
1	yes	yes	yes	**High**
1	no	yes	yes	**High**
3	no	no	NA	**Medium**
2	no	yes	NA	**Medium**
1	no	no	yes	**Medium**
2	no	no	NA	**Low**
1	yes/no	yes/no	no	**Low**

Figure 176. Decision key for likelihood of exposure finding for designated critical habitat

The effect of exposure and likelihood of exposure determinations are then combined for each use site to determine the overall risk associated with the risk hypothesis. This is done following the same criteria as with the species assessment (described earlier). Once we have determined the risk ranking for a risk hypothesis, we then evaluate the level of confidence we have in that ranking. The level of confidence underscores the level of certainty we have in the risk determination for each risk hypothesis. The confidence level in the risk determination is evaluated and assigned a low, medium, or high level. The factors evaluated in characterizing confidence in the critical habitat assessment are similar to those used in the species assessment (described above).

Similar to the effects of the action on the species, the arrangement of risk and confidence pairing of the risk hypotheses dictated the placement of a risk bar along a risk continuum. The graphic denotes the overall risk identified in the effects analysis section of designated critical habitat (see Figure 177). Each pesticide and designated critical habitat pairing receives a risk bar.

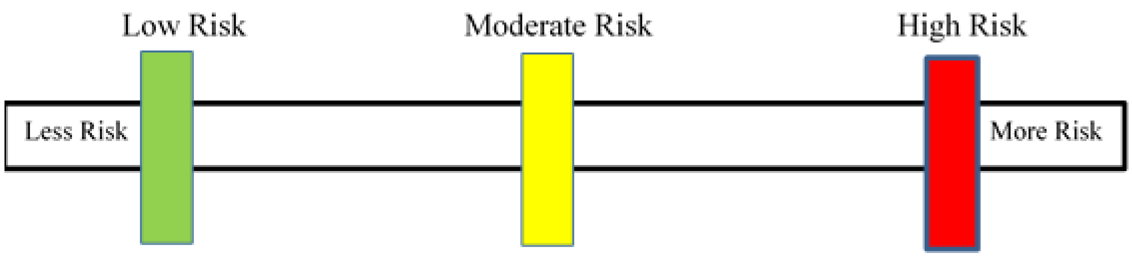


Figure 177. Depiction of risk to designated critical habitat from the stressors of the action

We conclude the Effects of the Action analysis for designated critical habitat by composing a narrative to summarize our evaluation and findings of risk hypotheses. The statement of risk for a species and chemical is carried forward in the integration and synthesis section. The risk statement is presented as a horizontal bar to denote the overall finding for risk and confidence found at the top of a scorecard.

The action area for this Opinion encompasses all designated critical habitat for listed Pacific salmonids in Washington, Oregon, California and Idaho. As the species of salmonids addressed in this Opinion have similar life history characteristics, they share many of the same PBFs. These PBFs include sites that support one or more life stages and contain physical or biological features essential to the conservation of the ESU/DPS. PBFs outlined above include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas.

Water quality, prey availability, and aquatic vegetation in freshwater and estuarine areas may be susceptible to pesticide effects where critical habitat overlaps with or is adjacent to use sites. Effects to water quality, prey availability, and aquatic vegetation will be evaluated to determine the likelihood of reducing the quality of freshwater, estuarine, and nearshore marine areas. Given the use and environmental fate profile of the pesticide formulations containing these active ingredients, we do not expect offshore marine areas to be directly affected. Therefore, a risk hypothesis was not developed for this area and we have determined that further evaluation of this PBF is not warranted.

Sufficient water quality is a necessary attribute of many aquatic PBFs to support the conservation role of designated critical habitat, and water quality unimpaired by toxins is necessary to the PBFs of the critical habitats affected by the stressors of this action. For example, all species of juvenile salmon need clean cold water. Clean and cold water is essential support for producing abundant prey for salmonid growth and development. Water quality is clearly degraded when pesticides and other stressors of the action reach levels in habitat that are sufficient to adversely affect aquatic vegetation, aquatic organisms, and reduce individual fitness of exposed ESA-listed species. Impacts to species fitness were evaluated earlier in the document and these impacts are used as indicators of degraded water quality. We evaluate exposure and effect concentrations to determine whether PBFs are impacted.

We evaluate effects to prey because forage is an essential attribute of many PBFs. Freshwater juvenile rearing and migratory habitats as well as estuarine and nearshore marine areas must provide sufficient forage to support growth and development of the listed species. Reductions in the abundance of prey items can decrease the quality of rearing, migration, and estuarine PBFs, as less available food will support fewer individuals. Reductions in prey can reduce a PBF's potential to support species (juvenile development, growth, maturation, survival), thereby reducing the carrying capacity of critical habitat. We evaluated the toxicity assessment endpoints including prey and fish survival to determine whether expected concentrations of the stressors of the action are sufficient to affect PBFs of species critical habitats. We also evaluate effects to aquatic vegetation because of its role in providing cover to migrating juvenile salmon from predation and as substrate to the production of some invertebrates.

Designated critical habitat is located within the action area. Many freshwater areas overlap with the allowable uses of the active ingredients. The stressors of the action may contaminate these habitats via spray drift and/or runoff (including from irrigation returns), and to a lesser extent from atmospheric deposition. Once in species habitats, the active ingredients persist for varying periods of time, depending in part on the chemical, biological, and physical environment of the contaminated aquatic habitats. Expected concentrations of other/inert ingredients and adjuvants added to formulations prior to application remain unknown, and are an identified data gap.

See Chapter 16 (Integration and Synthesis for Designated Critical Habitat) for the final conclusion of whether EPA's proposed action with end-use products containing metolachlor and 1,3-D (and 1,3-D/chloropicrin formulated mixtures) are likely to adversely modify or destroy a species' designated or proposed critical habitat.

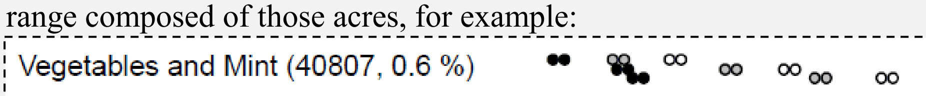
15 Effects of the Action Analysis: Designated Critical Habitat

15.1 Introduction

See Chapters 4 (Approach to the Assessment), 11 (Effects Analysis Introduction), and 12 (Effects of the Action to ESA-listed Species) for descriptions of the methods and information used in this section. In this section we integrate the exposure and response information to evaluate the likelihood of adverse effects from stressors of the action to designated critical habitat. The information is organized by species. Within each section the information is presented in the following order:

1. R- Plots figures: Demonstrate the relationship between geographically-specific potential exposure distributions and assessment measures (response distributions). These figures also convey the prevalence of registered use sites within the species designated critical habitats by providing potential acreage of allowed uses within the species range and what the percent overlap of that use relative to the size of the species range. See Table 168 below and the assessment framework chapter for more information on the interpretation of risk plots. Additional information on the effects information displayed in risk plots is provided in the beginning of each of the effects analysis sections.

Table 512. General risk plot components

Title Species name is given, with ESU or DPS abbreviated, for example: **Chinook salmon PS (Range)** "(Range)" indicates that the species range, rather than designated critical habitat (Habitat), was used to calculate overlap percentages.
Effect Concentrations See Tables below for 1,3-D, chloropricrin, and metolachlor specific information.
Exposure Concentrations The overlap use category is listed, followed by the acres within species range and percent of species range composed of those acres, for example:  Some use categories such as "field crops" and "fruit and nuts" show multiple overlap percentages. This reflects that more than one crop is lumped into this use category. See chapter 11 for a crosswalk of authorized use sites to overlap category. Circles represent estimated exposure concentrations for three modeled scenarios: bin 0 (open circles); bin 2 (gray circles); bin 7 (black circles). Note that there are three rows of estimated exposure concentrations for each overlap category; each row represents a different time-weighted average: 1-day (bottom row); 4-day (middle row); and 21-day (top row).

2. Likelihood of exposure tables: Tables summarizing assessment of likelihood of exposure to each pesticide use that can occur within the species designated critical habitat.

3. Risk Hypotheses Tables: tables for each risk hypothesis summarizing risk and confidence associated with each registered use that occurs within the species designated critical habitat.

4. Final effects analysis table and narrative summary: Each section concludes with a table indicating which risk hypotheses were supported and an associated narrative summary of overall risk of the action to the designated critical habitat.

15.2 Products Containing 1,3-Dichloropropene Effects Analysis

The response endpoints displayed in the 1,3-Dichloropropene and chloropicrin risk plots that follow are provided in Table 513 & Table 514. See the introduction to the effects analysis chapter for more information regarding the available relevant toxicological data for these compounds.

Table 513. Effects endpoints displayed in risk plots for 1,3-Dichloropropene

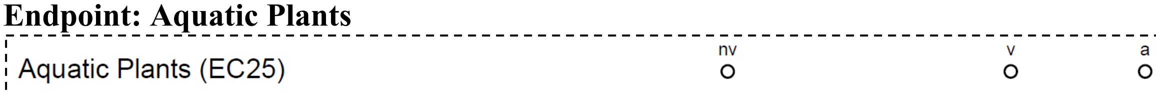
Endpoint: Prey Abundance
Invertebrates

Test species: Water flea; Water flea
Duration: 48-hr
Toxicity value (ppb): EC50 (50) = 90; 6200; geometric mean* (gm) = 747; slope = 4.5 (assumed)
Citation/MRID: 40098001; 00117044

Fish

Test species: Rainbow Trout
Duration: 96-hr
Toxicity value (ppb): LC50 (50) = 2780; slope = 4.5 (assumed); None Expected (NE) = 244
Citation/MRID: 49382003

Endpoint: Aquatic Plants



Test species: Freshwater diatom (nv); Duckweed (v); Green algae (a)
Duration: 5-day; 7-day; 96-hr
Toxicity value (ppb): EC25= 30; 1310; 7850
Citation/MRID: 44843909; 44843914; 44940314

**The calculation and reference to the geometric mean of the two different LC50s was determined appropriate as the studies were otherwise comparable in regards to species tested, exposure duration, and overall data quality.*

Table 514. Effects endpoints displayed in risk plots for chloropicrin

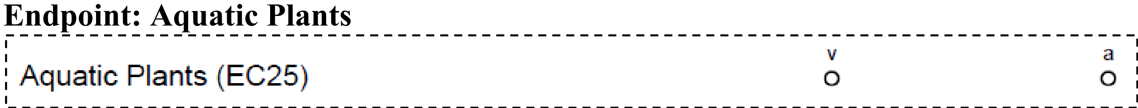
Endpoint: Prey Abundance
Invertebrates

Test species: Water flea
Duration: Acute
Toxicity value (ppb): EC50 (50) = 120; slope = 4.5 (assumed)
Citation/MRID: 48442401

Fish

Test species: Rainbow Trout
Duration: Acute
Toxicity value (ppb): LC50 (50) = 11; slope = 4.5 (assumed); None Expected (NE) = 1
Citation/MRID: 48442405

Endpoint: Aquatic Plants



Test species: Duckweed (v); Green Algae (a)
Duration: not specified
Toxicity value (ppb): EC25 = 4.6; 85
Citation/MRID: 48442801; 49559701

Characterizing the "effect of exposure" for chloropicrin.

The effects analysis for 1,3-Dichloropropene, like metolachlor, is an assessment of the effects of the action which includes (1) approved product labels containing the primary active ingredient, (2) degradates and metabolites of that active ingredient, (3) formulations, including other ingredients within formulations, (4) adjuvants, and (5) tank mixtures. Some aspects of the effects of the action are considered quantitatively (e.g. prey availability response to the primary active ingredient), whereas others are considered more qualitatively (e.g. recommended tank mixtures). Here we present a semi-quantitative analysis of chloropicrin, a common co-active ingredient in 1,3-Dichloropropene formulated products. A semi-quantitative assessment was determined to be appropriate for chloropicrin given the frequency at which it is co-formulated with 1,3-Dichloropropene as well as its relatively greater toxicity to freshwater fish.

The effect of chloropicrin was considered in evaluating the prey availability, vegetative cover, and water quality risk hypotheses, as these are primary biological features for each of the designated critical habitats considered. For prey abundance, the effect of exposure was “none expected” for invertebrate prey and “medium” for juvenile fish (depicted as “Direct Mortality” on risk plots). This follows from the criteria described in the assessment framework chapter i.e. the overlap between EECs and effects endpoints (Figure 59). In assessing the effects to vegetative cover, the effect of exposure was characterized as medium for riparian vegetation and low for aquatic vegetation (depicted as “Aquatic Plants” on risk plots). The effects of exposure to terrestrial (riparian) vegetation is not depicted in risk plots for 1,3-D or chloropicrin, instead a more qualitative narrative approach was taken. See chapter 11 and the vegetative cover risk hypothesis tables for more information. The effect of exposure of chloropicrin on water quality was characterized as medium due to the toxicity to freshwater fish. Our confidence associated with the risk characterizations was decreased with the added consideration of chloropicrin. This was primarily due to uncertainties in the exposure estimates and response data. Note also that not all 1,3-D/chloropicrin formulated products contain chloropicrin at levels indicating the potential for adverse effects. For example, Figure 60 shows EECs associated with the maximum label rates of all formulated products authorized for use on vegetables and mint. In this example, about half of the label’s maximum rates do not result in bin 2 estimates which exceed the 1% effects level for fish mortality.

The designated critical habitat-specific assessments that follow include effect of exposure characterizations for chloropicrin within the risk hypothesis tables. Chloropicrin risk plots are not provided separately for each ESU or DPS habitat assessment.

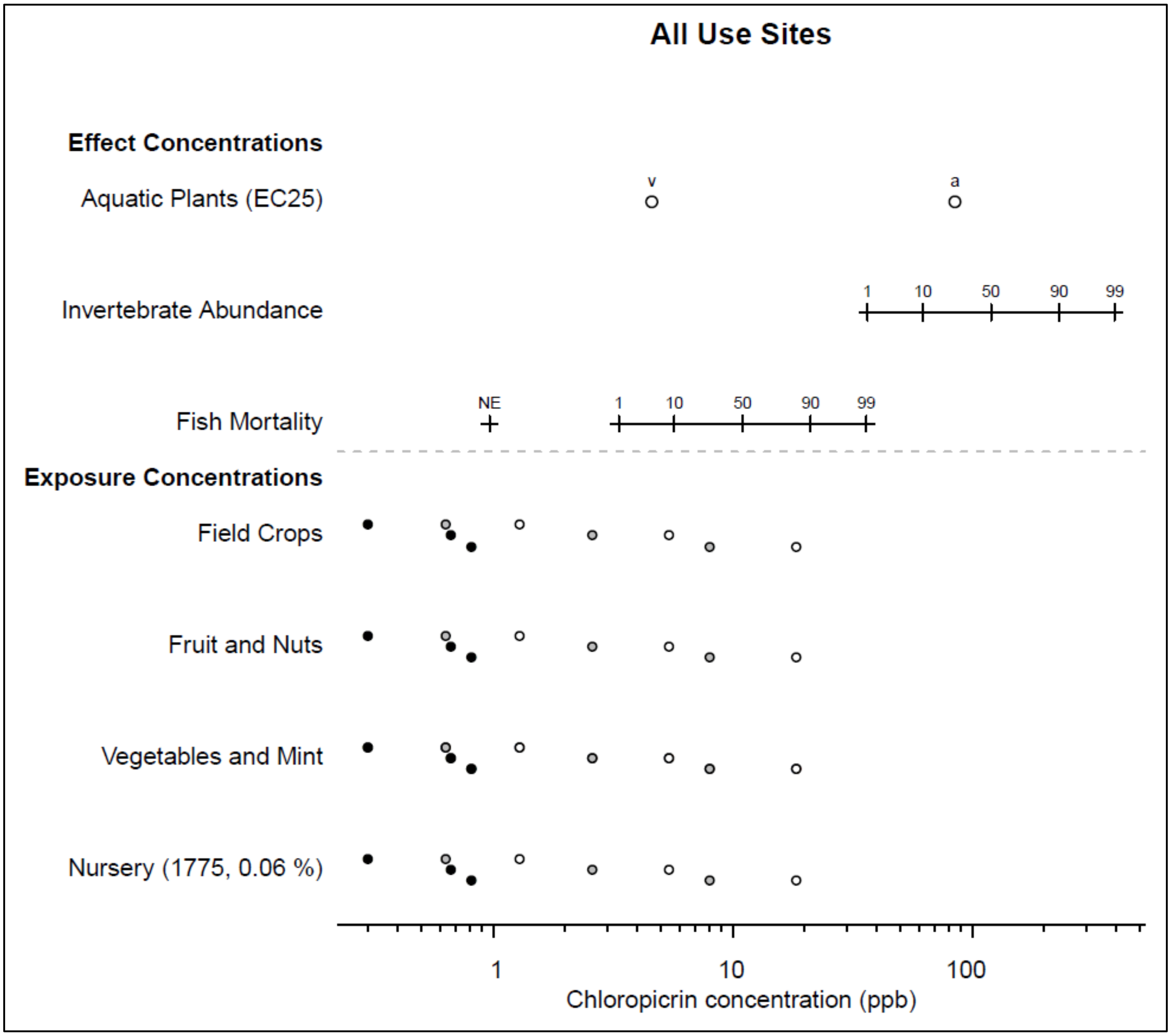


Figure 178. Chloropicrin estimated concentrations associated with the maximum label rates within each of the FIFRA section 3 uses authorized for 1,3-D/chloropicrin formulated products.

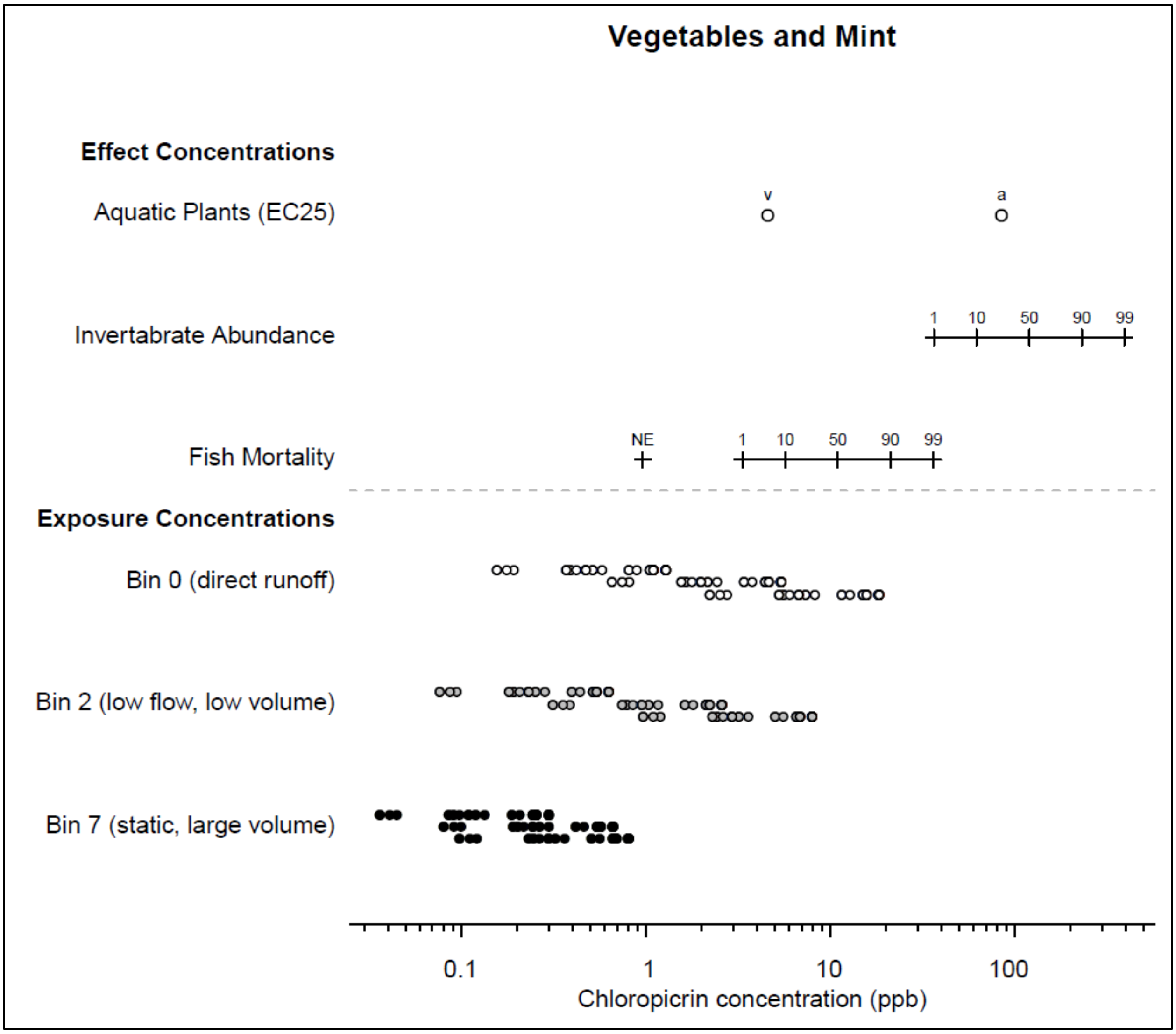


Figure 179. Chloropicrin estimated concentrations associated with the maximum rates in labels authorized for use on vegetables and mint.

15.2.1 Columbia River Chum Salmon (O. keta) Designated Critical Habitat; Products Containing 1,3-D

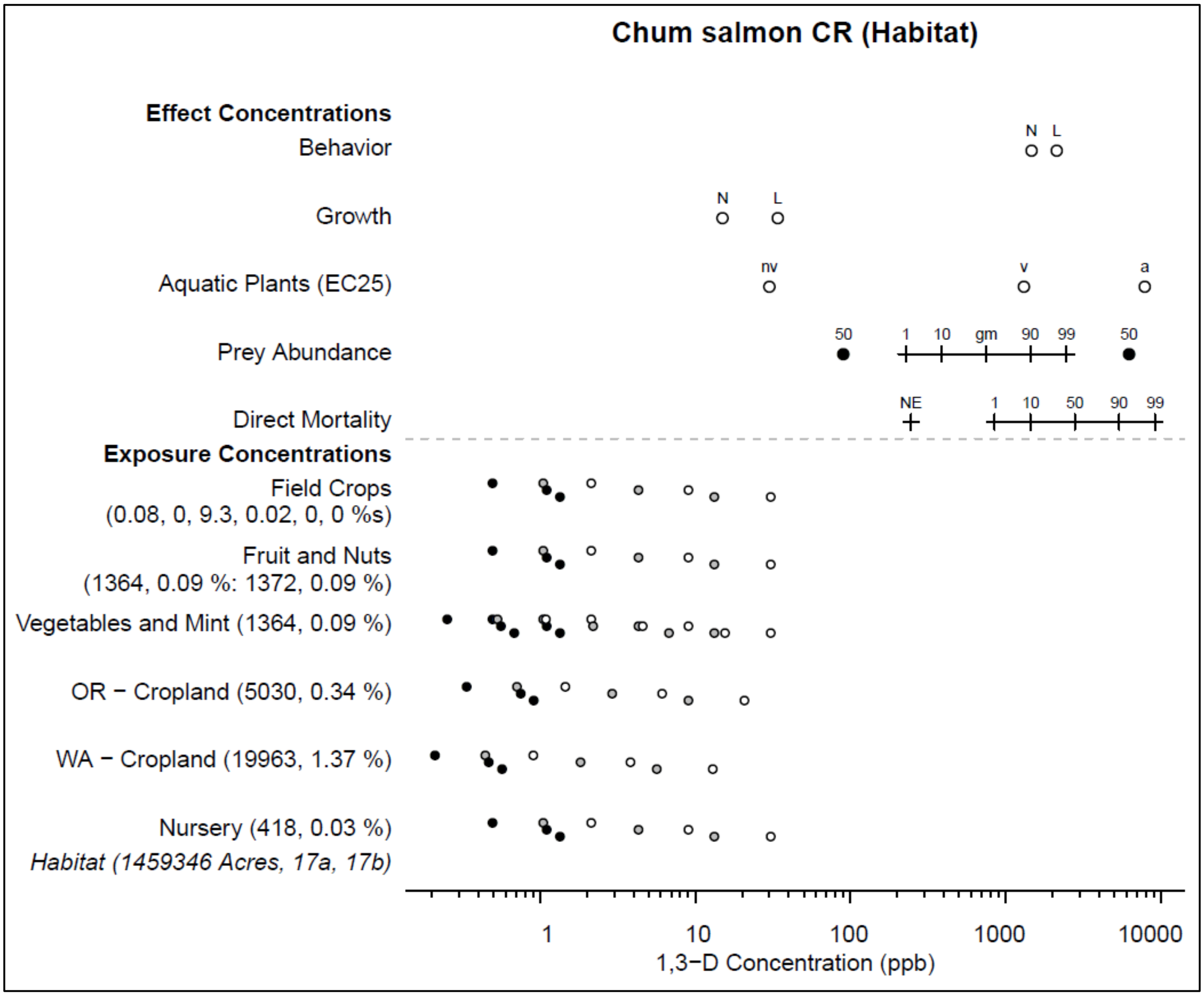


Figure 180. Effects analysis Risk-plot; chum salmon, Columbia River ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 515. Likelihood of exposure determination for chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA - Cropland	2	no	yes	NA	Medium
OR - Cropland	1	no	yes	yes	High
Mint	1	no	no	yes	Medium
Nursery	1	no	no	no	Low
Fruit and Nuts	1	no	no	yes	Medium
Field Crops	3	no	no	NA	Medium
Vegetable Crops	1	no	no	yes	Medium

Table 516. Prey risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	1.37	None Expected	None Expected	Medium
OR – Cropland	0.34	None Expected	None Expected	High
Mint	0.09	None Expected	None Expected	Medium
Nursery	0.03	None Expected	None Expected	Low
Fruit and Nuts	0.09, 0.09	None Expected	None Expected	Medium
Field Crops	0.08, 0, 9.3, 0.02, 0, 0	None Expected	None Expected	Medium

Vegetable Crops	0.09	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 517. Vegetative cover risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
WA - Cropland	1.37	Low	Low	Medium
OR – Cropland	0.34	Low	Low	High
Mint	0.09	Low	Low	Medium
Nursery	0.03	Low	Low	Low
Fruit and Nuts	0.09, 0.09	Low	Low	Medium
Field Crops	0.08, 0, 9.3, 0.02, 0, 0	Low	Low	Medium
Vegetable Crops	0.09	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin,				

vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

Risk	**Confidence**	
Medium	**Low**	

Table 518. Water quality risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Columbia River chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

Risk	**Confidence**	
Medium	**Low**	

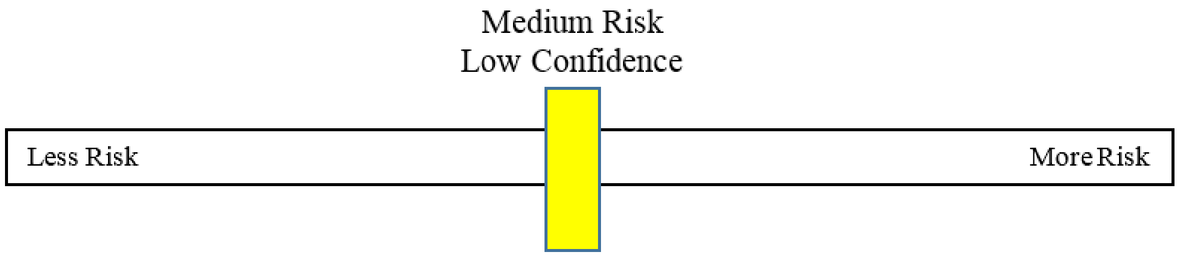
Table 519. Effects analysis summary table; chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported?**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

			Yes/No
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Columbia River chum salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Columbia River chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.


Medium Risk
Low Confidence
Less Risk
More Risk

15.2.2 Hood Canal summer-run Chum (O. keta) Designated Critical Habitat; Products Containing 1,3-D

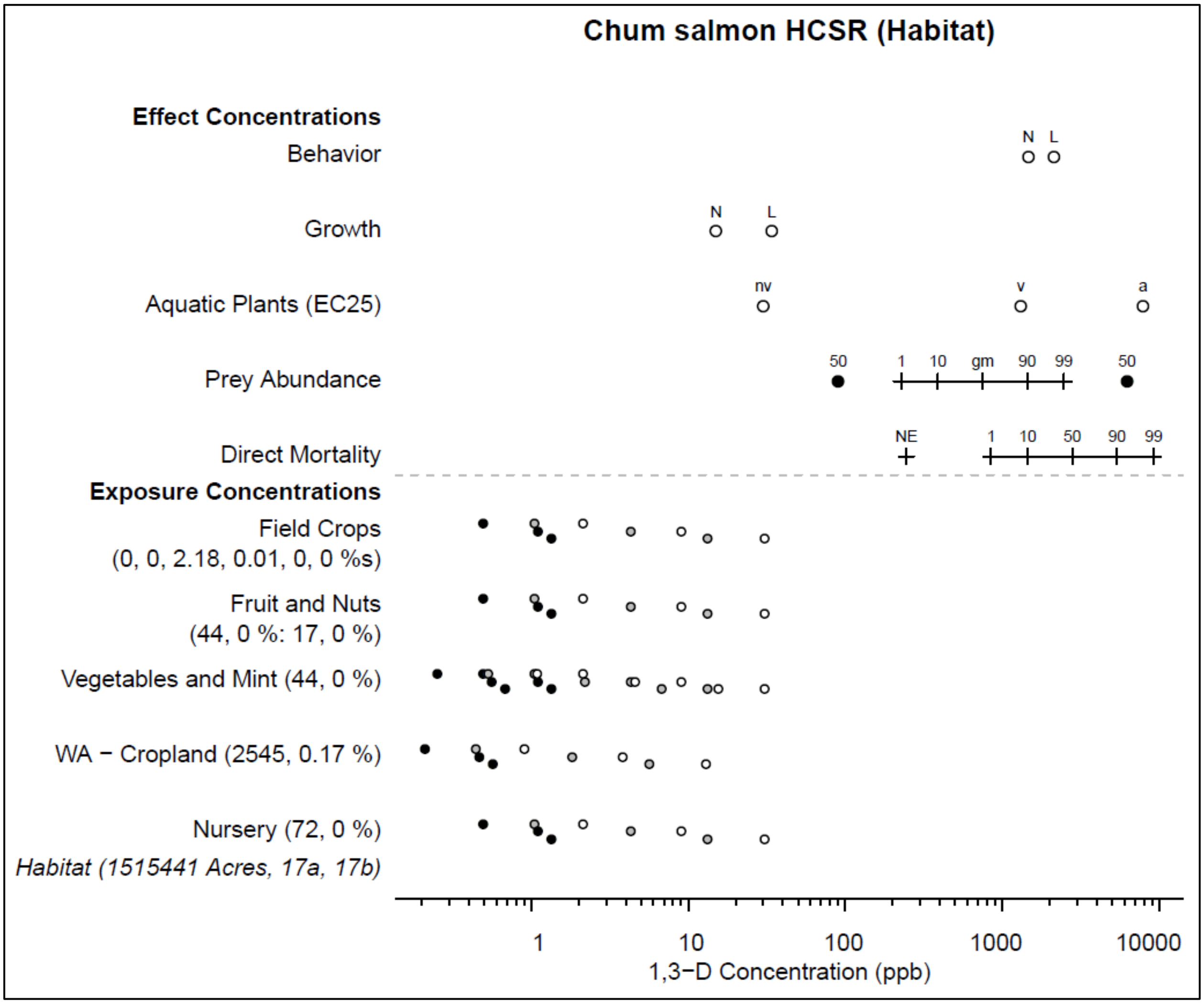


Figure 181. Effects analysis Risk-plot; chum salmon, Hood Canal summer-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 520. Likelihood of exposure determination for chum salmon, Hood Canal summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA - Cropland	1	no	yes	no	**Low**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	2	no	no	NA	**Low**
Vegetable Crops	1	no	no	no	**Low**

Table 521. Prey risk hypothesis; chum salmon, Hood Canal summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	0.17	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0, 0	None Expected	None Expected	Low
Field Crops	0, 0, 2.18, 0.01, 0, 0	None Expected	None Expected	Low
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				

Risk	Confidence	
Low	**Medium**	

Table 522. Vegetative cover risk hypothesis; chum salmon, Hood Canal summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
WA - Cropland	0.17	Low	Low	Low
Mint	0	Low	Low	Low
Nursery	0	Low	Low	Low
Fruit and Nuts	0, 0	Low	Low	Low
Field Crops	0, 0, 2.18, 0.01, 0, 0	Low	Low	Low
Vegetable Crops	0	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 523. Water quality risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

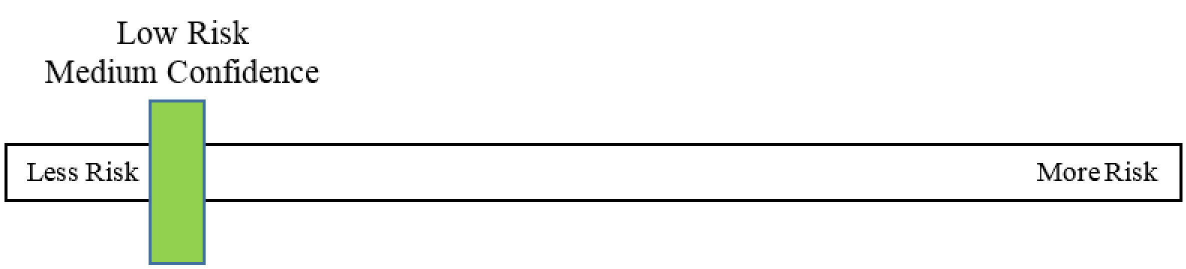
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Hood Canal summer-run chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 524. Effects analysis summary table; chum salmon, Hood Canal summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Hood Canal summer-run chum salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Hood Canal summer-run chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.3 California Coastal Chinook (O. tshawytscha) Designated Critical Habitat; Products Containing 1,3-D

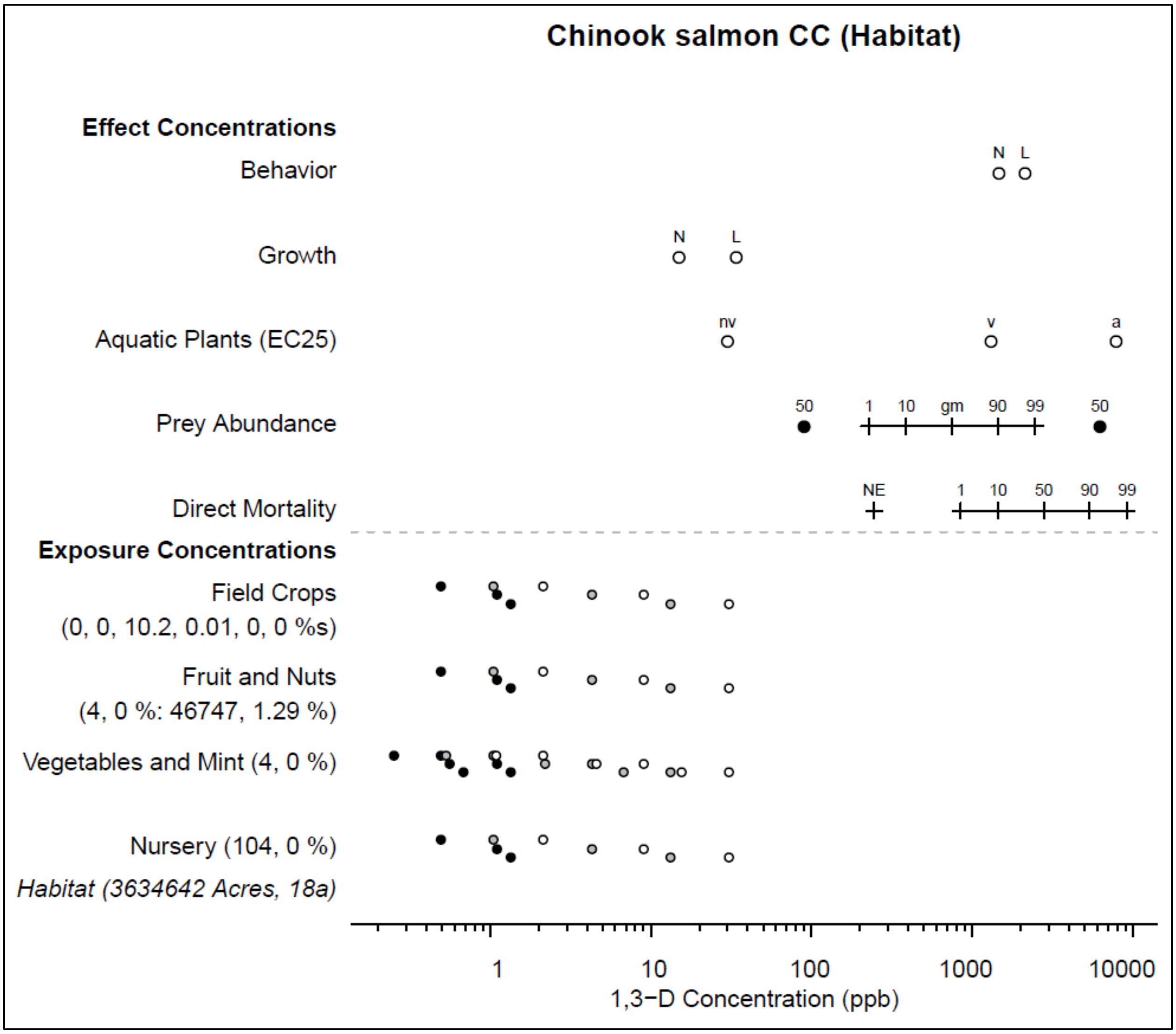


Figure 182. Effects analysis Risk-plot; Chinook salmon, California Coastal ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 525. Likelihood of exposure determination for Chinook salmon, California Coastal ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	no	Low
Nursery	1	no	no	no	Low
Fruit and Nuts	2	no	no	NA	Low
Field Crops	3	no	no	NA	Medium
Vegetable Crops	1	no	no	no	Low

Table 526. Prey risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0, 1.29	None Expected	None Expected	Low
Field Crops	0, 0, 10.2, 0.01, 0, 0	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 527. Vegetative cover risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and products containing 1,3-Dichloropropene

<table>
<tr><td colspan="5">Endpoint: Vegetative Cover</td></tr>
<tr><td rowspan="2">Use Category</td><td rowspan="2">% Overlap</td><td colspan="2">Effect of Exposure</td><td rowspan="2">Likelihood of Exposure</td></tr>
<tr><td>1,3-D</td><td>Chloropicrin</td></tr>
<tr><td colspan="5">Aquatic Plants</td></tr>
<tr><td>Mint</td><td>0</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Nursery</td><td>0</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>0, 1.29</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Field Crops</td><td>0, 0, 10.2, 0.01, 0, 0</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>0</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td colspan="5">Terrestrial Plants</td></tr>
<tr><td colspan="5">Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.</td></tr>
<tr><td colspan="5">Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.</td></tr>
<tr><td>Risk</td><td>Confidence</td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Low</td><td>Medium</td></tr>
</table>

Table 528. Water quality risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality

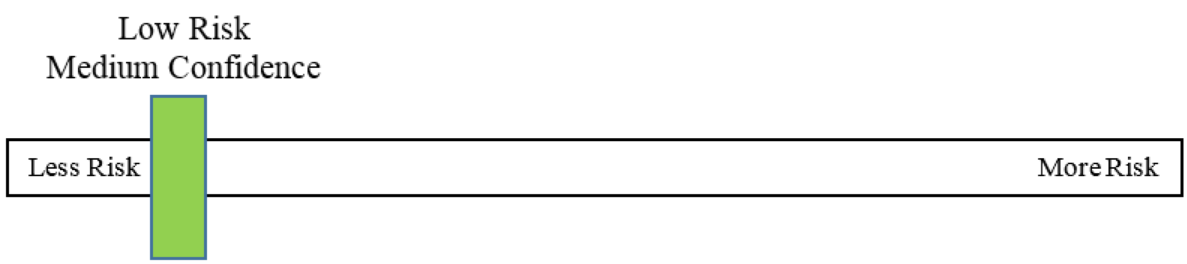
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the California Coastal Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 529. Effects analysis summary table; Chinook salmon, California Coastal ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of California Coastal Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the California Coastal Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.4 Central Valley Spring-run Chinook Designated Critical Habitat; Products Containing 1,3-D

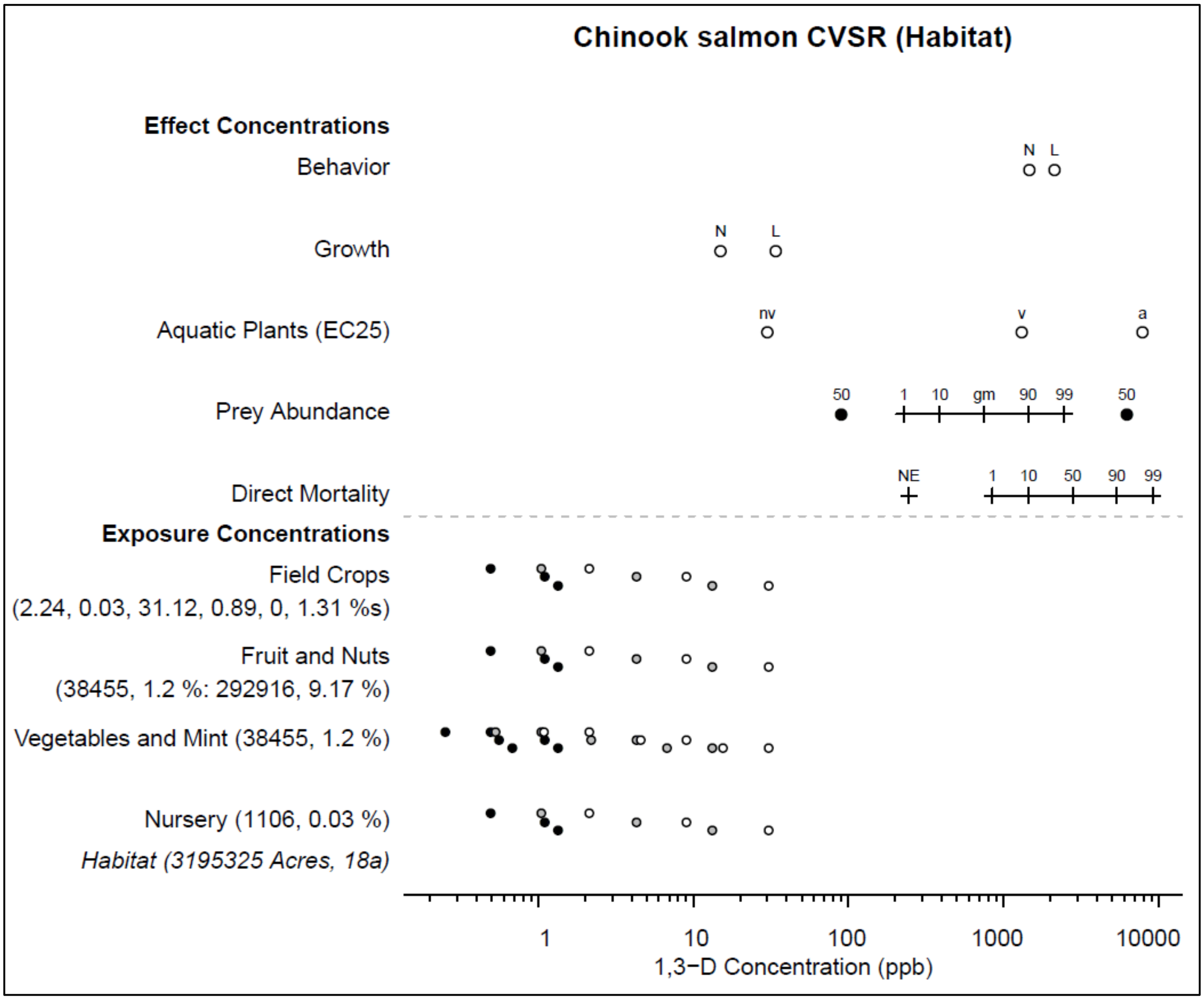


Figure 183. Effects analysis Risk-plot; Chinook salmon, California Central Valley Spring-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 530. Likelihood of exposure determination for Chinook salmon, California Central Valley Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	2	no	no	NA	Low
Nursery	1	no	no	no	Low
Fruit and Nuts	3	no	no	NA	Medium
Field Crops	3	no	no	NA	Medium
Vegetable Crops	2	no	no	NA	Low

Table 531. Prey risk hypothesis; Chinook salmon, California Central Valley Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	1.2	None Expected	None Expected	Low
Nursery	0.03	None Expected	None Expected	Low
Fruit and Nuts	1.2, 9.17	None Expected	None Expected	Medium
Field Crops	2.24, 0.03, 31.12, 0.89, 0, 1.31	None Expected	None Expected	Medium
Vegetable Crops	1.2	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			

Low	**Medium**	

Table 532. Vegetative cover risk hypothesis; Chinook salmon, California Central Valley Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
Mint	1.2	Low	Low	Low
Nursery	0.03	Low	Low	Low
Fruit and Nuts	1.2, 9.17	Low	Low	Medium
Field Crops	2.24, 0.03, 31.12, 0.89, 0, 1.31	Low	Low	Medium
Vegetable Crops	1.2	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Medium	**Low**			

Table 533. Water quality risk hypothesis; Chinook salmon, California Central Valley Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

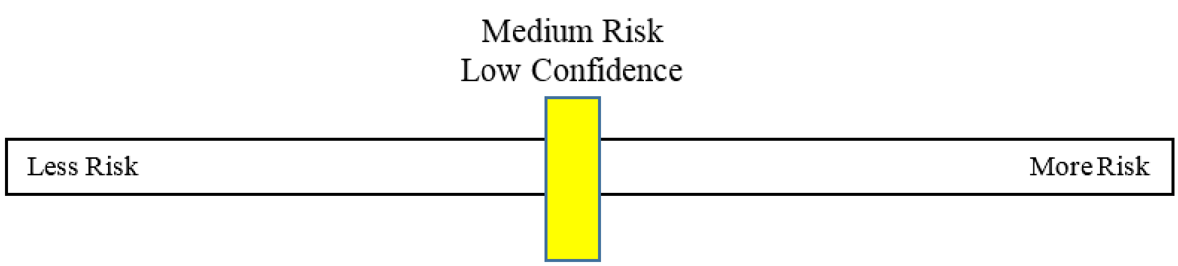
<table>
<tr><td colspan="3">Endpoint: Water Quality</td></tr>
<tr><td colspan="3">Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the California Central Valley Spring-run Chinook chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.</td></tr>
<tr><td colspan="3">Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.</td></tr>
<tr><td>Risk</td><td>Confidence</td><td rowspan="2"></td></tr>
<tr><td>Medium</td><td>Low</td></tr>
</table>

Table 534. Effects analysis summary table; Chinook salmon, California Central Valley Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

<table>
<tr><th rowspan="2">Designated Critical Habitat; Risk Hypotheses</th><th colspan="2">R-plot Derived</th><th rowspan="2">Risk Hypothesis Supported?
Yes/No</th></tr>
<tr><th>Risk</th><th>Confidence</th></tr>
<tr><td>Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.</td><td>Low</td><td>Medium</td><td>No</td></tr>
<tr><td>Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.</td><td>Medium</td><td>Low</td><td>No</td></tr>
<tr><td>Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.</td><td>Medium</td><td>Low</td><td>No</td></tr>
</table>

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of California Central Valley Spring-run Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the California Central Valley Spring-run Chinook salmon ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.5 Lower Columbia River Chinook Designated Critical Habitat; Products Containing 1,3-D

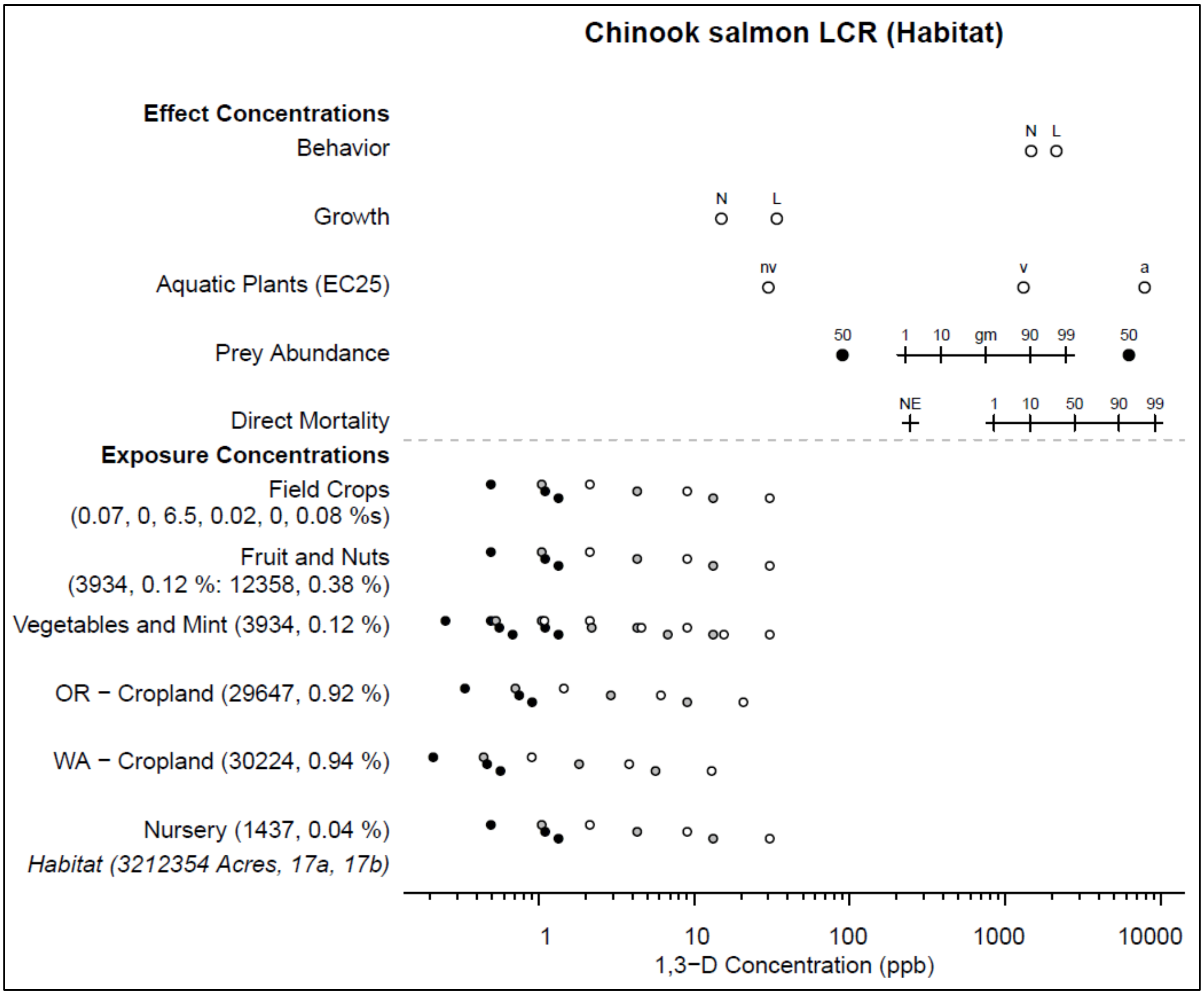


Figure 184. Effects analysis Risk-plot; Chinook salmon, Lower Columbia River ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 535. Likelihood of exposure determination for Chinook salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR - Cropland	1	no	yes	yes	**High**
WA - Cropland	1	no	yes	yes	**High**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 536. Prey risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR - Cropland	0.92	None Expected	None Expected	High
WA - Cropland	0.94	None Expected	None Expected	High
Mint	0.12	None Expected	None Expected	Low
Nursery	0.03	None Expected	None Expected	Low
Fruit and Nuts	0.12, 0.38	None Expected	None Expected	Medium
Field Crops	0.07, 0, 6.5, 0.02, 0, 0.08	None Expected	None Expected	Medium

Vegetable Crops	0.12	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 537. Vegetative cover risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR - Cropland	0.92	Low	Low	High
WA - Cropland	0.94	Low	Low	High
Mint	0.12	Low	Low	Low
Nursery	0.03	Low	Low	Low
Fruit and Nuts	0.12, 0.38	Low	Low	Medium
Field Crops	0.07, 0, 6.5, 0.02, 0, 0.08	Low	Low	Medium
Vegetable Crops	0.12	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 538. Water quality risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Lower Columbia River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

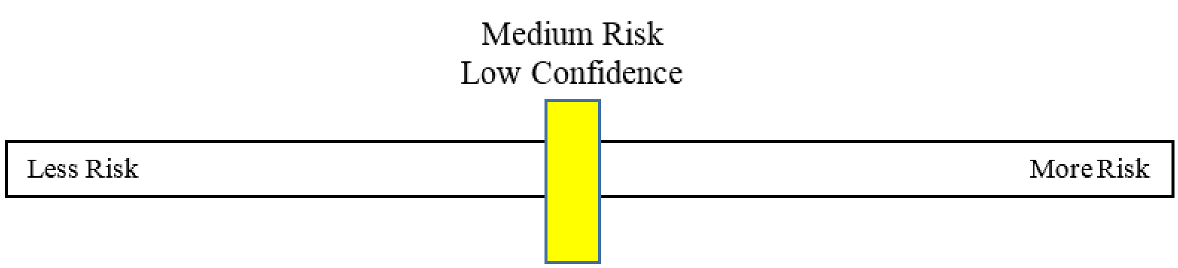
Table 539. Effects analysis summary table; Chinook salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Lower Columbia River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.6 Puget Sound Chinook Designated Critical Habitat; Products Containing 1,3-D

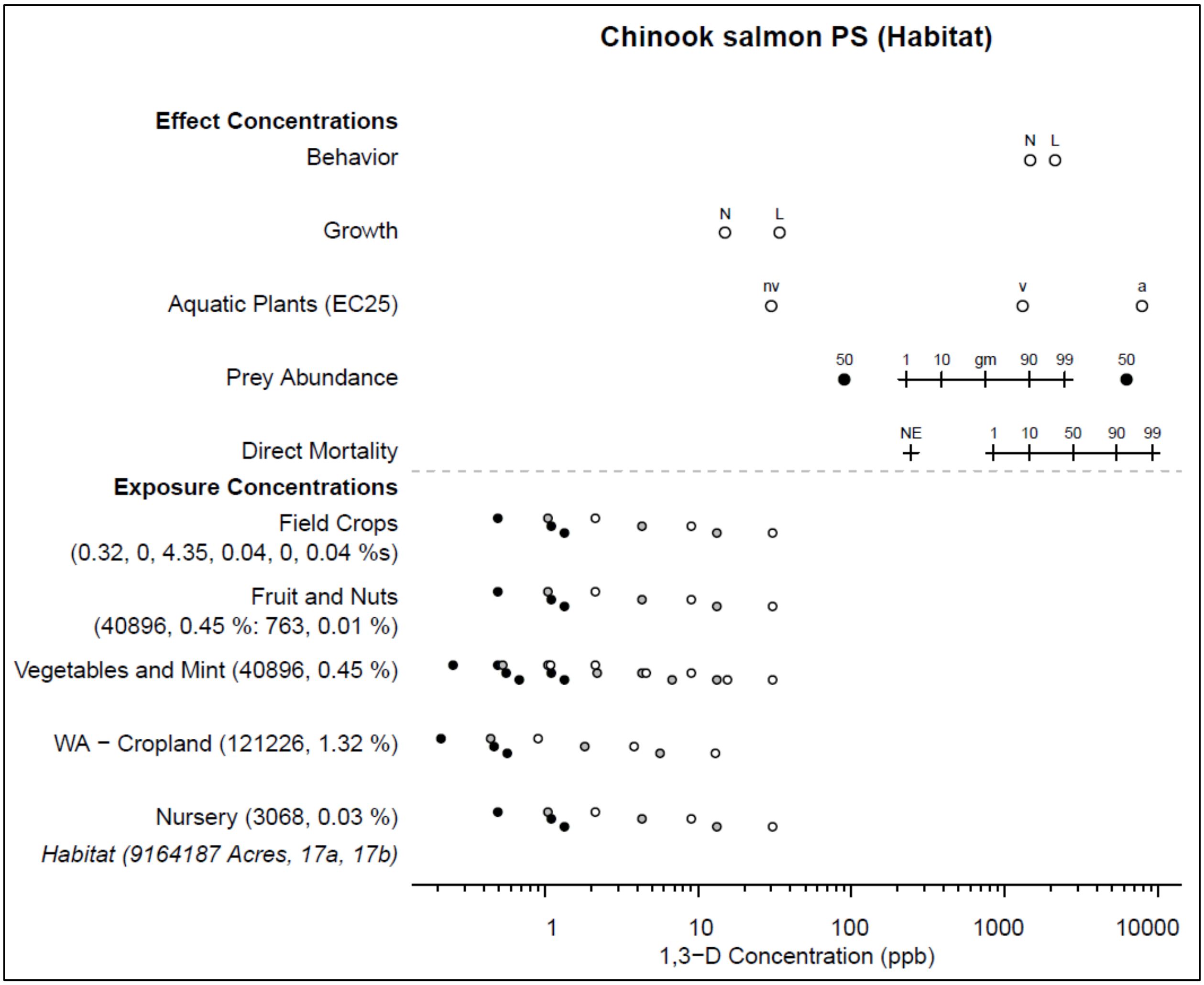


Figure 185. Effects analysis Risk-plot; Chinook salmon, Puget Sound ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 540. Likelihood of exposure determination for Chinook salmon, Puget Sound ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA - Cropland	2	no	yes	NA	Medium
Mint	1	no	no	yes	Medium
Nursery	1	no	no	no	Low
Fruit and Nuts	1	no	no	yes	Medium
Field Crops	2	no	no	NA	Low
Vegetable Crops	1	no	no	yes	Medium

Table 541. Prey risk hypothesis; Chinook salmon, Puget Sound ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	1.32	None Expected	None Expected	Medium
Mint	0.45	None Expected	None Expected	Medium
Nursery	0.03	None Expected	None Expected	Low
Fruit and Nuts	0.45, 0.01	None Expected	None Expected	Medium
Field Crops	0.32, 0, 4.35, 0.04, 0, 0.04	None Expected	None Expected	Low
Vegetable Crops	0.45	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				

Risk	Confidence	
Low	**Medium**	

Table 542. Vegetative cover risk hypothesis; Chinook salmon, Puget Sound ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
WA - Cropland	1.32	Low	Low	Medium
Mint	0.45	Low	Low	Medium
Nursery	0.03	Low	Low	Low
Fruit and Nuts	0.45, 0.01	Low	Low	Medium
Field Crops	0.32, 0, 4.35, 0.04, 0, 0.04	Low	Low	Low
Vegetable Crops	0.45	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Medium	**Low**			

Table 543. Water quality risk hypothesis; Chinook salmon, Puget Sound ESU designated critical habitat and products containing 1,3-Dichloropropene

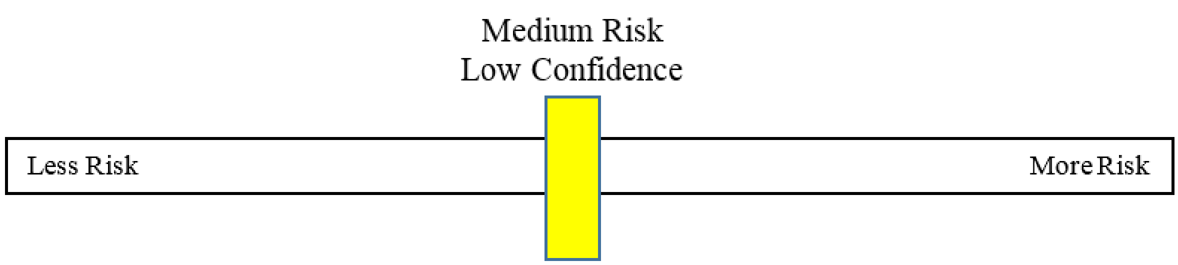
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Puget Sound Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 544. Effects analysis summary table; Chinook salmon, Puget Sound ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Puget Sound Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Puget Sound Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.7 Sacramento River Winter-run Chinook Salmon Designated Critical Habitat; Products Containing 1,3-D

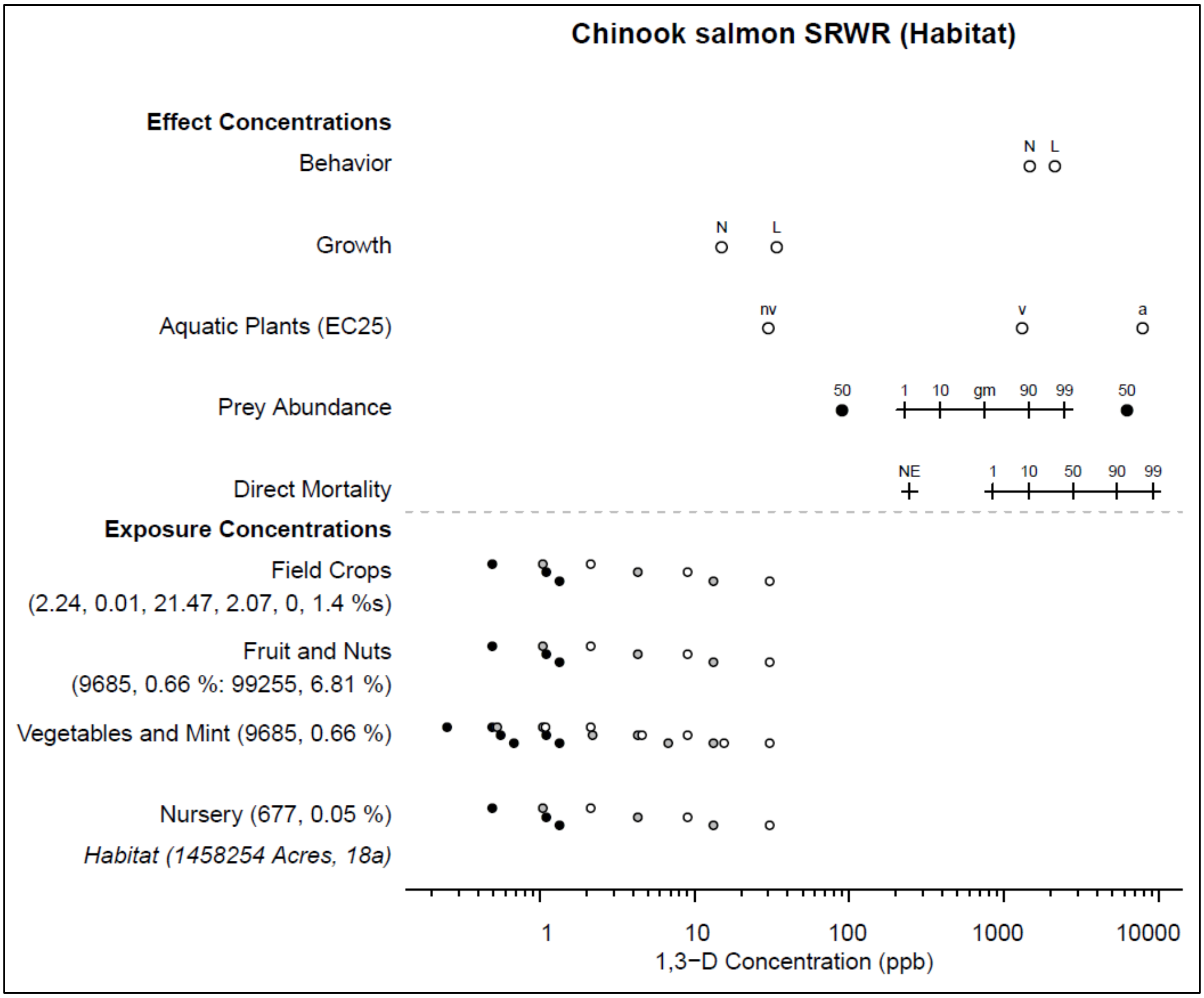


Figure 186. Effects analysis Risk-plot; Chinook salmon, Sacramento River Winter-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 545. Likelihood of exposure determination for Chinook salmon, Sacramento River Winter-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	3	no	no	NA	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 546. Prey risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.66	None Expected	None Expected	Low
Nursery	0.05	None Expected	None Expected	Low
Fruit and Nuts	0.66, 6.81	None Expected	None Expected	Medium
Field Crops	2.24, 0.01, 21.47, 2.07, 0, 1.4	None Expected	None Expected	Medium
Vegetable Crops	0.66	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 547. Vegetative cover risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU designated critical habitat and products containing 1,3-Dichloropropene

<table>
<tr><th colspan="5">Endpoint: Vegetative Cover</th></tr>
<tr><th rowspan="2">Use Category</th><th rowspan="2">% Overlap</th><th colspan="2">Effect of Exposure</th><th rowspan="2">Likelihood of Exposure</th></tr>
<tr><th>1,3-D</th><th>Chloropicrin</th></tr>
<tr><th colspan="5">Aquatic Plants</th></tr>
<tr><td>Mint</td><td>0.66</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Nursery</td><td>0.05</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>0.66, 6.81</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Field Crops</td><td>2.24, 0.01, 21.47, 2.07, 0, 1.4</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>0.66</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><th colspan="5">Terrestrial Plants</th></tr>
<tr><td colspan="5">Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.</td></tr>
<tr><th colspan="5">Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.</th></tr>
<tr><th>Risk</th><th>Confidence</th><td colspan="3" rowspan="2"></td></tr>
<tr><th>Medium</th><th>Low</th></tr>
</table>

Table 548. Water quality risk hypothesis; Chinook salmon, Sacramento River Winter-run ESU designated critical habitat and products containing 1,3-Dichloropropene

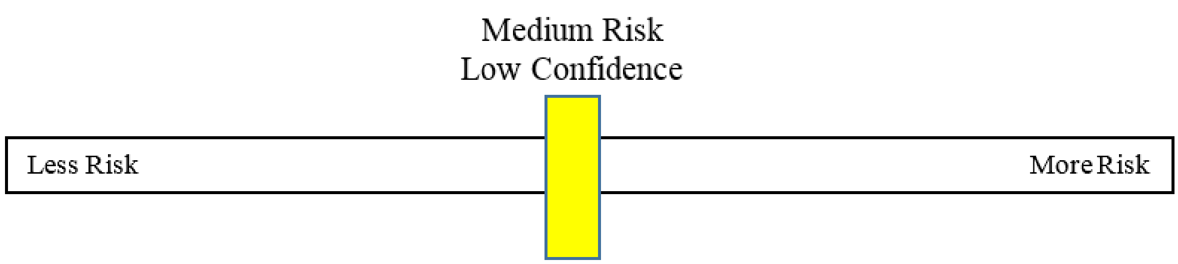
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Sacramento River Winter-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 549. Effects analysis summary table; Chinook salmon, Sacramento River Winter-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Sacramento River Winter-run Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Sacramento River Winter-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.8 Snake River Fall-run Chinook Salmon Designated Critical Habitat; Products Containing 1,3-D

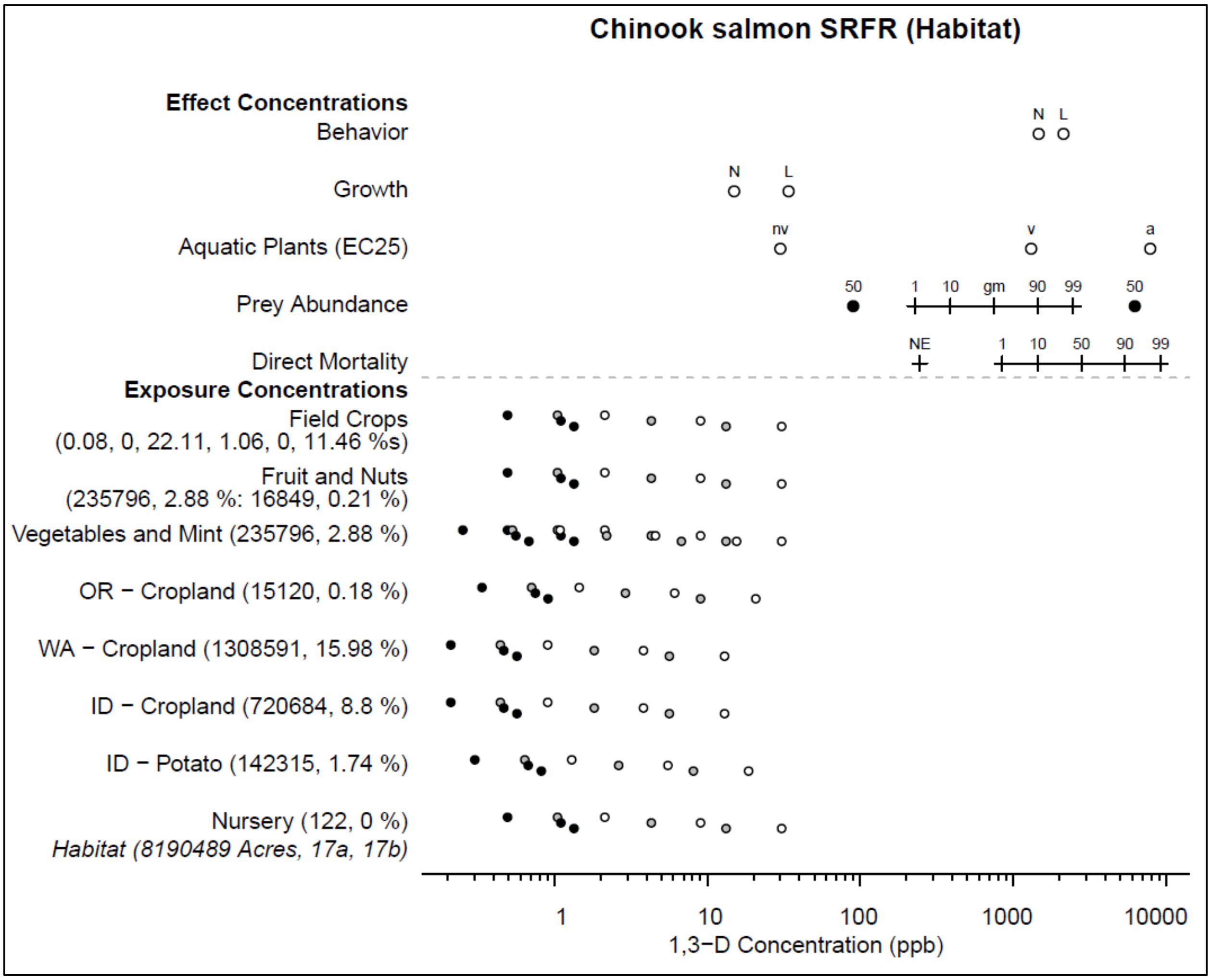


Figure 187. Effects analysis Risk-plot; Chinook salmon, Snake River Fall-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 550. Likelihood of exposure determination for Chinook salmon, Snake River Fall-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	1	no	yes	no	**Low**
WA Cropland	3	no	yes	NA	**High**
ID Cropland	3	no	yes	NA	**High**
ID Potato	2	no	yes	NA	**Medium**
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 551. Prey risk hypothesis; Chinook salmon, Snake River Fall-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	0.18	None Expected	None Expected	Low
WA – Cropland	15.98	None Expected	None Expected	High
ID – Cropland	8.8	None Expected	None Expected	High
ID – Potato	1.74	None Expected	None Expected	Medium
Mint	2.88	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low

Fruit and Nuts	2.88, 0.21	None Expected	None Expected	Low
Field Crops	0.08, 0, 22.11, 1.06, 0, 11.46	None Expected	None Expected	Medium
Vegetable Crops	2.88	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 552. Vegetative cover risk hypothesis; Chinook salmon, Snake River Fall-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	0.18	Low	Low	Low
WA – Cropland	15.98	Low	Low	High
ID – Cropland	8.8	Low	Low	High
ID – Potato	1.74	Low	Low	Medium
Mint	2.88	Low	Low	Low
Nursery	0	Low	Low	Low
Fruit and Nuts	2.88, 0.21	Low	Low	Low
Field Crops	0.08, 0, 22.11, 1.06, 0, 11.46	Low	Low	Medium
Vegetable Crops	2.88	Low	Low	Low
Terrestrial Plants				

Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

Risk	**Confidence**	
Medium	**Low**	

Table 553. Water quality risk hypothesis; Chinook salmon, Snake River Fall-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Snake River Fall-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

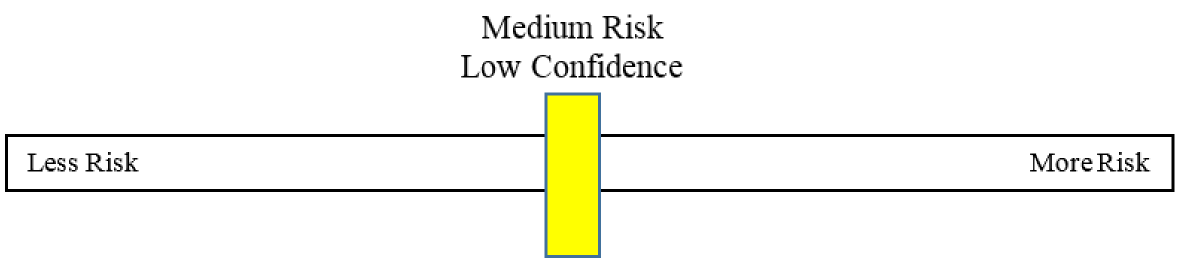
Risk	**Confidence**	
Medium	**Low**	

Table 554. Effects analysis summary table; Chinook salmon, Snake River Fall-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River Fall-run Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Snake River Fall-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.9 Snake River Spring/Summer-run Chinook Salmon Designated Critical Habitat; Products Containing 1,3-D

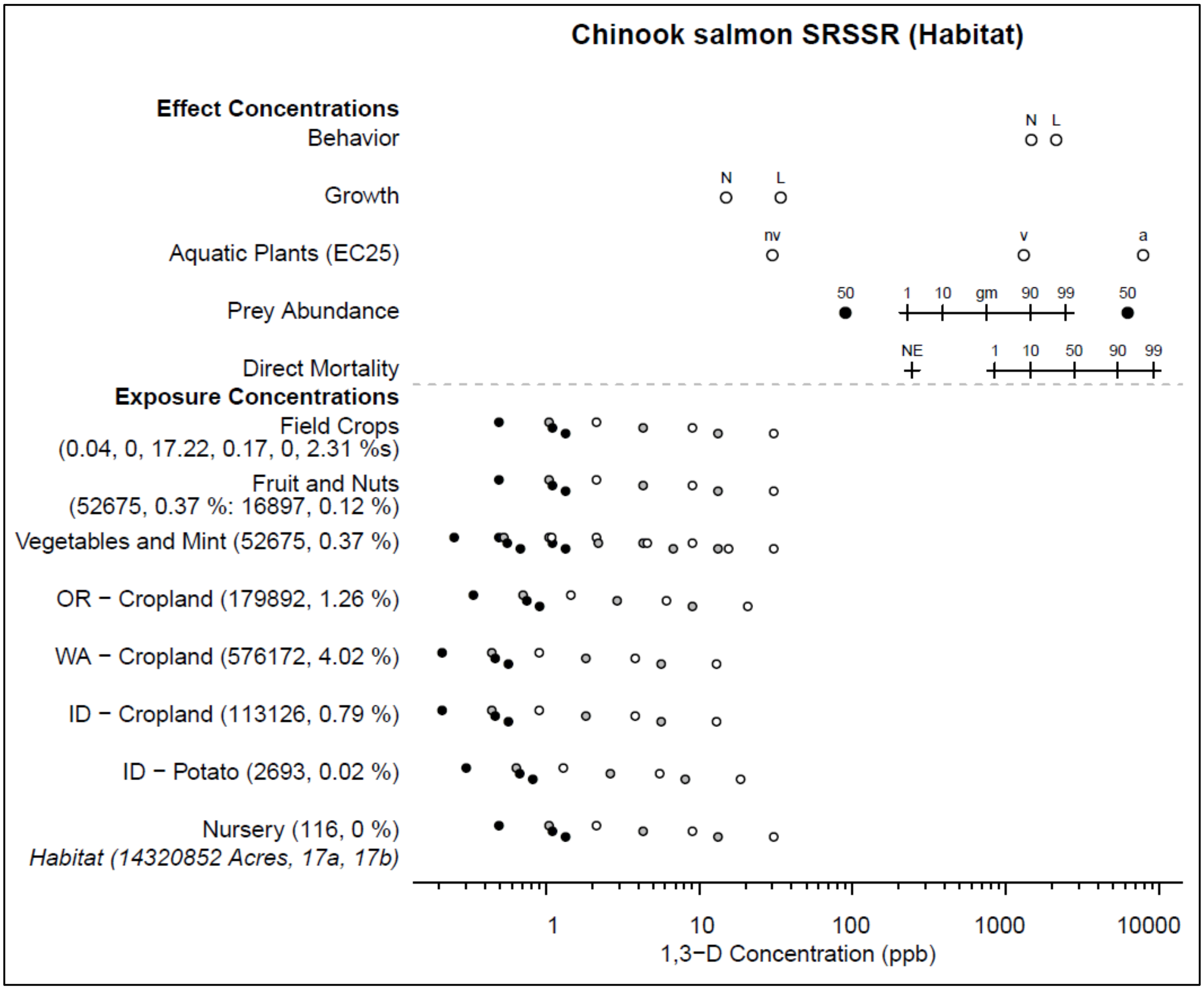


Figure 188. Effects analysis Risk-plot; Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 555. Likelihood of exposure determination for Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	2	no	yes	NA	**Medium**
WA Cropland	2	no	yes	NA	**Medium**
ID Cropland	1	no	yes	yes	**High**
ID Potato	1	no	yes	no	**Low**
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 556. Prey risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	1.26	None Expected	None Expected	Medium
WA – Cropland	4.02	None Expected	None Expected	Medium
ID – Cropland	0.79	None Expected	None Expected	High
ID – Potato	0.02	None Expected	None Expected	Low
Mint	0.37	None Expected	None Expected	Medium

Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0.37, 0.12	None Expected	None Expected	Medium
Field Crops	0.04, 0, 17.22, 0.17, 0, 2.31	None Expected	None Expected	Medium
Vegetable Crops	0.37	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 557. Vegetative cover risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	1.26	Low	Low	Medium
WA – Cropland	4.02	Low	Low	Medium
ID – Cropland	0.79	Low	Low	High
ID – Potato	0.02	Low	Low	Low
Mint	0.37	Low	Low	Medium
Nursery	0	Low	Low	Low
Fruit and Nuts	0.37, 0.12	Low	Low	Medium
Field Crops	0.04, 0, 17.22, 0.17, 0, 2.31	Low	Low	Medium
Vegetable Crops	0.37	Low	Low	Medium

Terrestrial Plants		
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 558. Water quality risk hypothesis; Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

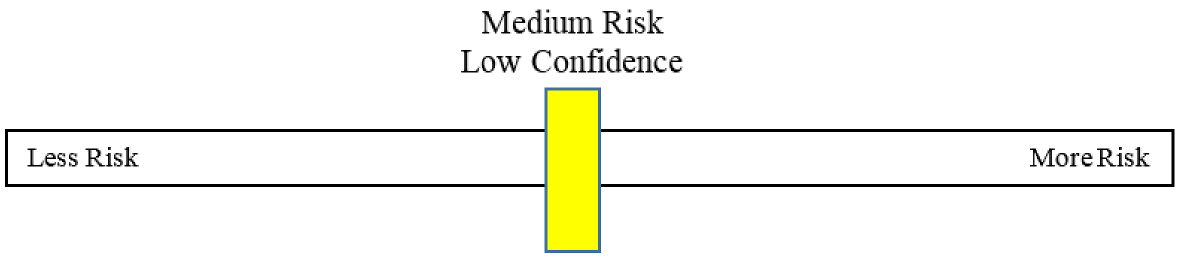
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Snake River Spring/Summer-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 559. Effects analysis summary table; Chinook salmon, Snake River Spring/Summer-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River Spring/Summer-run Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Snake River Spring/Summer-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.10 Upper Columbia River Spring-run Chinook Salmon Designated Critical Habitat; Products Containing 1,3-D

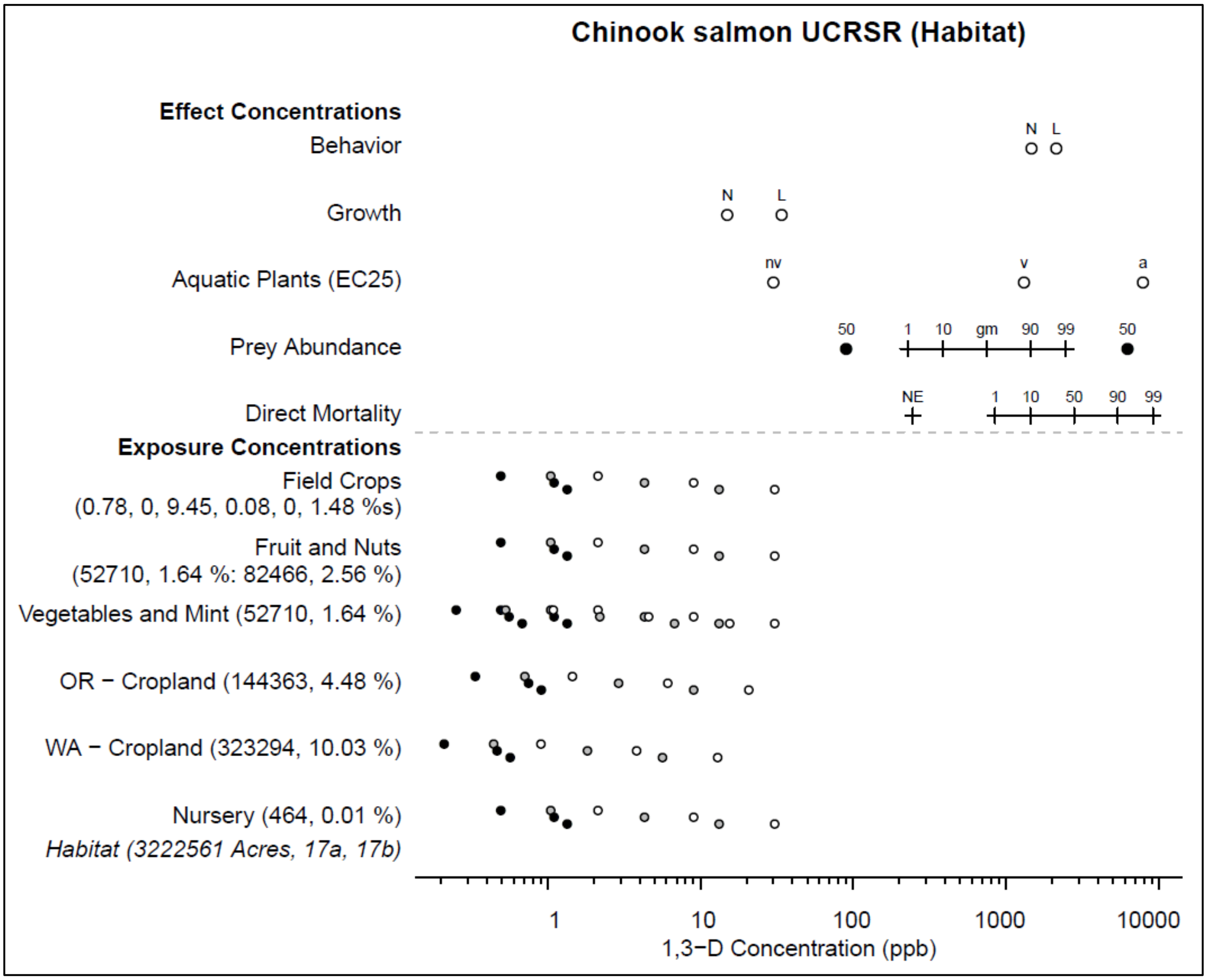


Figure 189. Effects analysis Risk-plot; Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 560. Likelihood of exposure determination for Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	2	no	yes	NA	**Medium**
WA Cropland	3	no	yes	NA	**High**
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 561. Prey risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	4.48	None Expected	None Expected	Medium
WA – Cropland	10.03	None Expected	None Expected	High
Mint	1.64	None Expected	None Expected	Low
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	1.64, 2.56	None Expected	None Expected	Low
Field Crops	0.78, 0, 9.45, 0.08, 0, 1.48	None Expected	None Expected	Medium

Vegetable Crops	1.64	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 562. Vegetative cover risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	4.48	Low	Low	Medium
WA – Cropland	10.03	Low	Low	High
Mint	1.64	Low	Low	Low
Nursery	0.01	Low	Low	Low
Fruit and Nuts	1.64, 2.56	Low	Low	Low
Field Crops	0.78, 0, 9.45, 0.08, 0, 1.48	Low	Low	Medium
Vegetable Crops	1.64	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 563. Water quality risk hypothesis; Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Upper Columbia River Spring-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

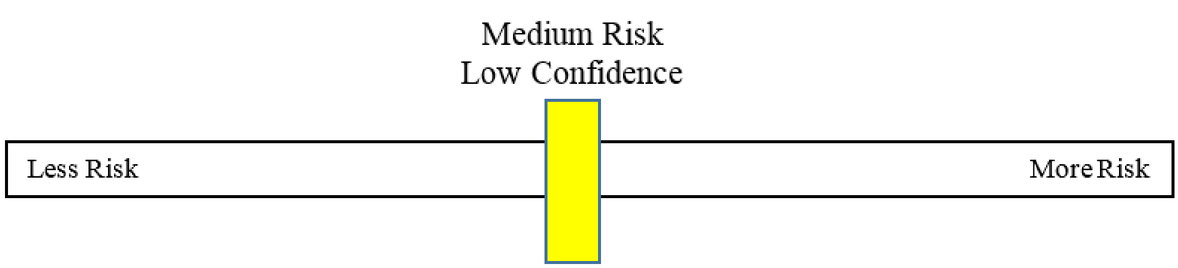
Table 564. Effects analysis summary table; Chinook salmon, Upper Columbia River Spring-run ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Columbia River Spring-run Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Upper Columbia River Spring-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.11 Upper Willamette River Chinook Salmon Designated Critical Habitat; Products Containing 1,3-D

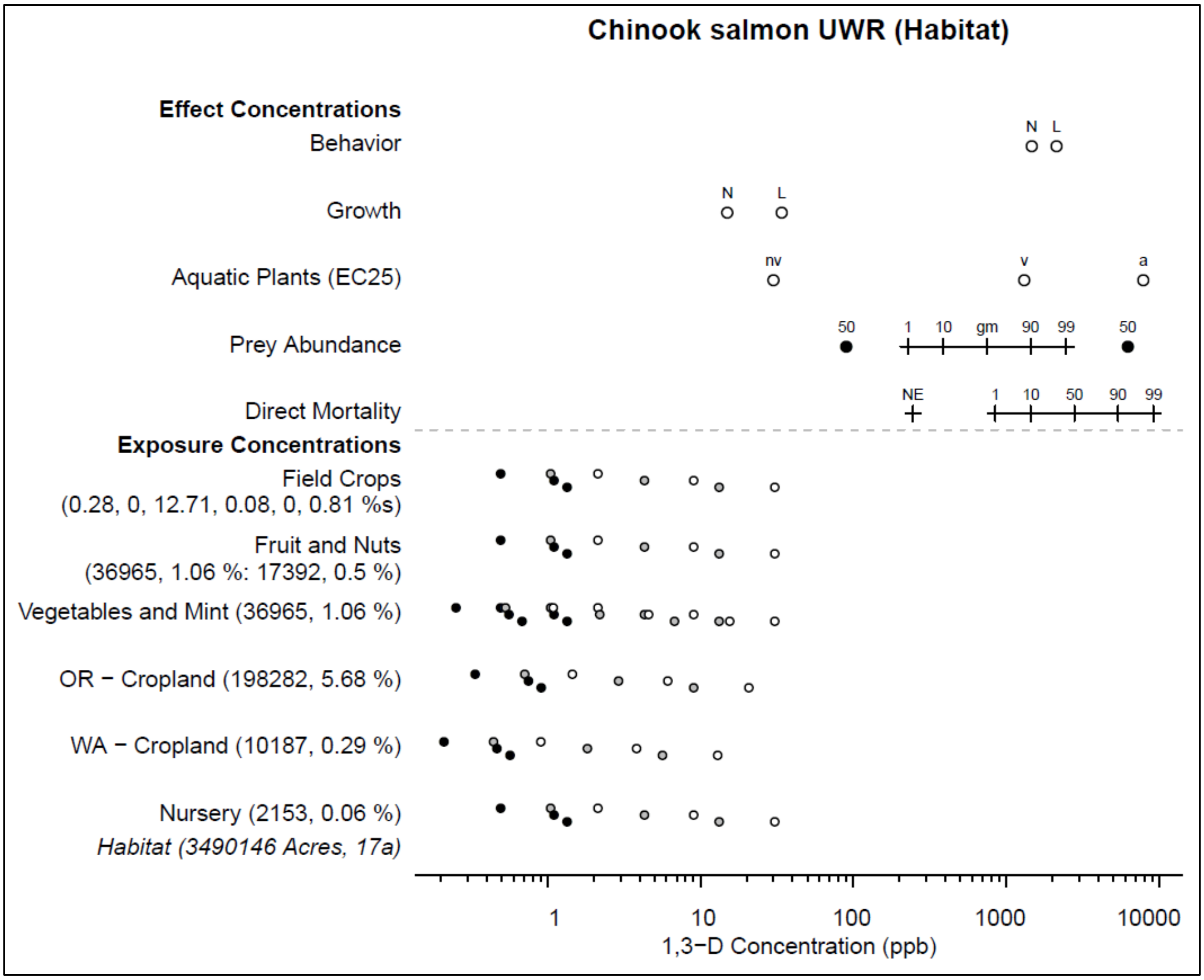


Figure 190. Effects analysis Risk-plot; Chinook salmon, Upper Willamette River ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 565. Likelihood of exposure determination for Chinook salmon, Upper Willamette River ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	3	no	yes	NA	**High**
WA Cropland	1	no	yes	no	**Low**
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 566. Prey risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	5.68	None Expected	None Expected	High
WA – Cropland	0.29	None Expected	None Expected	Low
Mint	1.06	None Expected	None Expected	Low
Nursery	0.06	None Expected	None Expected	Low
Fruit and Nuts	1.06, 0.5	None Expected	None Expected	Low
Field Crops	0.28, 0, 12.71, 0.08, 0, 0.81	None Expected	None Expected	Medium

Vegetable Crops	1.06	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 567. Vegetative cover risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	5.68	Low	Low	High
WA – Cropland	0.29	Low	Low	Low
Mint	1.06	Low	Low	Low
Nursery	0.06	Low	Low	Low
Fruit and Nuts	1.06, 0.5	Low	Low	Low
Field Crops	0.28, 0, 12.71, 0.08, 0, 0.81	Low	Low	Medium
Vegetable Crops	1.06	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 568. Water quality risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Upper Willamette River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

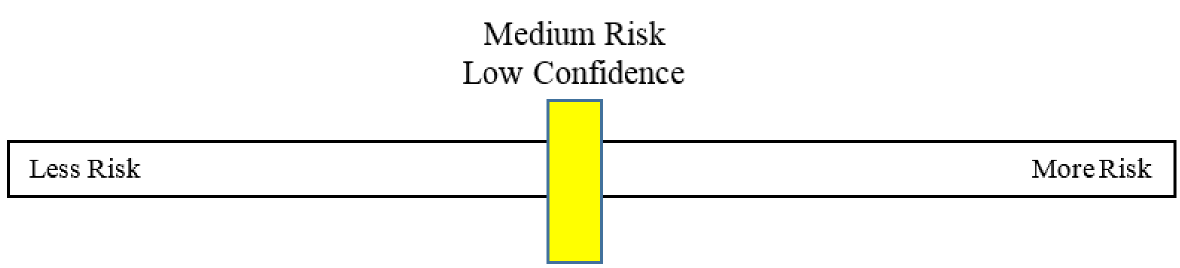
Table 569. Effects analysis summary table; Chinook salmon, Upper Willamette River ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Willamette River Chinook salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Upper Willamette River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.12 Central California Coast Coho Salmon Designated Critical Habitat; Products Containing 1,3-D

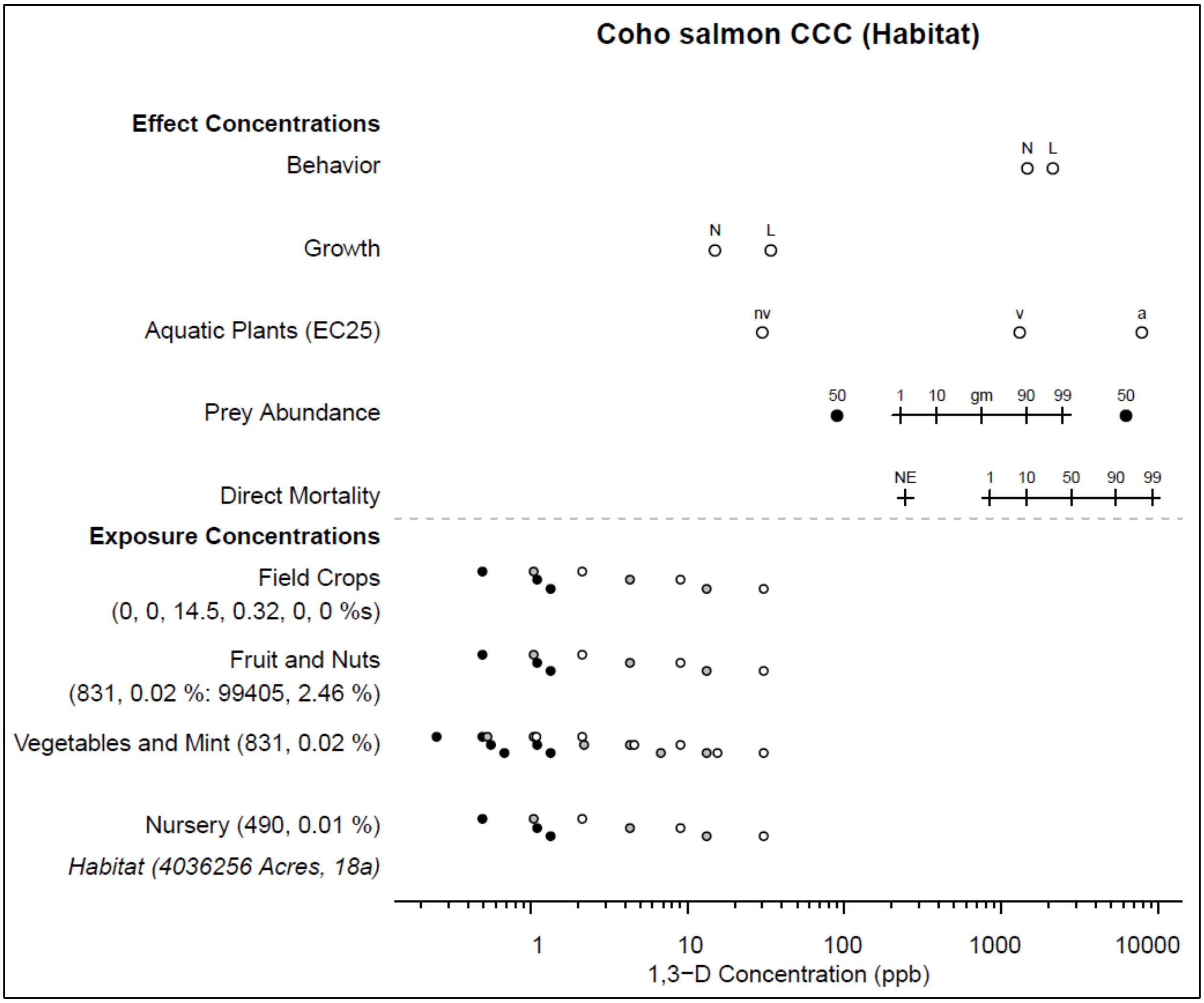


Figure 191. Effects analysis Risk-plot; Coho salmon, Central California Coast ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 570. Likelihood of exposure determination for Coho salmon, Central California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 571. Prey risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.02	None Expected	None Expected	Low
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	0.02, 2.46	None Expected	None Expected	Low
Field Crops	0, 0, 14.5, 0.32, 0, 0	None Expected	None Expected	Medium
Vegetable Crops	1.02	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 572. Vegetative cover risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
Mint	0.02	Low	Low	Low
Nursery	0.01	Low	Low	Low
Fruit and Nuts	0.02, 2.46	Low	Low	Low
Field Crops	0, 0, 14.5, 0.32, 0, 0	Low	Low	Medium
Vegetable Crops	1.02	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 573. Water quality risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality

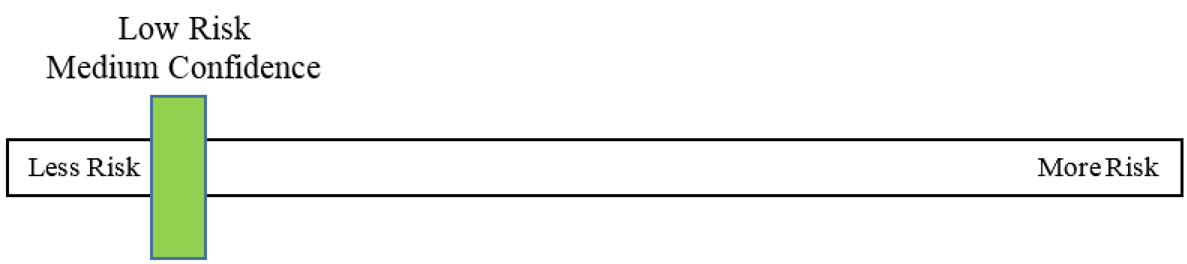
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Central California Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 574. Effects analysis summary table; Coho salmon, Central California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Central California Coast coho salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Central California Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.13 Lower Columbia River Coho Salmon Designated Critical Habitat; Products Containing 1,3-D

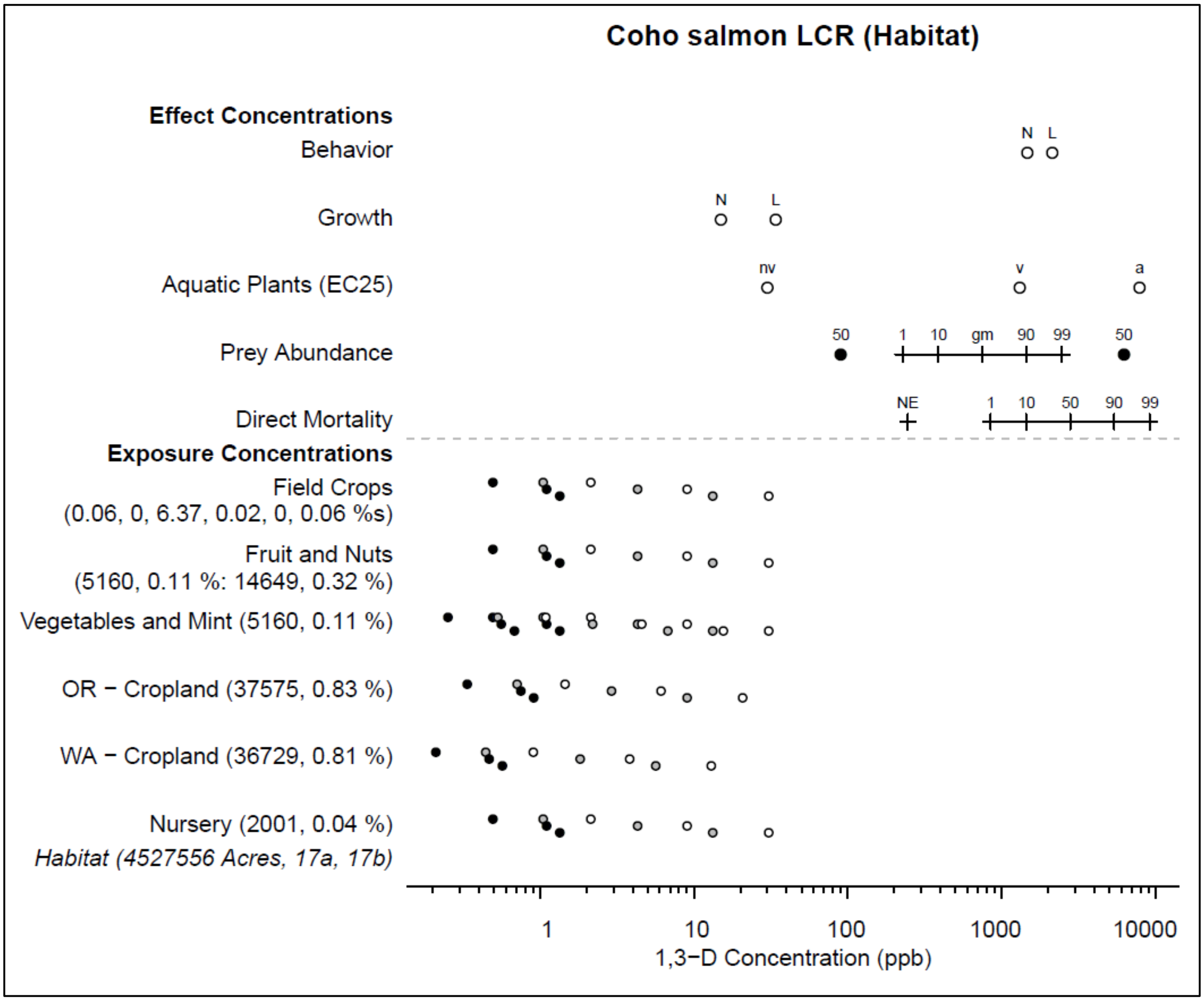


Figure 192. Effects analysis Risk-plot; Coho salmon, Lower Columbia River ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 575. Likelihood of exposure determination for Coho salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	1	no	yes	yes	**High**
WA Cropland	1	no	yes	yes	**High**
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 576. Prey risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	0.83	None Expected	None Expected	High
WA – Cropland	0.81	None Expected	None Expected	High
Mint	0.11	None Expected	None Expected	Medium
Nursery	0.04	None Expected	None Expected	Low
Fruit and Nuts	0.11, 0.32	None Expected	None Expected	Medium
Field Crops	0.06, 0, 6.37, 0.02, 0, 0.06	None Expected	None Expected	Medium

Vegetable Crops	0.11	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 577. Vegetative cover risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	0.83	Low	Low	High
WA – Cropland	0.81	Low	Low	High
Mint	0.11	Low	Low	Medium
Nursery	0.04	Low	Low	Low
Fruit and Nuts	0.11, 0.32	Low	Low	Medium
Field Crops	0.06, 0, 6.37, 0.02, 0, 0.06	Low	Low	Medium
Vegetable Crops	0.11	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 578. Water quality risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Lower Columbia River coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

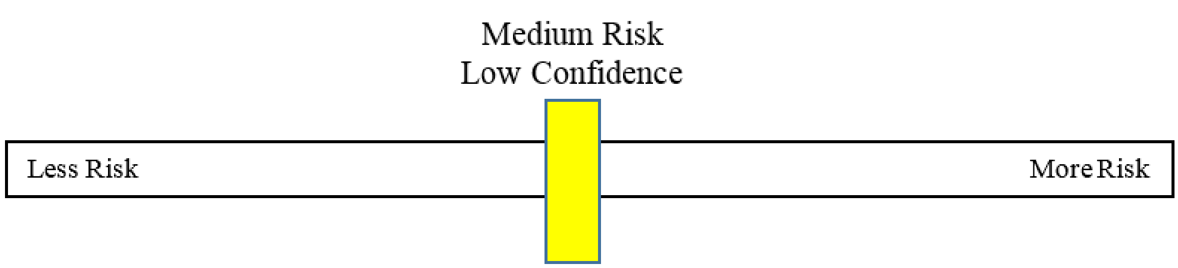
Table 579. Effects analysis summary table; Coho salmon, Lower Columbia River ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River coho salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Lower Columbia River coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.14 Oregon Coast Coho Salmon Designated Critical Habitat; Products Containing 1,3-D

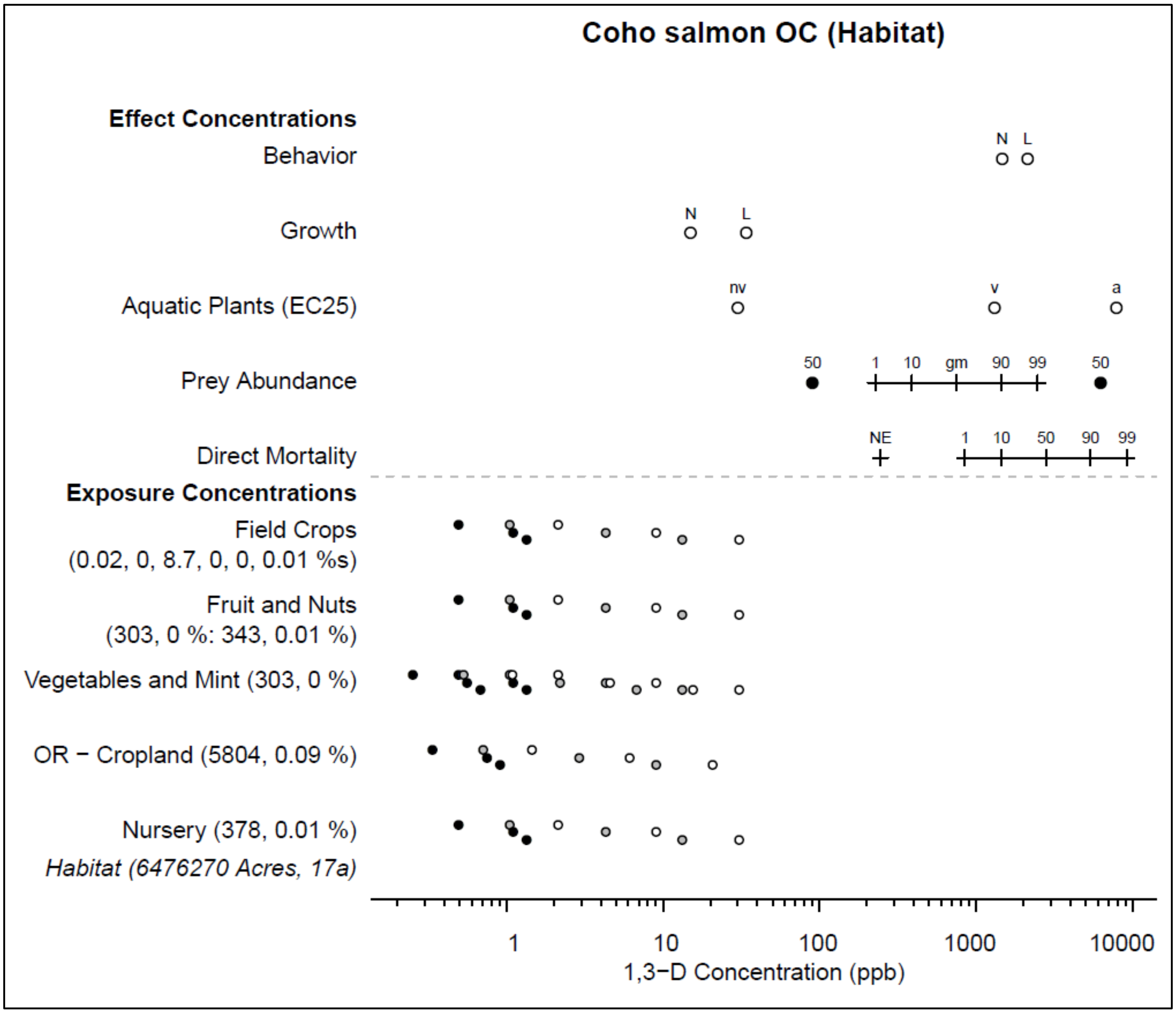


Figure 193. Effects analysis Risk-plot; Coho salmon, Oregon Coast ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 580. Likelihood of exposure determination for Coho salmon, Oregon Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	1	no	yes	no	**Low**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 581. Prey risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR Cropland	0.09	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0.01	None Expected	None Expected	Low
Fruit and Nuts	0, 0.01	None Expected	None Expected	Low
Field Crops	0.02, 0, 8.7, 0, 0, 0.01	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				

Risk	Confidence	
Low	**Medium**	

Table 582. Vegetative cover risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR Cropland	0.09	Low	Low	Low
Mint	0	Low	Low	Low
Nursery	0.01	Low	Low	Low
Fruit and Nuts	0, 0.01	Low	Low	Low
Field Crops	0.02, 0, 8.7, 0, 0, 0.01	Low	Low	Medium
Vegetable Crops	0	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 583. Water quality risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

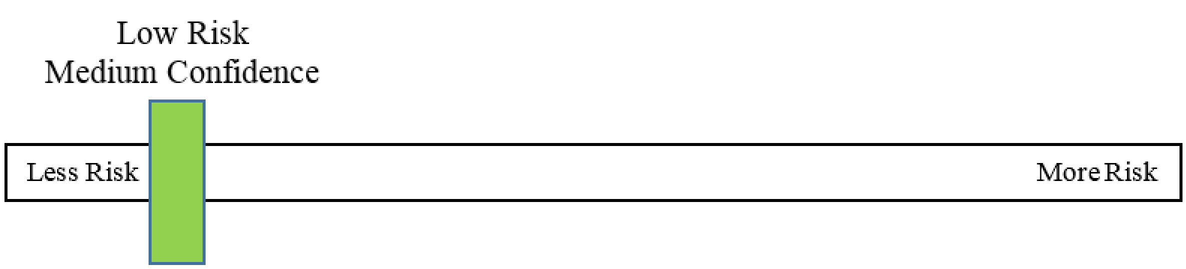
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Oregon Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 584. Effects analysis summary table; Coho salmon, Oregon Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Oregon Coast coho salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Oregon Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.15 Southern Oregon Northern California (SONC) Coho Salmon Designated Critical Habitat; Products Containing 1,3-D

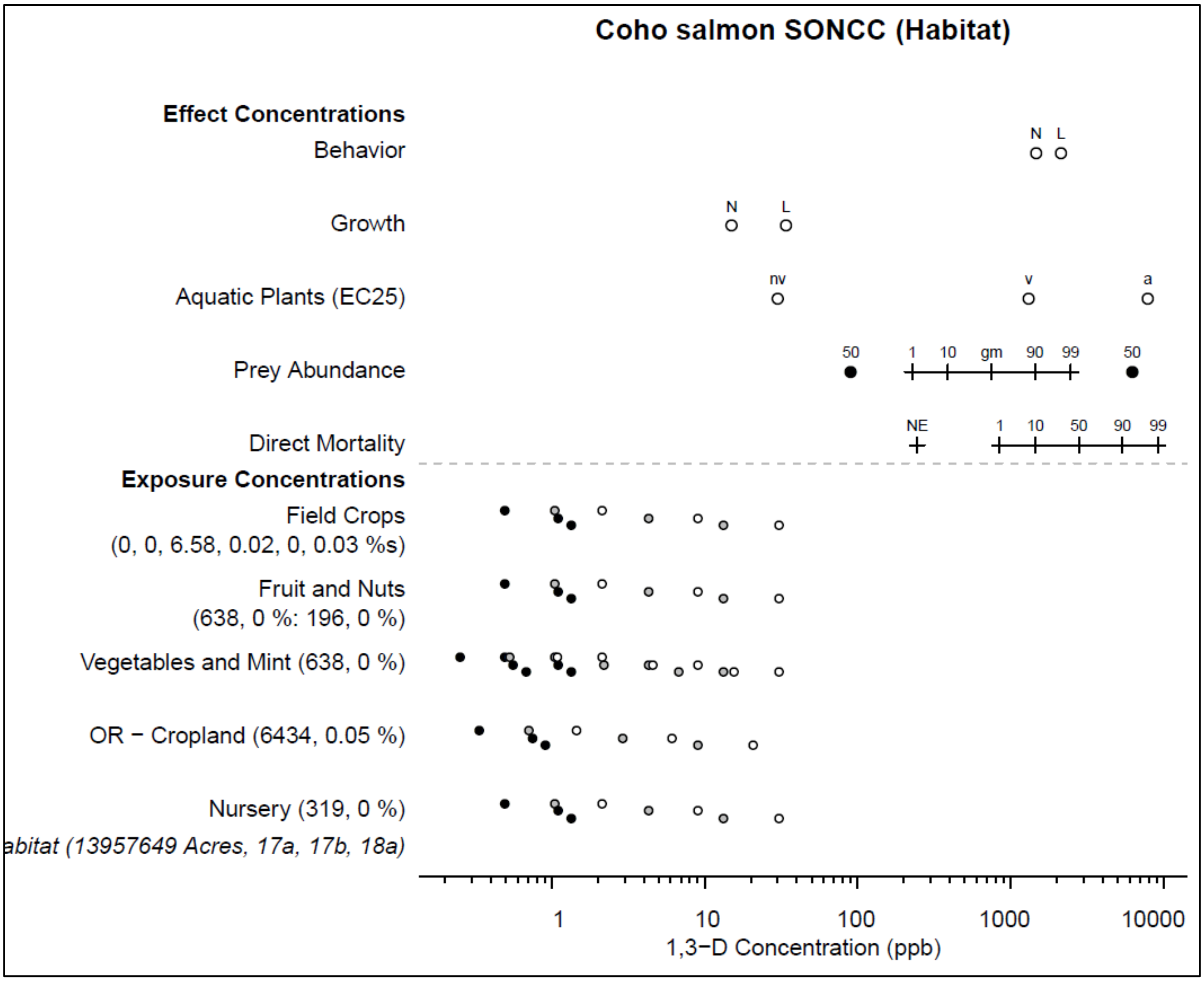


Figure 194. Effects analysis Risk-plot; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 585. Likelihood of exposure determination for Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
OR Cropland	1	no	yes	yes	**High**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	3	no	no	yes	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 586. Prey risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	0.05	None Expected	None Expected	High
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0, 0	None Expected	None Expected	Low
Field Crops	0, 0, 6.58, 0.02, 0, 0.03	None Expected	None Expected	Medium
Vegetable Crops	0	None Expected	None Expected	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**Medium**	

Table 587. Vegetative cover risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	0.05	Low	Low	High
Mint	0	Low	Low	Low
Nursery	0	Low	Low	Low
Fruit and Nuts	0, 0	Low	Low	Low
Field Crops	0, 0, 6.58, 0.02, 0, 0.03	Low	Low	Medium
Vegetable Crops	0	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**Medium**	

Table 588. Water quality risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Southern Oregon Northern California Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

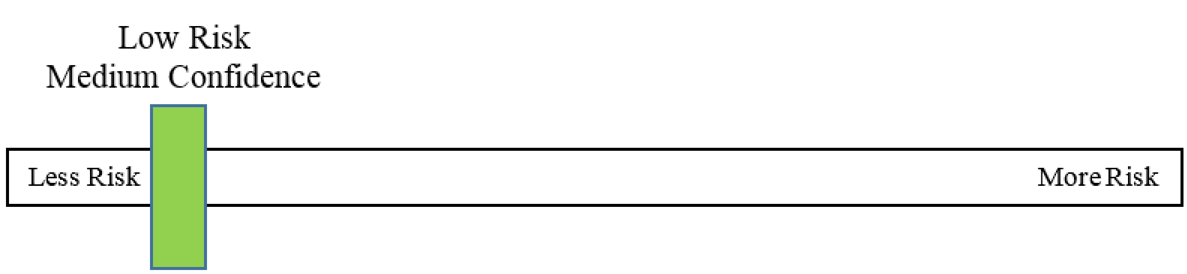
Table 589. Effects analysis summary table; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Southern Oregon Northern California Coast coho salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Southern Oregon Northern California Coast coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.16 Ozette Lake Sockeye Designated Critical Habitat; Products Containing 1,3-D

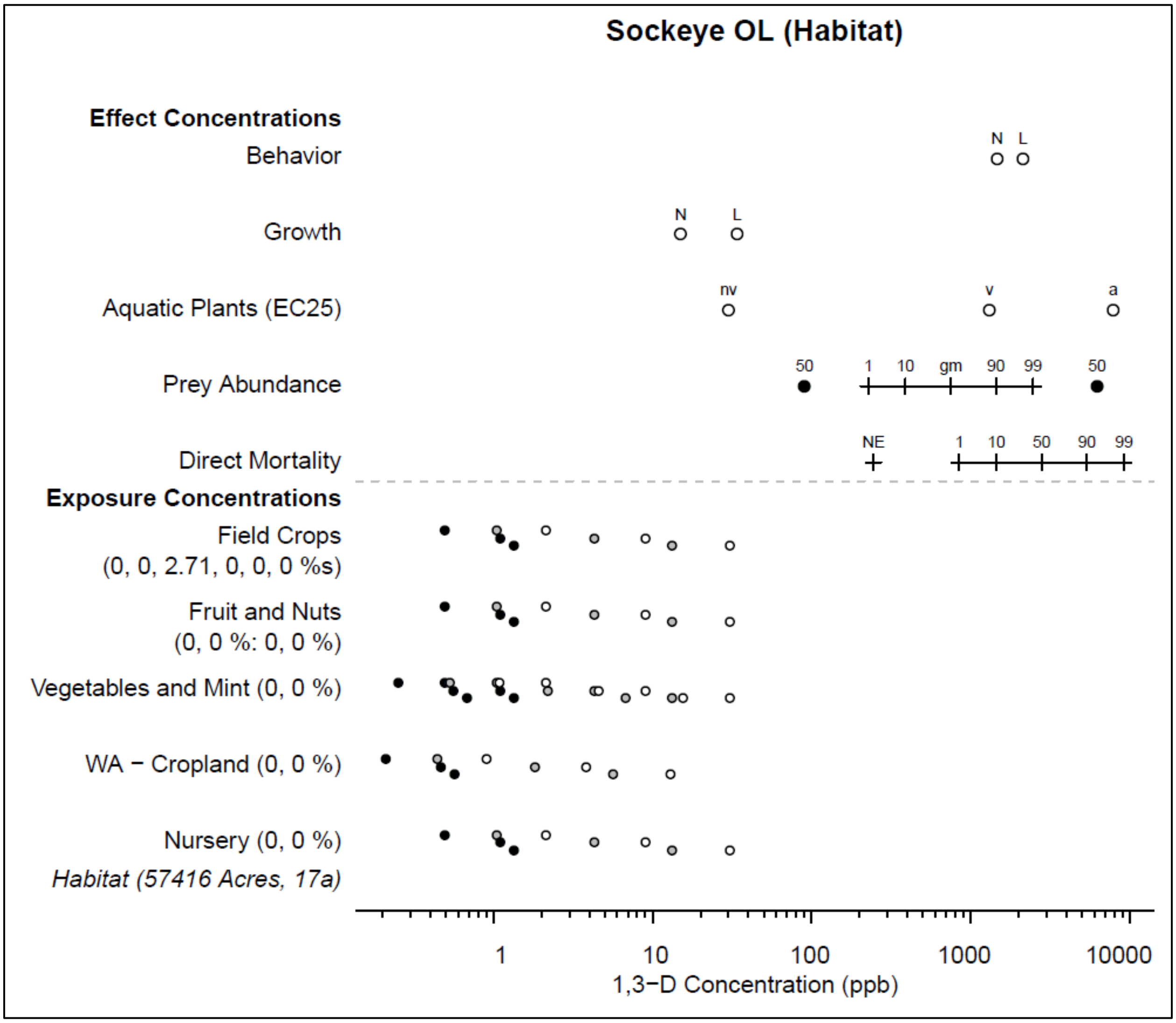


Figure 195. Effects analysis Risk-plot; Sockeye salmon, Ozette Lake ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 590. Likelihood of exposure determination for Sockeye salmon, Ozette Lake ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	1	no	yes	no	**Low**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	2	no	no	NA	**Low**
Vegetable Crops	1	no	no	no	**Low**

Table 591. Prey risk hypothesis; Sockeye salmon, Ozette Lake ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	0	None Expected	None Expected	Low
Mint	0	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low
Fruit and Nuts	0, 0	None Expected	None Expected	Low
Field Crops	0, 0, 2.71, 0, 0, 0	None Expected	None Expected	Low
Vegetable Crops	0	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				

Risk	Confidence	
Low	**Medium**	

Table 592. Vegetative cover risk hypothesis; Sockeye salmon, Ozette Lake ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
WA - Cropland	0	Low	Low	Low
Mint	0			Low
Nursery	0	Low	Low	Low
Fruit and Nuts	0, 0	Low	Low	Low
Field Crops	0, 0, 2.71, 0, 0, 0	Low	Low	Low
Vegetable Crops	0	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 593. Water quality risk hypothesis; Sockeye salmon, Ozette Lake ESU designated critical habitat and products containing 1,3-Dichloropropene

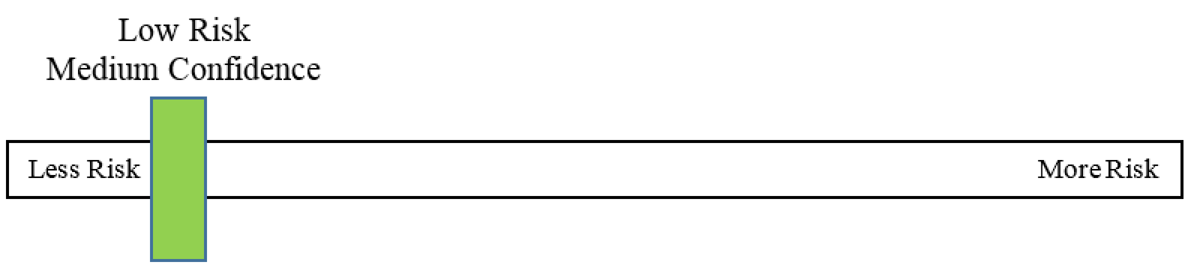
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Ozette Lake sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 594. Effects analysis summary table; Sockeye salmon, Ozette Lake ESU designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Ozette Lake sockeye salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Ozette Lake sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as low, and the confidence in that risk as medium. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.17 Snake River Sockeye Salmon Designated Critical Habitat; Products Containing 1,3-D

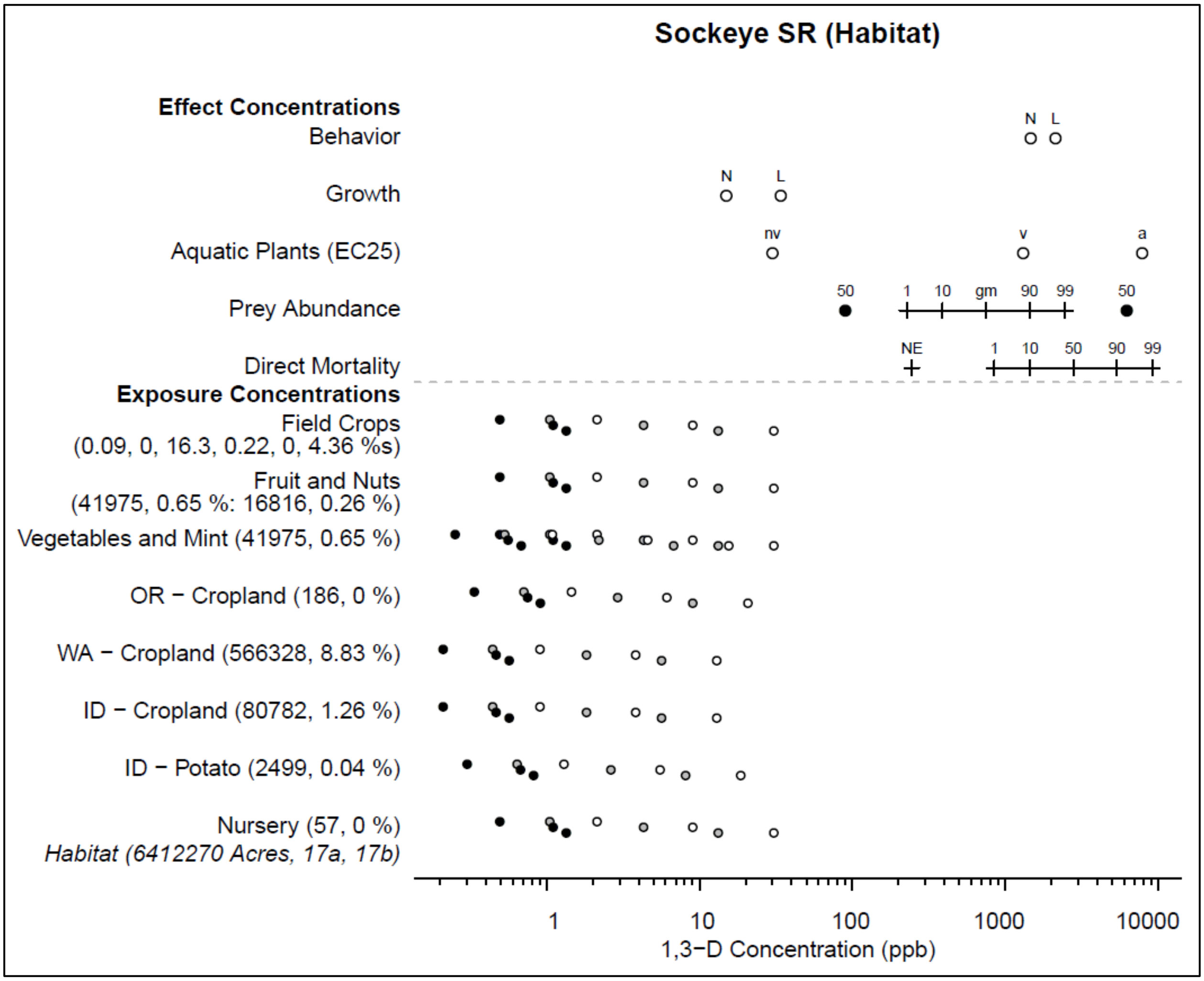


Figure 196. Effects analysis Risk-plot; Sockeye salmon, Snake River ESU designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 595. Likelihood of exposure determination for Sockeye salmon, Snake River ESU designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	3	no	yes	NA	**High**
OR Cropland	1	no	yes	no	**Low**
ID Cropland	2	no	yes	NA	**Medium**
ID Potato	1	no	yes	no	**Low**
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 596. Prey risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	0	None Expected	None Expected	Low
WA – Cropland	8.83	None Expected	None Expected	High
ID – Cropland	1.26	None Expected	None Expected	Medium
ID – Potato	0.04	None Expected	None Expected	Low
Mint	0.65	None Expected	None Expected	Low
Nursery	0	None Expected	None Expected	Low

Fruit and Nuts	0.65, 0.26	None Expected	None Expected	Low
Field Crops	0.09, 0, 16.3, 0.22, 0, 4.36	None Expected	None Expected	Medium
Vegetable Crops	0.65	None Expected	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 597. Vegetative cover risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	0	Low	Low	Low
WA – Cropland	8.83	Low	Low	High
ID – Cropland	1.26	Low	Low	Medium
ID – Potato	0.04	Low	Low	Low
Mint	0.65	Low	Low	Low
Nursery	0	Low	Low	Low
Fruit and Nuts	0.65, 0.26	Low	Low	Low
Field Crops	0.09, 0, 16.3, 0.22, 0, 4.36	Low	Low	Medium
Vegetable Crops	0.65	Low	Low	Low
Terrestrial Plants				

Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

Risk	Confidence	
Medium	**Low**	

Table 598. Water quality risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Snake River sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

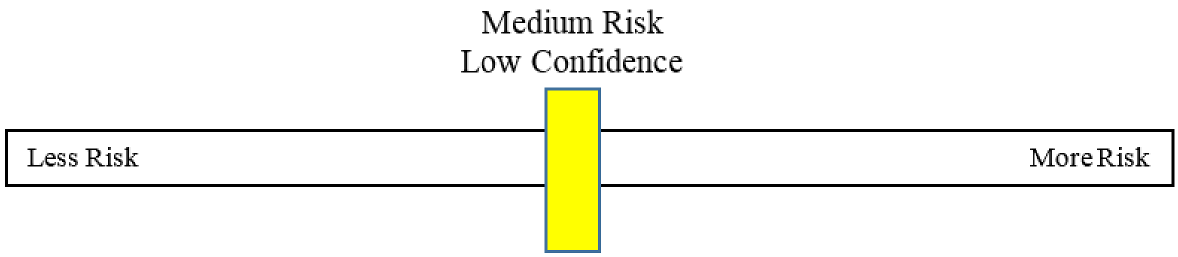
Risk	**Confidence**	
Medium	**Low**	

Table 599. Effects analysis summary table; Sockeye salmon, Snake River ESU designated critical habitat and products containing 1,3-Dichloropropene

Designated Critical Habitat; Risk Hypotheses	R-plot Derived		Risk Hypothesis Supported? Yes/No
	Risk	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River sockeye salmon designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Snake River sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.18 California Central Valley Steelhead Designated Critical Habitat; Products Containing 1,3-D

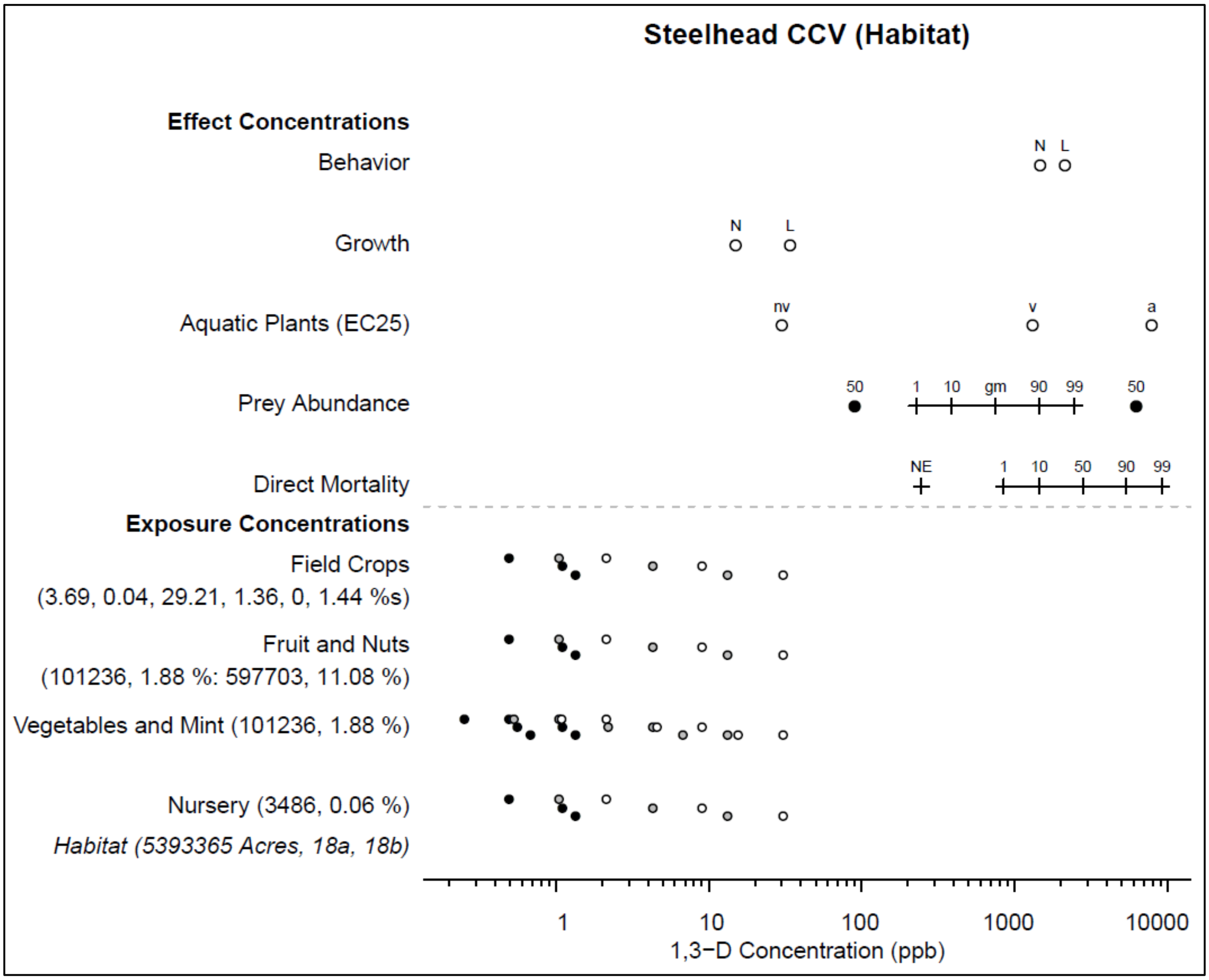


Figure 197. Effects analysis Risk-plot; Steelhead, California Central Valley DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 600. Likelihood of exposure determination for Steelhead, California Central Valley DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	3	no	no	NA	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 601. Prey risk hypothesis; Steelhead, California Central Valley DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates/Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	1.88	None Expected	None Expected / Medium	Low
Nursery	0.06	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.88, 11.08	None Expected	None Expected / Medium	Medium
Field Crops	3.69, 0.04, 29.21, 1.36, 0, 1.44	None Expected	None Expected / Medium	Medium
Vegetable Crops	1.88	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			

Low	**Medium**	

Table 602. Vegetative cover risk hypothesis; Steelhead, California Central Valley DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
Mint	1.88	Low	Low	Low
Nursery	0.06	Low	Low	Low
Fruit and Nuts	1.88, 11.08	Low	Low	Medium
Field Crops	3.69, 0.04, 29.21, 1.36, 0, 1.44	Low	Low	Medium
Vegetable Crops	1.88	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Medium	**Low**			

Table 603. Water quality risk hypothesis; Steelhead, California Central Valley DPS designated critical habitat and products containing 1,3-Dichloropropene

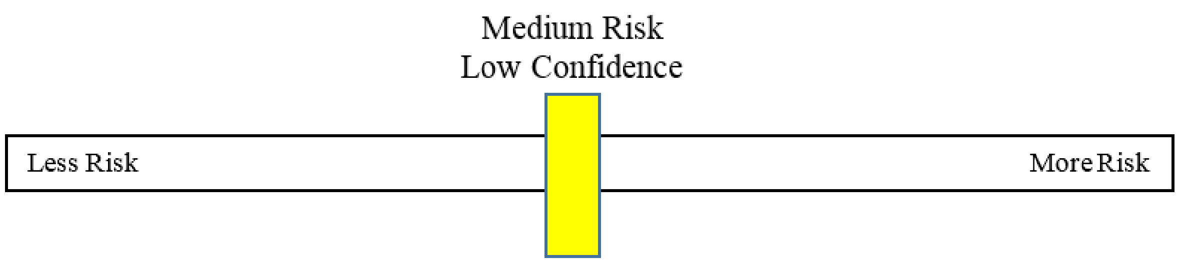
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the California Central Valley steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 604. Effects analysis summary table; Steelhead, California Central Valley DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of California Central Valley steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the California Central Valley steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.19 Central California Coast Steelhead Designated Critical Habitat; Products Containing 1,3-D

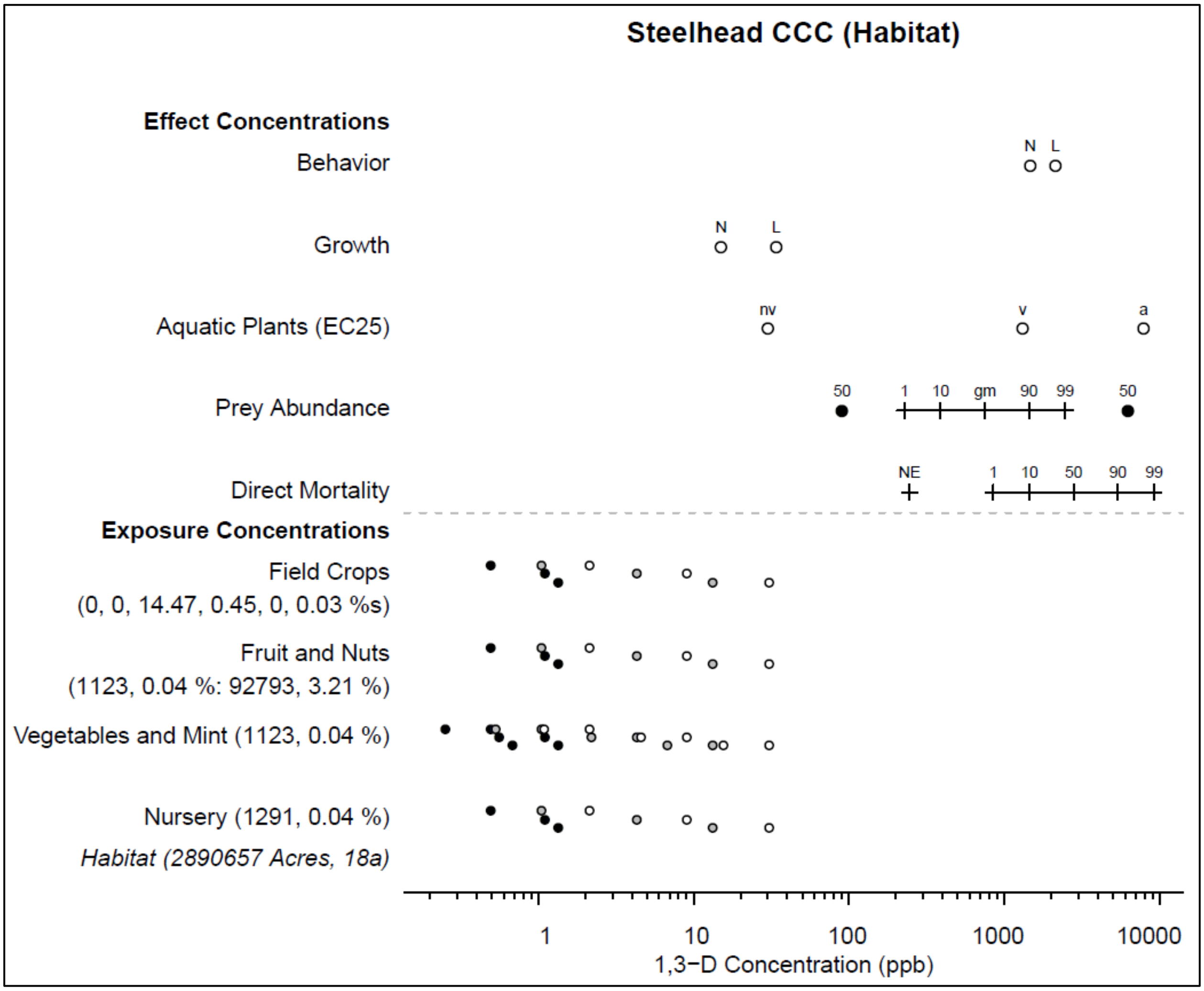


Figure 198. Effects analysis Risk-plot; Steelhead, Central California Coast DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 605. Likelihood of exposure determination for Steelhead, Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 606. Prey risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.04	None Expected	None Expected / Medium	Low
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.04, 3.21	None Expected	None Expected / Medium	Low
Field Crops	0, 0, 14.47, 0.45, 0, 0.03	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.04	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 607. Vegetative cover risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

<table>
<tr><td colspan="5">Endpoint: Vegetative Cover</td></tr>
<tr><td rowspan="2">Use Category</td><td rowspan="2">% Overlap</td><td colspan="2">Effect of Exposure</td><td rowspan="2">Likelihood of Exposure</td></tr>
<tr><td>1,3-D</td><td>Chloropicrin</td></tr>
<tr><td colspan="5">Aquatic Plants</td></tr>
<tr><td>Mint</td><td>0.04</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Nursery</td><td>0.04</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>0.04, 3.21</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Field Crops</td><td>0, 0, 14.47, 0.45, 0, 0.03</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>0.04</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td colspan="5">Terrestrial Plants</td></tr>
<tr><td colspan="5">Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.</td></tr>
<tr><td colspan="5">Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.</td></tr>
<tr><td>Risk</td><td>Confidence</td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Low</td><td>Medium</td></tr>
</table>

Table 608. Water quality risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

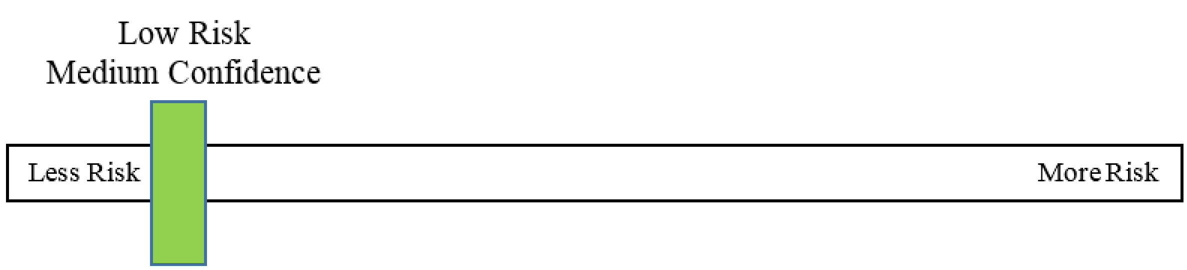
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Central California Coast steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 609. Effects analysis summary table; Steelhead, Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported?**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	**Yes/No**
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Central California Coast steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Central California Coast steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.20 Lower Columbia River Steelhead Designated Critical Habitat; Products Containing 1,3-D

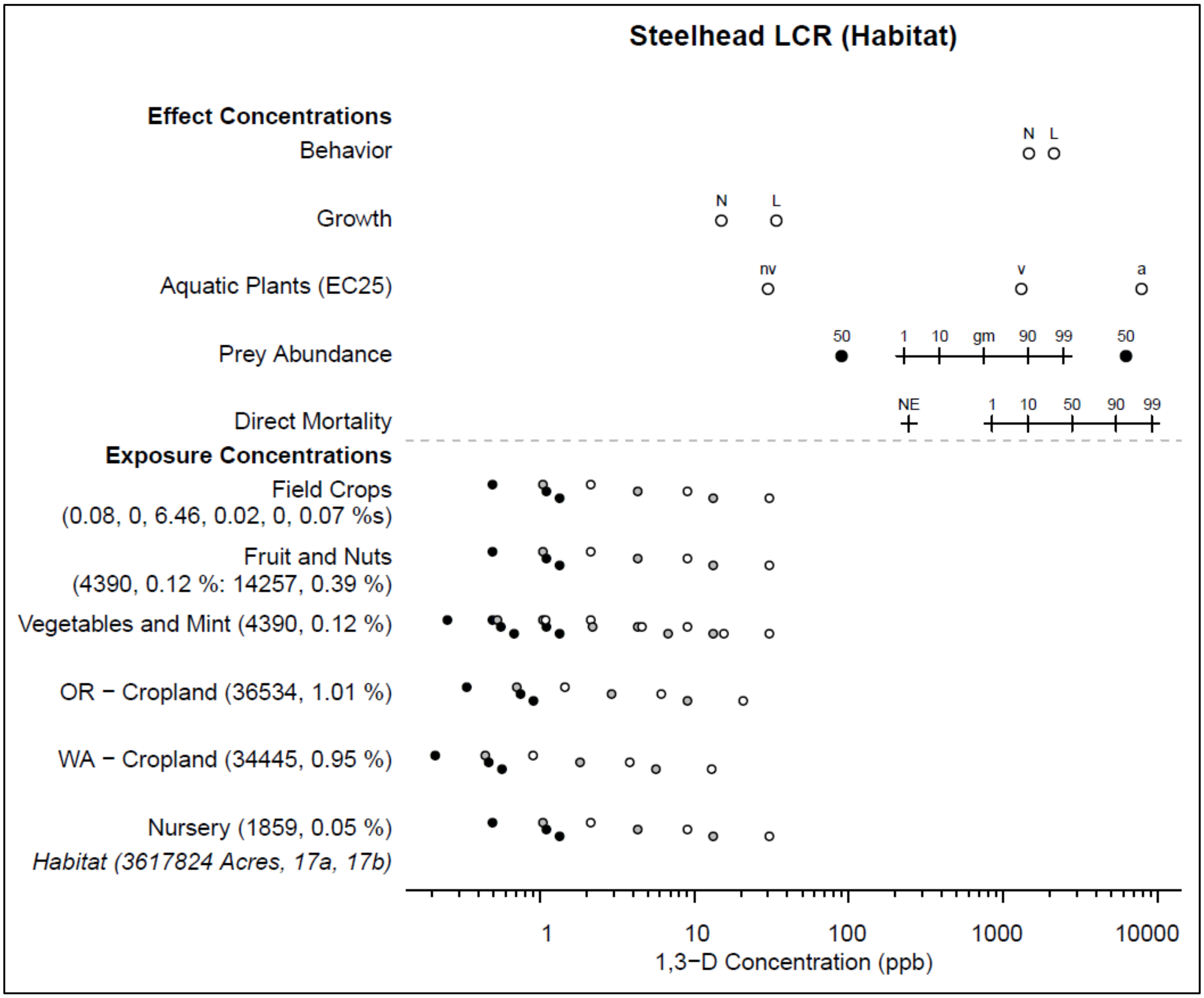


Figure 199. Effects analysis Risk-plot; Steelhead, Lower Columbia River DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 610. Likelihood of exposure determination for Steelhead, Lower Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	1	no	yes	yes	**High**
OR Cropland	2	no	yes	NA	**Medium**
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 611. Prey risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	1.01	None Expected	None Expected / Medium	Medium
WA – Cropland	0.95	None Expected	None Expected / Medium	High
Mint	0.12	None Expected	None Expected / Medium	Medium
Nursery	0.05	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.12, 0.39	None Expected	None Expected / Medium	Medium
Field Crops	0.08, 0, 6.46, 0.02, 0, 0.07	None Expected	None Expected / Medium	Medium

Vegetable Crops	0.12	None Expected	None Expected	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 612. Vegetative cover risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	1.01	Low	Low	Medium
WA – Cropland	0.95	Low	Low	High
Mint	0.12	Low	Low	Low
Nursery	0.05	Low	Low	Low
Fruit and Nuts	0.12, 0.39	Low	Low	Low
Field Crops	0.08, 0, 6.46, 0.02, 0, 0.07	Low	Low	Medium
Vegetable Crops	0.12	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 613. Water quality risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Lower Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

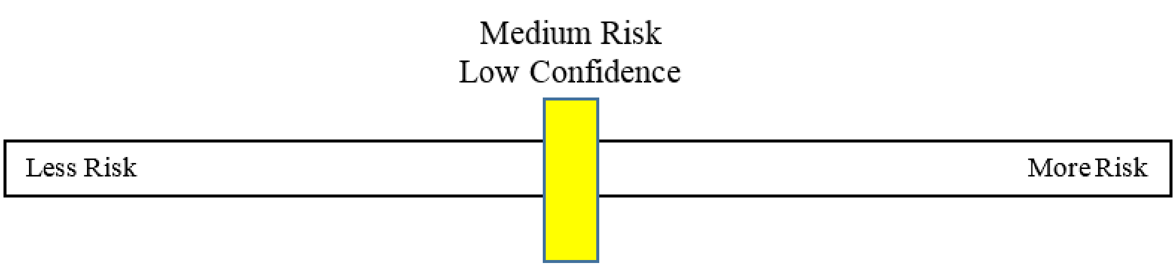
Table 614. Effects analysis summary table; Steelhead, Lower Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Designated Critical Habitat; Risk Hypotheses	R-plot Derived		Risk Hypothesis Supported? Yes/No
	Risk	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Lower Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.21 Middle Columbia River Steelhead Designated Critical Habitat; Products Containing 1,3-D

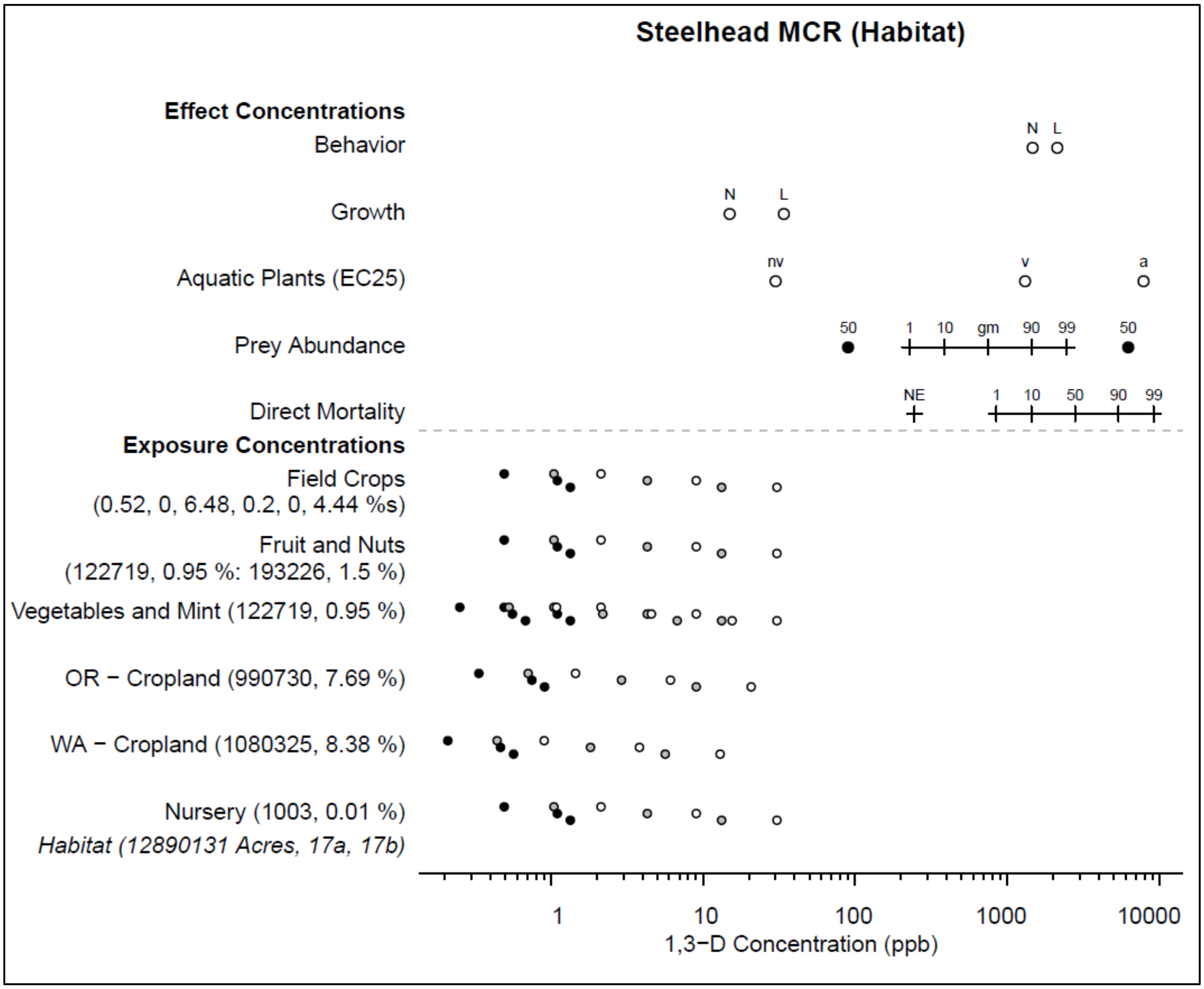


Figure 200. Effects analysis Risk-plot; Steelhead, Middle Columbia River DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 615. Likelihood of exposure determination for Steelhead, Middle Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	3	no	yes	NA	High
OR Cropland	3	no	yes	NA	High
Mint	1	no	no	no	Low
Nursery	1	no	no	no	Low
Fruit and Nuts	2	no	no	NA	Low
Field Crops	3	no	no	NA	Medium
Vegetable Crops	1	no	no	no	Low

Table 616. Prey risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	7.69	None Expected	None Expected / Medium	High
WA – Cropland	8.38	None Expected	None Expected / Medium	High
Mint	0.95	None Expected	None Expected / Medium	Low
Nursery	0.01	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.95, 1.5	None Expected	None Expected / Medium	Low
Field Crops	0.52, 0, 6.48, 0.2, 0, 4.44	None Expected	None Expected / Medium	Medium

Vegetable Crops	0.95	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 617. Vegetative cover risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	7.69	Low	Low	High
WA – Cropland	8.38	Low	Low	High
Mint	0.95	Low	Low	Low
Nursery	0.01	Low	Low	Low
Fruit and Nuts	0.95, 1.5	Low	Low	Low
Field Crops	0.52, 0, 6.48, 0.2, 0, 4.44	Low	Low	Medium
Vegetable Crops	0.95	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 618. Water quality risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Middle Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

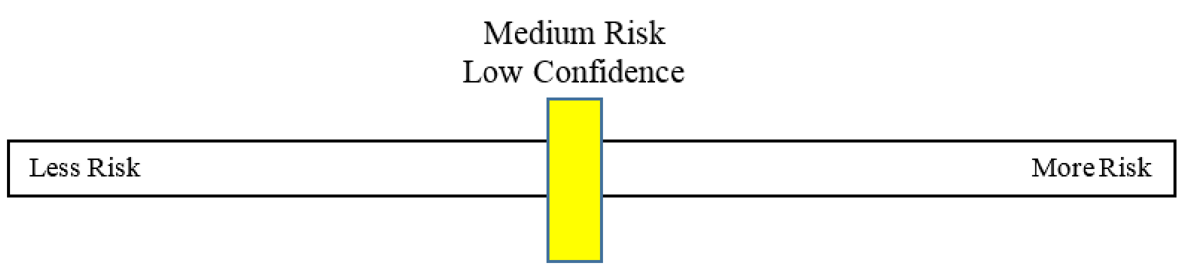
Table 619. Effects analysis summary table; Steelhead, Middle Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Middle Columbia River steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Middle Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.22 Northern California Steelhead Designated Critical Habitat ; Products Containing 1,3-D

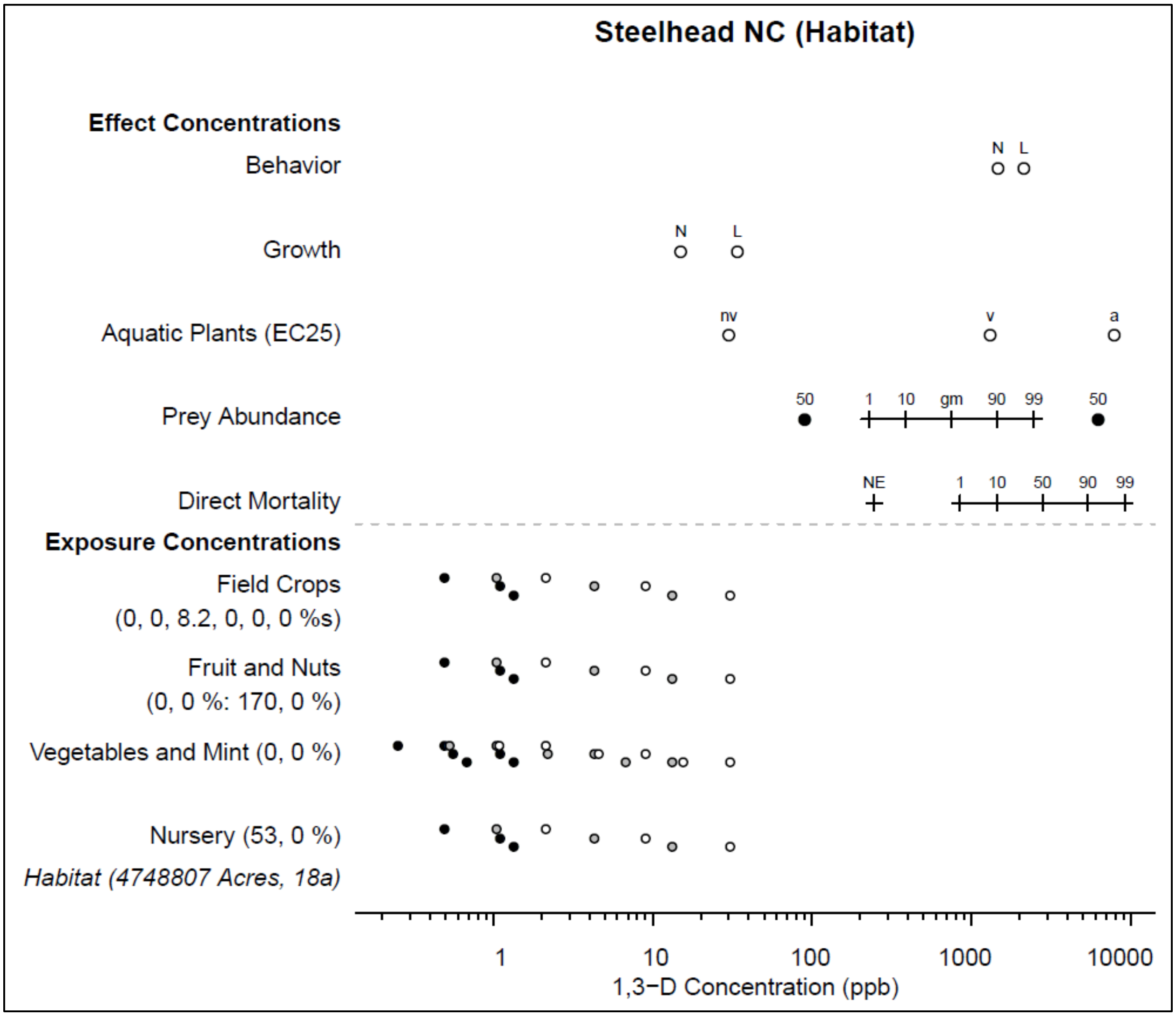


Figure 201. Effects analysis Risk-plot; Steelhead, Northern California DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 620. Likelihood of exposure determination for Steelhead, Northern California DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	no	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	no	**Low**

Table 621. Prey risk hypothesis; Steelhead, Northern California DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0	None Expected	None Expected / Medium	Low
Nursery	0	None Expected	None Expected / Medium	Low
Fruit and Nuts	0, 0	None Expected	None Expected / Medium	Low
Field Crops	0, 0, 8.2, 0, 0, 0	None Expected	None Expected / Medium	Medium
Vegetable Crops	0	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 622. Vegetative cover risk hypothesis; Steelhead, Northern California DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
Mint	0	Low	Low	Low
Nursery	0	Low	Low	Low
Fruit and Nuts	0, 0	Low	Low	Low
Field Crops	0, 0, 8.2, 0, 0, 0	Low	Low	Medium
Vegetable Crops	0	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 623. Water quality risk hypothesis; Steelhead, Northern California DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality

Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Northern California steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

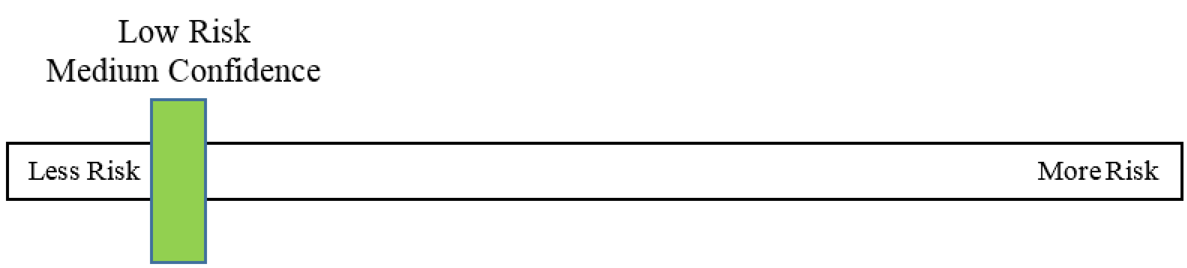
Risk	**Confidence**	
Medium	**Low**	

Table 624. Effects analysis summary table; Steelhead, Northern California DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Northern California steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Northern California steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is medium due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.23 Puget Sound Steelhead Designated Critical Habitat; Products Containing 1,3-D

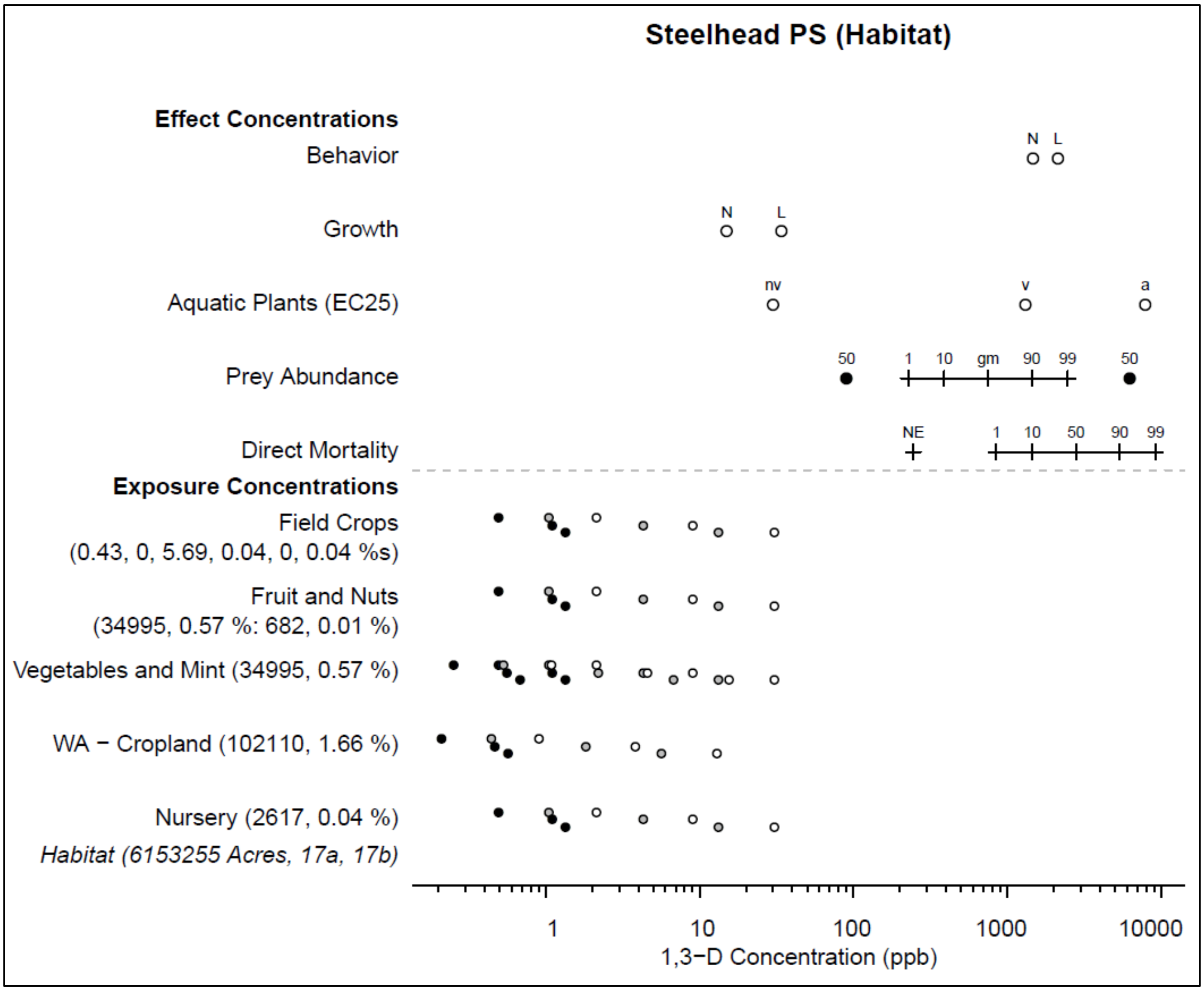


Figure 202. Effects analysis Risk-plot; Steelhead, Puget Sound DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 625. Likelihood of exposure determination for Steelhead, Puget Sound DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	2	no	yes	NA	**Medium**
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 626. Prey risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
WA - Cropland	1.66	None Expected	None Expected / Medium	Medium
Mint	0.57	None Expected	None Expected / Medium	Medium
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.57, 0.01	None Expected	None Expected / Medium	Medium
Field Crops	0.43, 0, 5.69, 0.04, 0, 0.04	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.57	None Expected	None Expected / Medium	Medium

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**Medium**	

Table 627. Vegetative cover risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
WA - Cropland	1.66	Low	Low	Medium
Mint	0.57	Low	Low	Medium
Nursery	0.04	Low	Low	Low
Fruit and Nuts	0.57, 0.01	Low	Low	Medium
Field Crops	0.43, 0, 5.69, 0.04, 0, 0.04	Low	Low	Medium
Vegetable Crops	0.57	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				

Risk	Confidence	
Medium	**Low**	

Table 628. Water quality risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Puget Sound steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

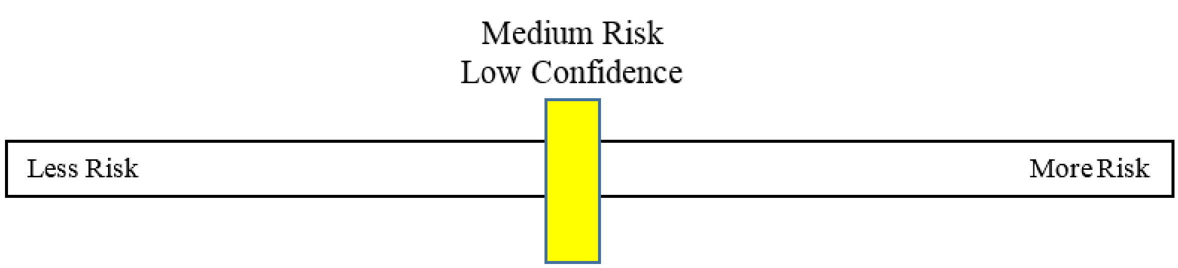
Table 629. Effects analysis summary table; Steelhead, Puget Sound DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported?**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	**Yes/No**
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation	Medium	Low	No

of water quality in migration, spawning, and rearing sites.			

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Puget Sound steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Puget Sound steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.24 Snake River Basin Steelhead Designated Critical Habitat; Products Containing 1,3-D

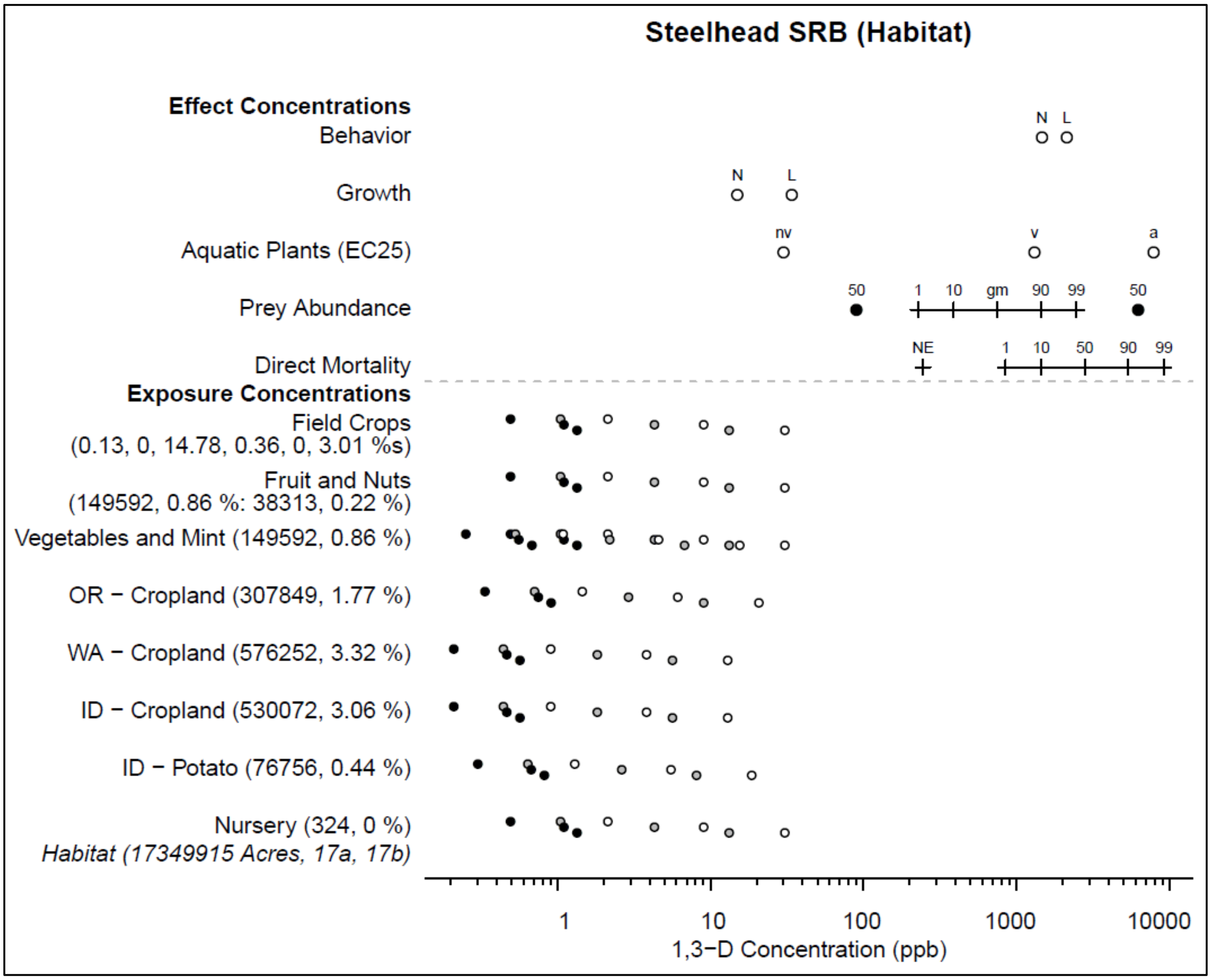


Figure 203. Effects analysis Risk-plot; Steelhead, Snake River Basin DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 630. Likelihood of exposure determination for Steelhead, Snake River Basin DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	2	no	yes	NA	**Medium**
OR Cropland	2	no	yes	NA	**Medium**
ID Cropland	2	no	yes	NA	**Medium**
ID Potato	1	no	yes	no	**Low**
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	no	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 631. Prey risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	1.77	None Expected	None Expected / Medium	Medium
WA – Cropland	3.32	None Expected	None Expected / Medium	Medium
ID – Cropland	3.06	None Expected	None Expected / Medium	Medium
ID – Potato	0.44	None Expected	None Expected / Medium	Low
Mint	0.86	None Expected	None Expected / Medium	Medium

Nursery	0	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.86, 0.22	None Expected	None Expected / Medium	Low
Field Crops	0.13, 0, 14.78, 0.36, 0, 3.01	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.86	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 632. Vegetative cover risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	1.77	Low	Low	Medium
WA – Cropland	3.32	Low	Low	Medium
ID – Cropland	3.06	Low	Low	Medium
ID – Potato	0.44	Low	Low	Low
Mint	0.86	Low	Low	Medium
Nursery	0	Low	Low	Low
Fruit and Nuts	0.86, 0.22	Low	Low	Low
Field Crops	0.13, 0, 14.78, 0.36, 0, 3.01	Low	Low	Medium
Vegetable Crops	0.86	Low	Low	Medium
Terrestrial Plants				

Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

Risk	Confidence	
Medium	**Low**	

Table 633. Water quality risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Snake River Basin steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

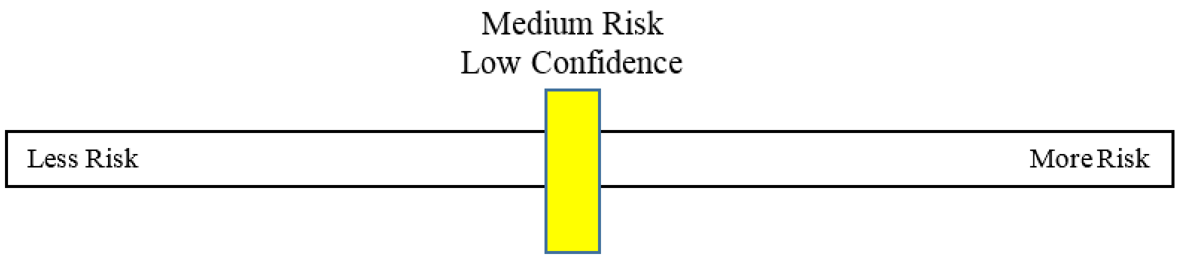
Risk	Confidence	
Medium	**Low**	

Table 634. Effects analysis summary table; Steelhead, Snake River Basin DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River Basin steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Snake River Basin steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.25 South Central California Coast Steelhead Designated Critical Habitat; Products Containing 1,3-D

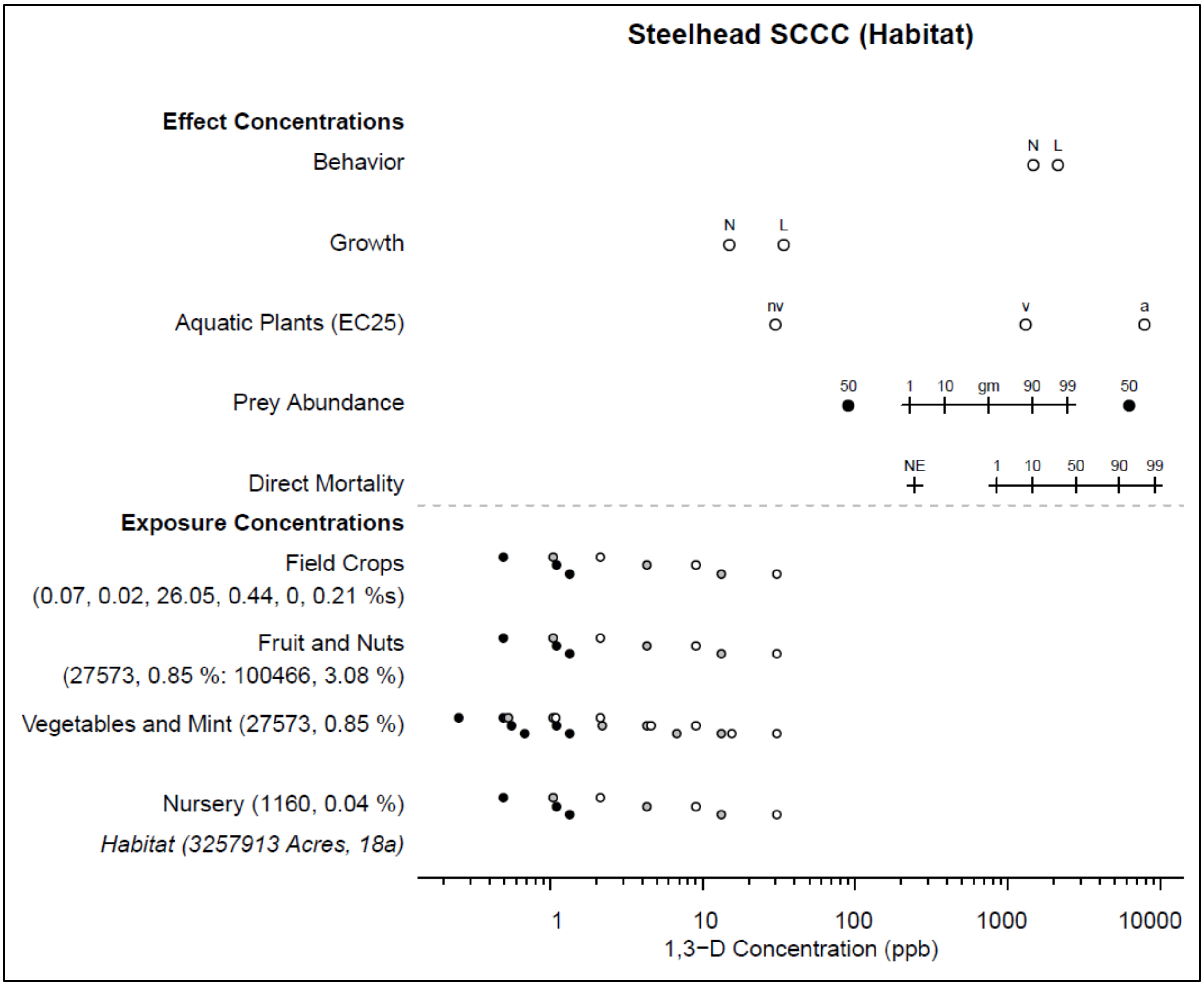


Figure 204. Effects analysis Risk-plot; Steelhead, South Central California Coast DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 635. Likelihood of exposure determination for Steelhead, South Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 636. Prey risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.85	None Expected	None Expected / Medium	Medium
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.85, 3.08	None Expected	None Expected / Medium	Medium
Field Crops	0.07, 0.02, 26.05, 0.44, 0, 0.21	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.85	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			

Low	**Medium**	

Table 637. Vegetative cover risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
Mint	0.85	Low	Low	Medium
Nursery	0.04	Low	Low	Low
Fruit and Nuts	0.85, 3.08	Low	Low	Medium
Field Crops	0.07, 0.02, 26.05, 0.44, 0, 0.21	Low	Low	Medium
Vegetable Crops	0.85	Low	Low	Medium
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.				
Risk	**Confidence**			
Medium	**Low**			

Table 638. Water quality risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

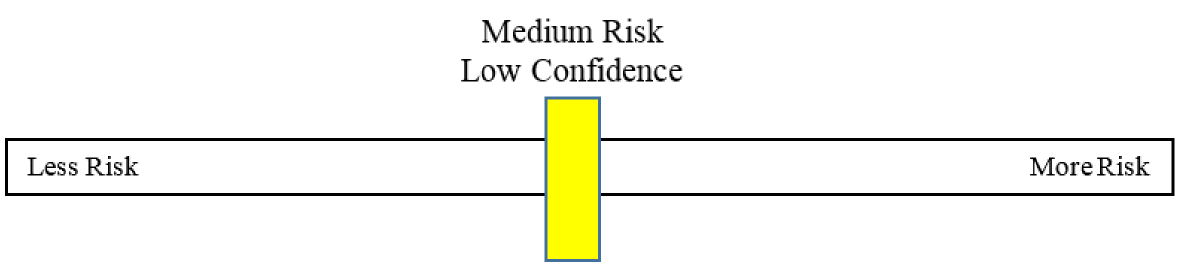
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the South Central California Coast steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 639. Effects analysis summary table; Steelhead, South Central California Coast DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported?**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	**Yes/No**
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of South Central California Coast steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the South Central California Coast steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.26 Southern California Steelhead Designated Critical Habitat; Products Containing 1,3-D

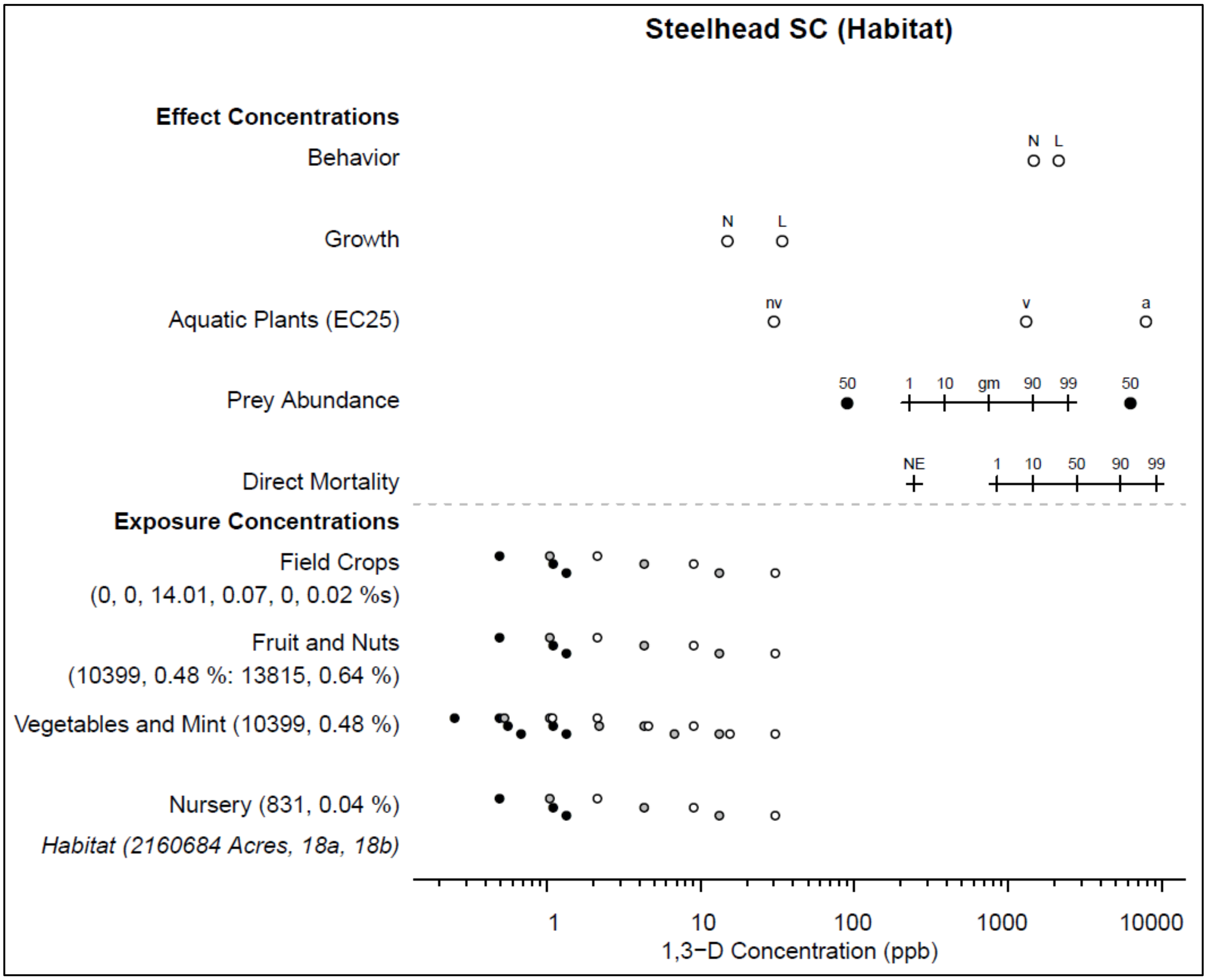


Figure 205. Effects analysis Risk-plot; Steelhead, Southern California DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 640. Likelihood of exposure determination for Steelhead, Southern California DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Mint	1	no	no	yes	**Medium**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	1	no	no	yes	**Medium**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	1	no	no	yes	**Medium**

Table 641. Prey risk hypothesis; Steelhead, Southern California DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Mint	0.48	None Expected	None Expected / Medium	Medium
Nursery	0.04	None Expected	None Expected / Medium	Low
Fruit and Nuts	0.48, 0.64	None Expected	None Expected / Medium	Medium
Field Crops	0, 0, 14.01, 0.07, 0, 0.02	None Expected	None Expected / Medium	Medium
Vegetable Crops	0.48	None Expected	None Expected / Medium	Medium
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 642. Vegetative cover risk hypothesis; Steelhead, Southern California DPS designated critical habitat and products containing 1,3-Dichloropropene

<table>
<tr><td colspan="5">Endpoint: Vegetative Cover</td></tr>
<tr><td rowspan="2">Use Category</td><td rowspan="2">% Overlap</td><td colspan="2">Effect of Exposure</td><td rowspan="2">Likelihood of Exposure</td></tr>
<tr><td>1,3-D</td><td>Chloropicrin</td></tr>
<tr><td colspan="5">Aquatic Plants</td></tr>
<tr><td>Mint</td><td>0.48</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Nursery</td><td>0.04</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Fruit and Nuts</td><td>0.48, 0.64</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Field Crops</td><td>0, 0, 14.01, 0.07, 0, 0.02</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Vegetable Crops</td><td>0.48</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td colspan="5">Terrestrial Plants</td></tr>
<tr><td colspan="5">Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.</td></tr>
<tr><td colspan="5">Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.</td></tr>
<tr><td>Risk</td><td>Confidence</td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Medium</td><td>Low</td></tr>
</table>

Table 643. Water quality risk hypothesis; Steelhead, Southern California DPS designated critical habitat and products containing 1,3-Dichloropropene

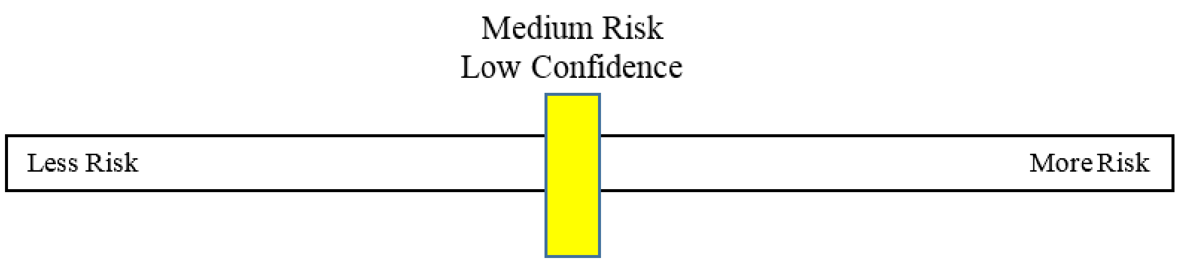
Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Southern California steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 644. Effects analysis summary table; Steelhead, Southern California DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		**Risk Hypothesis Supported?**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	**Yes/No**
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Southern California steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Southern California steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.27 Upper Columbia River Steelhead Designated Critical Habitat; Products Containing 1,3-D

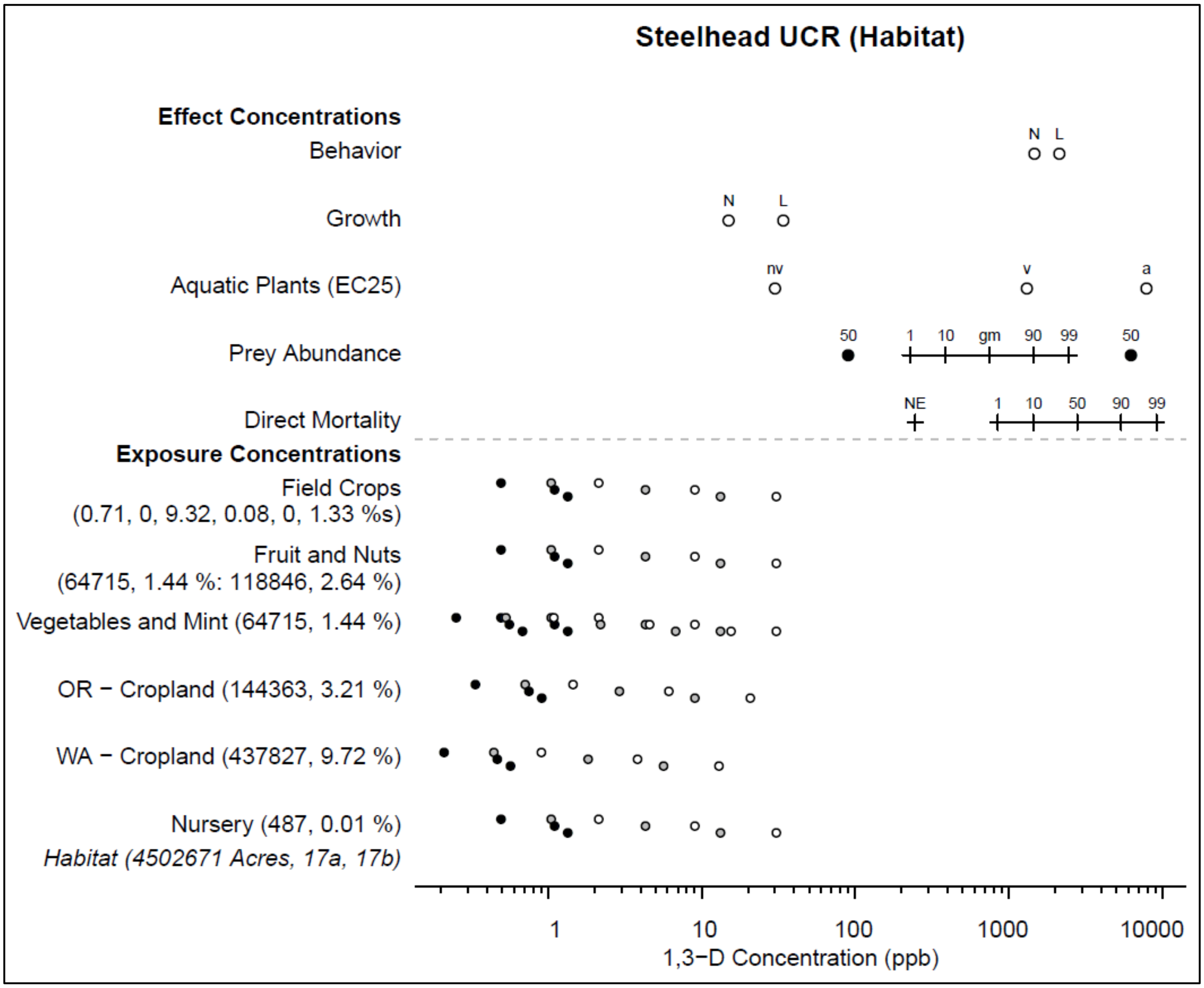


Figure 206. Effects analysis Risk-plot; Steelhead, Upper Columbia River DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 645. Likelihood of exposure determination for Steelhead, Upper Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	3	no	yes	NA	**High**
OR Cropland	2	no	yes	NA	**Medium**
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 646. Prey risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	3.21	None Expected	None Expected / Medium	Medium
WA – Cropland	9.72	None Expected	None Expected / Medium	High
Mint	1.44	None Expected	None Expected / Medium	Low
Nursery	0.01	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.44, 2.64	None Expected	None Expected / Medium	Low
Field Crops	0.71, 0, 9.32, 0.08, 0, 1.33	None Expected	None Expected / Medium	Medium

Vegetable Crops	1.44	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 647. Vegetative cover risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	3.21	Low	Low	Medium
WA – Cropland	9.72	Low	Low	High
Mint	1.44	Low	Low	Low
Nursery	0.01	Low	Low	Low
Fruit and Nuts	1.44, 2.64	Low	Low	Low
Field Crops	0.71, 0, 9.32, 0.08, 0, 1.33	Low	Low	Medium
Vegetable Crops	1.44	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 648. Water quality risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Upper Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

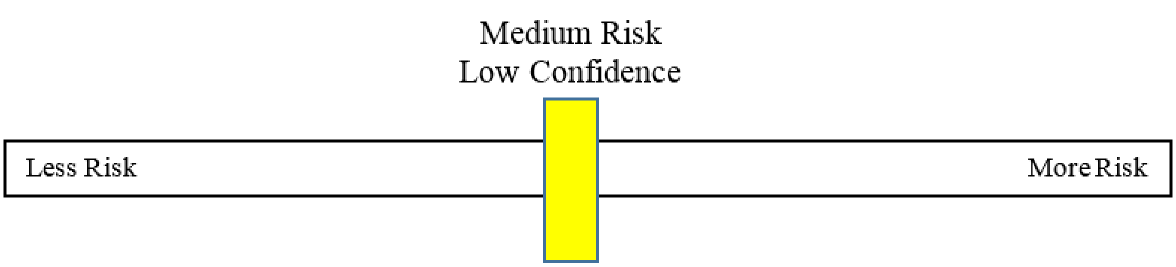
Table 649. Effects analysis summary table; Steelhead, Upper Columbia River DPS designated critical habitat and products containing 1,3-Dichloropropene

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Columbia River steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Upper Columbia River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.2.28 Upper Willamette River Steelhead Designated Critical Habitat; Products Containing 1,3-D

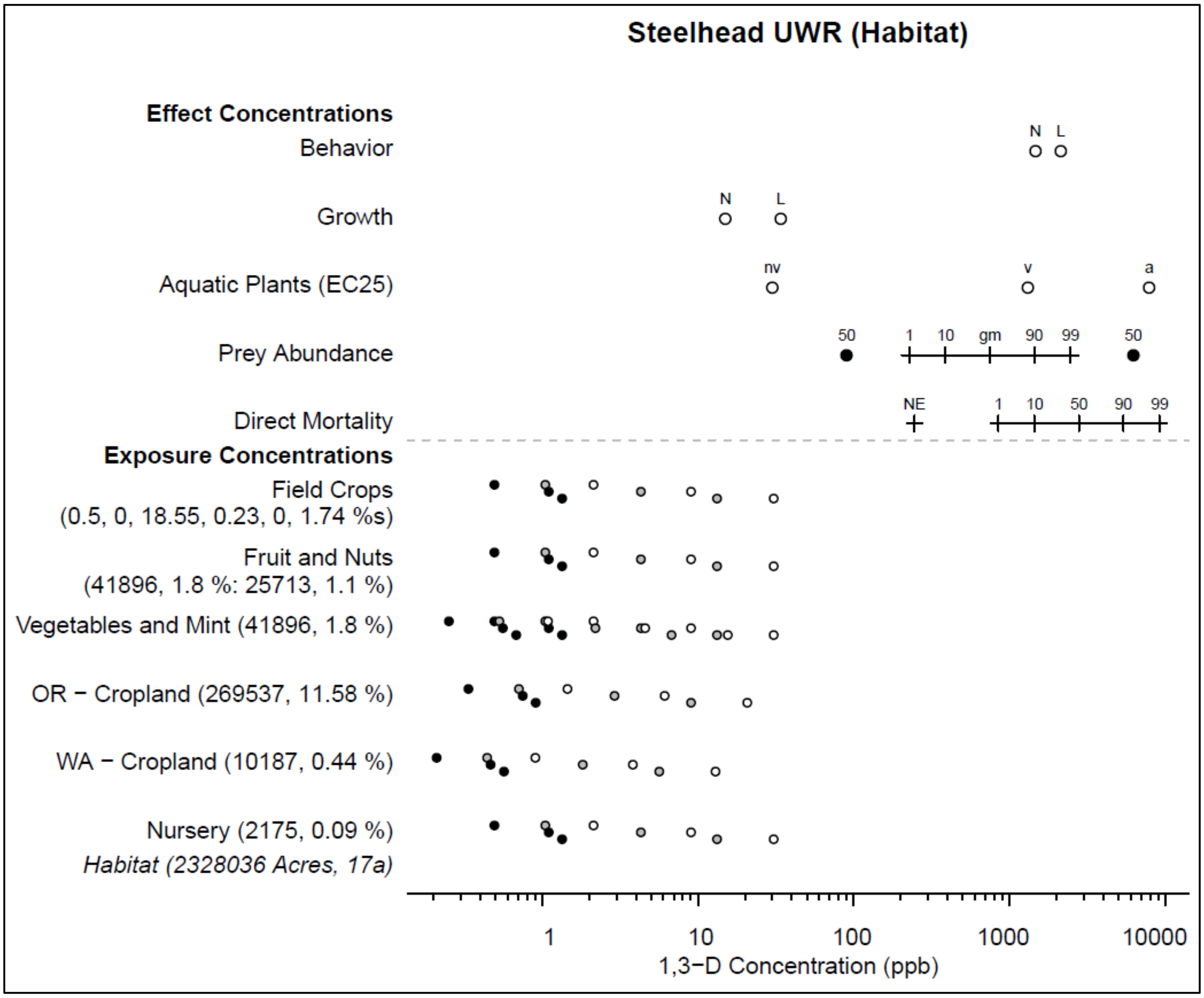


Figure 207. Effects analysis Risk-plot; Steelhead, Upper Willamette River DPS designated critical habitat; aquatic plants and products containing 1,3-Dichloropropene

Table 650. Likelihood of exposure determination for Steelhead, Upper Willamette River DPS designated critical habitat and products containing 1,3-Dichloropropene

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
WA Cropland	1	no	yes	no	**Low**
OR Cropland	3	no	yes	NA	**High**
Mint	2	no	no	NA	**Low**
Nursery	1	no	no	no	**Low**
Fruit and Nuts	2	no	no	NA	**Low**
Field Crops	3	no	no	NA	**Medium**
Vegetable Crops	2	no	no	NA	**Low**

Table 651. Prey risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Prey				
Use Category	**% Overlap**	**Effect of Exposure (Invertebrates / Fish)**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
OR – Cropland	11.58	None Expected	None Expected / Medium	High
WA – Cropland	0.44	None Expected	None Expected / Medium	Low
Mint	1.8	None Expected	None Expected / Medium	Low
Nursery	0.09	None Expected	None Expected / Medium	Low
Fruit and Nuts	1.8, 1.1	None Expected	None Expected / Medium	Low
Field Crops	0.5, 0, 18.55, 0.23, 0, 1.74	None Expected	None Expected / Medium	Medium

Vegetable Crops	1.8	None Expected	None Expected / Medium	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.				
Risk	**Confidence**			
Low	**Medium**			

Table 652. Vegetative cover risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Vegetative Cover				
Use Category	**% Overlap**	**Effect of Exposure**		**Likelihood of Exposure**
		1,3-D	**Chloropicrin**	
Aquatic Plants				
OR – Cropland	11.58	Low	Low	High
WA – Cropland	0.44	Low	Low	Low
Mint	1.8	Low	Low	Low
Nursery	0.09	Low	Low	Low
Fruit and Nuts	1.8, 1.1	Low	Low	Low
Field Crops	0.5, 0, 18.55, 0.23, 0, 1.74	Low	Low	Medium
Vegetable Crops	1.8	Low	Low	Low
Terrestrial Plants				
Exposure to riparian terrestrial vegetation was considered from both vapor drift and surface run-off exposure pathways. For 1,3-D the effect of exposure to riparian plants via vapor drift is low. This is based on comparisons of vegetative vigor and seedling emergence endpoints to exposure estimates from field studies, monitoring data, as well as modeled concentrations. For chloropicrin, the effect of exposure to riparian plants via vapor drift is medium, this is based on the exceedance of vegetative vigor EC_{25} values with modeled air concentrations. The effect of exposure of 1,3-D to riparian vegetation via runoff is low. This is based on comparisons of EECs from field studies as well as those calculated using exposure modeling. For chloropicrin, vegetative vigor and seedling emergence data relevant to the run-off exposure pathway are not available.				

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 653. Water quality risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and products containing 1,3-Dichloropropene

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. The anticipated levels of products containing 1,3-Dichloropropene within the designated critical habitat of the Upper Willamette River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. However, products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur. Adverse effects to aquatic plants are not anticipated. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 654. Effects analysis summary table; Steelhead, Upper Willamette River DPS designated critical habitat and products containing 1,3-Dichloropropene

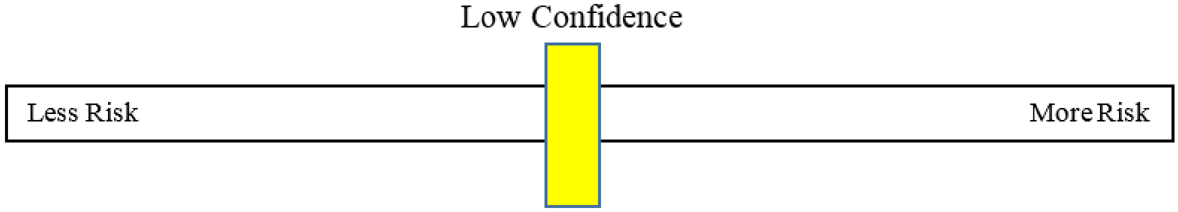
	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	Medium	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Medium	Low	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Willamette River steelhead designated critical habitat. The anticipated levels of products containing 1,3-D within the designated critical habitat of the Upper Willamette River steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. 1,3-D products containing chloropicrin, however, may result in some reductions in the availability of juvenile fish as steelhead prey in low flow, low volume habitats. We characterized risk associated with effects to aquatic vegetative cover as low, and terrestrial vegetation as medium, and although adverse effects to terrestrial vegetation could occur, we expect them to be limited in scope. Overall, we characterized risk associated with vegetative cover as medium, and the confidence in that risk as low. Additionally, the likelihood of exposure characterizations for products containing 1,3-D indicate a greater likelihood than is anticipated because labeled use sites are broadly categorized (e.g. field crops). 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

Medium Risk
Low Confidence



15.3 Metolachlor Effects Analysis

The response endpoints displayed in the metolachlor risk plots that follow are provided in Table 655. See the introduction to the effects analysis chapter for more information regarding the available relevant toxicological data for these compounds.

Table 655. Effects endpoints displayed in risk plots for metolachlor

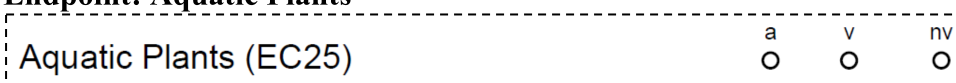
Endpoint: Prey Abundance
Invertebrates

Test species: Water flea
Duration: 96-hr
Toxicity value (ppb): LC50 (black diamond) = 23,500; 25,100; geometric mean* (gm) = 24,287; slope = 4.5 (assumed)
Citation/MRID: 40098001; 00015546

Fish

Test species: Rainbow Trout; Rainbow Trout
Duration: 96-hr
Toxicity value (ppb): LC50 (black diamond) = 3,900; 11,900; geometric mean* (gm) = 6,840 slope = 4.5 (assumed); None Expected (NE) = 600
Citation/MRID: 00018722; 43928911

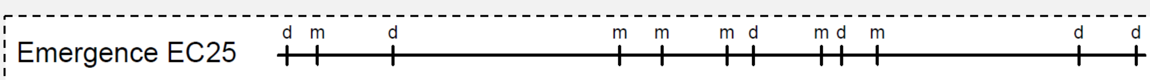
Endpoint: Aquatic Plants



Test species: Green algae (a); Duckweed (v); Freshwater diatom (nv)
Duration: 5-day
Toxicity value (ppb): EC25= 4.8; 13; 42
Citation/MRID: 43928929; 43928931; 43541302

Endpoint: Terrestrial Plants

Test species (symbol) EC25 in lbs a.i./A: Ryegrass (m) 0.41; Cucumber (d) 0.44; Lettuce (d) 0.86; Soybean (d) 0.95; Barley (m) 1.09; Tomato (d) 1.28; Maize (m) 1.56; Sugar beet (d) 1.98; Oilseed rape (d) 2.71; Rice (m) 3.01; Oat (m) 3.66; Onion (m) >4.46
Duration: 21-day
Citation/MRID: 49930013



Test species (symbol) EC25 in lbs a.i./A: Lettuce (d) 0.02; Ryegrass (m) 0.03; Cucumber (d) 0.04; Barley (m) 0.064; Onion (m) 0.18; Rice (m) 0.24; Oat (m) 0.36; Tomato (d) 0.42; Sugar Beet (d) 0.72; Maize (m) 0.9; Oilseed rape (d) 3.13; Soybean (d) >4.46 Duration: 21-day Citation/MRID: 49930012
**The calculation and reference to the geometric mean of the two different LC50s was determined appropriate as the studies were otherwise comparable in regards to species tested, exposure duration, and overall data quality.*

15.3.1 Columbia River Chum Salmon (O. keta) Designated Critical Habitat; Metolachlor

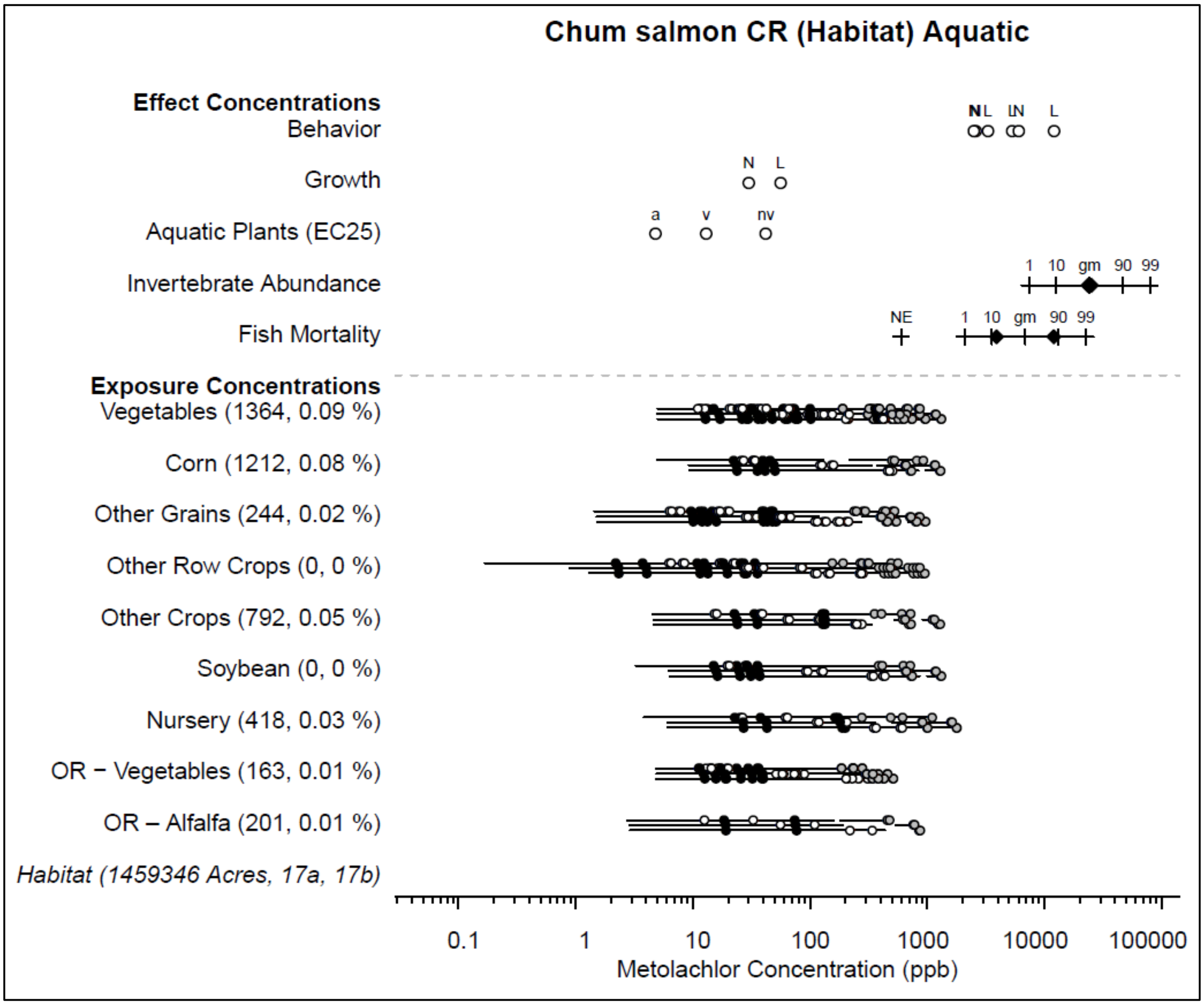


Figure 208. Effects analysis Risk-plot; chum salmon, Columbia River ESU designated critical habitat; aquatic plants and Metolachlor

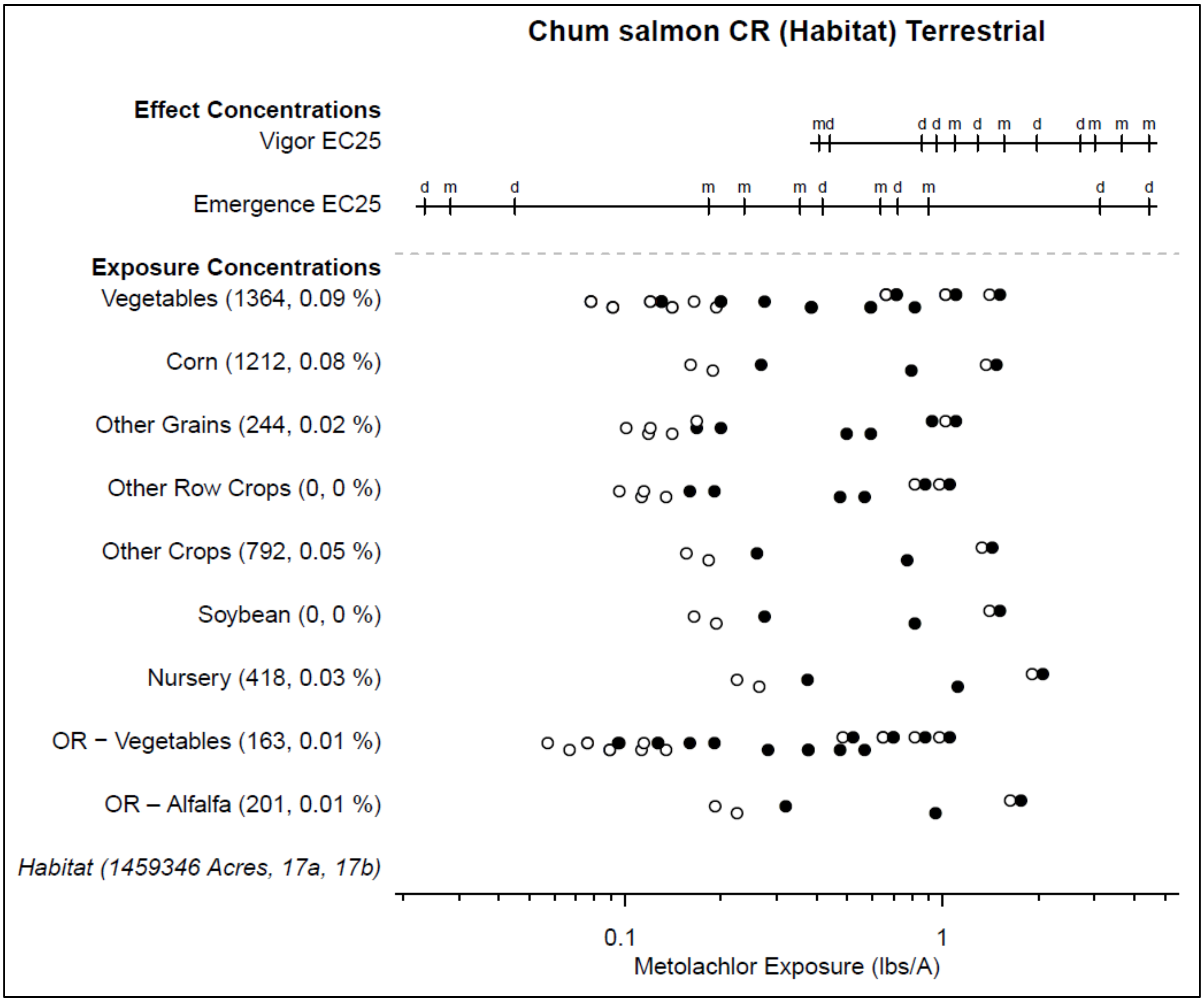


Figure 209. Effects analysis Risk-plot; chum salmon, Columbia River ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 656. Likelihood of exposure determination for chum salmon, Columbia River ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	High
Corn	1	no	yes	yes	High
Other Grains	1	no	yes	no	Low
Other Row Crops	1	no	yes	no	Low
Other Crops	1	no	yes	yes	High
Soybean	1	no	yes	no	Low
Nursery	1	no	yes	no	Low
OR - Vegetables	1	no	yes	yes	High
OR - Alfalfa	1	no	yes	no	Low

Table 657. Prey risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.09	None Expected	High
Corn	0.08	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.05	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.03	Low	Low
OR – Vegetables	0.01	None Expected	High
OR – Alfalfa	0.01	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 658. Vegetative cover risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.09	High	High
Corn	0.08	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.05	High	High
Soybean	0	High	Low
Nursery	0.03	High	Low
OR – Vegetables	0.01	High	High
OR – Alfalfa	0.01	High	Low
Terrestrial			
Vegetables	0.09	High	High
Corn	0.08	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.05	High	High
Soybean	0	High	Low
Nursery	0.03	High	Low
OR – Vegetables	0.01	High	High
OR – Alfalfa	0.01	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 659. Water quality risk hypothesis; chum salmon, Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Columbia River chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

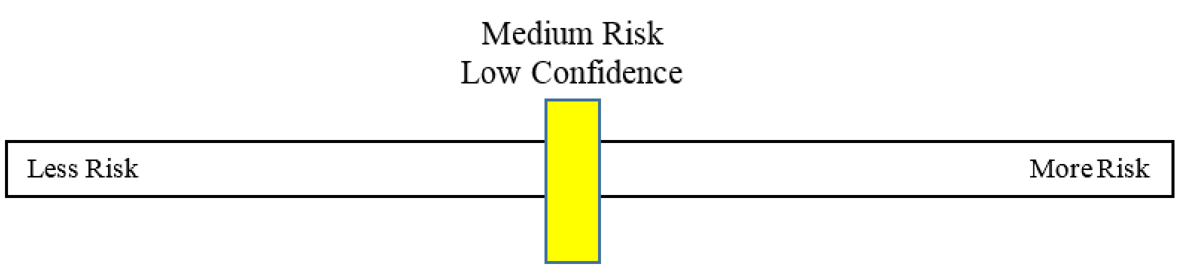
Table 660. Effects analysis summary table; chum salmon, Columbia River ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Columbia River chum salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Columbia River chum salmon are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.2 Hood Canal summer-run Chum (O. keta) Designated Critical Habitat; Metolachlor

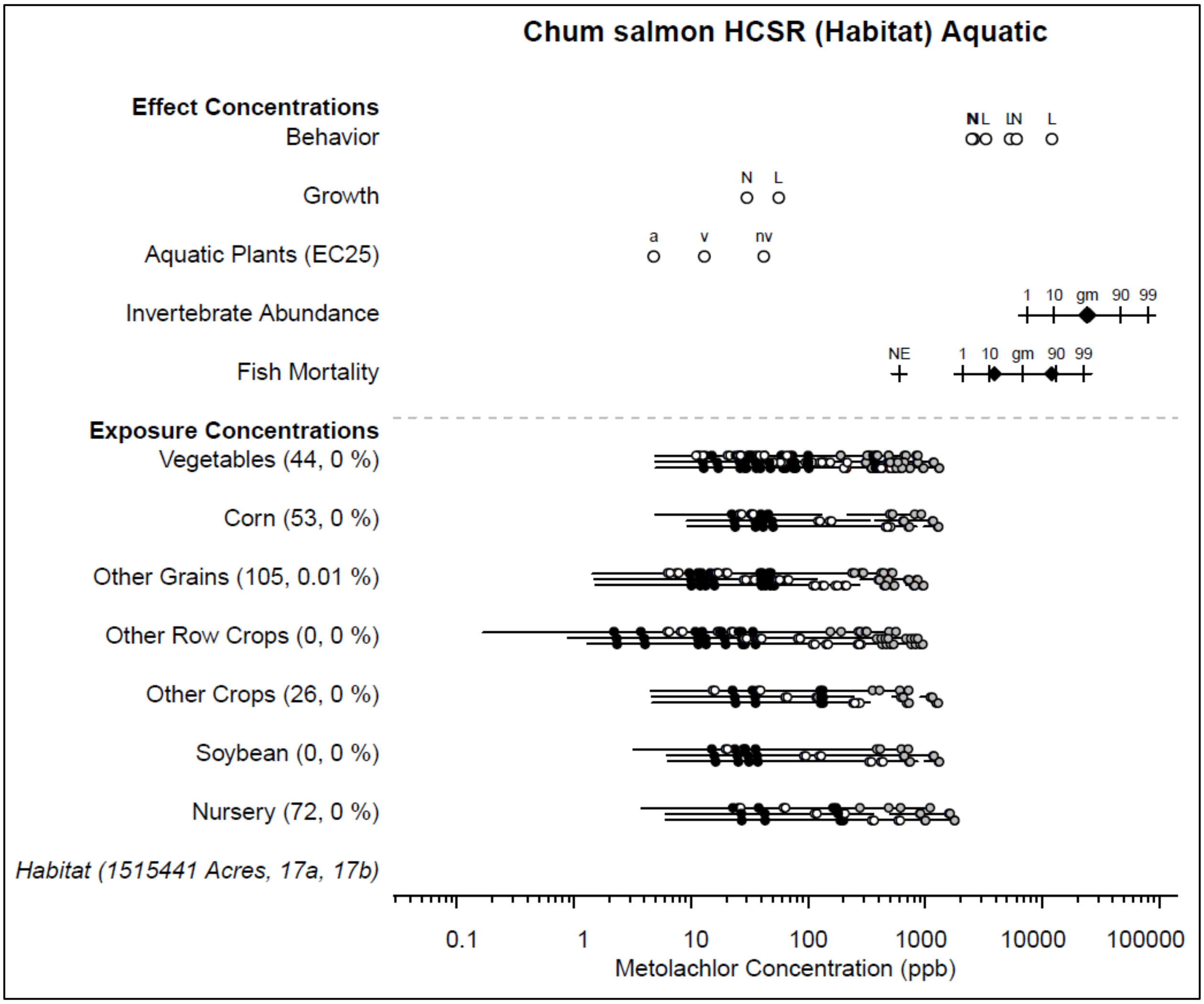


Figure 210. Effects analysis Risk-plot; chum salmon, Hood Canal summer-run ESU designated critical habitat; aquatic plants and Metolachlor

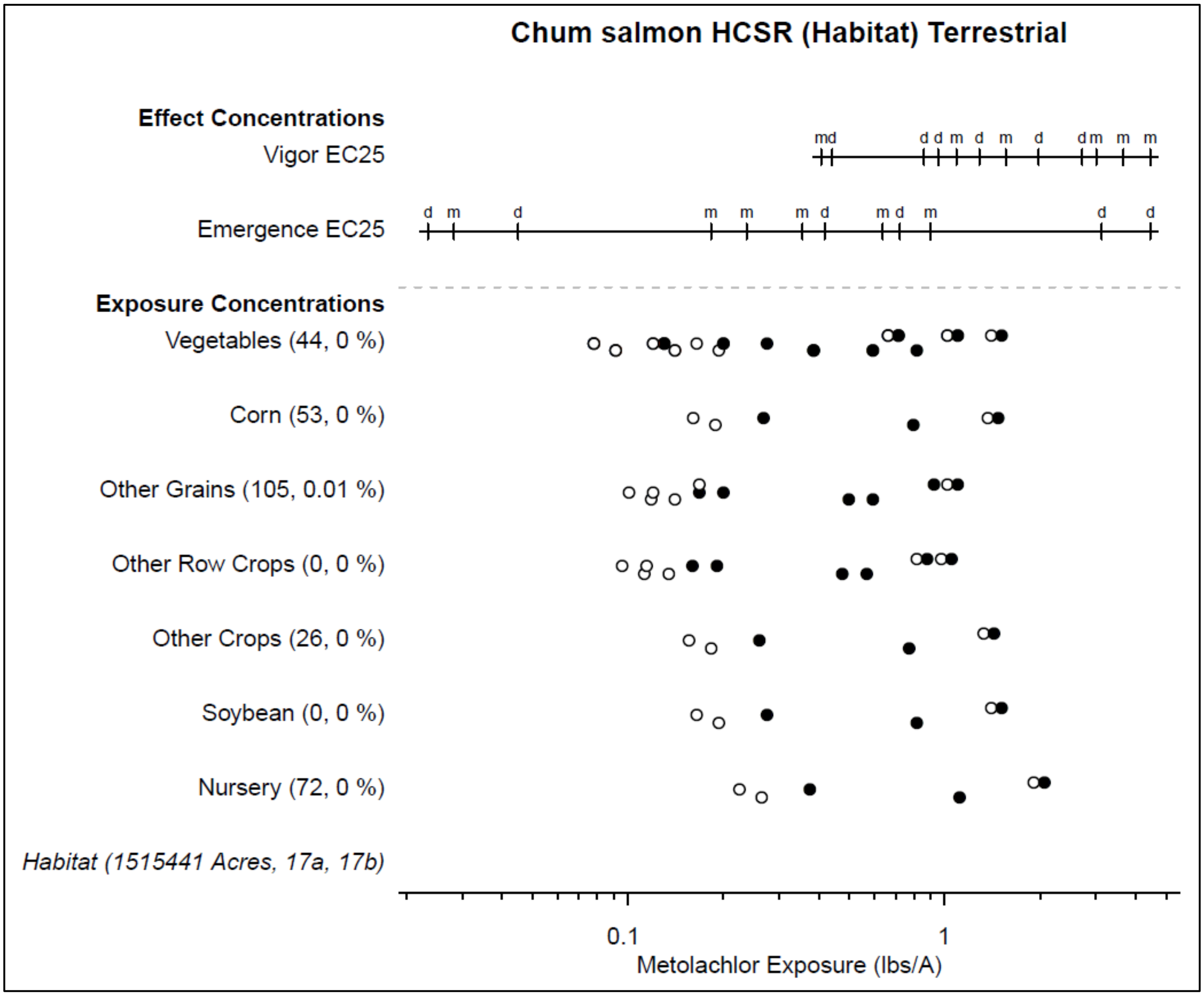


Figure 211. Effects analysis Risk-plot; chum salmon, Hood Canal summer-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 661. Likelihood of exposure determination for chum salmon, Hood Canal summer-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**

Table 662. Prey risk hypothesis; chum salmon, Hood Canal summer-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 663. Vegetative cover risk hypothesis; chum salmon, Hood Canal summer-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.01	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.01	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 664. Water quality risk hypothesis; chum salmon, Hood Canal summer-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality

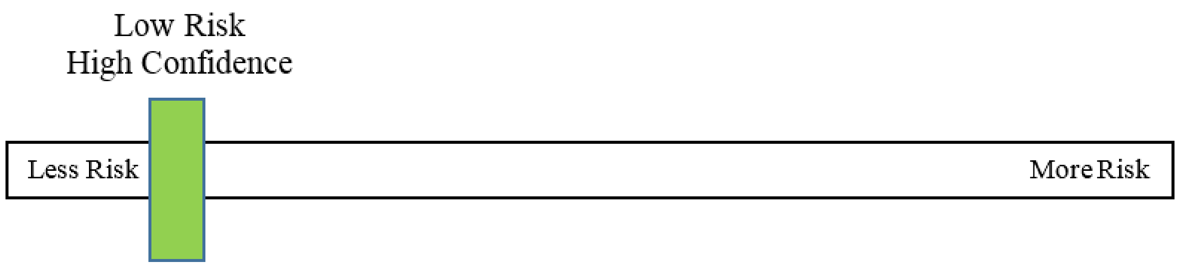
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Hood Canal summer-run chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 665. Effects analysis summary table; chum salmon, Hood Canal summer-run ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Hood Canal summer-run chum salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Hood Canal summer-run chum ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.3 California Coastal Chinook (O. tshawytscha) Designated Critical Habitat; Metolachlor

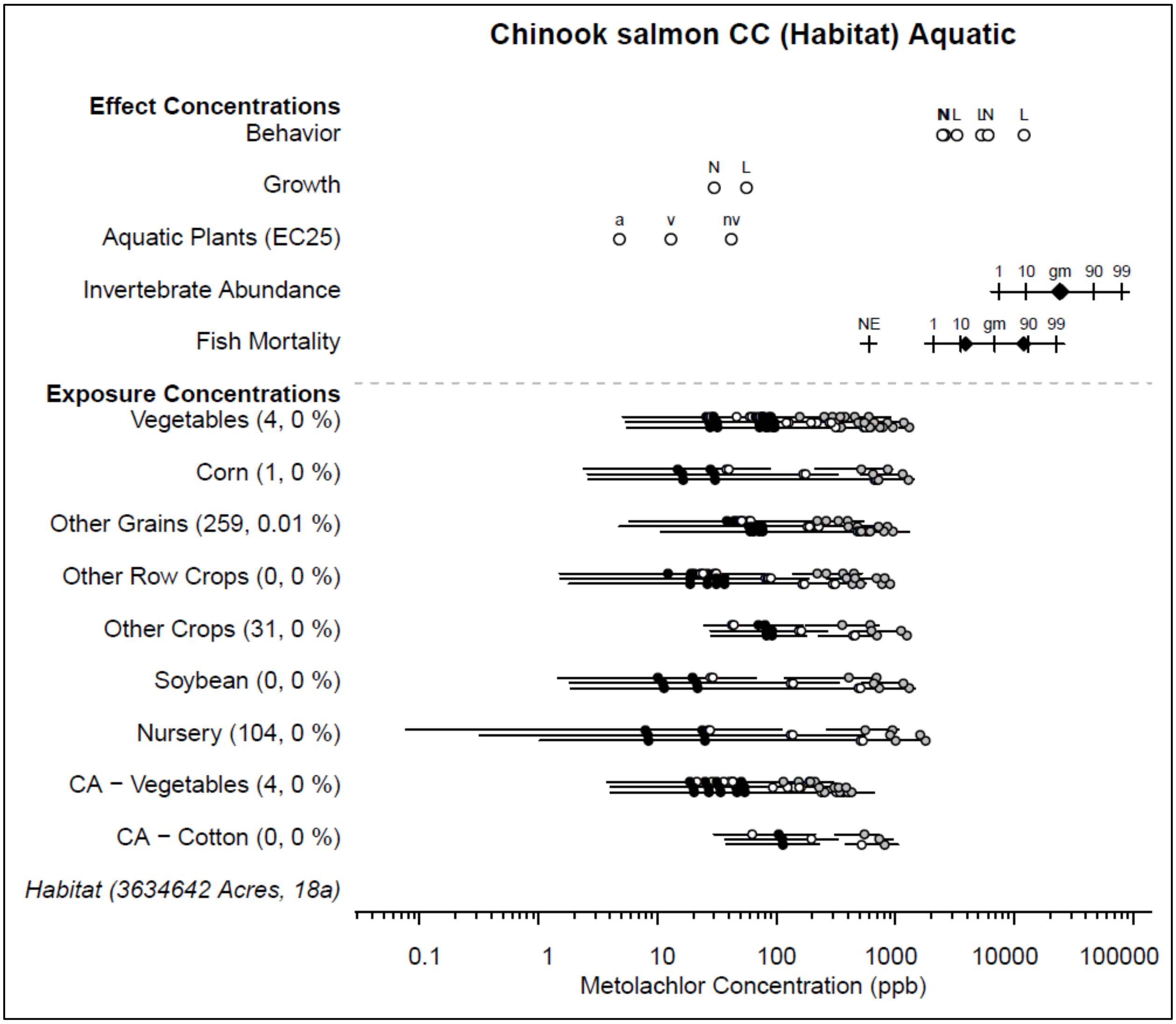


Figure 212. Effects analysis Risk-plot; Chinook salmon, California Coastal ESU designated critical habitat; aquatic plants and Metolachlor

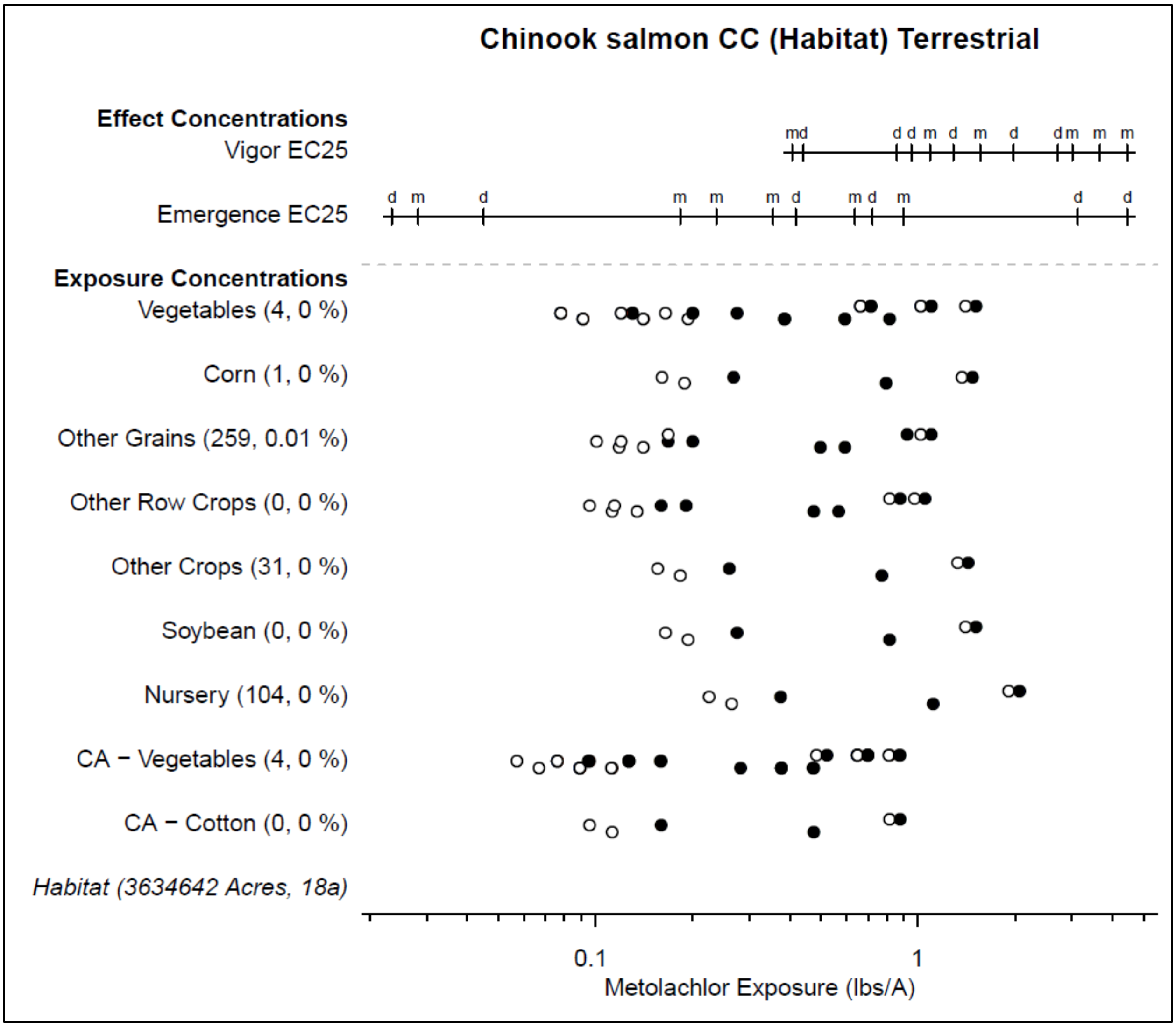


Figure 213. Effects analysis Risk-plot; Chinook salmon, California Coastal ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 666. Likelihood of exposure determination for Chinook salmon, California Coastal ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**

Table 667. Prey risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.01	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA – Vegetables	0	None Expected	Low
CA – Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 668. Vegetative cover risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.01	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.01	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 669. Water quality risk hypothesis; Chinook salmon, California Coastal ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the California Coastal Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

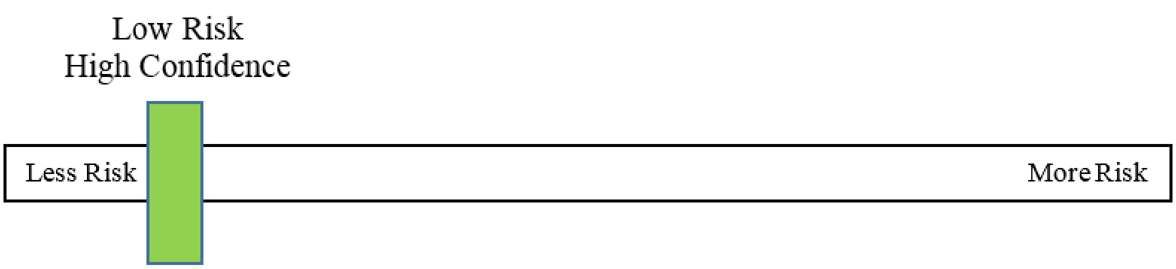
Table 670. Effects analysis summary table; Chinook salmon, California Coastal ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Low	High	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of California Coastal Chinook ESU designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the California Coastal Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.5 Central Valley Spring-run Chinook Designated Critical Habitat; Metolachlor

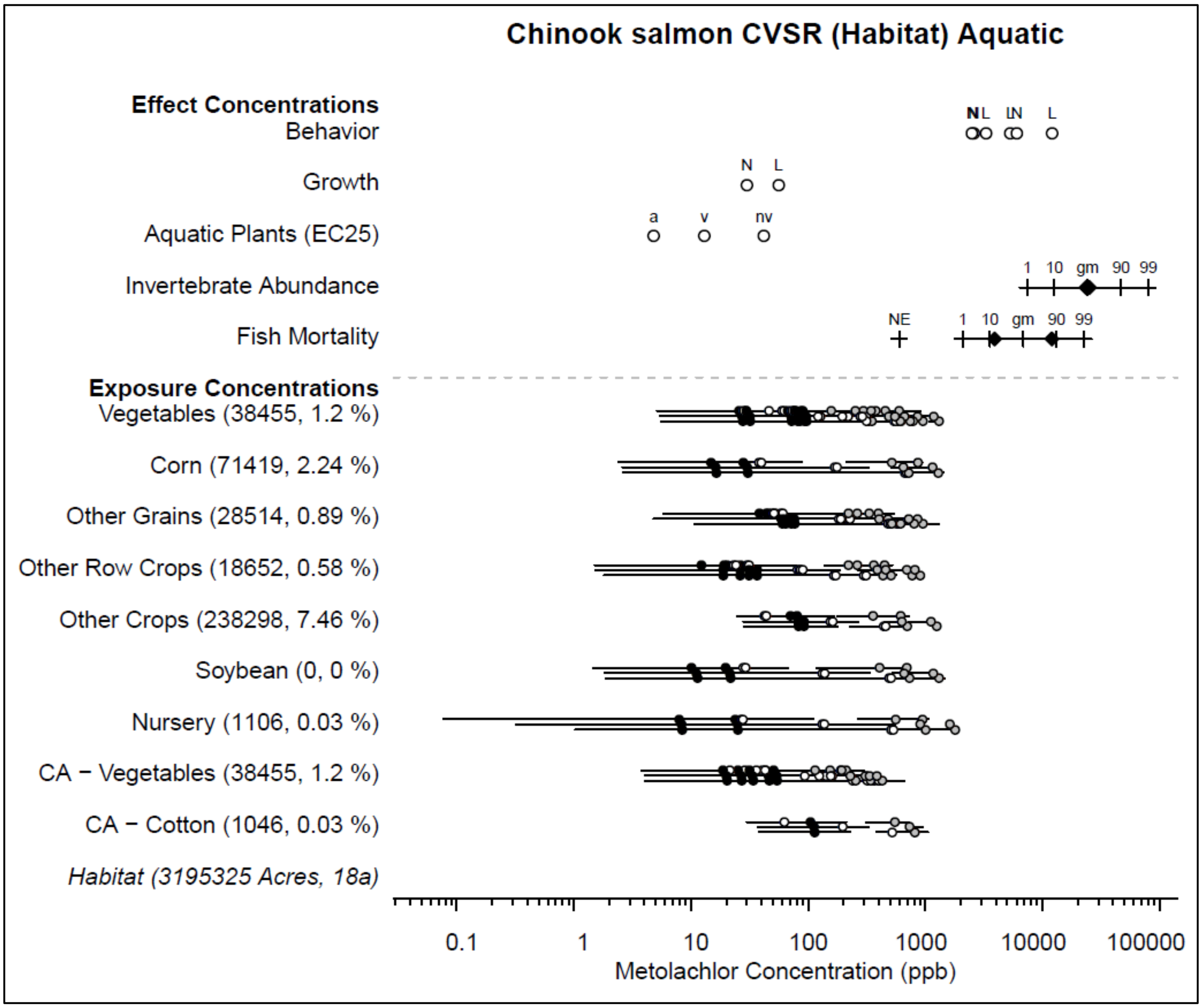


Figure 214. Effects analysis Risk-plot; Chinook salmon, Central Valley spring-run ESU designated critical habitat; aquatic plants and Metolachlor

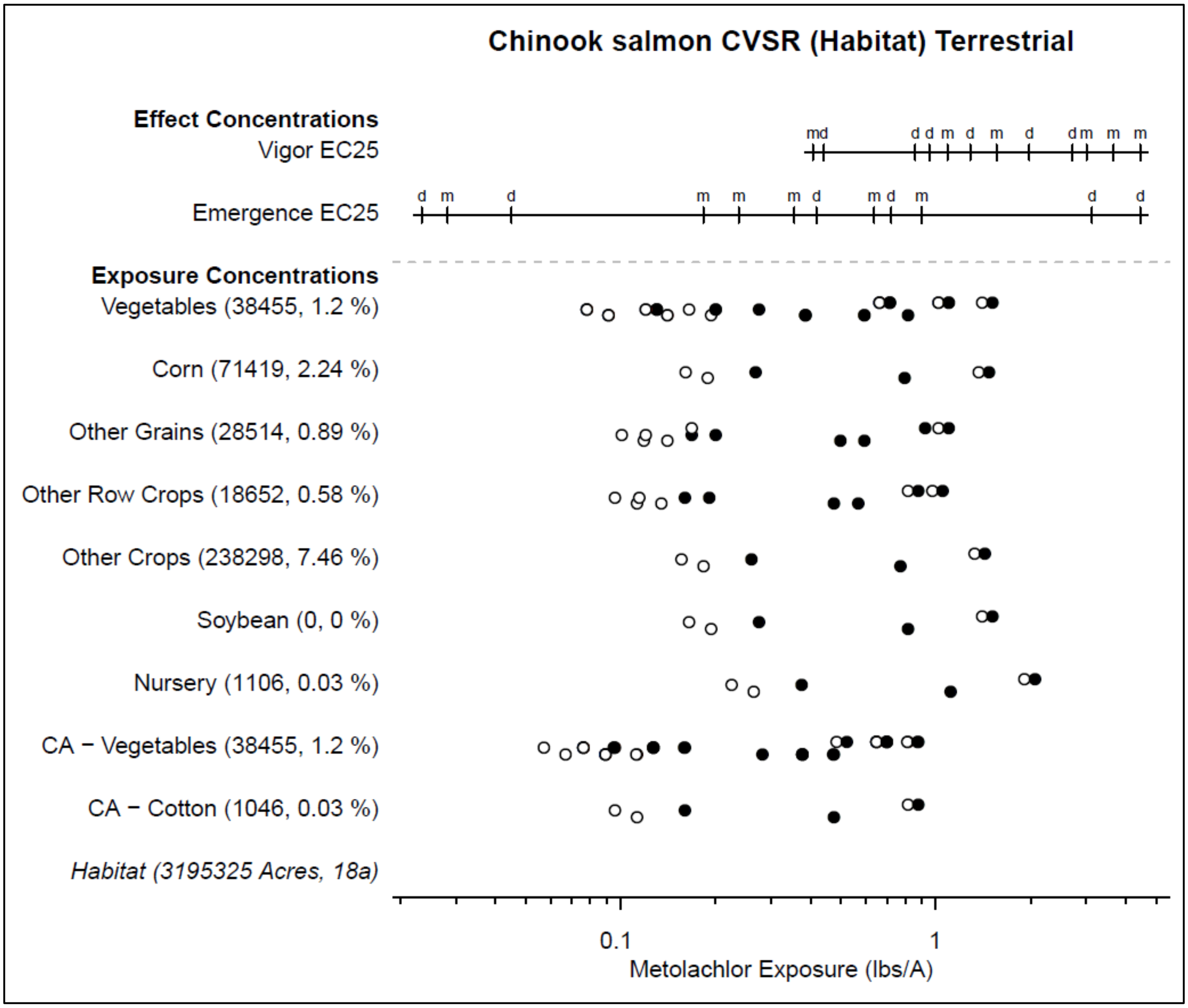


Figure 215. Effects analysis Risk-plot; Chinook salmon, Central Valley spring-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 671. Likelihood of exposure determination for Chinook salmon, Central Valley spring-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	2	no	yes	NA	**Medium**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	yes	**High**
Other Crops	3	no	yes	NA	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	2	no	yes	NA	**Medium**
CA - Cotton	1	no	yes	no	**Low**

Table 672. Prey risk hypothesis; Chinook salmon, Central Valley spring-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.2	None Expected	Medium
Corn	2.24	None Expected	Medium
Other Grains	0.89	None Expected	Low
Other Row Crops	0.58	None Expected	High
Other Crops	7.46	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.03	Low	Low
CA – Vegetables	1.2	None Expected	Medium
CA – Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 673. Vegetative cover risk hypothesis; Chinook salmon, Central Valley spring-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.2	High	Medium
Corn	2.24	High	Medium
Other Grains	0.89	High	Low
Other Row Crops	0.58	High	High
Other Crops	7.46	High	High
Soybean	0	High	Low
Nursery	0.03	High	Low
CA – Vegetables	1.2	High	Medium
CA – Cotton	0.03	High	Low
Terrestrial			
Vegetables	1.2	High	Medium
Corn	2.24	High	Medium
Other Grains	0.89	High	Low
Other Row Crops	0.58	High	High
Other Crops	7.46	High	High
Soybean	0	High	Low
Nursery	0.03	High	Low
CA – Vegetables	1.2	High	Medium
CA – Cotton	0.03	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 674. Water quality risk hypothesis; Chinook salmon, Central Valley spring-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Central Valley spring-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

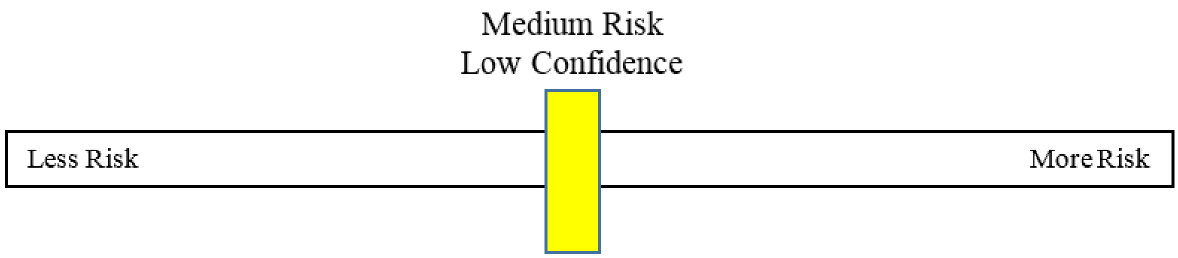
Table 675. Effects analysis summary table; Chinook salmon, Central Valley spring-run ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of California Central Valley spring-run Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the California Central Valley spring-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.


Medium Risk
Low Confidence
Less Risk
More Risk

15.3.6 Lower Columbia River Chinook Designated Critical Habitat; Metolachlor

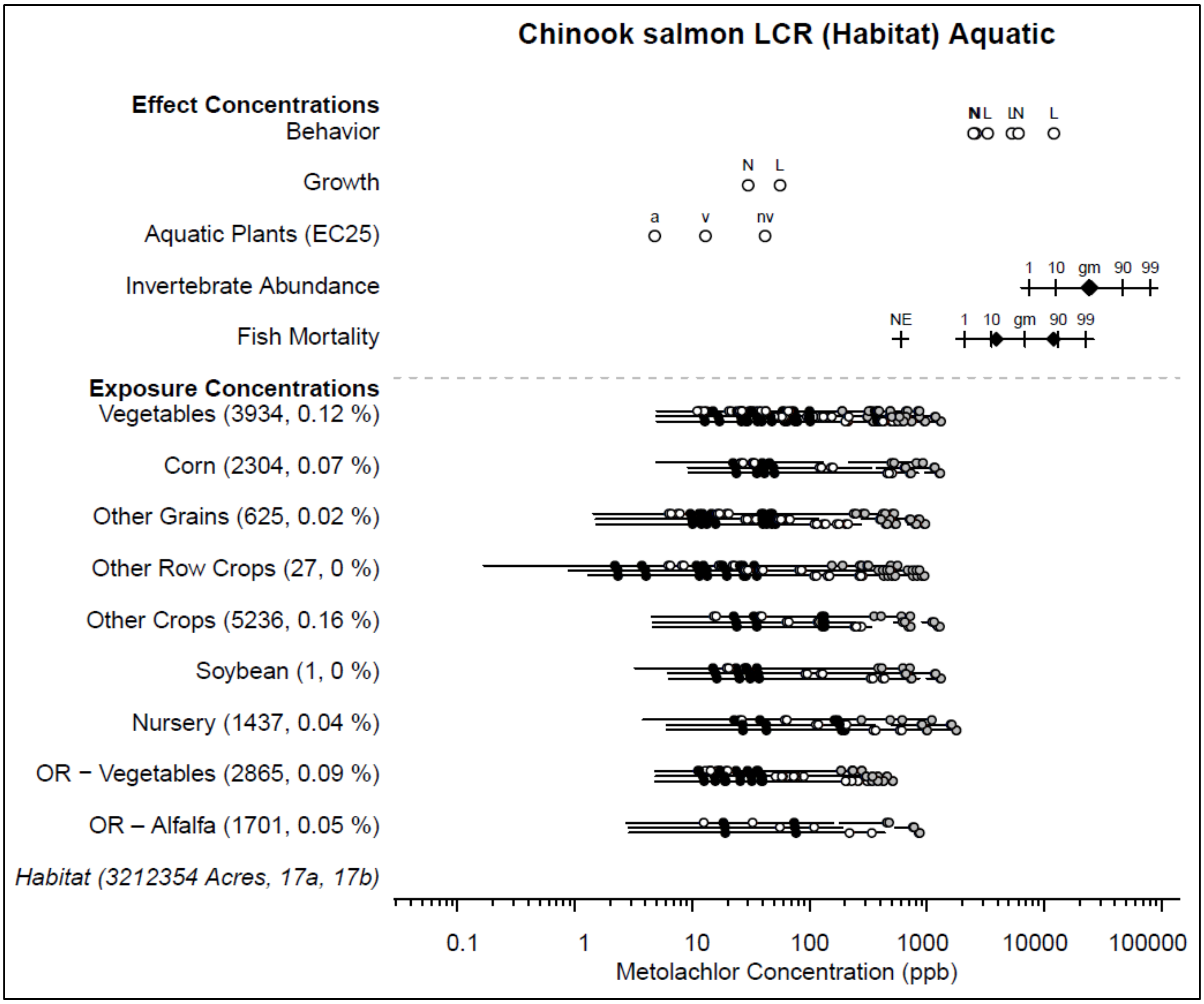


Figure 216. Effects analysis Risk-plot; Chinook salmon, Lower Columbia River ESU designated critical habitat; aquatic plants and Metolachlor

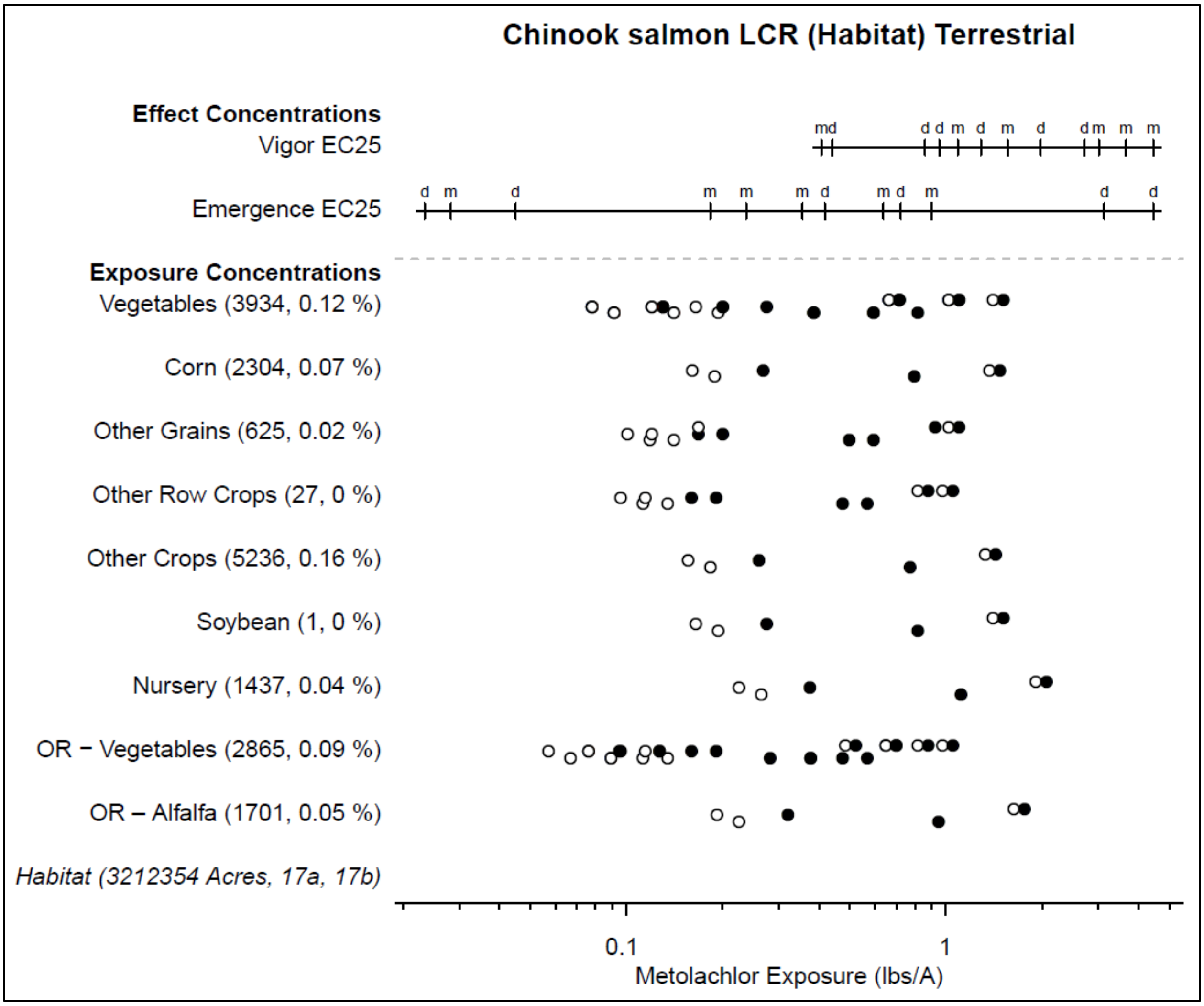


Figure 217. Effects analysis Risk-plot; Chinook salmon, Lower Columbia River ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 676. Likelihood of exposure determination for Chinook salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	no	**Low**
OR - Alfalfa	1	no	yes	no	**Low**

Table 677. Prey risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.12	None Expected	High
Corn	0.07	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.16	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
OR – Vegetables	0.09	None Expected	Low
OR – Alfalfa	0.05	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 678. Vegetative cover risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.12	High	High
Corn	0.07	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.16	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
OR – Vegetables	0.09	High	Low
OR – Alfalfa	0.05	High	Low
Terrestrial			
Vegetables	0.12	High	High
Corn	0.07	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.16	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
OR – Vegetables	0.09	High	Low
OR – Alfalfa	0.05	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 679. Water quality risk hypothesis; Chinook salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Lower Columbia River ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 680. Effects analysis summary table; Chinook salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

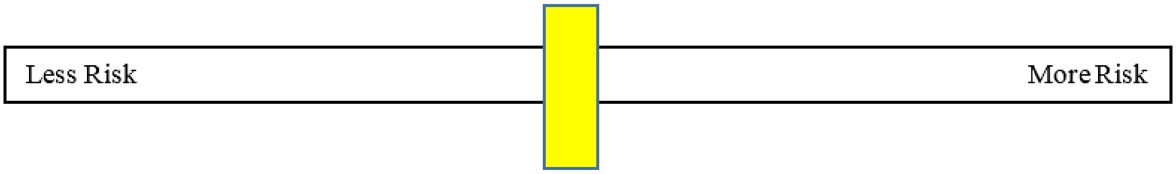
	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Lower Columbia River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

Medium Risk
Low Confidence



15.3.7 Puget Sound Chinook Designated Critical Habitat; Metolachlor

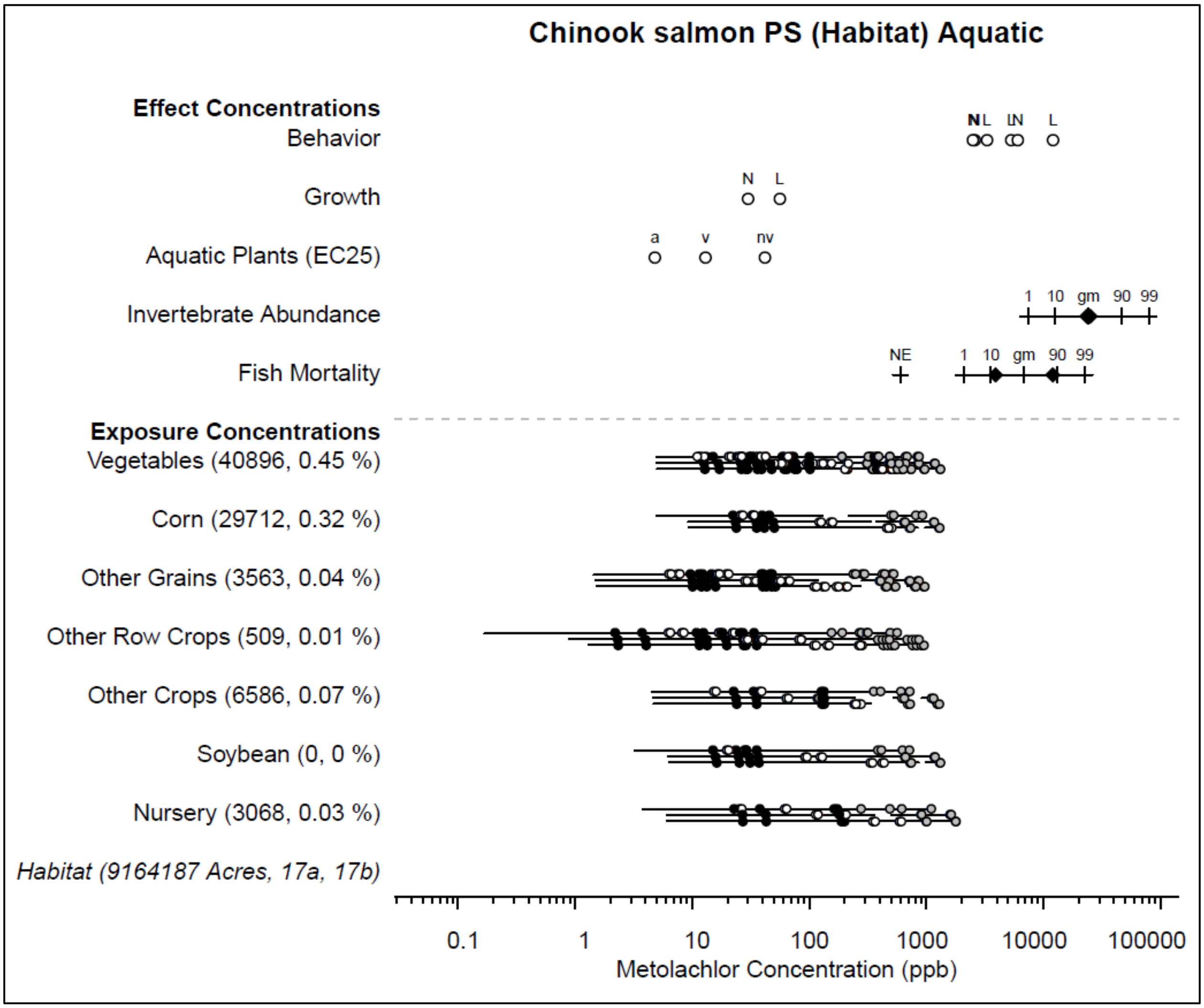


Figure 218. Effects analysis Risk-plot; Chinook Salmon, Puget Sound ESU designated critical habitat; aquatic plants and Metolachlor

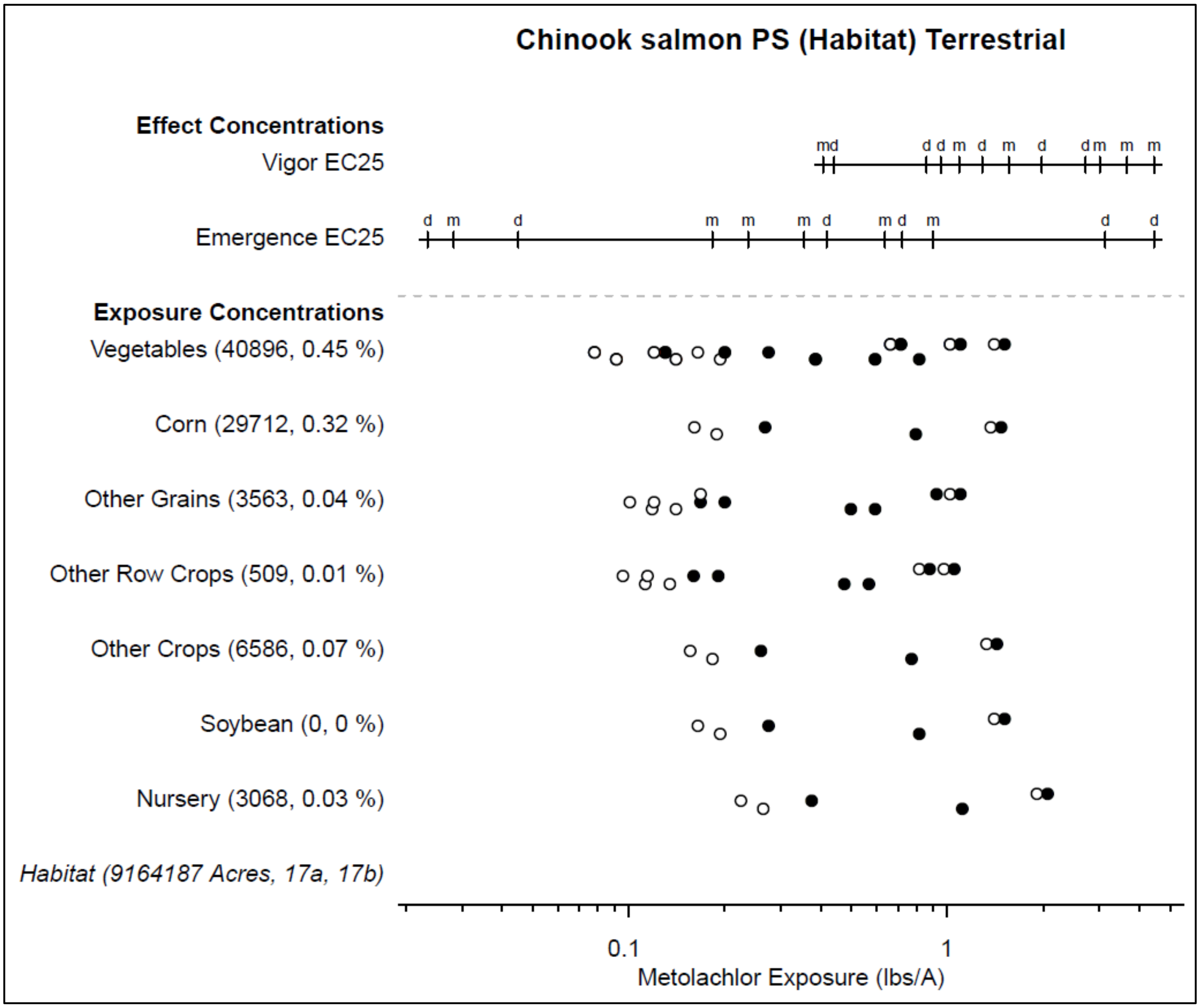


Figure 219. Effects analysis Risk-plot; Chinook Salmon, Puget Sound ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 681. Likelihood of exposure determination for Chinook Salmon, Puget Sound ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**

Table 682. Prey risk hypothesis; Chinook Salmon, Puget Sound ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.45	None Expected	High
Corn	0.32	None Expected	High
Other Grains	0.04	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.07	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.03	Low	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 683. Vegetative cover risk hypothesis; Chinook Salmon, Puget Sound ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.45	High	High
Corn	0.32	High	High
Other Grains	0.04	High	Low
Other Row Crops	0.01	High	Low
Other Crops	0.07	High	Low
Soybean	0	High	Low
Nursery	0.03	High	Low
Terrestrial			
Vegetables	0.45	High	High
Corn	0.32	High	High
Other Grains	0.04	High	Low
Other Row Crops	0.01	High	Low
Other Crops	0.07	High	Low
Soybean	0	High	Low
Nursery	0.03	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
High	**Medium**		

Table 684. Water quality risk hypothesis; Chinook Salmon, Puget Sound ESU designated critical habitat and Metolachlor

Endpoint: Water Quality

Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Puget Sound ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.

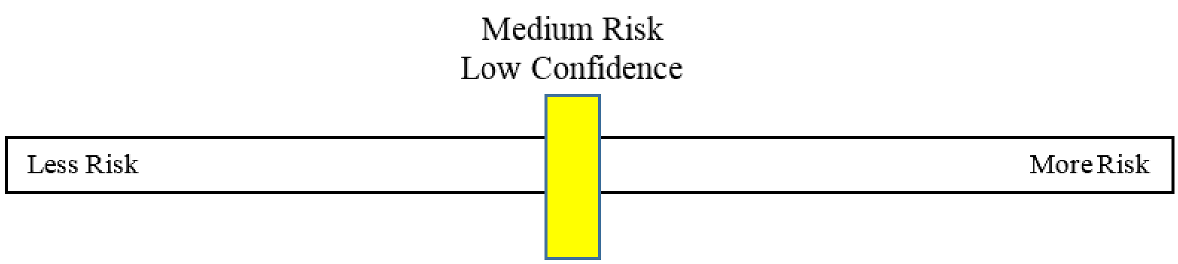
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 685. Effects analysis summary table; Chinook Salmon, Puget Sound ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Puget Sound Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Puget Sound Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.8 Sacramento River Winter-run Chinook Salmon Designated Critical Habitat; Metolachlor

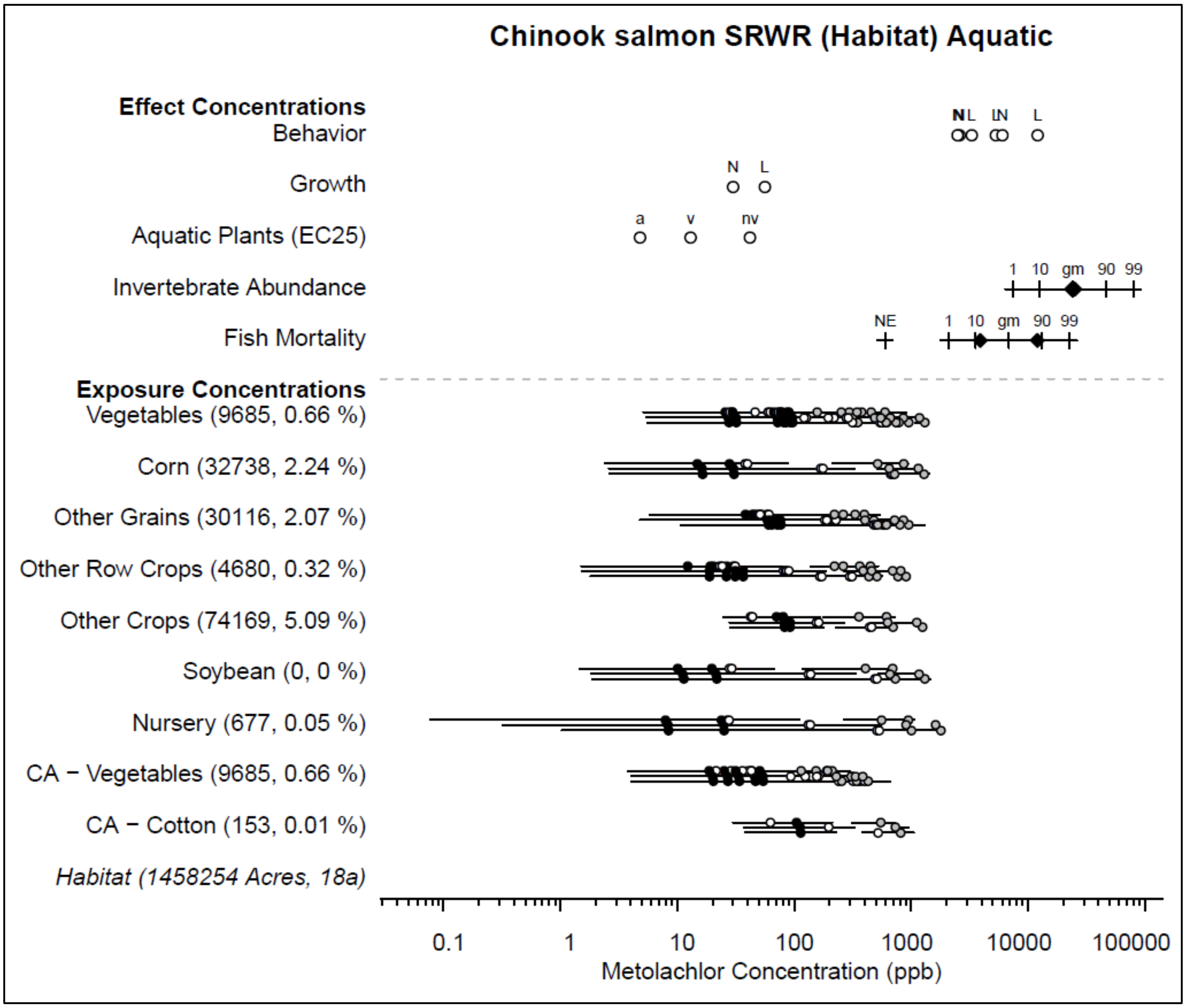


Figure 220. Effects analysis Risk-plot; Chinook salmon, Sacramento River winter-run ESU designated critical habitat; aquatic plants and Metolachlor

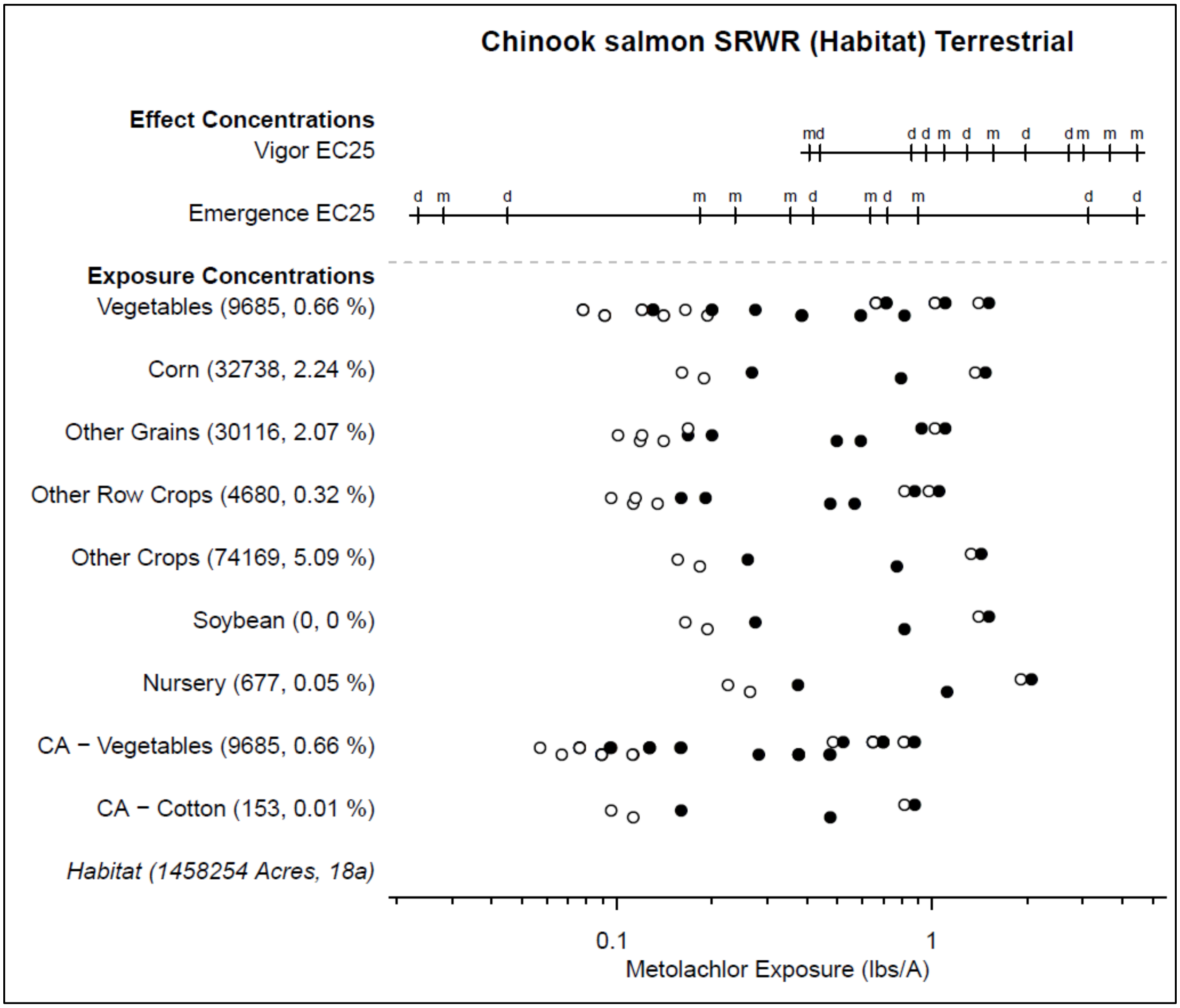


Figure 221. Effects analysis Risk-plot; Chinook salmon, Sacramento River winter-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 686. Likelihood of exposure determination for Chinook salmon, Sacramento River winter-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	2	no	yes	NA	**Medium**
Other Grains	2	no	yes	NA	**Medium**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	3	no	yes	NA	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**

Table 687. Prey risk hypothesis; Chinook salmon, Sacramento River winter-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.66	None Expected	Low
Corn	2.24	None Expected	Medium
Other Grains	2.07	None Expected	Medium
Other Row Crops	0.32	None Expected	Low
Other Crops	5.09	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
CA – Vegetables	0.66	None Expected	Low
CA – Cotton	0.01	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 688. Vegetative cover risk hypothesis; Chinook salmon, Sacramento River winter-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.66	High	Low
Corn	2.24	High	Medium
Other Grains	2.07	High	Medium
Other Row Crops	0.32	High	Low
Other Crops	5.09	High	High
Soybean	0	High	Low
Nursery	0.05	High	Low
CA – Vegetables	0.66	High	Low
CA – Cotton	0.01	High	Low
Terrestrial			
Vegetables	0.66	High	Low
Corn	2.24	High	Medium
Other Grains	2.07	High	Medium
Other Row Crops	0.32	High	Low
Other Crops	5.09	High	High
Soybean	0	High	Low
Nursery	0.05	High	Low
CA – Vegetables	0.66	High	Low
CA – Cotton	0.01	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 689. Water quality risk hypothesis; Chinook salmon, Sacramento River winter-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Sacramento River winter-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

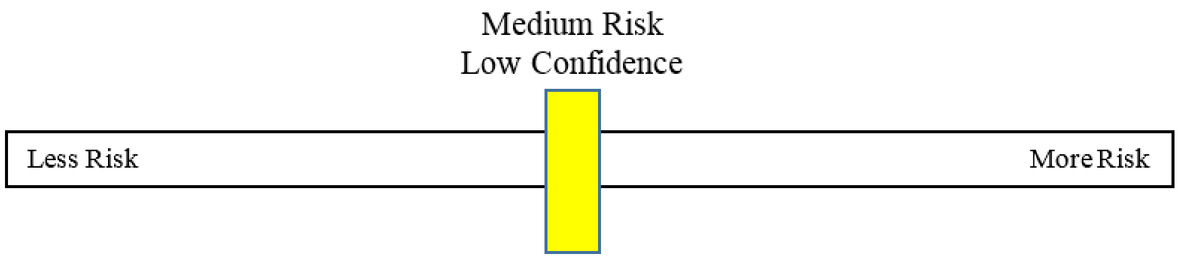
Table 690. Effects analysis summary table; Chinook salmon, Sacramento River winter-run ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Sacramento River winter-run Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Sacramento River winter-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.


Medium Risk
Low Confidence
Less Risk
More Risk

15.3.9 Snake River Fall-run Chinook Salmon Designated Critical Habitat; Metolachlor

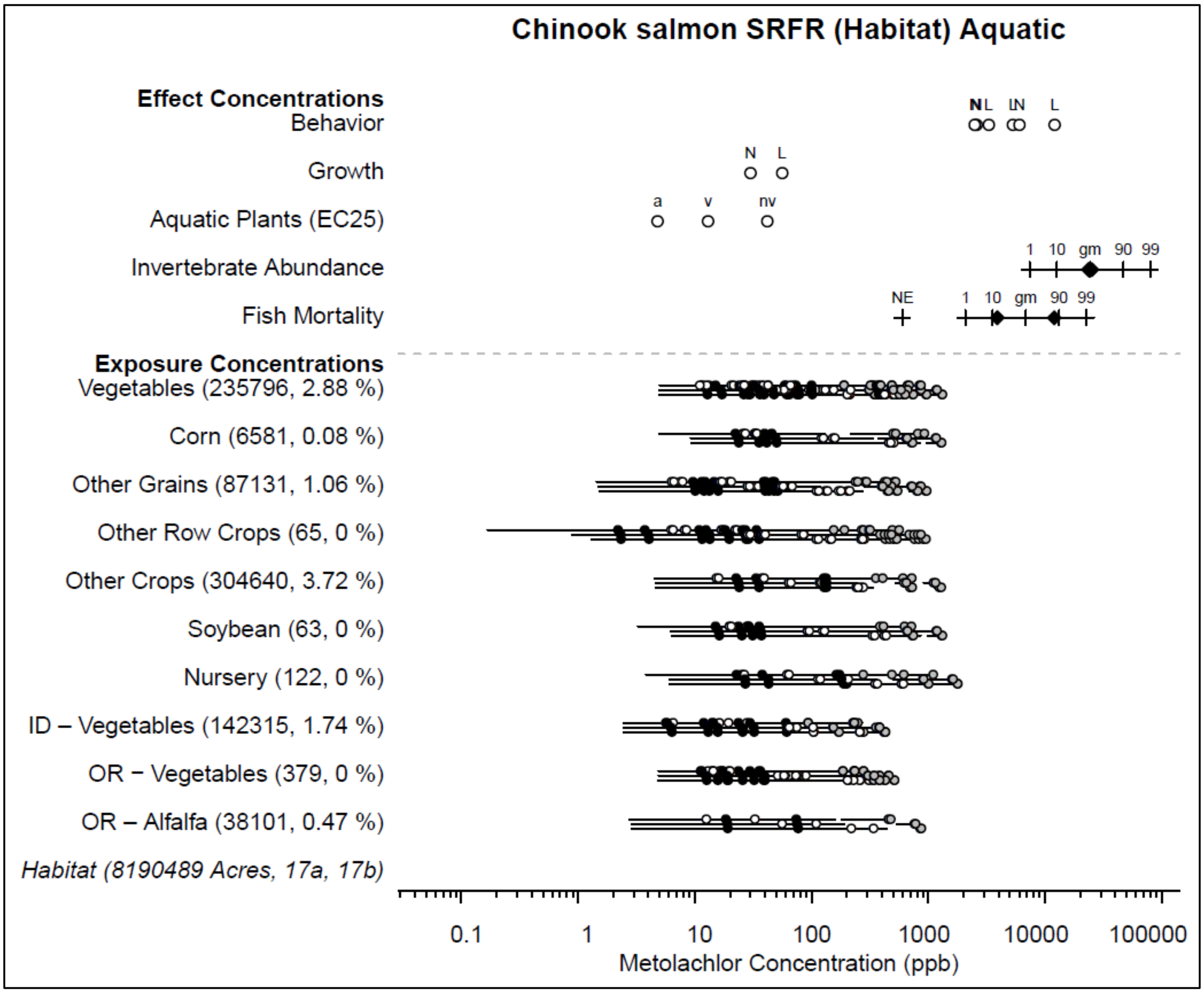


Figure 222. Effects analysis Risk-plot; Chinook salmon, Snake River fall-run ESU designated critical habitat; aquatic plants and Metolachlor

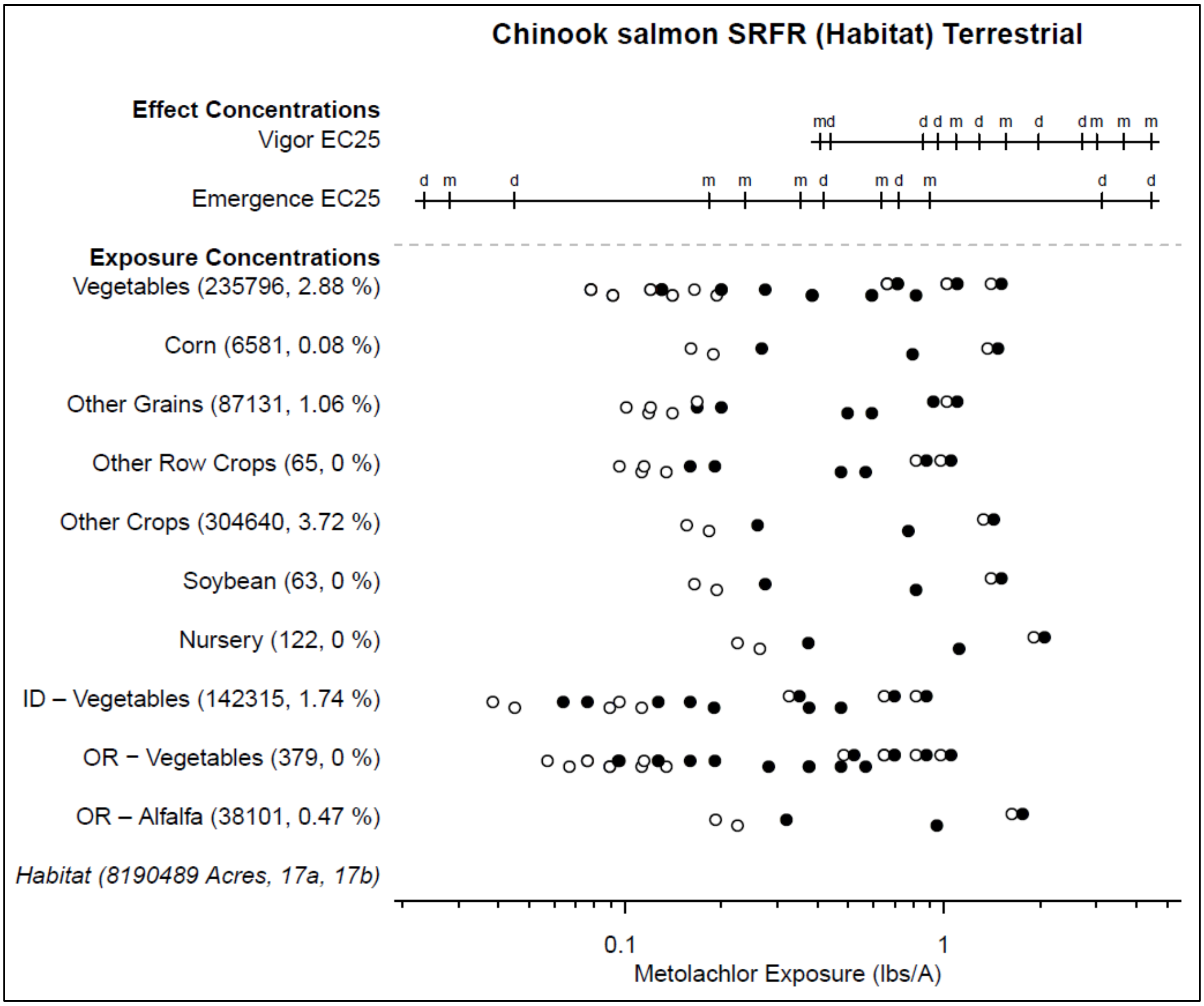


Figure 223. Effects analysis Risk-plot; Chinook salmon, Snake River fall-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 691. Likelihood of exposure determination for Chinook salmon, Snake River fall-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	Medium
Corn	1	no	yes	yes	High
Other Grains	2	no	yes	NA	Medium
Other Row Crops	1	no	yes	no	Low
Other Crops	2	no	yes	NA	Medium
Soybean	1	no	yes	no	Low
Nursery	1	no	yes	no	Low
ID - Vegetables	2	no	yes	NA	Medium
OR - Vegetables	1	no	yes	no	Low
OR - Alfalfa	1	no	yes	no	Low

Table 692. Prey risk hypothesis; Chinook salmon, Snake River fall-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	2.88	None Expected	Medium
Corn	0.08	None Expected	High
Other Grains	1.06	None Expected	Medium
Other Row Crops	0	None Expected	Low
Other Crops	3.72	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0	Low	Low
ID – Vegetables	1.74	None Expected	Medium
OR – Vegetables	0	None Expected	Low
OR – Alfalfa	0.47	None Expected	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 693. Vegetative cover risk hypothesis; Chinook salmon, Snake River fall-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	2.88	High	Medium
Corn	0.08	High	High
Other Grains	1.06	High	Medium
Other Row Crops	0	High	Low
Other Crops	3.72	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low
ID – Vegetables	1.74	High	Medium
OR – Vegetables	0	High	Low
OR – Alfalfa	0.47	High	Low
Terrestrial			
Vegetables	2.88	High	Medium
Corn	0.08	High	High
Other Grains	1.06	High	Medium
Other Row Crops	0	High	Low
Other Crops	3.72	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low

ID – Vegetables	1.74	High	Medium
OR – Vegetables	0	High	Low
OR – Alfalfa	0.47	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
High	**Medium**		

Table 694. Water quality risk hypothesis; Chinook salmon, Snake River fall-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Snake River fall-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

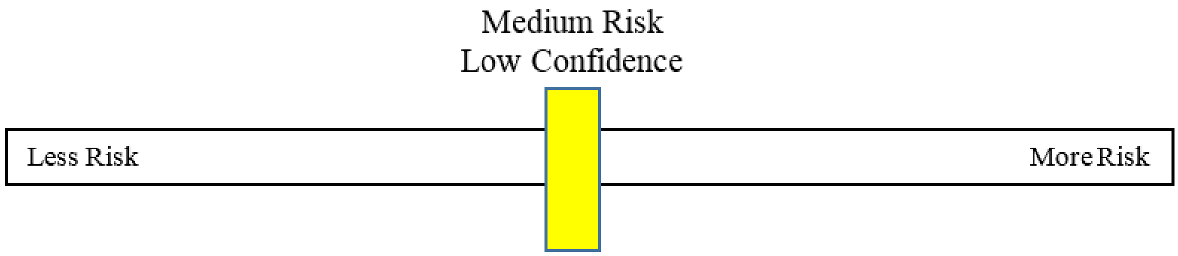
Table 695. Effects analysis summary table; Chinook salmon, Snake River fall-run ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River Chinook salmon fall-run designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Snake River fall-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.


Medium Risk
Low Confidence
Less Risk
More Risk

15.3.10 Snake River Spring/Summer-run Chinook Salmon Designated Critical Habitat;

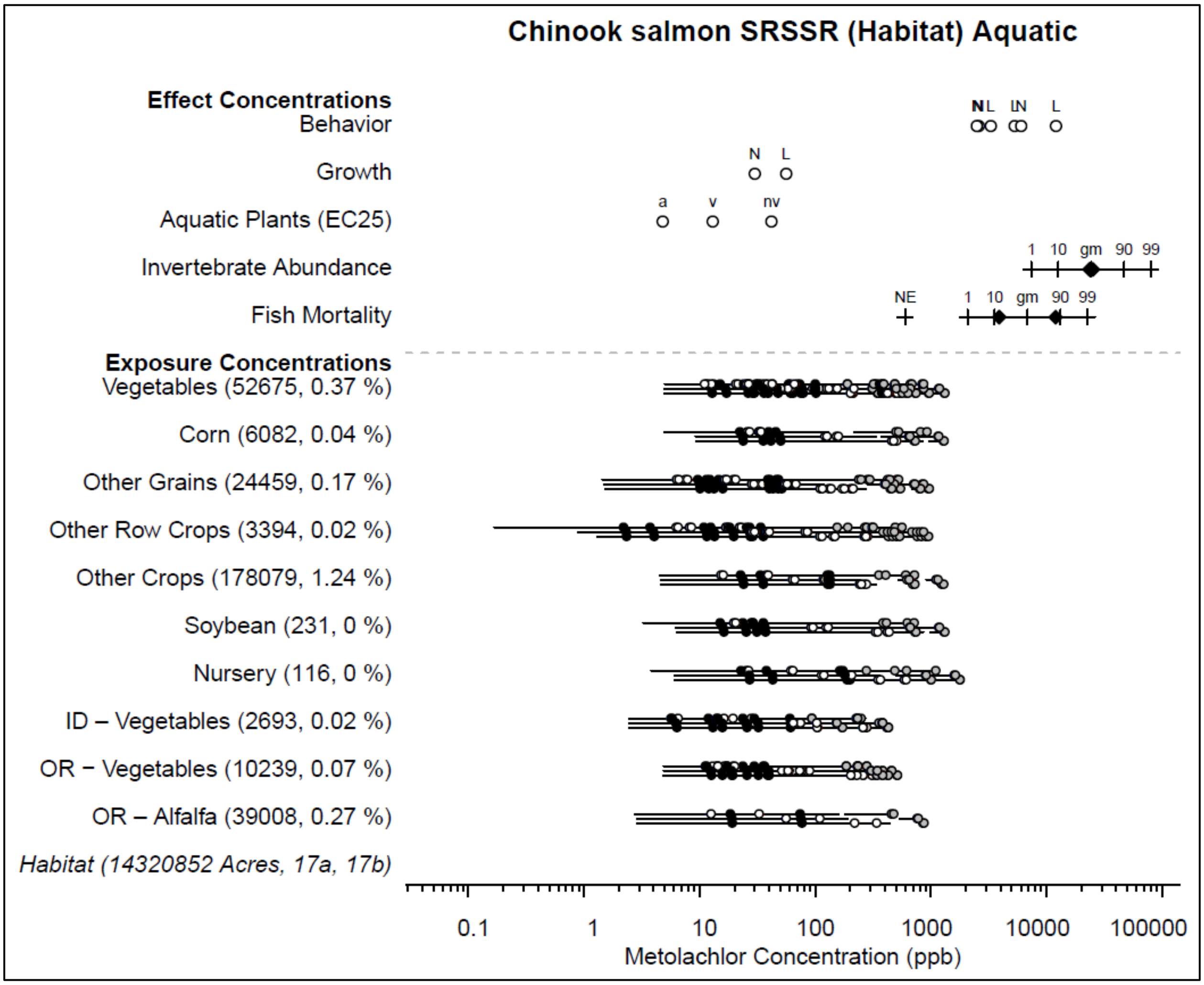


Figure 224. Effects analysis Risk-plot; Chinook salmon Snake River spring/summer-run ESU designated critical habitat; aquatic plants and Metolachlor

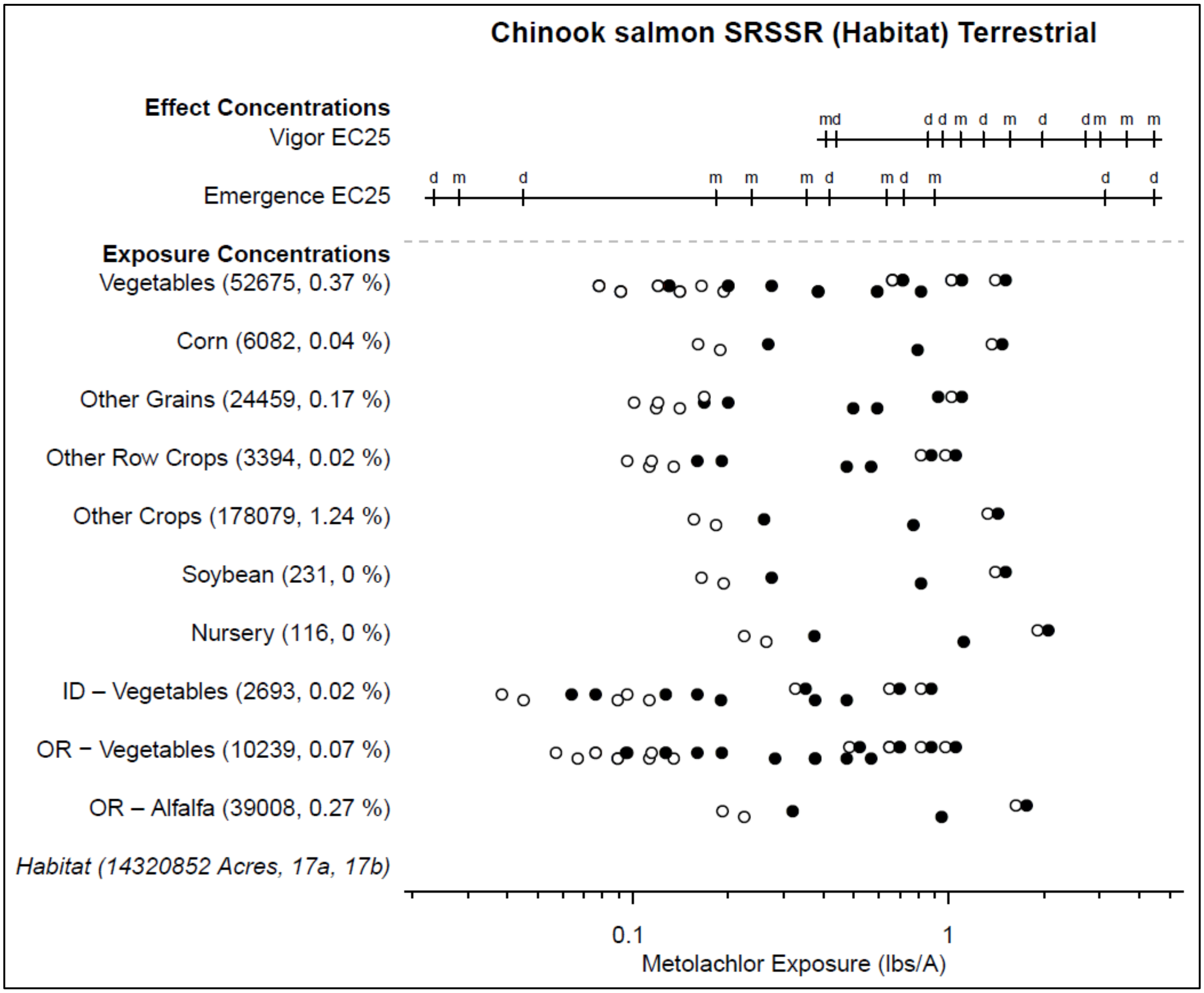


Figure 225. Effects analysis Risk-plot; Chinook salmon Snake River spring/summer-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 696. Likelihood of exposure determination for Chinook salmon Snake River spring/summer-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	Low
Corn	1	no	yes	yes	High
Other Grains	1	no	yes	no	Low
Other Row Crops	1	no	yes	no	Low
Other Crops	2	no	yes	NA	Medium
Soybean	1	no	yes	no	Low
Nursery	1	no	yes	no	Low
ID - Vegetables	1	no	yes	no	Low
OR - Vegetables	1	no	yes	no	Low
OR - Alfalfa	1	no	yes	no	Low

Table 697. Prey risk hypothesis; Chinook salmon Snake River spring/summer-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.37	None Expected	Low
Corn	0.04	None Expected	High
Other Grains	0.17	None Expected	Low
Other Row Crops	0.02	None Expected	Low
Other Crops	1.24	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0	Low	Low
ID – Vegetables	0.02	None Expected	Low
OR – Vegetables	0.07	None Expected	Low
OR – Alfalfa	0.27	None Expected	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 698. Vegetative cover risk hypothesis; Chinook salmon Snake River spring/summer-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.37	High	Low
Corn	0.04	High	High
Other Grains	0.17	High	Low
Other Row Crops	0.02	High	Low
Other Crops	1.24	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low
ID – Vegetables	0.02	High	Low
OR – Vegetables	0.07	High	Low
OR – Alfalfa	0.27	High	Low
Terrestrial			
Vegetables	0.37	High	Low
Corn	0.04	High	High
Other Grains	0.17	High	Low
Other Row Crops	0.02	High	Low
Other Crops	1.24	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low

ID – Vegetables	0.02	High	Low
OR – Vegetables	0.07	High	Low
OR – Alfalfa	0.27	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
High	**Medium**		

Table 699. Water quality risk hypothesis; Chinook salmon Snake River spring/summer-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Snake River spring/summer-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

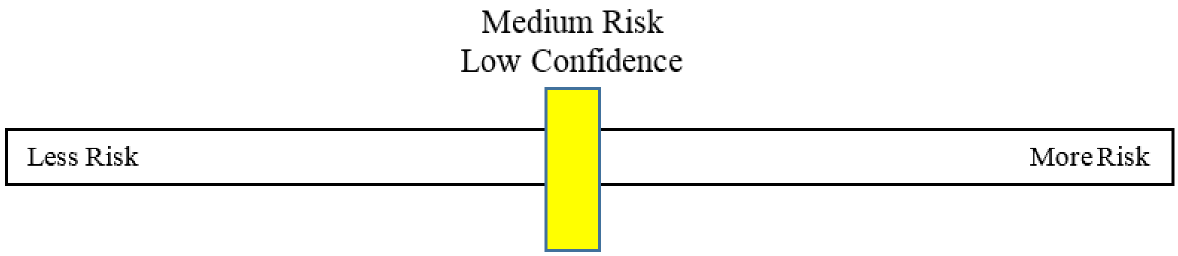
Table 700. Effects analysis summary table; Chinook salmon Snake River spring/summer-run ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River spring/summer-run Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Snake River spring/summer-run Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.


Medium Risk
Low Confidence
Less Risk
More Risk

15.3.11 Upper Columbia River Spring-run Chinook Salmon Designated Critical Habitat; Metolachlor

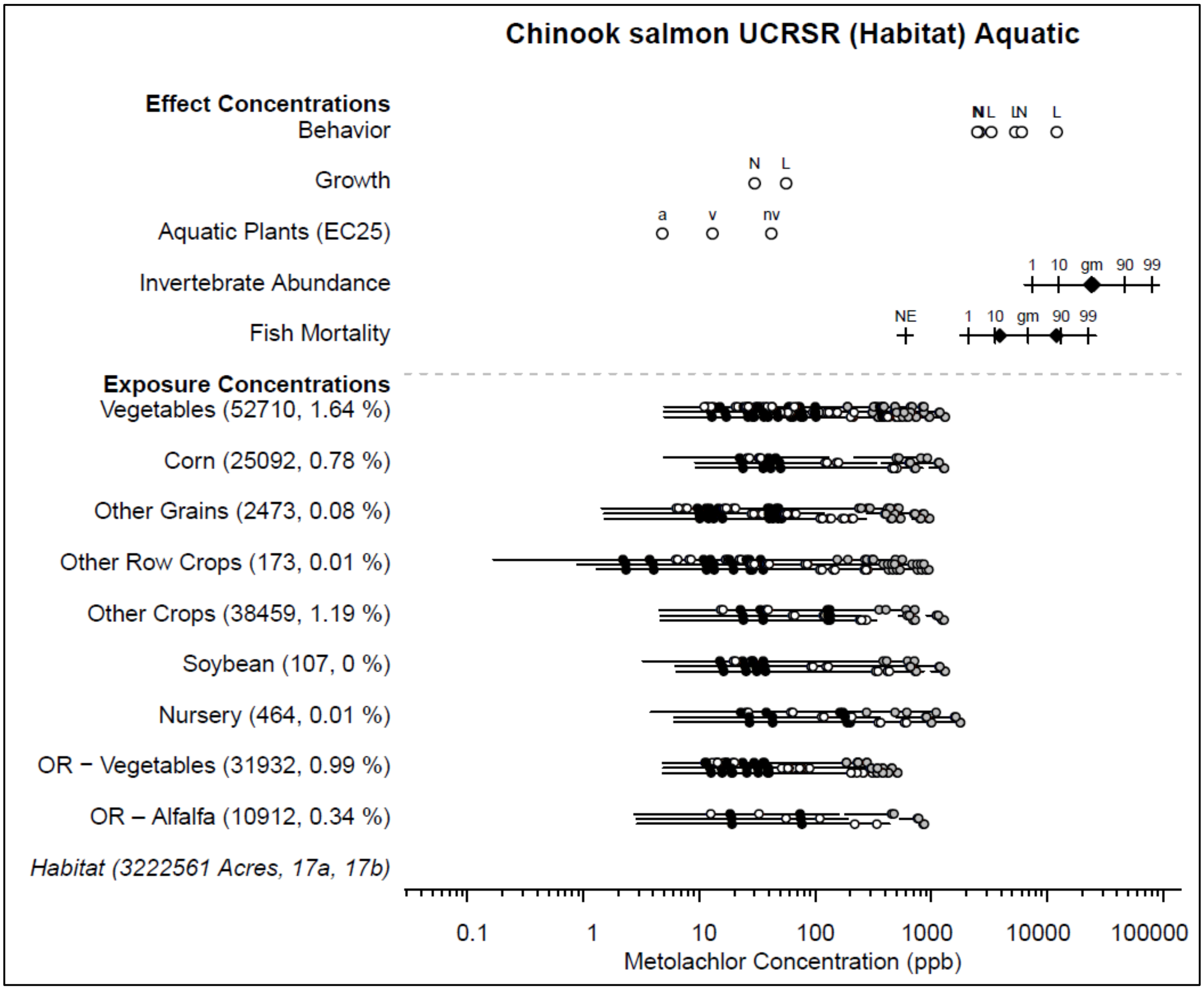


Figure 226. Effects analysis Risk-plot; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat; aquatic plants and Metolachlor

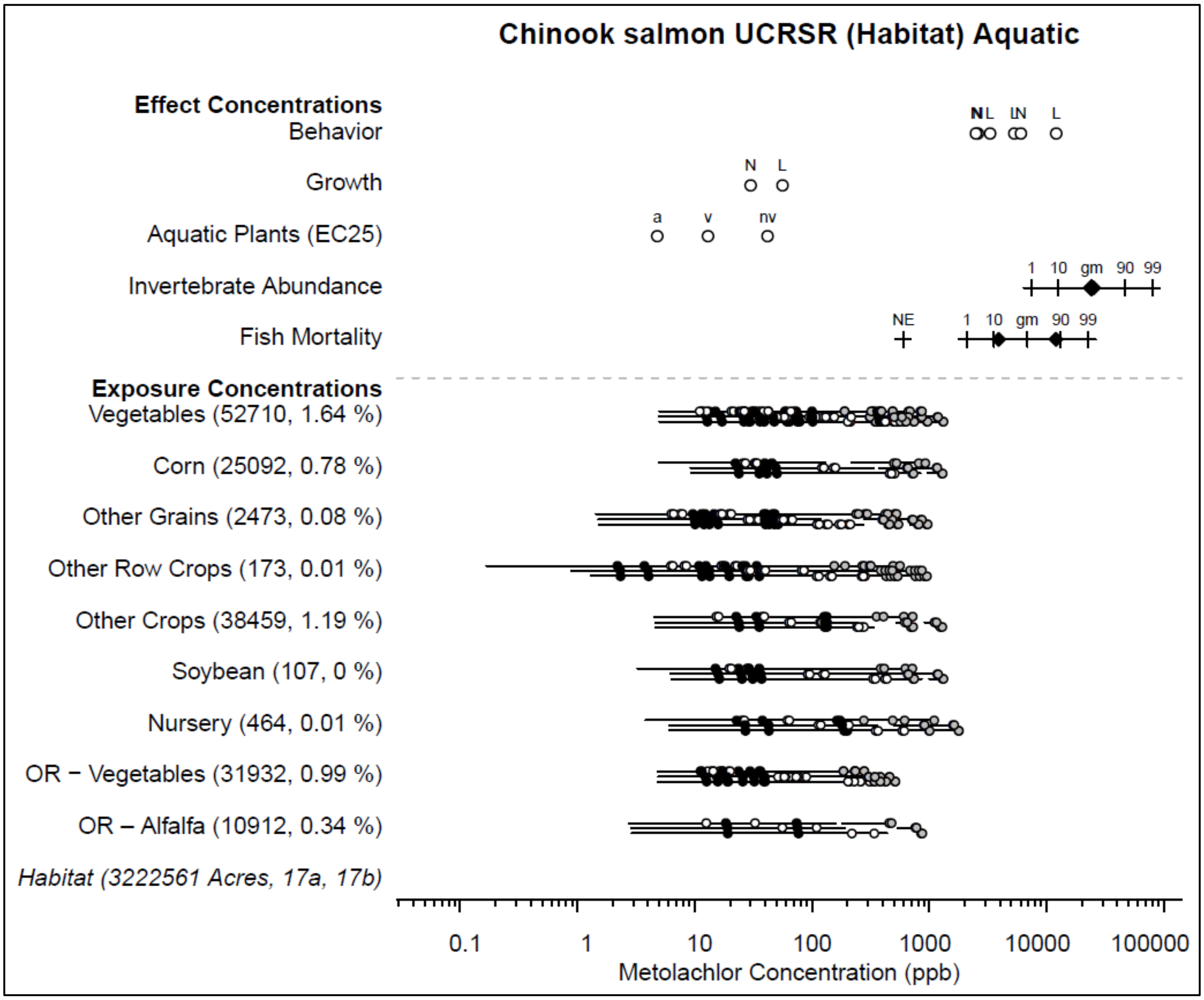


Figure 227. Effects analysis Risk-plot; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 701. Likelihood of exposure determination for Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	2	no	yes	NA	**Medium**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	no	**Low**
OR - Alfalfa	1	no	yes	no	**Low**

Table 702. Prey risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.64	None Expected	Medium
Corn	0.78	None Expected	High
Other Grains	0.08	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	1.19	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
OR – Vegetables	0.99	None Expected	Low
OR – Alfalfa	0.34	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 703. Vegetative cover risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.64	High	Medium
Corn	0.78	High	High
Other Grains	0.08	High	Low
Other Row Crops	0.01	High	Low
Other Crops	1.19	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.99	High	Low
OR – Alfalfa	0.34	High	Low
Terrestrial			
Vegetables	1.64	High	Medium
Corn	0.78	High	High
Other Grains	0.08	High	Low
Other Row Crops	0.01	High	Low
Other Crops	1.19	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.99	High	Low
OR – Alfalfa	0.34	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 704. Water quality risk hypothesis; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Upper Columbia River spring-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 705. Effects analysis summary table; Chinook salmon, Upper Columbia River spring-run ESU designated critical habitat and Metolachlor

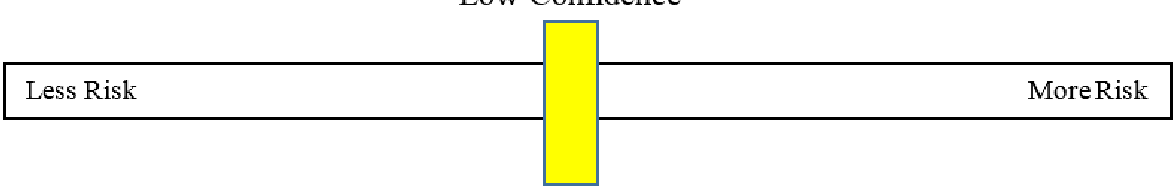
	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Columbia River Chinook salmon spring-run designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Upper Columbia River Chinook spring-run ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

Medium Risk
Low Confidence



15.3.12 Upper Willamette River Chinook Salmon Designated Critical Habitat; Metolachlor

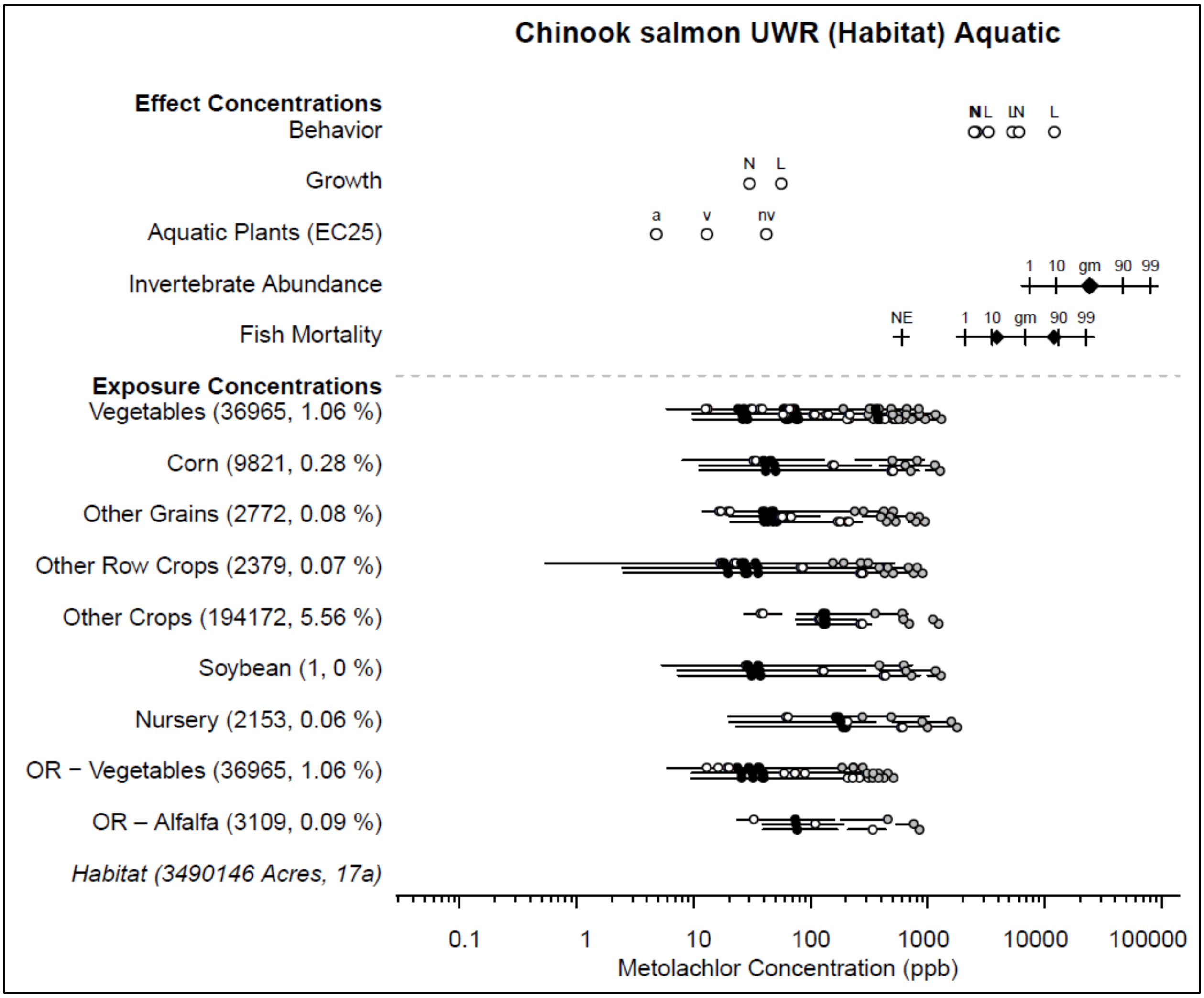


Figure 228. Effects analysis Risk-plot; Chinook salmon, Upper Willamette River ESU designated critical habitat; aquatic plants and Metolachlor

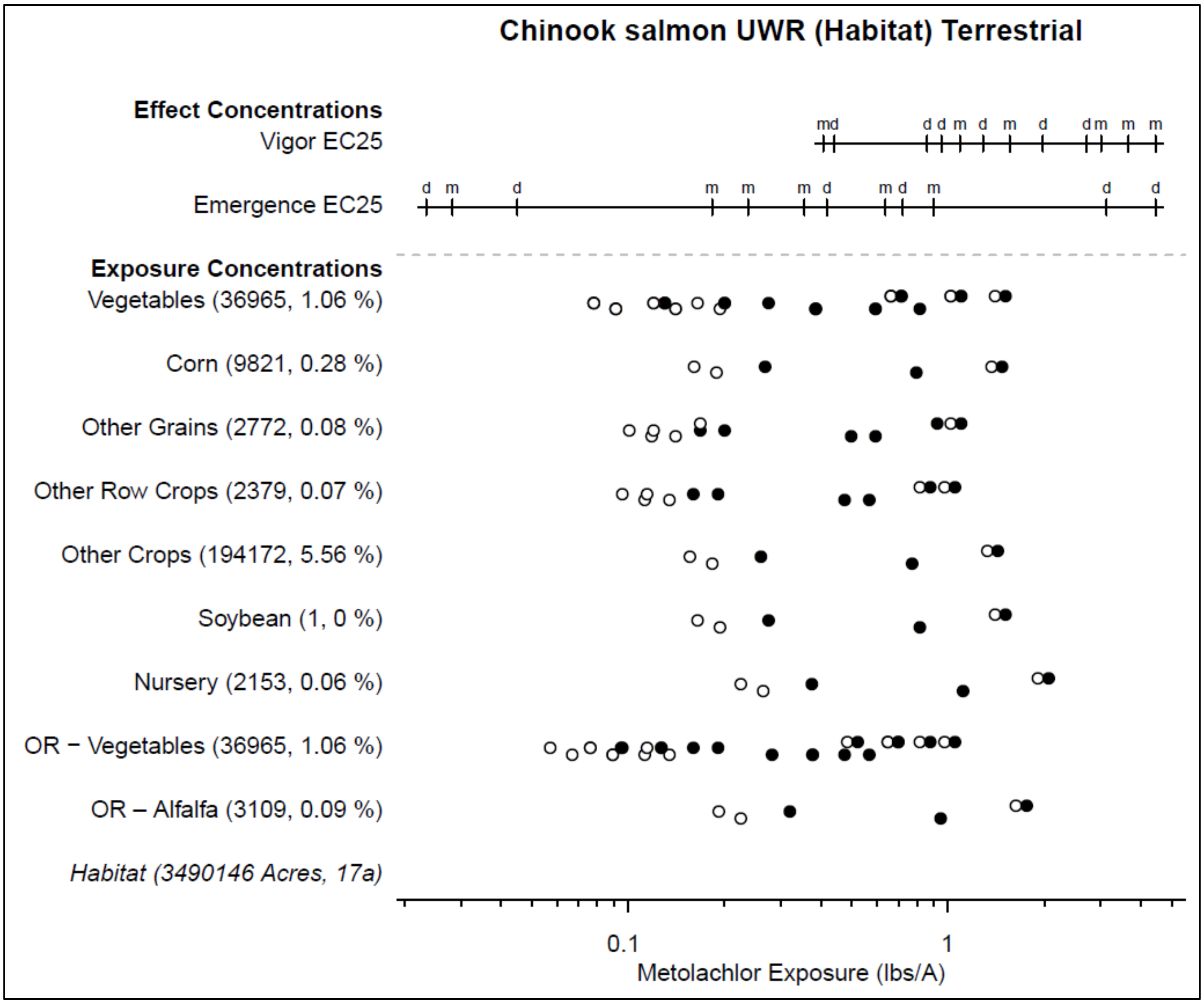


Figure 229. Effects analysis Risk-plot; Chinook salmon, Upper Willamette River ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 706. Likelihood of exposure determination for Chinook salmon, Upper Willamette River ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	yes	**High**
Other Crops	3	no	yes	NA	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	2	no	yes	NA	**Medium**
OR - Alfalfa	1	no	yes	no	**Low**

Table 707. Prey risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.06	None Expected	Medium
Corn	0.28	None Expected	High
Other Grains	0.08	None Expected	High
Other Row Crops	0.07	None Expected	High
Other Crops	5.56	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.06	Low	Low
OR – Vegetables	1.06	None Expected	Medium
OR – Alfalfa	0.09	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 708. Vegetative cover risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.06	High	Medium
Corn	0.28	High	High
Other Grains	0.08	High	High
Other Row Crops	0.07	High	High
Other Crops	5.56	High	High
Soybean	0	High	Low
Nursery	0.06	High	Low
OR – Vegetables	1.06	High	Medium
OR – Alfalfa	0.09	High	Low
Terrestrial			
Vegetables	1.06	High	Medium
Corn	0.28	High	High
Other Grains	0.08	High	High
Other Row Crops	0.07	High	High
Other Crops	5.56	High	High
Soybean	0	High	Low
Nursery	0.06	High	Low
OR – Vegetables	1.06	High	Medium
OR – Alfalfa	0.09	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 709. Water quality risk hypothesis; Chinook salmon, Upper Willamette River ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Chinook salmon, Upper Willamette River ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

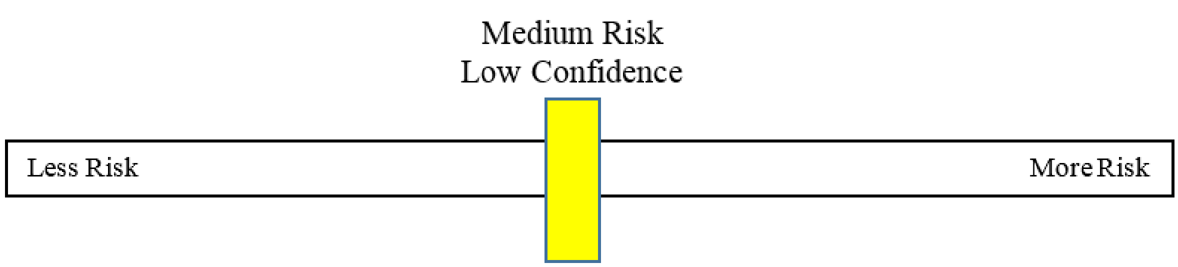
Table 710. Effects analysis summary table; Chinook salmon, Upper Willamette River ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Willamette River Chinook salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Upper Willamette River Chinook ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.13 Central California Coast Coho Salmon Designated Critical Habitat; Metolachlor

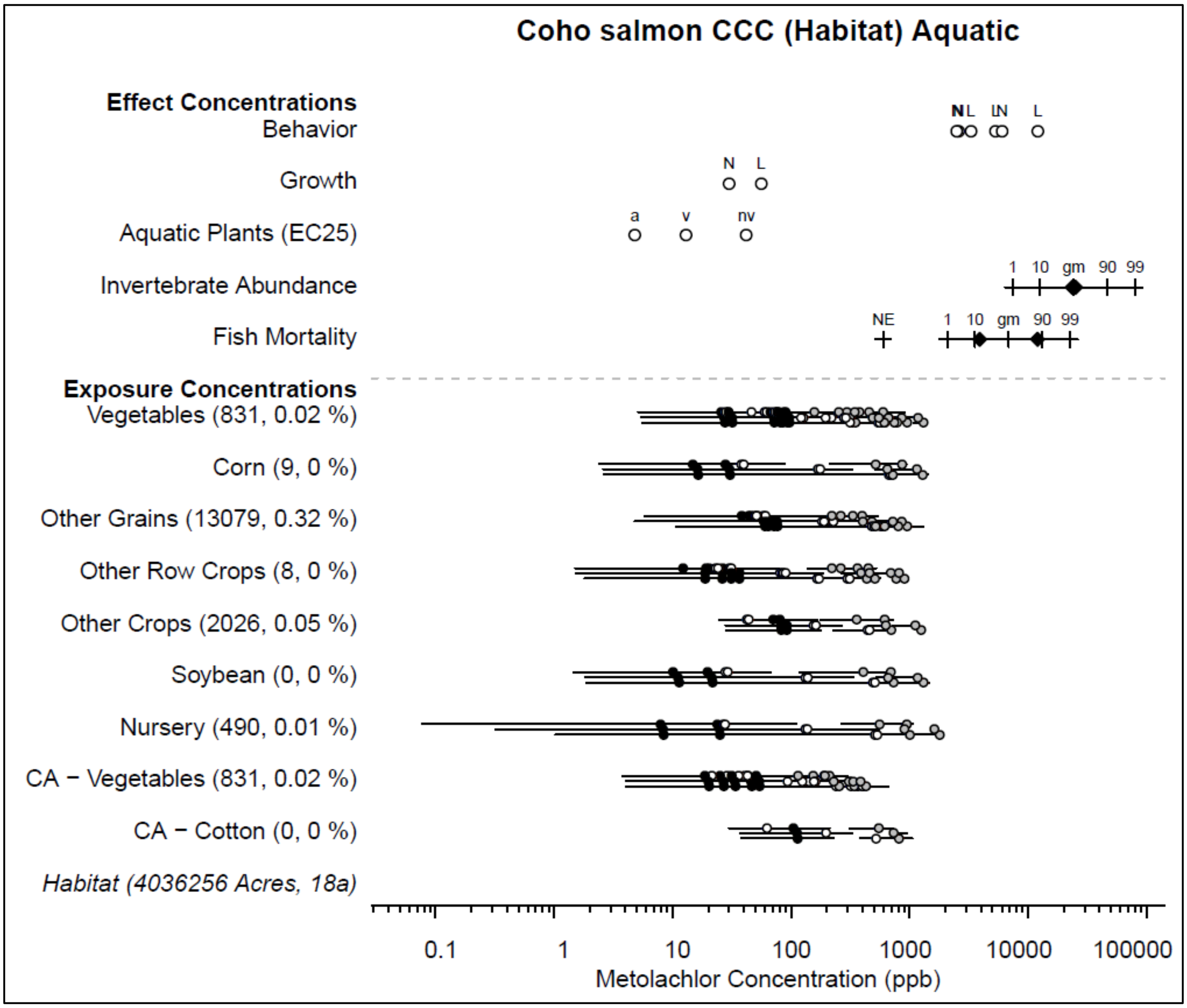


Figure 230. Effects analysis Risk-plot; Coho salmon, Central California Coast ESU designated critical habitat; aquatic plants and Metolachlor

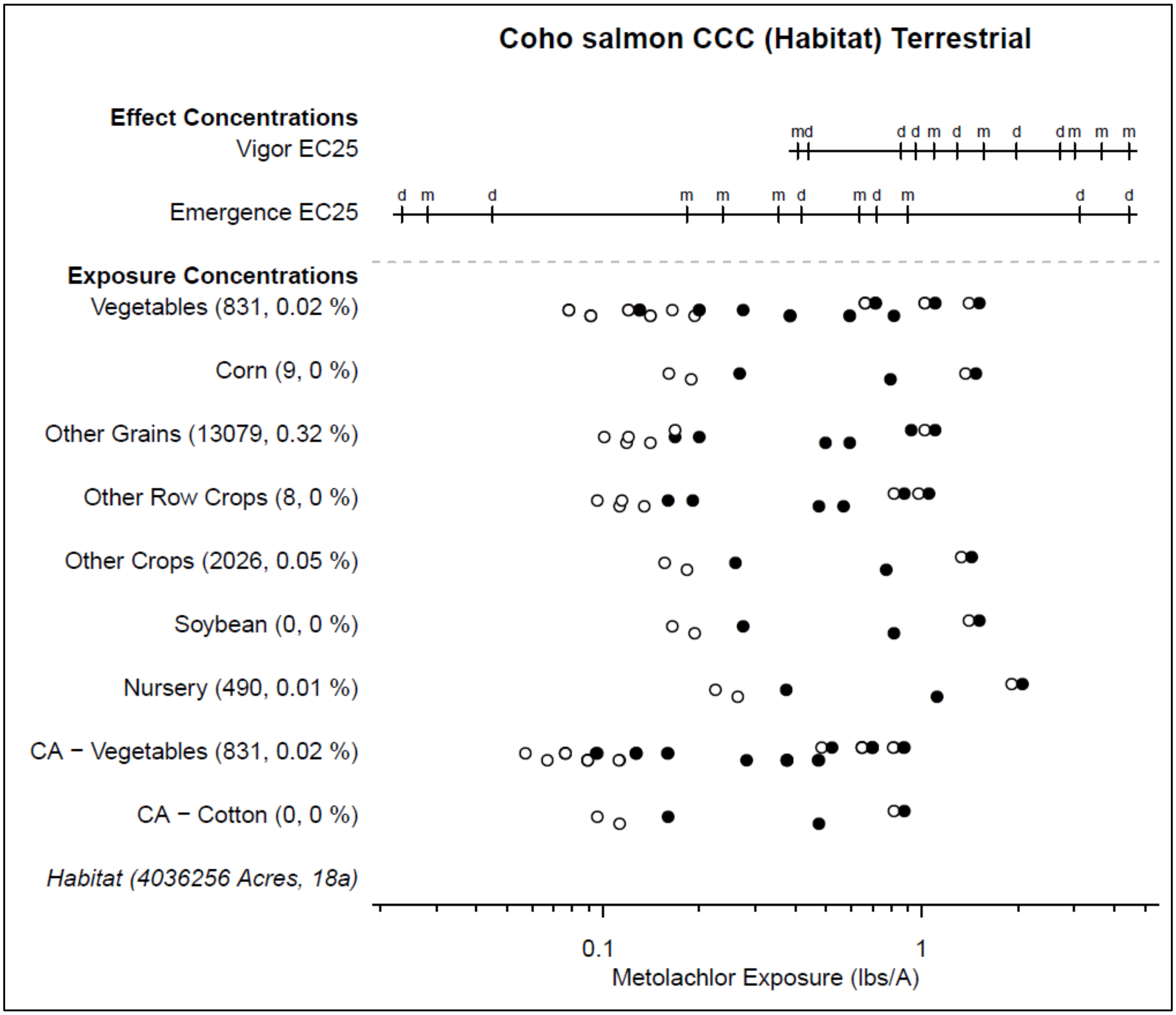


Figure 231. Effects analysis Risk-plot; Coho salmon, Central California Coast ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 711. Likelihood of exposure determination for Coho salmon, Central California Coast ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**

Table 712. Prey risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.02	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.32	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.05	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
CA – Vegetables	0.02	None Expected	Low
CA – Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 713. Vegetative cover risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.02	High	Low
Corn	0	High	Low
Other Grains	0.32	High	Low
Other Row Crops	0	High	Low
Other Crops	0.05	High	Low
Soybean	0	High	Low
Nursery	0.01	High	Low
CA – Vegetables	0.02	High	Low
CA – Cotton	0	High	Low
Terrestrial			
Vegetables	0.02	High	Low
Corn	0	High	Low
Other Grains	0.32	High	Low
Other Row Crops	0	High	Low
Other Crops	0.05	High	Low
Soybean	0	High	Low
Nursery	0.01	High	Low
CA – Vegetables	0.02	High	Low
CA – Cotton	0	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 714. Water quality risk hypothesis; Coho salmon, Central California Coast ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Central California Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

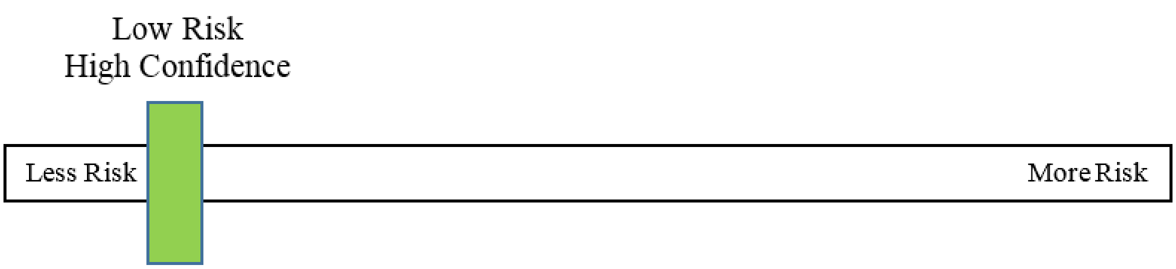
Table 715. Effects analysis summary table; Coho salmon, Central California Coast ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported?
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	**Yes/No**
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Low	High	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Central California Coast Coho salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Central California Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.14 Lower Columbia River Coho Salmon Designated Critical Habitat; Metolachlor

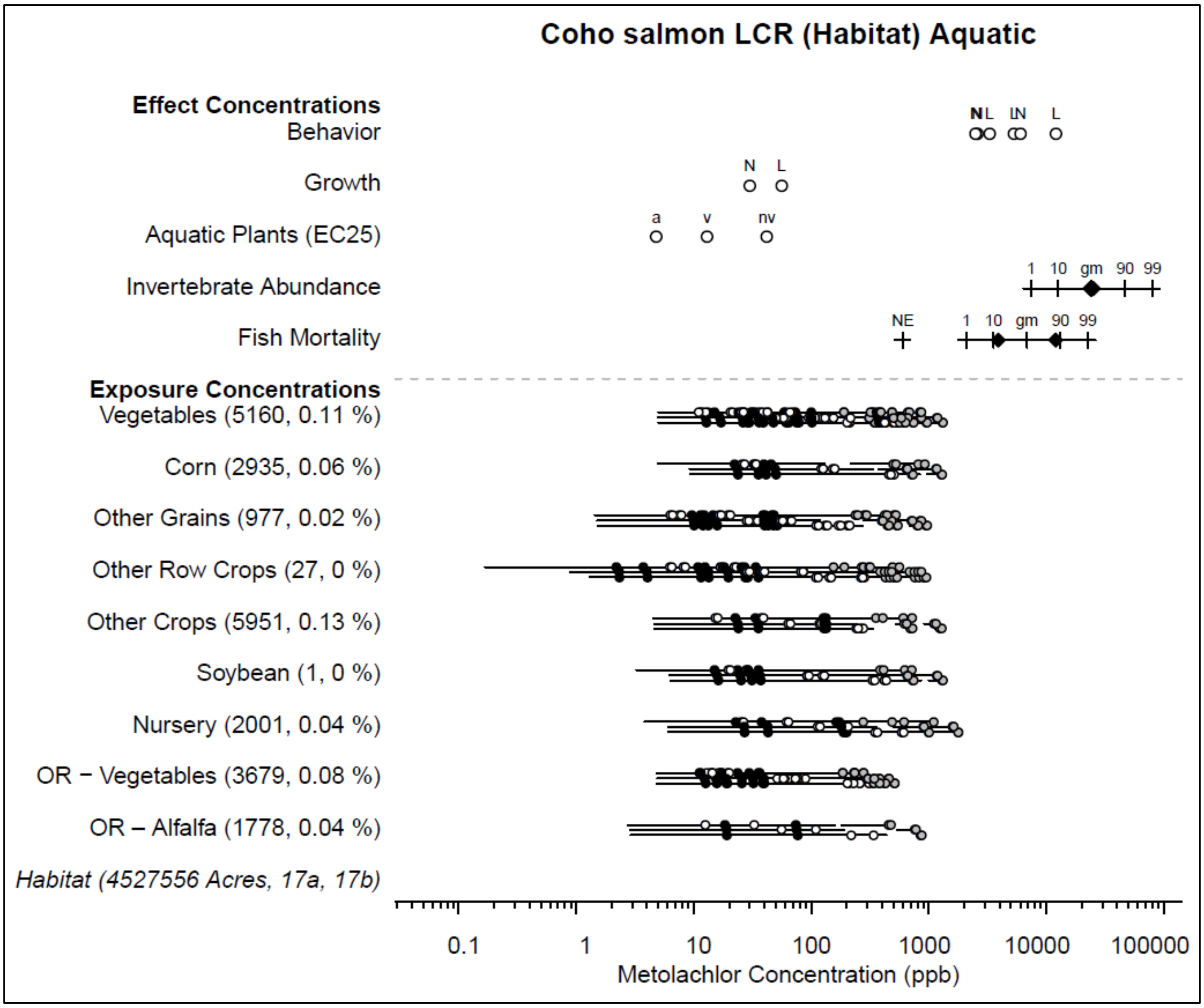


Figure 232. Effects analysis Risk-plot; Coho salmon, Lower Columbia River ESU designated critical habitat; aquatic plants and Metolachlor

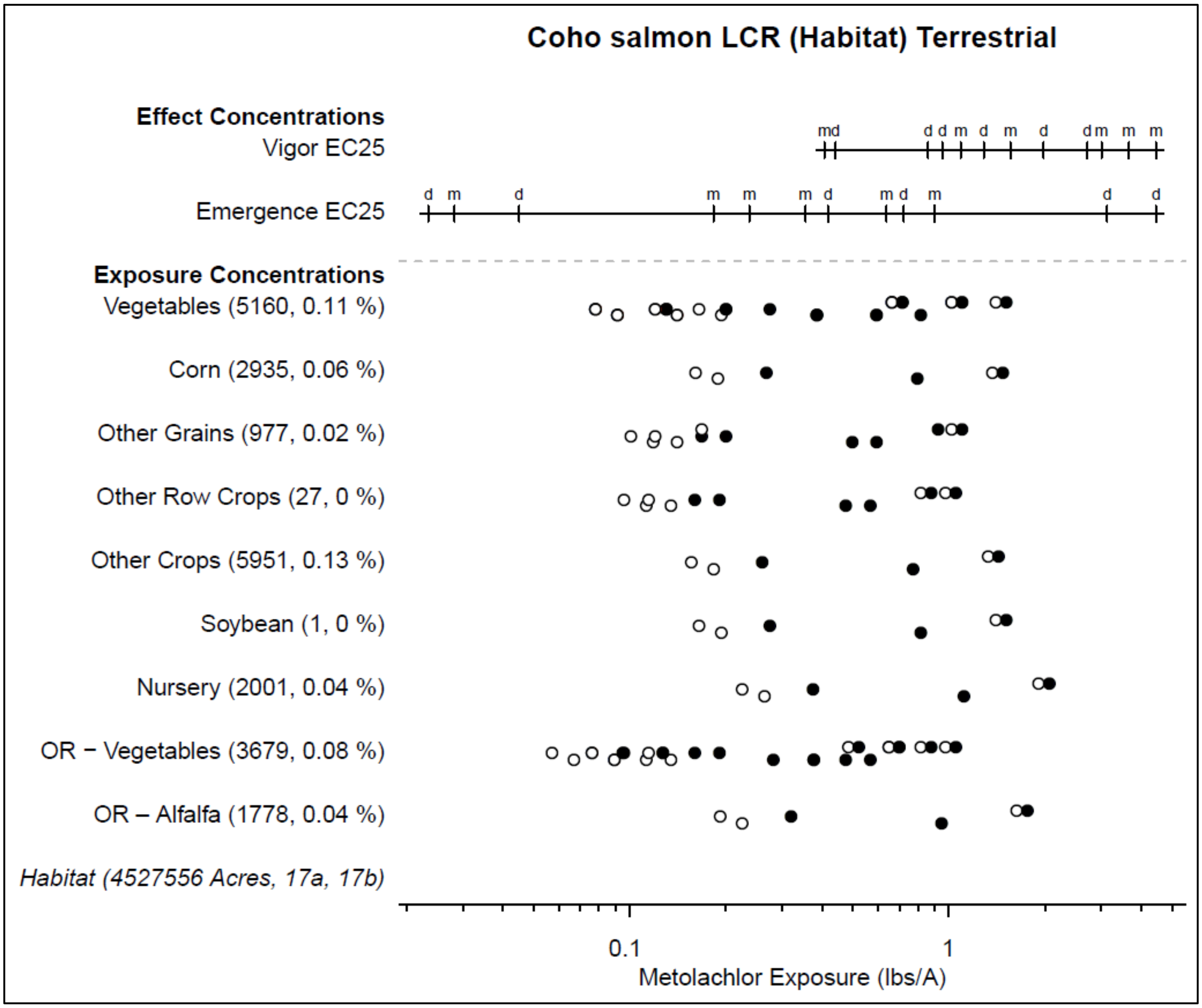


Figure 233. Effects analysis Risk-plot; Coho salmon, Lower Columbia River ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 716. Likelihood of exposure determination for Coho salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	yes	**High**
OR - Alfalfa	1	no	yes	no	**Low**

Table 717. Prey risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.11	None Expected	High
Corn	0.06	None Expected	High
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.13	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
OR – Vegetables	0.08	None Expected	High
OR – Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 718. Vegetative cover risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.11	High	High
Corn	0.06	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.13	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
OR – Vegetables	0.08	High	High
OR – Alfalfa	0.04	High	Low
Terrestrial			
Vegetables	0.11	High	High
Corn	0.06	High	High
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.13	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
OR – Vegetables	0.08	High	High
OR – Alfalfa	0.04	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 719. Water quality risk hypothesis; Coho salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Coho salmon, Lower Columbia River ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

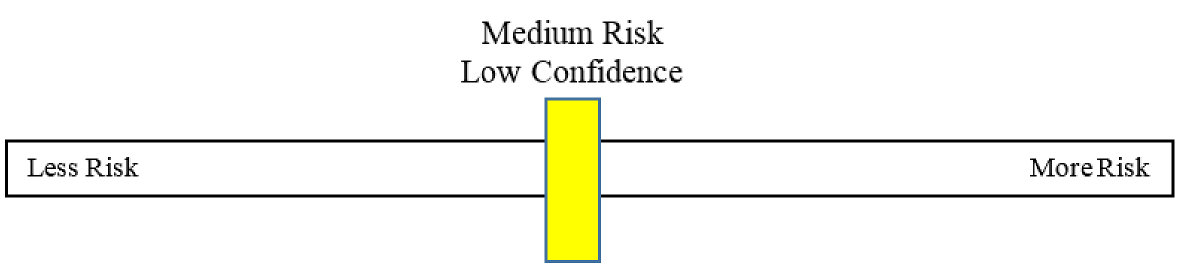
Table 720. Effects analysis summary table; Coho salmon, Lower Columbia River ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River Coho salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Lower Columbia River Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.15 Oregon Coast Coho Salmon Designated Critical Habitat; Metolachlor

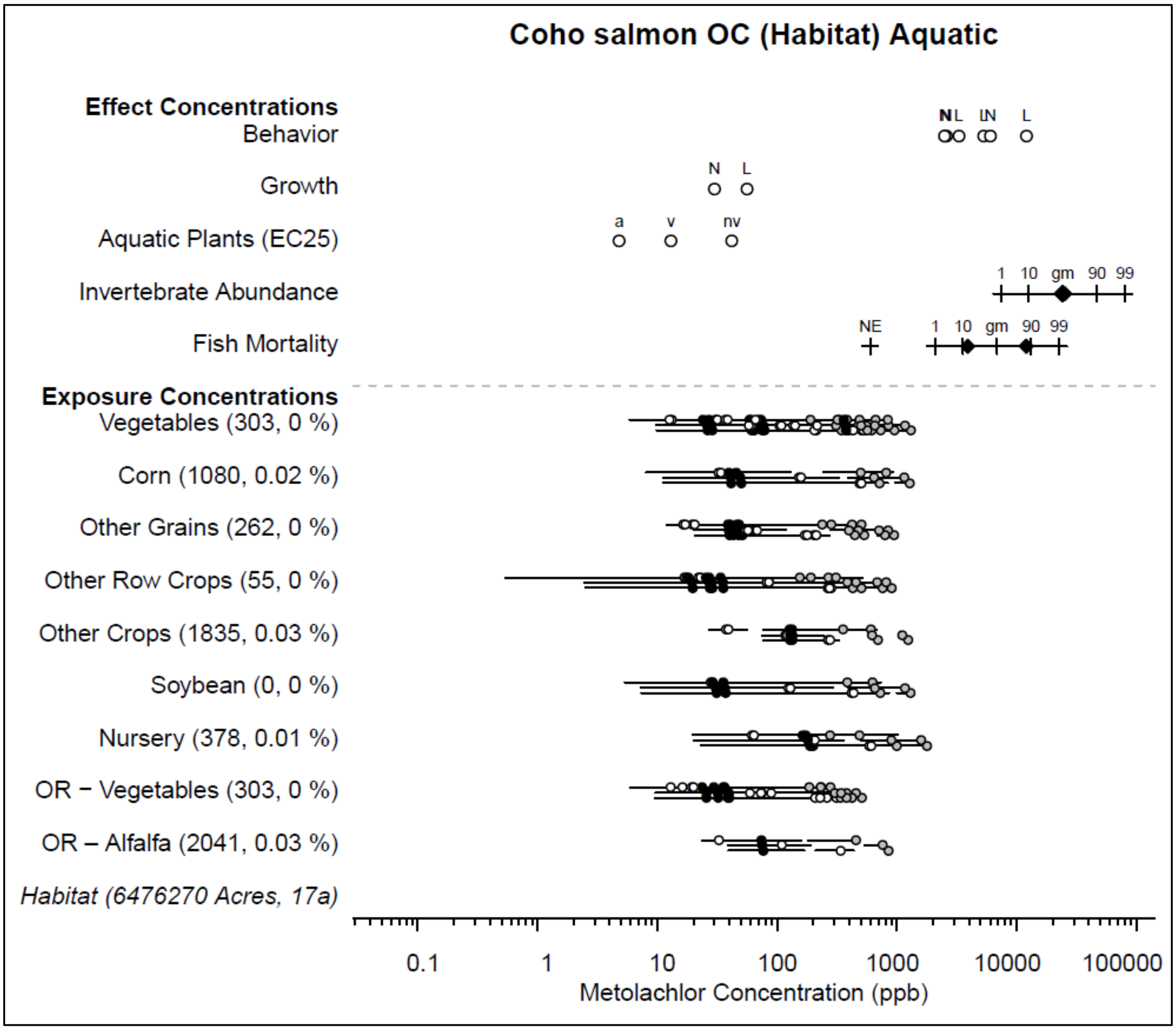


Figure 234. Effects analysis Risk-plot; Coho salmon, Oregon Coast ESU designated critical habitat; aquatic plants and Metolachlor

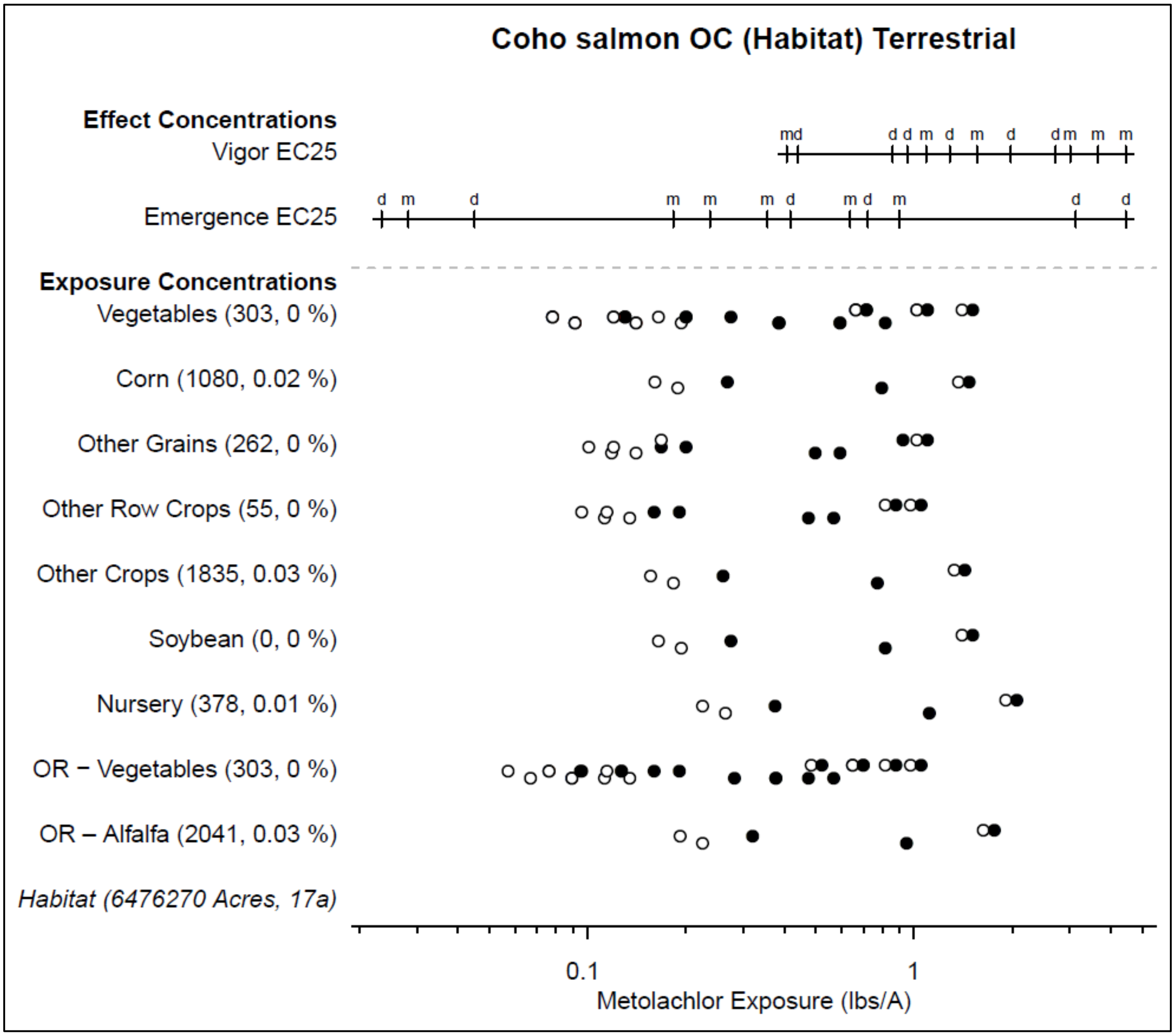


Figure 235. Effects analysis Risk-plot; Coho salmon, Oregon Coast ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 721. Likelihood of exposure determination for Coho salmon, Oregon Coast ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	no	**Low**
OR - Alfalfa	1	no	yes	no	**Low**

Table 722. Prey risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0.02	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.03	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
CA – Vegetables	0	None Expected	Low
CA – Cotton	0.03	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 723. Vegetative cover risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0.02	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0.03	High	Low
Soybean	0	High	Low
Nursery	0.01	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0.03	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0.02	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0.03	High	Low
Soybean	0	High	Low
Nursery	0.01	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0.03	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 724. Water quality risk hypothesis; Coho salmon, Oregon Coast ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Oregon Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

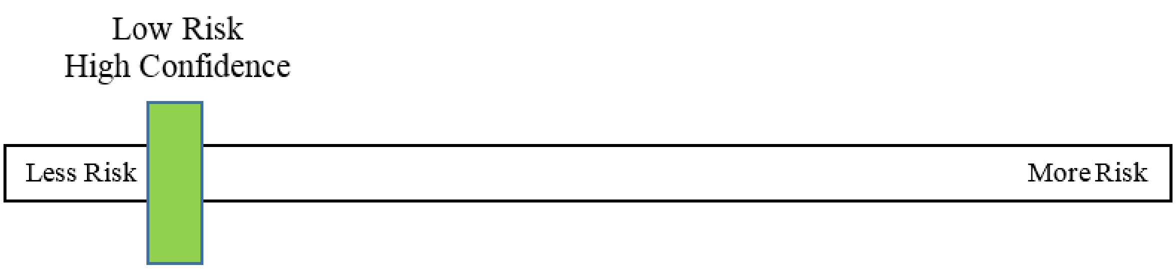
Table 725. Effects analysis summary table; Coho salmon, Oregon Coast ESU designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Low	High	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Oregon Coast Coho salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Oregon Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.16 Southern Oregon Northern California (SONC) Coho Salmon Designated Critical Habitat; Metolachlor

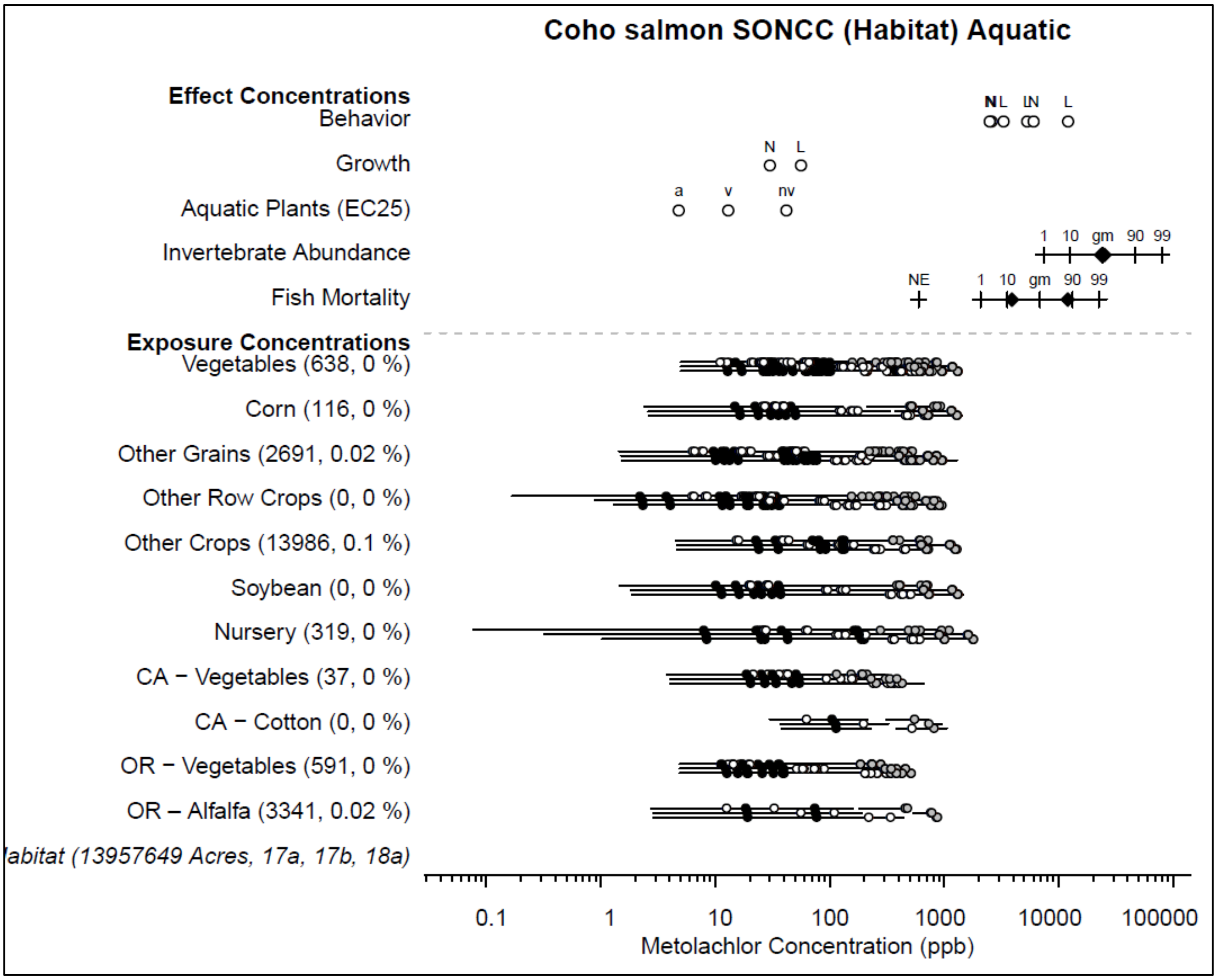


Figure 236. Effects analysis Risk-plot; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat; aquatic plants and Metolachlor

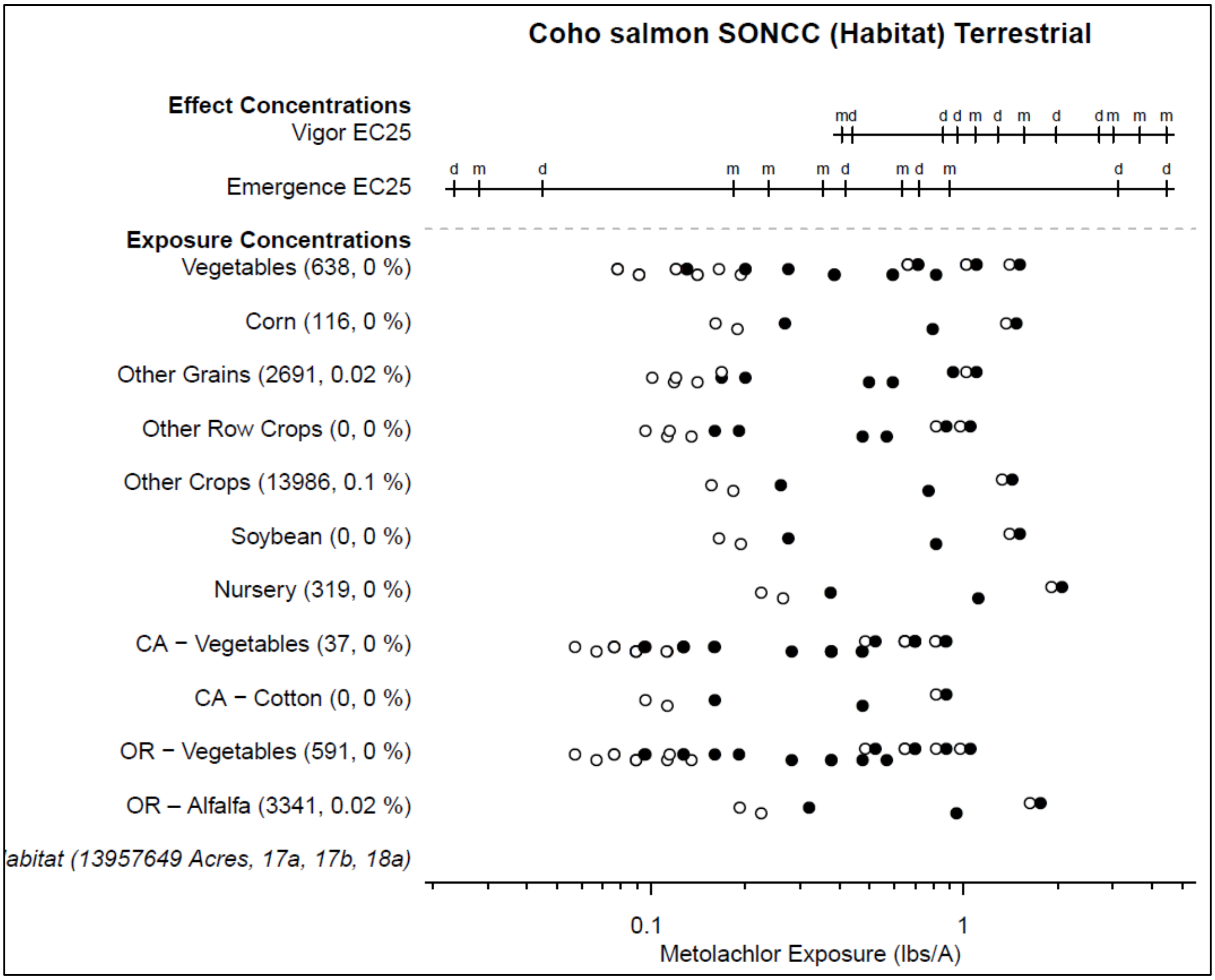


Figure 237. Effects analysis Risk-plot; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 726. Likelihood of exposure determination for Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	no	**Low**
OR - Alfalfa	1	no	yes	no	**Low**

Table 727. Prey risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.02	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0.1	None Expected	High
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA – Vegetables	0	None Expected	Low
CA – Cotton	0	None Expected	Low

OR – Vegetables	0	None Expected	Low
OR – Alfalfa	0.02	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 728. Vegetative cover risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low
Other Crops	0.1	High	High
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low
OR – Vegetables	0	High	Low
OR – Alfalfa	0.02	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0.02	High	Low
Other Row Crops	0	High	Low

Other Crops	0.1	High	High
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low
OR – Vegetables	0	High	Low
OR – Alfalfa	0.02	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
Medium	**Low**		

Table 729. Water quality risk hypothesis; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Southern Oregon Northern California Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

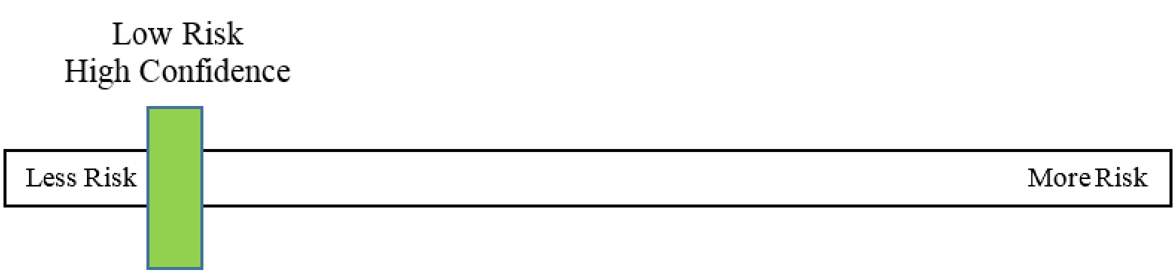
Table 730. Effects analysis summary table; Coho salmon, Southern Oregon Northern California Coast ESU designated critical habitat and Metolachlor

	R-plot Derived	

Designated Critical Habitat; Risk Hypotheses	Risk	Confidence	Risk Hypothesis Supported? Yes/No
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Southern Oregon Northern California Coast Coho salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Southern Oregon Northern California Coast Coho ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.17 Ozette Lake Sockeye Designated Critical Habitat; Metolachlor

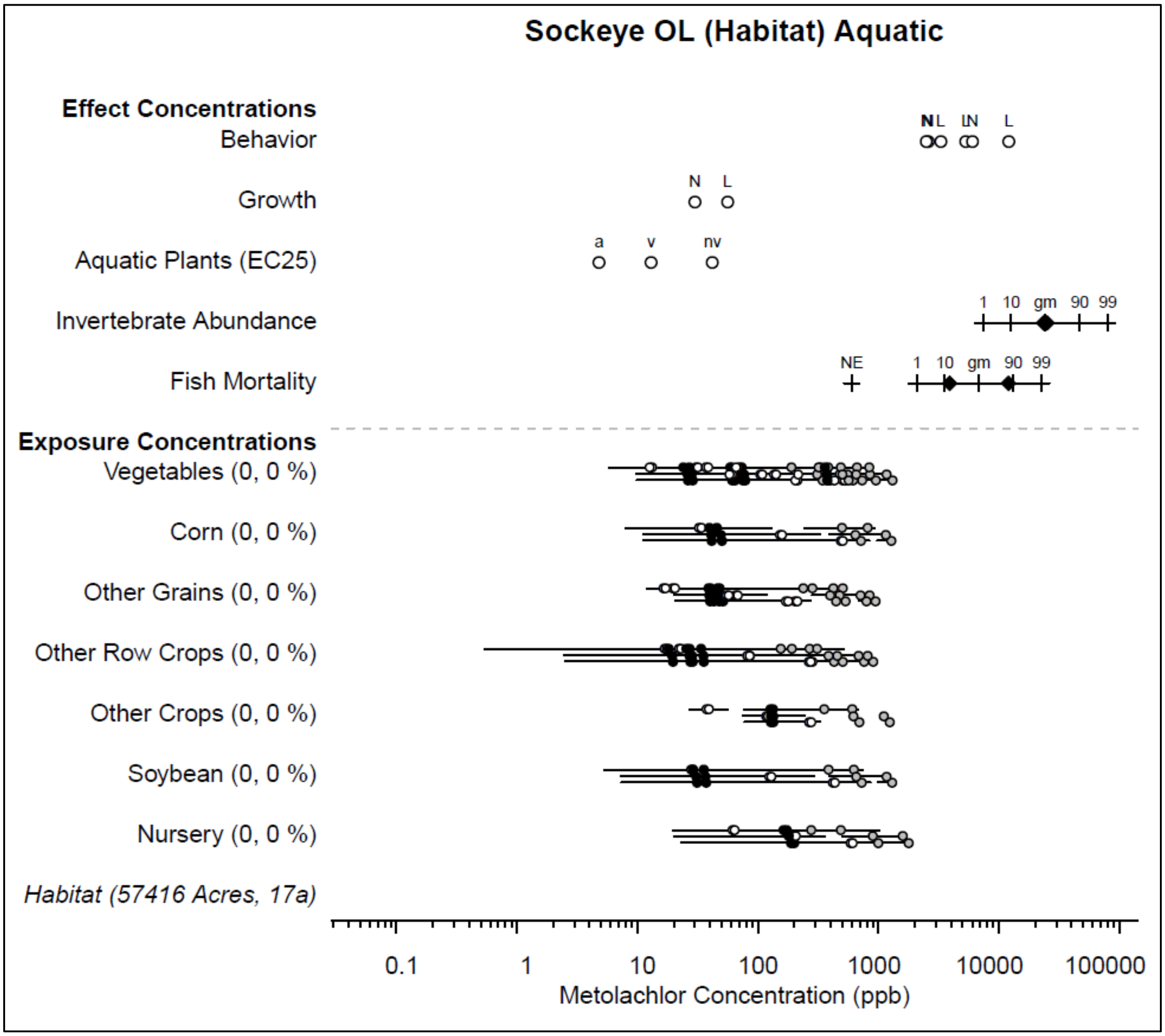


Figure 238. Effects analysis Risk-plot; Ozette Lake Sockeye ESU designated critical habitat; aquatic plants and Metolachlor

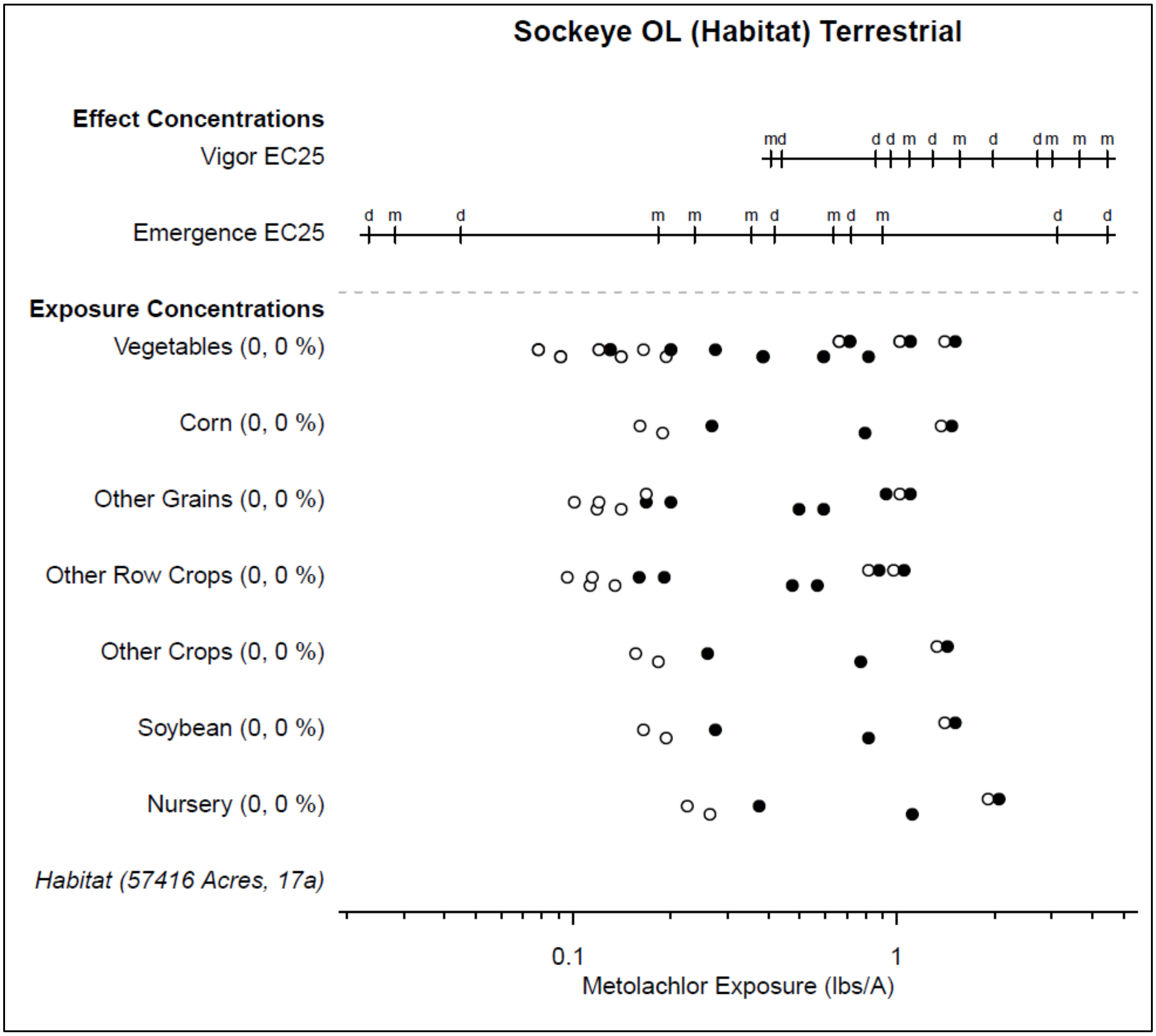


Figure 239. Effects analysis Risk-plot; Ozette Lake Sockeye ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 731. Likelihood of exposure determination for Ozette Lake Sockeye ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**

Table 732. Prey risk hypothesis; Ozette Lake Sockeye ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 733. Vegetative cover risk hypothesis; Ozette Lake Sockeye ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 734. Water quality risk hypothesis; Ozette Lake Sockeye ESU designated critical habitat and Metolachlor

Endpoint: Water Quality

Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, currently there are no authorized use sites of metolachlor within the designated critical habitat of the Ozette Lake Sockeye ESU and therefore reductions in the overall abundance and availability of aquatic invertebrates are not expected. Adverse effects to aquatic and terrestrial vegetation are also not expected.

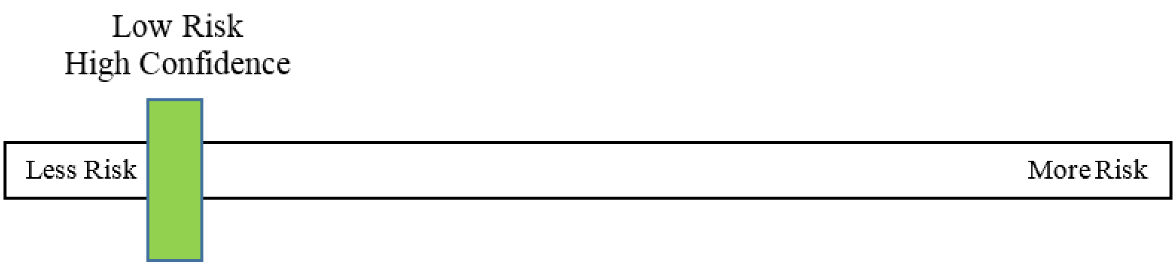
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 735. Effects analysis summary table; Ozette Lake Sockeye ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

There are no metolachlor authorized use sites within the designated critical habitat of the Ozette Lake Sockeye ESU, and therefore impacts to the overall abundance and availability of aquatic invertebrates, or adverse effects to aquatic and terrestrial vegetation are not expected. The conservation value of designated critical habitat is not anticipated to be affected by this action. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the lack of any current exposures predicted in the critical habitats over the 15-year duration of the action.



15.3.18 Snake River Sockeye Salmon Designated Critical Habitat; Metolachlor

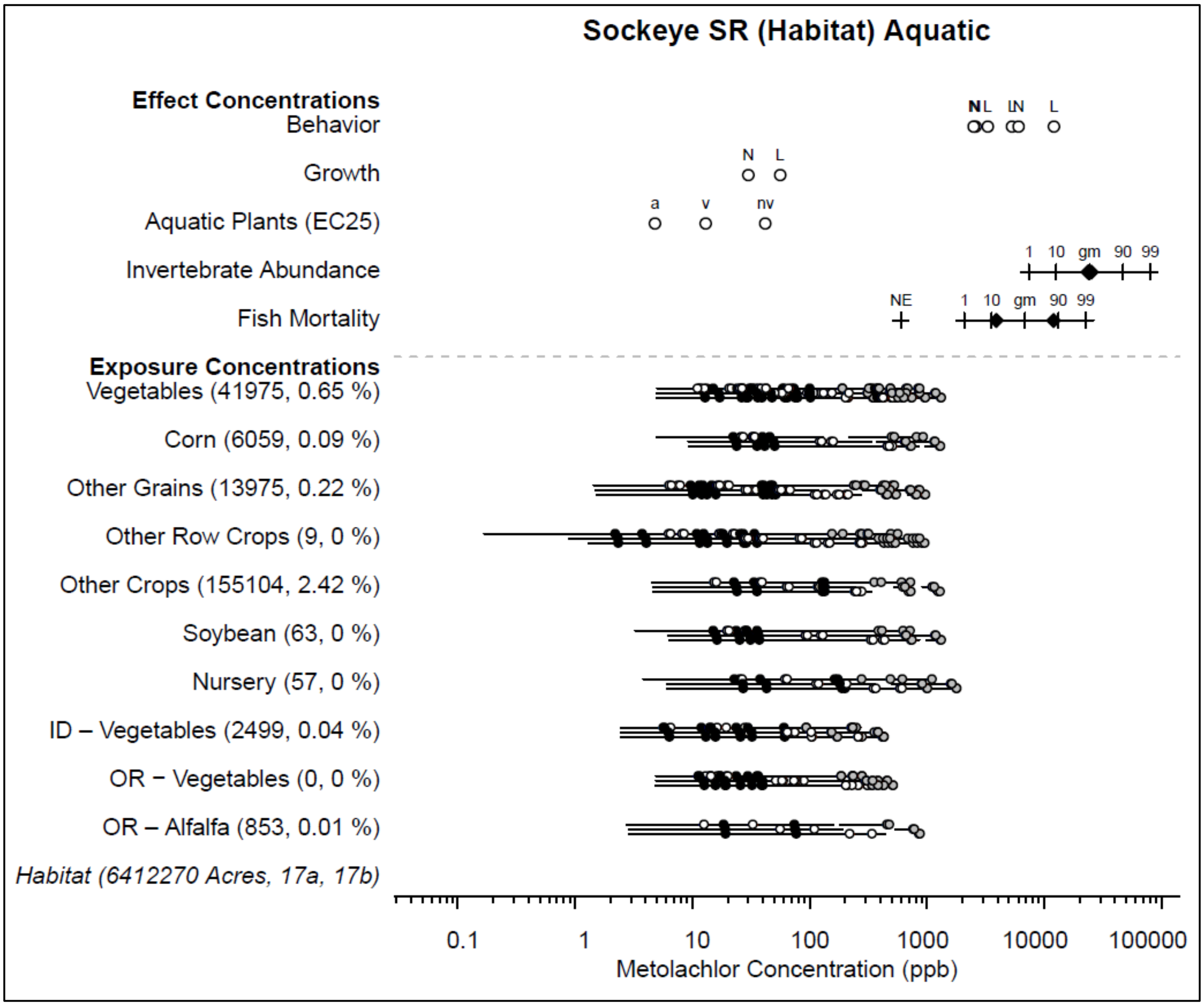


Figure 240. Effects analysis Risk-plot; Sockeye salmon, Snake River ESU designated critical habitat; aquatic plants and Metolachlor

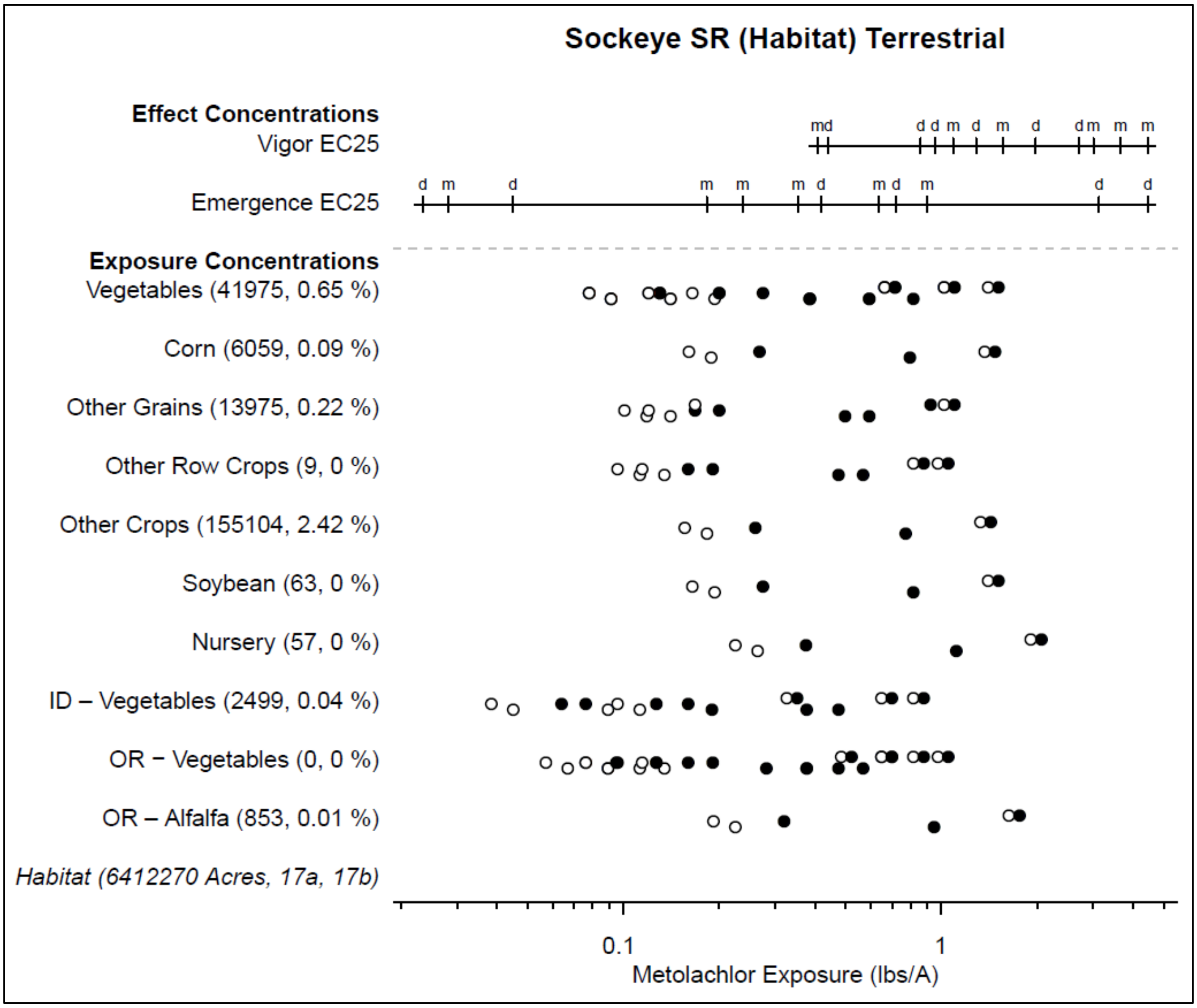


Figure 241. Effects analysis Risk-plot; Sockeye salmon, Snake River ESU designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 736. Likelihood of exposure determination for Sockeye salmon, Snake River ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	Low
Corn	1	no	yes	no	Low
Other Grains	1	no	yes	no	Low
Other Row Crops	1	no	yes	no	Low
Other Crops	2	no	yes	NA	Medium
Soybean	1	no	yes	no	Low
Nursery	1	no	yes	no	Low
ID - Vegetables	1	no	yes	no	Low
OR - Vegetables	1	no	yes	no	Low
OR - Alfalfa	1	no	yes	no	Low

Table 737. Prey risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and Metolachlor

Endpoint: Prey (invertebrates)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.65	None Expected	Low
Corn	0.09	None Expected	Low
Other Grains	0.22	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	2.42	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0	Low	Low
ID – Vegetables	0.04	None Expected	Low
OR – Vegetables	0	None Expected	Low
OR – Alfalfa	0.01	None Expected	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 738. Vegetative cover risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.65	High	Low
Corn	0.09	High	Low
Other Grains	0.22	High	Low
Other Row Crops	0	High	Low
Other Crops	2.42	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low
ID – Vegetables	0.04	High	Low
OR – Vegetables	0	High	Low
OR – Alfalfa	0.01	High	Low
Terrestrial			
Vegetables	0.65	High	Low
Corn	0.09	High	Low
Other Grains	0.22	High	Low
Other Row Crops	0	High	Low
Other Crops	2.42	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low

ID – Vegetables	0.04	High	Low
OR – Vegetables	0	High	Low
OR – Alfalfa	0.01	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
Medium	**Low**		

Table 739. Water quality risk hypothesis; Sockeye salmon, Snake River ESU designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Snake River Sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

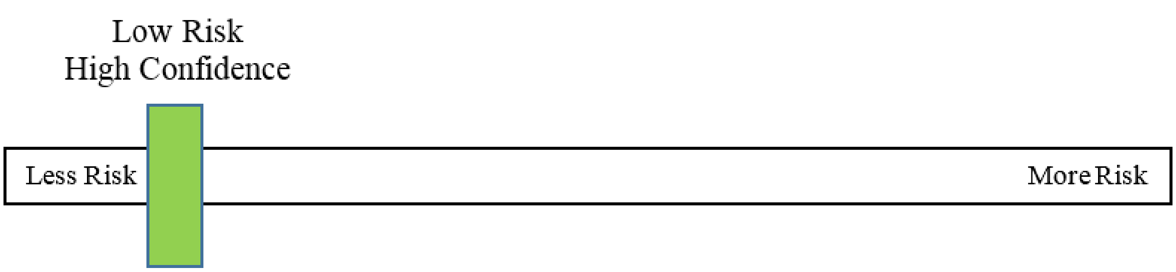
Table 740. Effects analysis summary table; Sockeye salmon, Snake River ESU designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	Medium	Low	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Snake River Sockeye salmon designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Snake River Sockeye ESU are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.19 California Central Valley Steelhead Designated Critical Habitat; Metolachlor

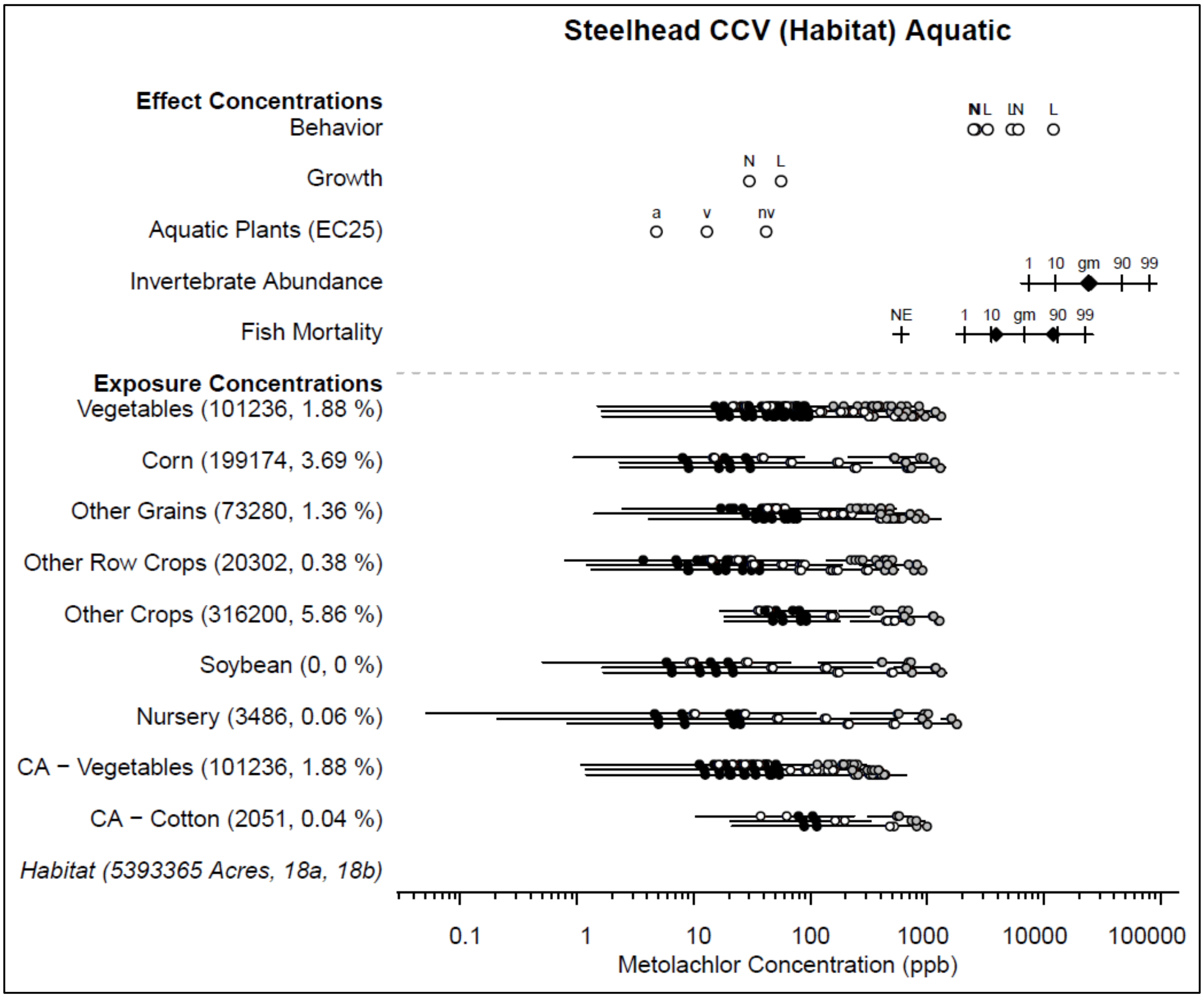


Figure 242. Effects analysis Risk-plot; Steelhead, California Central-Valley DPS designated critical habitat; aquatic plants and Metolachlor

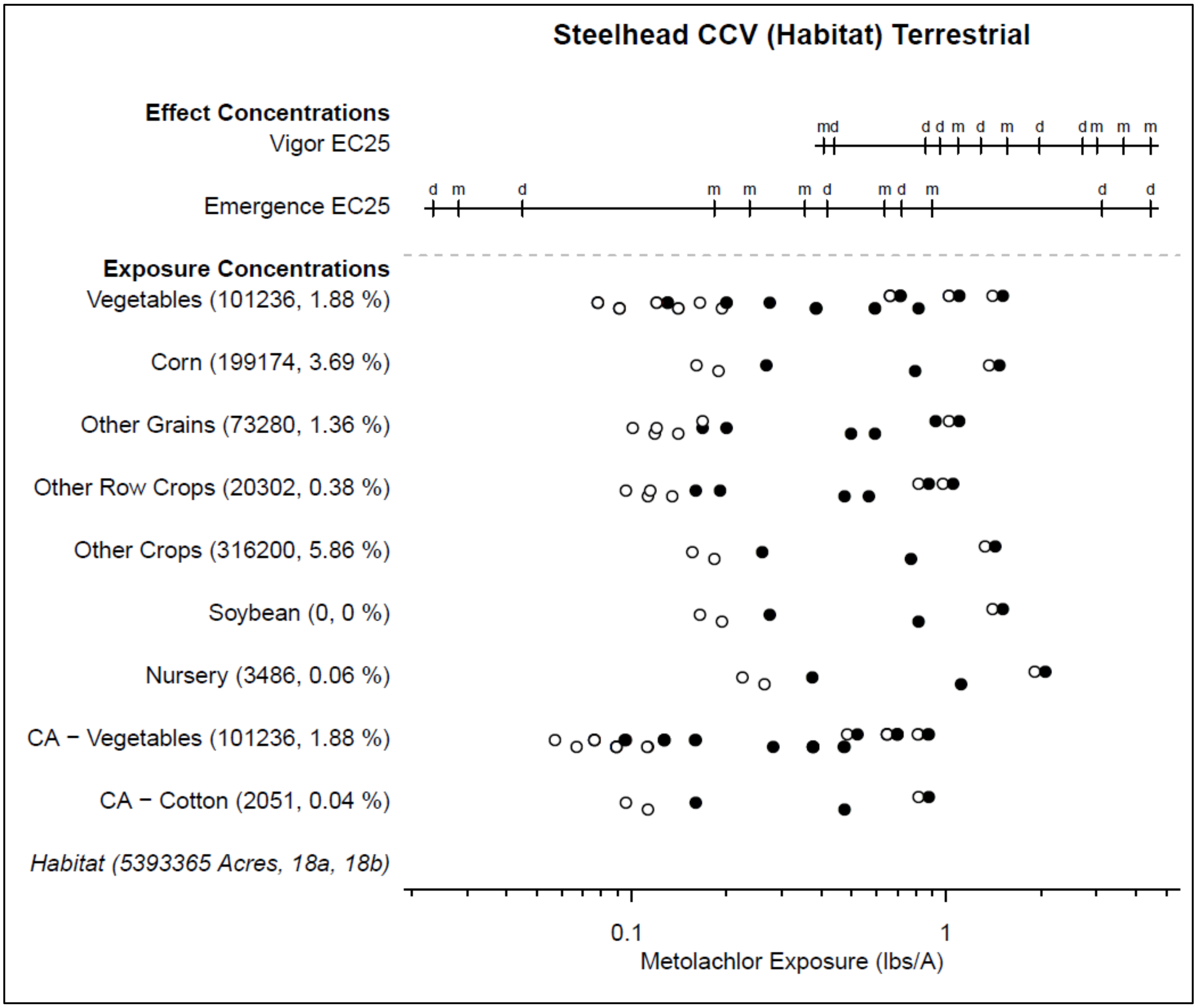


Figure 243. Effects analysis Risk-plot; Steelhead, California Central-Valley DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 741. Likelihood of exposure determination for Steelhead, California Central-Valley DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	2	no	yes	NA	**Medium**
Other Grains	2	no	yes	NA	**Medium**
Other Row Crops	1	no	yes	yes	**High**
Other Crops	3	no	yes	NA	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	2	no	yes	NA	**Medium**
CA - Cotton	1	no	yes	no	**Low**

Table 742. Prey risk hypothesis; Steelhead, California Central-Valley DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.88	None Expected	Medium
Corn	3.69	None Expected	Medium
Other Grains	1.36	None Expected	Medium
Other Row Crops	0.38	None Expected	High
Other Crops	5.86	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.06	Low	Low
CA – Vegetables	1.88	None Expected	Medium
CA – Cotton	0.04	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 743. Vegetative cover risk hypothesis; Steelhead, California Central-Valley DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.88	High	Medium
Corn	3.69	High	Medium
Other Grains	1.36	High	Medium
Other Row Crops	0.38	High	High
Other Crops	5.86	High	High
Soybean	0	High	Low
Nursery	0.06	High	Low
CA – Vegetables	1.88	High	Medium
CA – Cotton	0.04	High	Low
Terrestrial			
Vegetables	1.88	High	Medium
Corn	3.69	High	Medium
Other Grains	1.36	High	Medium
Other Row Crops	0.38	High	High
Other Crops	5.86	High	High
Soybean	0	High	Low
Nursery	0.06	High	Low
CA – Vegetables	1.88	High	Medium
CA – Cotton	0.04	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 744. Water quality risk hypothesis; Steelhead, California Central-Valley DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, California Central Valley DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

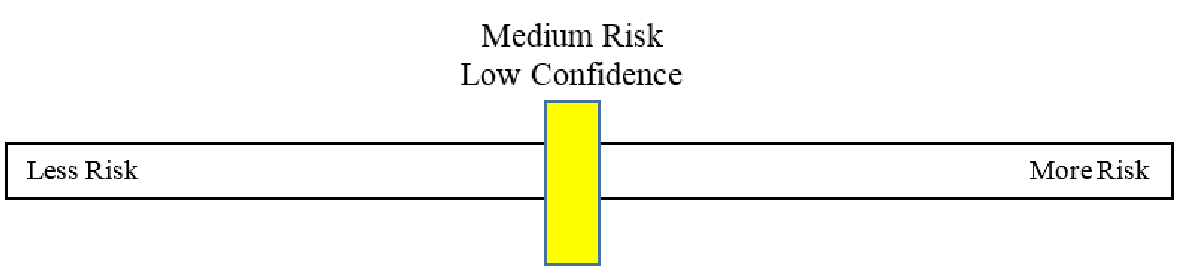
Table 745. Effects analysis summary table; Steelhead, California Central-Valley DPS designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	Risk	Confidence	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of California Central-Valley Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the California Central-Valley Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.20 Central California Coast Steelhead Designated Critical Habitat; Metolachlor

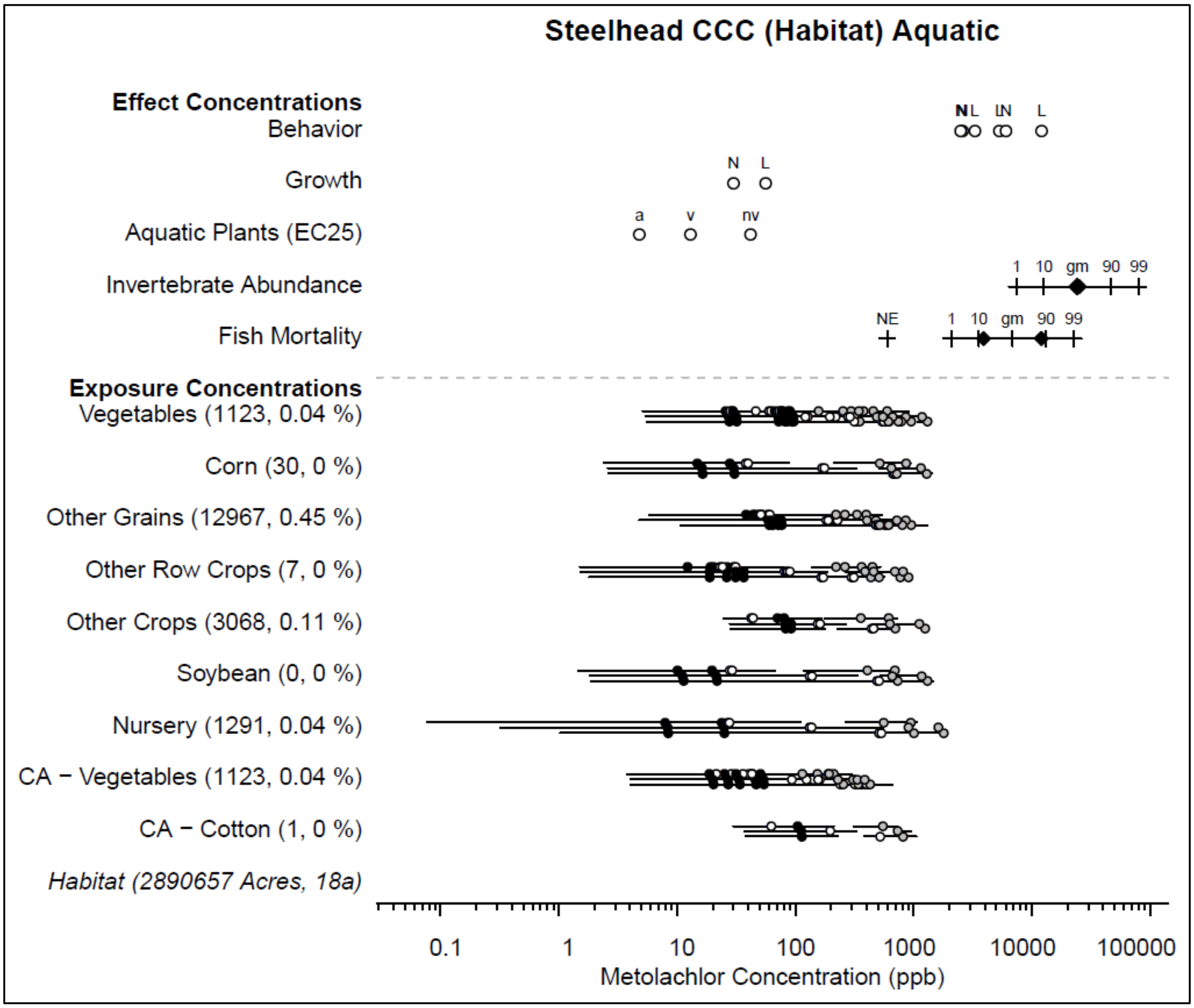


Figure 244. Effects analysis Risk-plot; Steelhead, Central California Coast DPS designated critical habitat; aquatic plants and Metolachlor

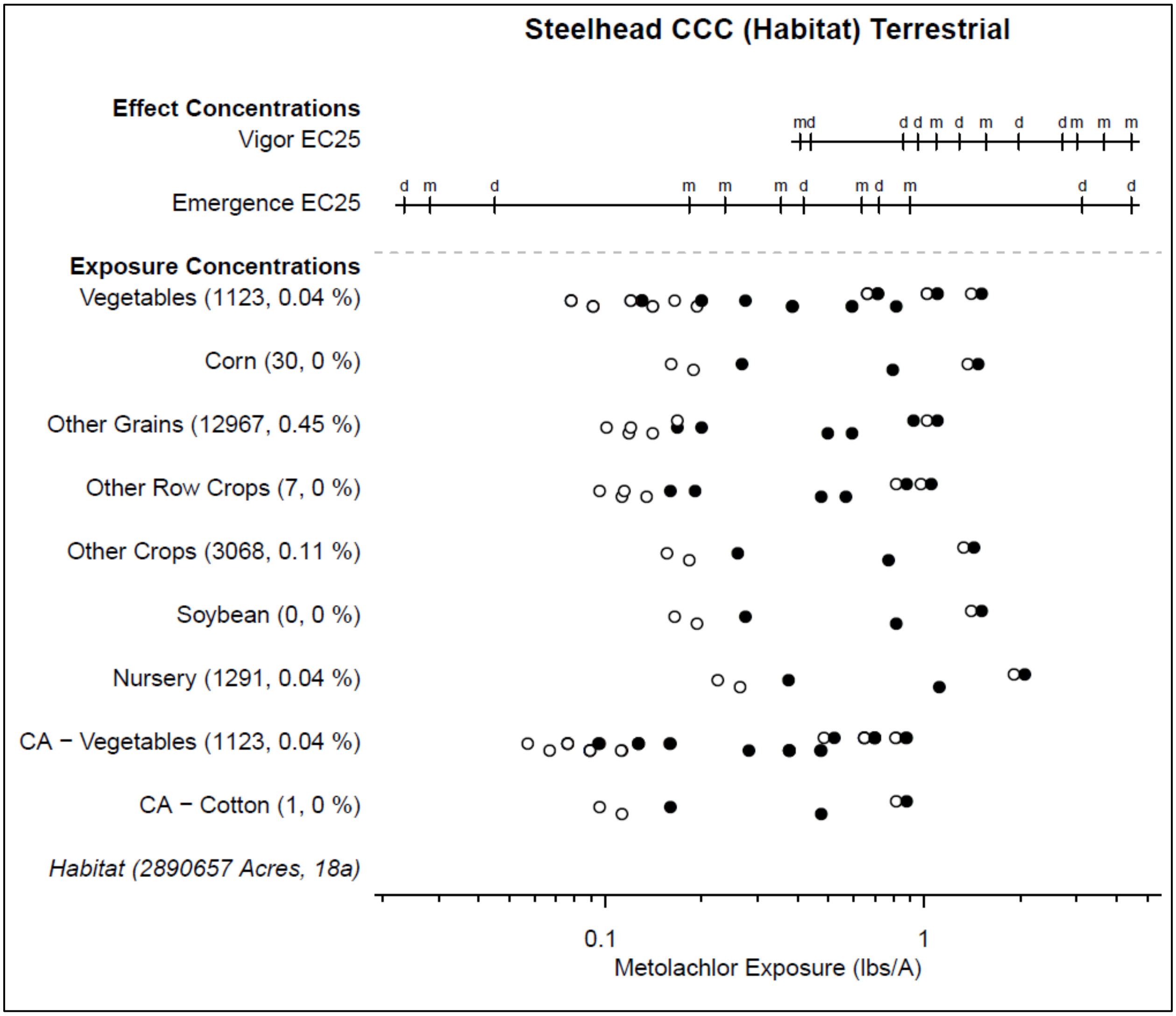


Figure 245. Effects analysis Risk-plot; Steelhead, Central California Coast DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 746. Likelihood of exposure determination for Steelhead, Central California Coast DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**

Table 747. Prey risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.04	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0.45	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.11	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
CA – Vegetables	0.04	None Expected	Low
CA – Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 748. Vegetative cover risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.04	High	Low
Corn	0	High	Low
Other Grains	0.45	High	High
Other Row Crops	0	High	Low
Other Crops	0.11	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.04	High	Low
CA – Cotton	0	High	Low
Terrestrial			
Vegetables	0.04	High	Low
Corn	0	High	Low
Other Grains	0.45	High	High
Other Row Crops	0	High	Low
Other Crops	0.11	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.04	High	Low
CA – Cotton	0	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 749. Water quality risk hypothesis; Steelhead, Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Central California Coast DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 750. Effects analysis summary table; Steelhead, Central California Coast DPS designated critical habitat and Metolachlor

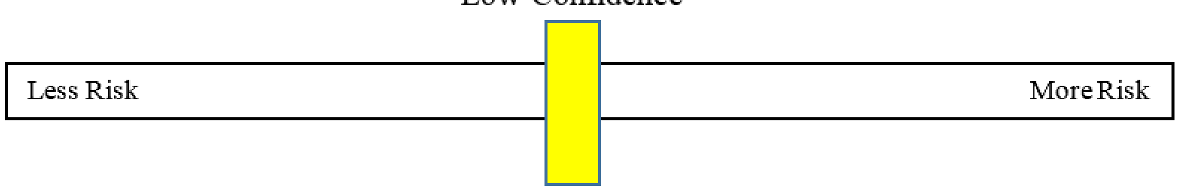
	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Central California Coast Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Central California Coast Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

Medium Risk
Low Confidence



15.3.21 Lower Columbia River Steelhead Designated Critical Habitat; Metolachlor

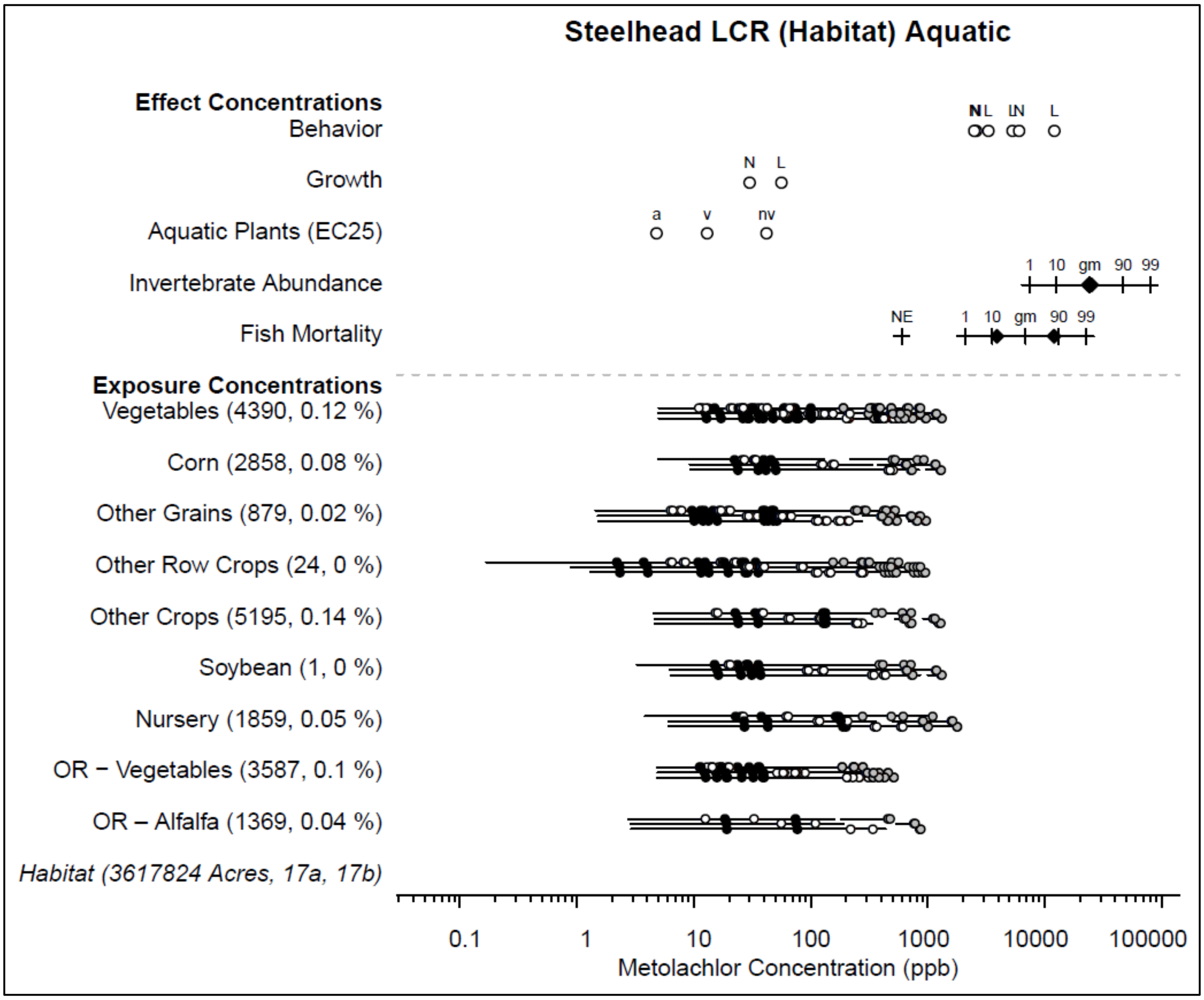


Figure 246. Effects analysis Risk-plot; Steelhead, Lower Columbia River DPS designated critical habitat; aquatic plants and Metolachlor

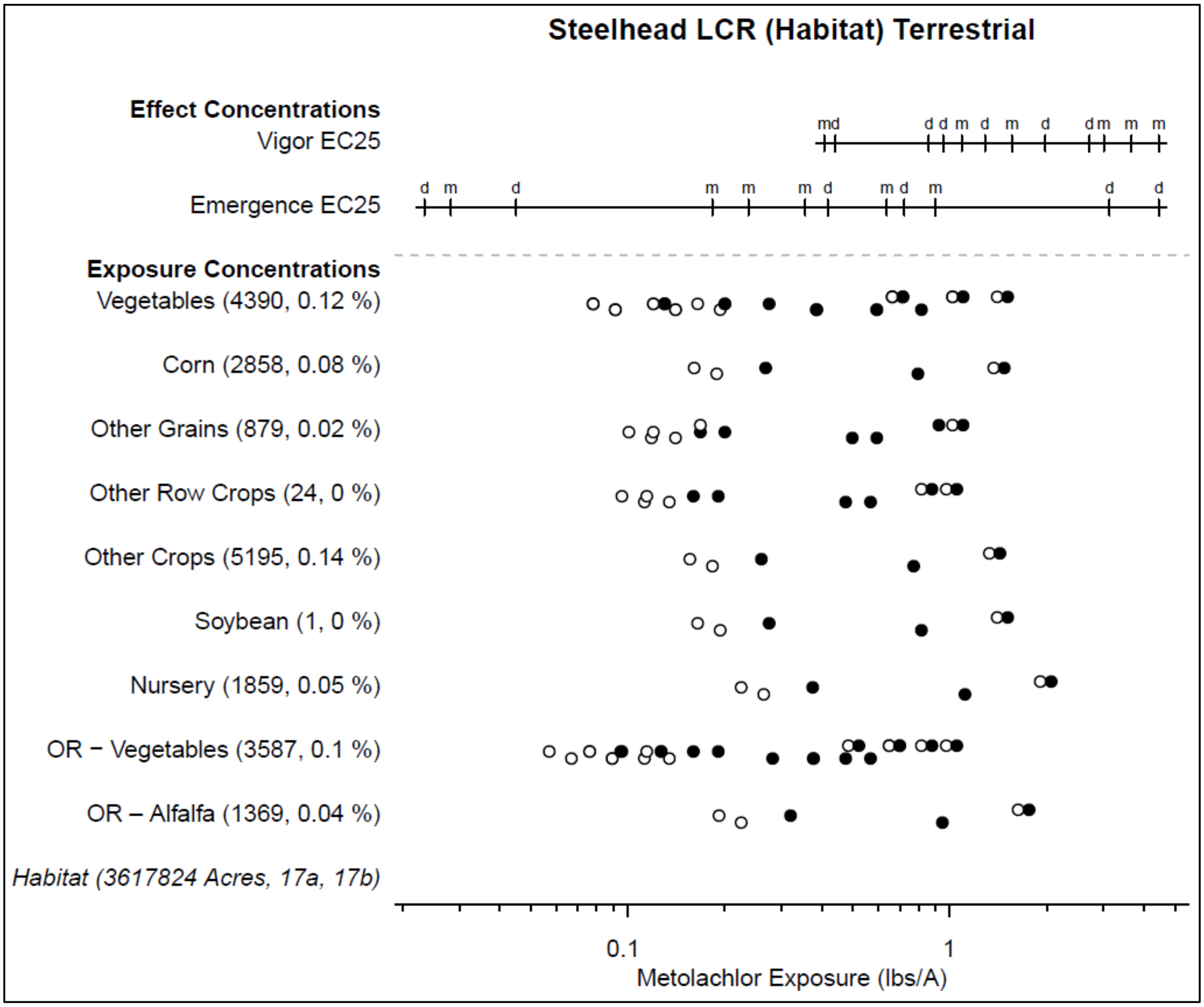


Figure 247. Effects analysis Risk-plot; Steelhead, Lower Columbia River DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 751. Likelihood of exposure determination for Steelhead, Lower Columbia River DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	yes	**High**
OR - Alfalfa	1	no	yes	no	**Low**

Table 752. Prey risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.12	None Expected	High
Corn	0.08	None Expected	High
Other Grains	0.02	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.14	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.05	Low	Low
OR – Vegetables	0.1	None Expected	High
OR – Alfalfa	0.04	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 753. Vegetative cover risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.12	High	High
Corn	0.08	High	High
Other Grains	0.02	High	High
Other Row Crops	0	High	Low
Other Crops	0.14	High	High
Soybean	0	High	Low
Nursery	0.05	High	Low
OR – Vegetables	0.1	High	High
OR – Alfalfa	0.04	High	Low
Terrestrial			
Vegetables	0.12	High	High
Corn	0.08	High	High
Other Grains	0.02	High	High
Other Row Crops	0	High	Low
Other Crops	0.14	High	High
Soybean	0	High	Low
Nursery	0.05	High	Low
OR – Vegetables	0.1	High	High
OR – Alfalfa	0.04	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 754. Water quality risk hypothesis; Steelhead, Lower Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Lower Columbia River DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 755. Effects analysis summary table; Steelhead, Lower Columbia River DPS designated critical habitat and Metolachlor

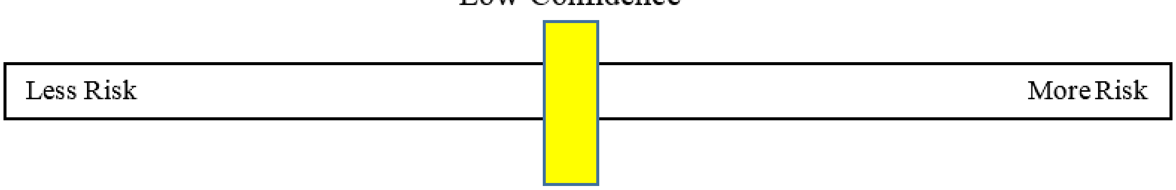
	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Lower Columbia River Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Lower Columbia River Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

Medium Risk
Low Confidence



15.3.22 Middle Columbia River Steelhead Designated Critical Habitat; Metolachlor

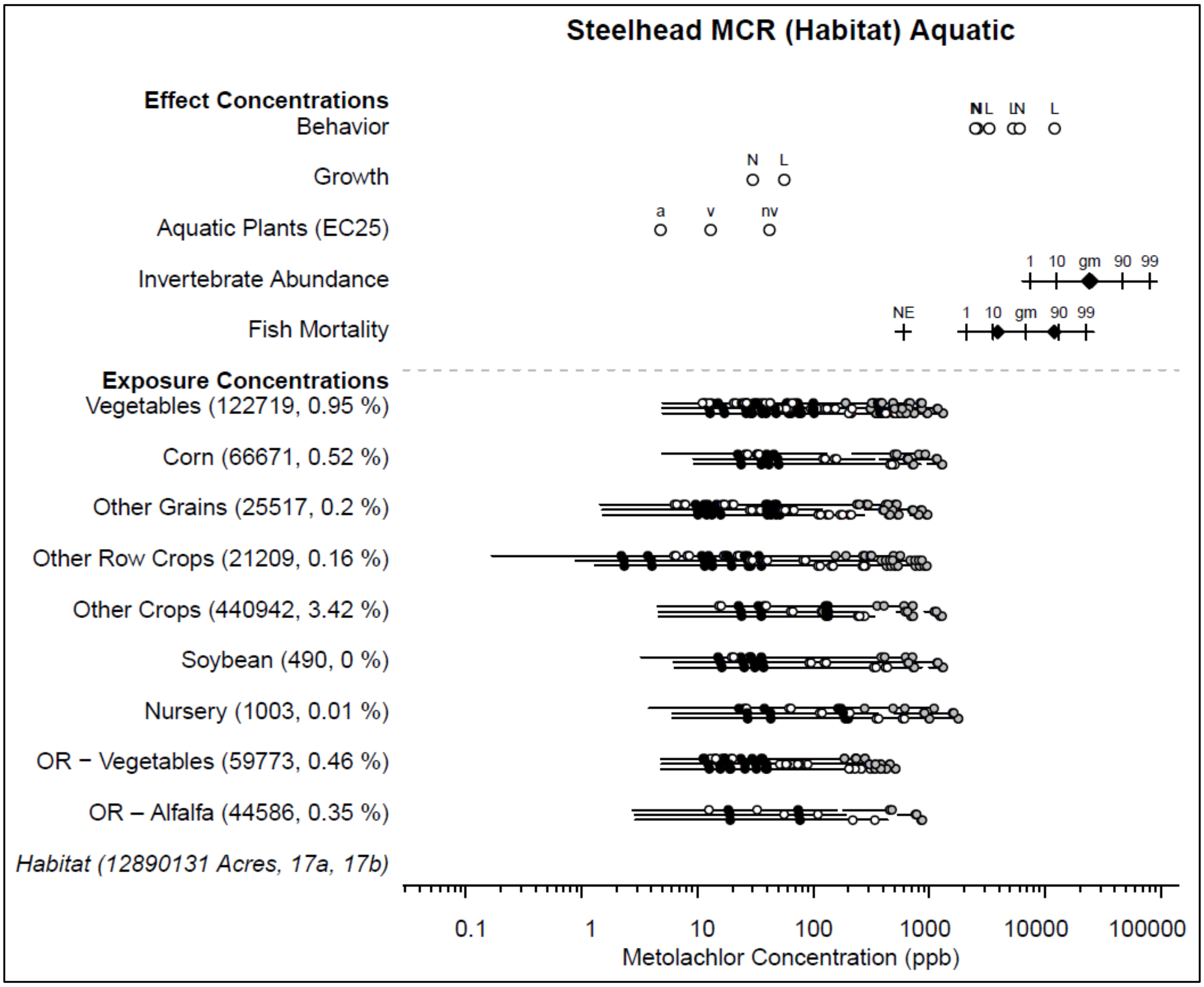


Figure 248. Effects analysis Risk-plot; Steelhead, Middle Columbia River DPS designated critical habitat; aquatic plants and Metolachlor

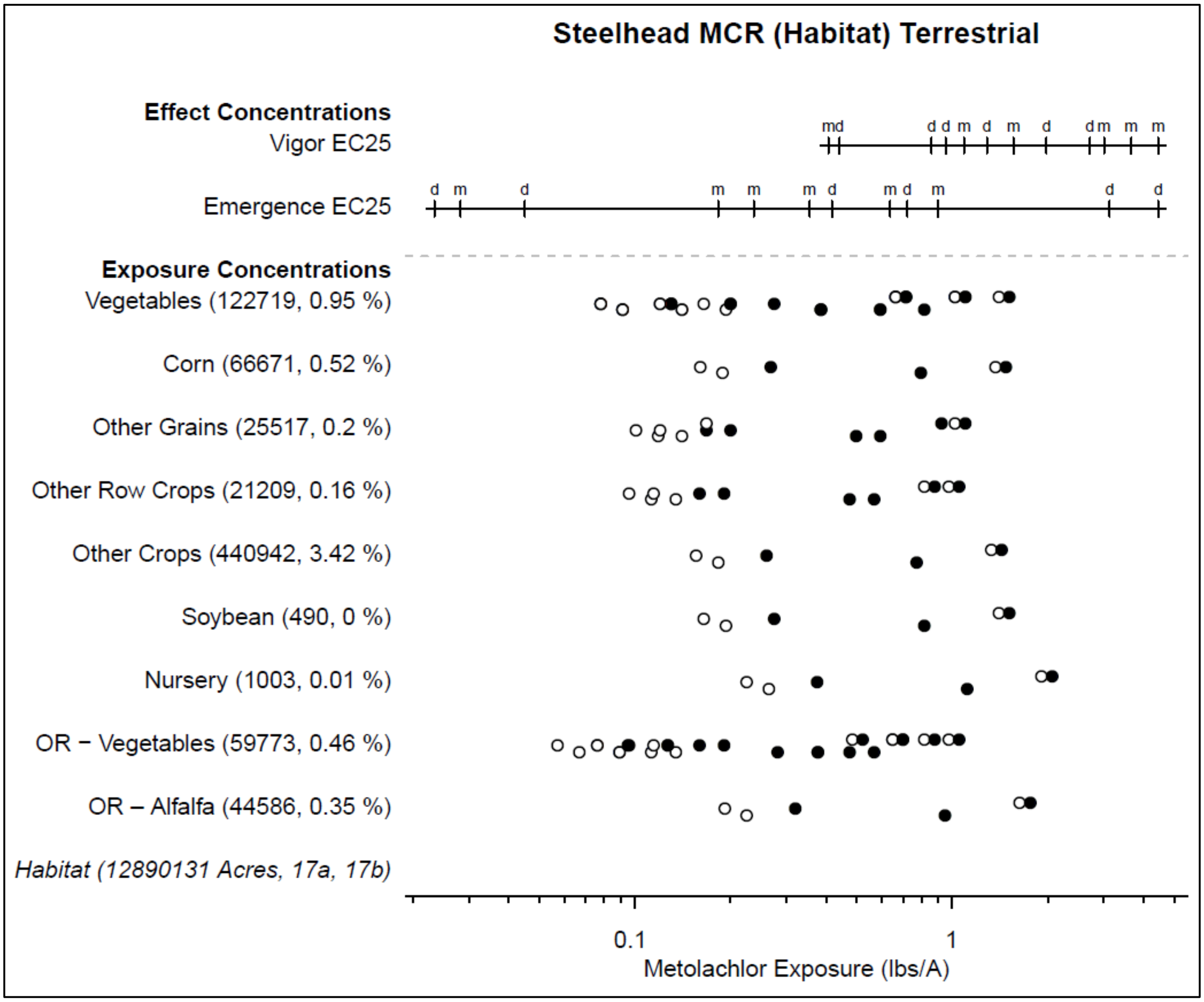


Figure 249. Effects analysis Risk-plot; Steelhead, Middle Columbia River DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 756. Likelihood of exposure determination for Steelhead, Middle Columbia River DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	High
Corn	1	no	yes	yes	High
Other Grains	1	no	yes	no	Low
Other Row Crops	1	no	yes	yes	High
Other Crops	2	no	yes	NA	Medium
Soybean	1	no	yes	no	Low
Nursery	1	no	yes	no	Low
OR - Vegetables	1	no	yes	yes	High
OR - Alfalfa	1	no	yes	no	Low

Table 757. Prey risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.95	None Expected	High
Corn	0.52	None Expected	High
Other Grains	0.2	None Expected	Low
Other Row Crops	0.16	None Expected	High
Other Crops	3.42	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
OR – Vegetables	0.46	None Expected	High
OR – Alfalfa	0.35	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 758. Vegetative cover risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.95	High	High
Corn	0.52	High	High
Other Grains	0.2	High	Low
Other Row Crops	0.16	High	High
Other Crops	3.42	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.46	High	High
OR – Alfalfa	0.35	High	Low
Terrestrial			
Vegetables	0.95	High	High
Corn	0.52	High	High
Other Grains	0.2	High	Low
Other Row Crops	0.16	High	High
Other Crops	3.42	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.46	High	High
OR – Alfalfa	0.35	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 759. Water quality risk hypothesis; Steelhead, Middle Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Middle Columbia River DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

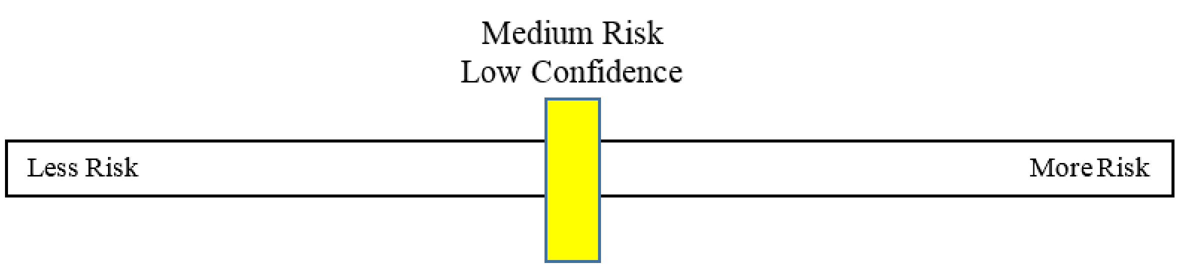
Table 760. Effects analysis summary table; Steelhead, Middle Columbia River DPS designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Middle Columbia River Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Middle Columbia River Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.23 Northern California Steelhead Designated Critical Habitat; Metolachlor

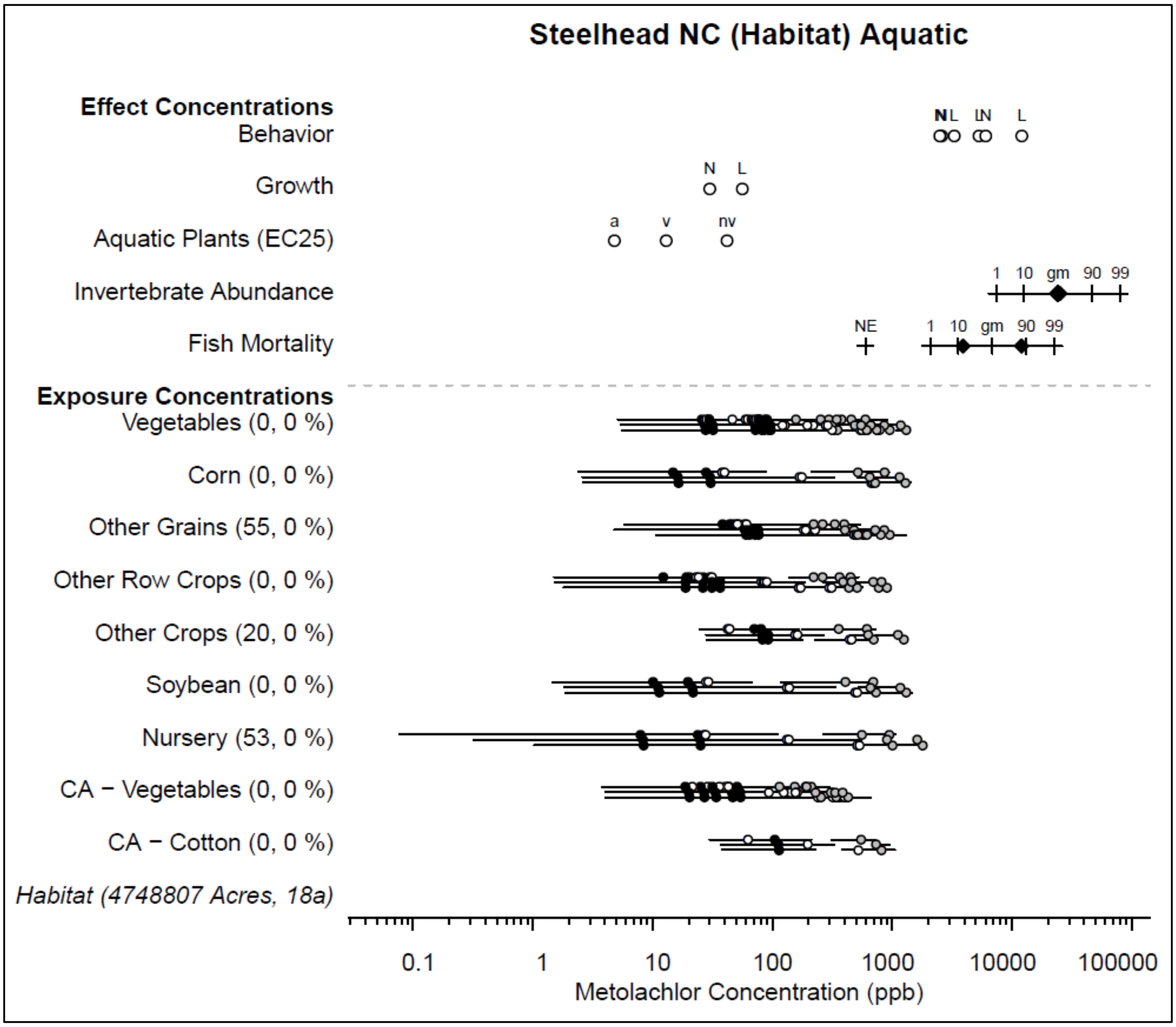


Figure 250. Effects analysis Risk-plot; Steelhead, Northern California DPS designated critical habitat; aquatic plants and Metolachlor

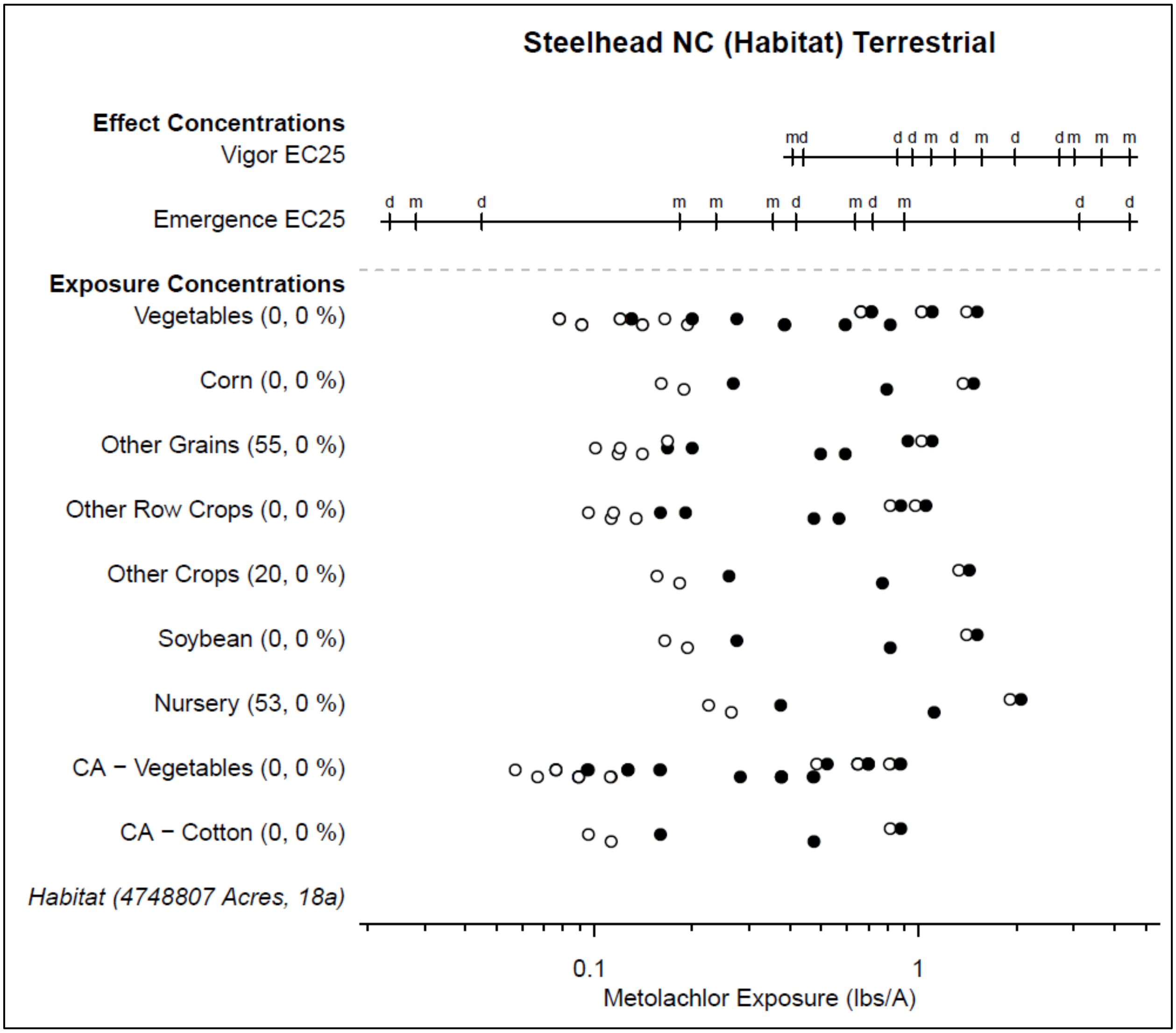


Figure 251. Effects analysis Risk-plot; Steelhead, Northern California DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 761. Likelihood of exposure determination for Steelhead, Northern California DPS ESU designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	no	**Low**
Corn	1	no	yes	no	**Low**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	no	**Low**
CA - Cotton	1	no	yes	no	**Low**

Table 762. Prey risk hypothesis; Steelhead, Northern California DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0	None Expected	Low
Corn	0	None Expected	Low
Other Grains	0	None Expected	Low
Other Row Crops	0	None Expected	Low
Other Crops	0	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0	Low	Low
CA – Vegetables	0	None Expected	Low
CA – Cotton	0	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 763. Vegetative cover risk hypothesis; Steelhead, Northern California DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low
Terrestrial			
Vegetables	0	High	Low
Corn	0	High	Low
Other Grains	0	High	Low
Other Row Crops	0	High	Low
Other Crops	0	High	Low
Soybean	0	High	Low
Nursery	0	High	Low
CA – Vegetables	0	High	Low
CA – Cotton	0	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 764. Water quality risk hypothesis; Steelhead, Northern California DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Northern California Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however, these effects will be limited by the minimal extent of exposure. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

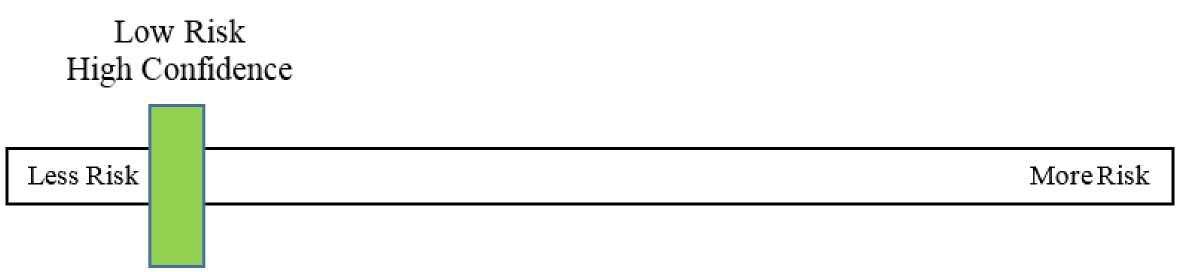
Table 765. Effects analysis summary table; Steelhead, Northern California DPS designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to	Low	High	No

vegetative cover in migration, spawning, and rearing sites.			
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Low	High	No

Designated Critical Habitat Effects Analysis Summary

We do not anticipate that the stressors of the action will negatively affect physical and biological features of Northern California Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Northern California Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Some adverse effects to aquatic and terrestrial vegetation may occur, however we anticipate these effects to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is low and the confidence associated with that risk is high due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.24 Puget Sound Steelhead Designated Critical Habitat; Metolachlor

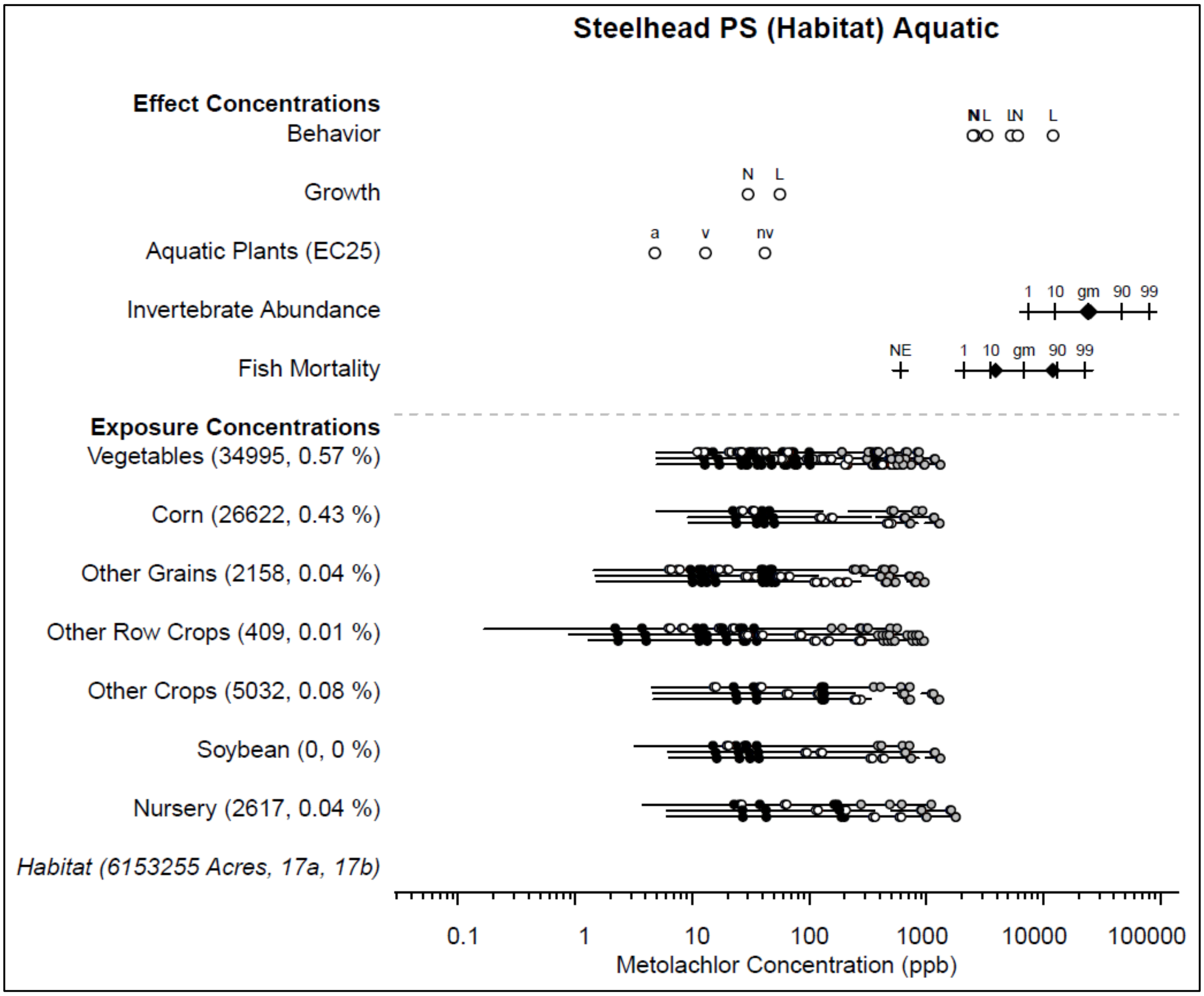


Figure 252. Effects analysis Risk-plot; Steelhead, Puget Sound DPS designated critical habitat; aquatic plants and Metolachlor

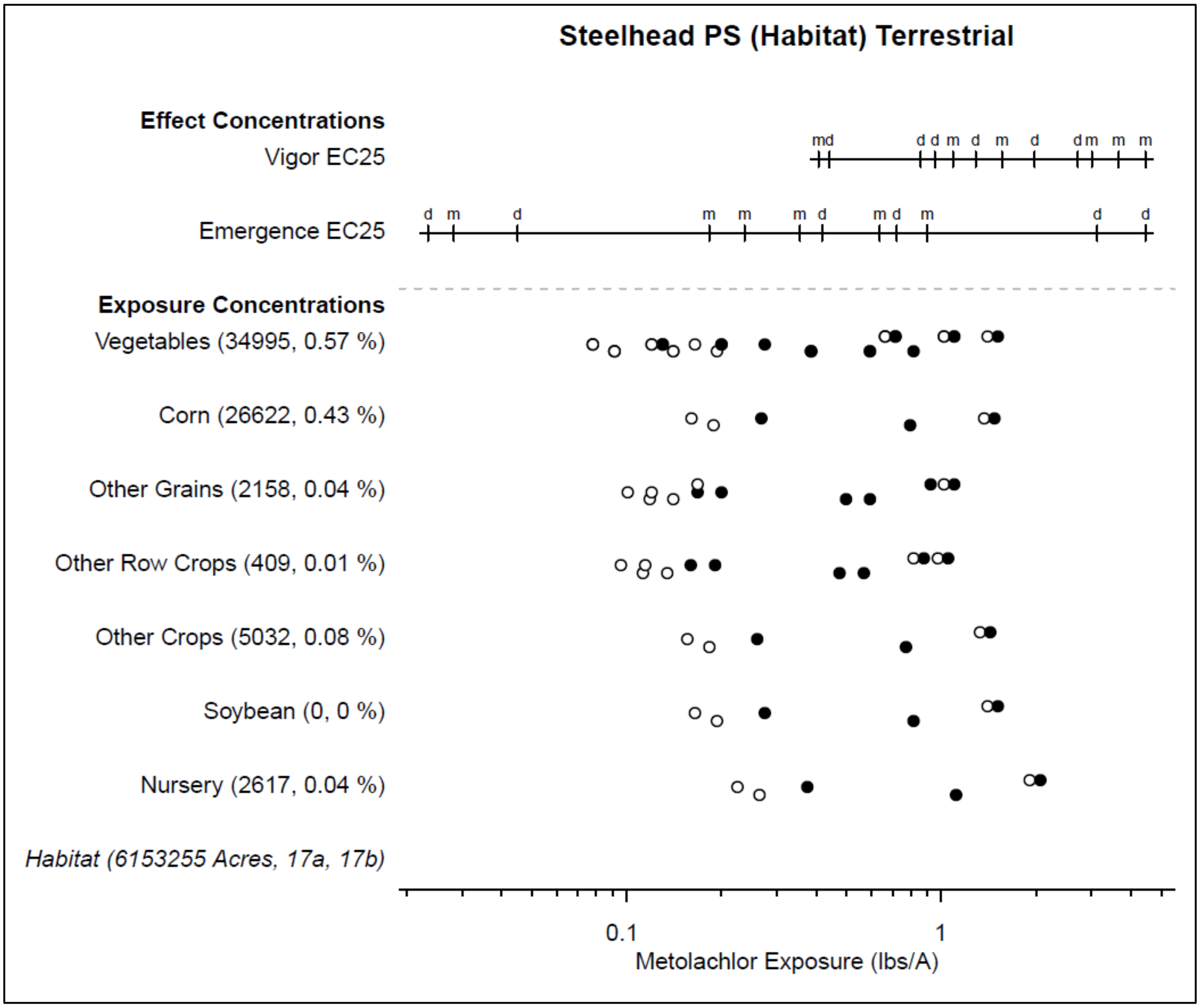


Figure 253. Effects analysis Risk-plot; Steelhead, Puget Sound DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 766. Likelihood of exposure determination for Steelhead, Puget Sound DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	no	**Low**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**

Table 767. Prey risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.57	None Expected	High
Corn	0.43	None Expected	High
Other Grains	0.04	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	0.08	None Expected	Low
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			
Risk	**Confidence**		
Low	**High**		

Table 768. Vegetative cover risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.57	High	High
Corn	0.43	High	High
Other Grains	0.04	High	Low
Other Row Crops	0.01	High	Low
Other Crops	0.08	High	Low
Soybean	0	High	Low
Nursery	0.04	High	Low
Terrestrial			
Vegetables	0.57	High	High
Corn	0.43	High	High
Other Grains	0.04	High	Low
Other Row Crops	0.01	High	Low
Other Crops	0.08	High	Low
Soybean	0	High	Low
Nursery	0.04	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
High	**Medium**		

Table 769. Water quality risk hypothesis; Steelhead, Puget Sound DPS designated critical habitat and Metolachlor

Endpoint: Water Quality

Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Puget Sound DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.

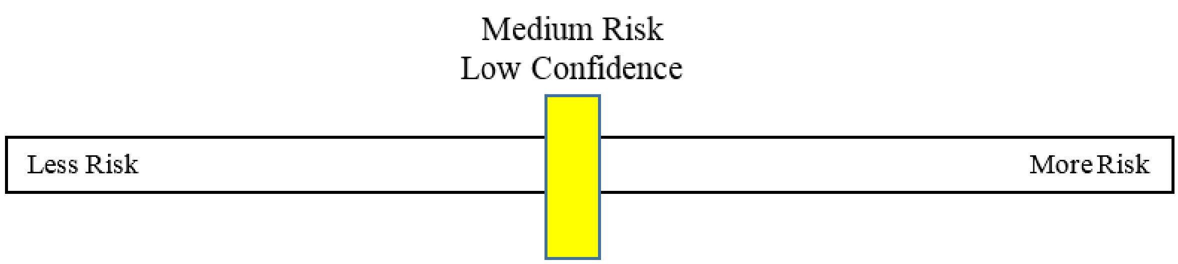
Risk	Confidence	
Medium	**Low**	

Table 770. Effects analysis summary table; Steelhead, Puget Sound DPS designated critical habitat and Metolachlor

	R-plot Derived		Risk Hypothesis Supported? Yes/No
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Puget Sound Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Puget Sound Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.25 Snake River Basin Steelhead Designated Critical Habitat; Metolachlor

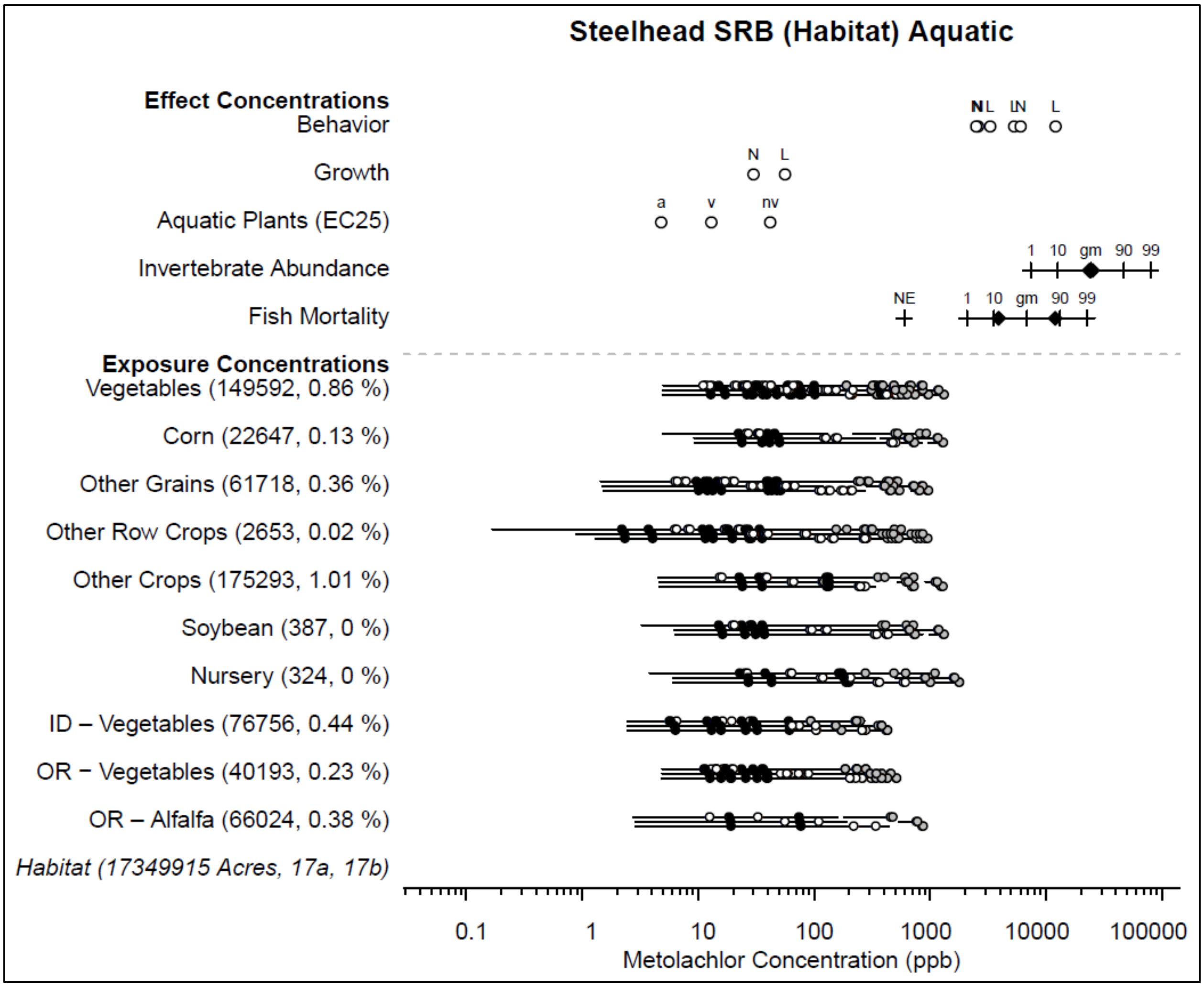


Figure 254. Effects analysis Risk-plot; Steelhead, Snake River Basin DPS designated critical habitat; aquatic plants and Metolachlor

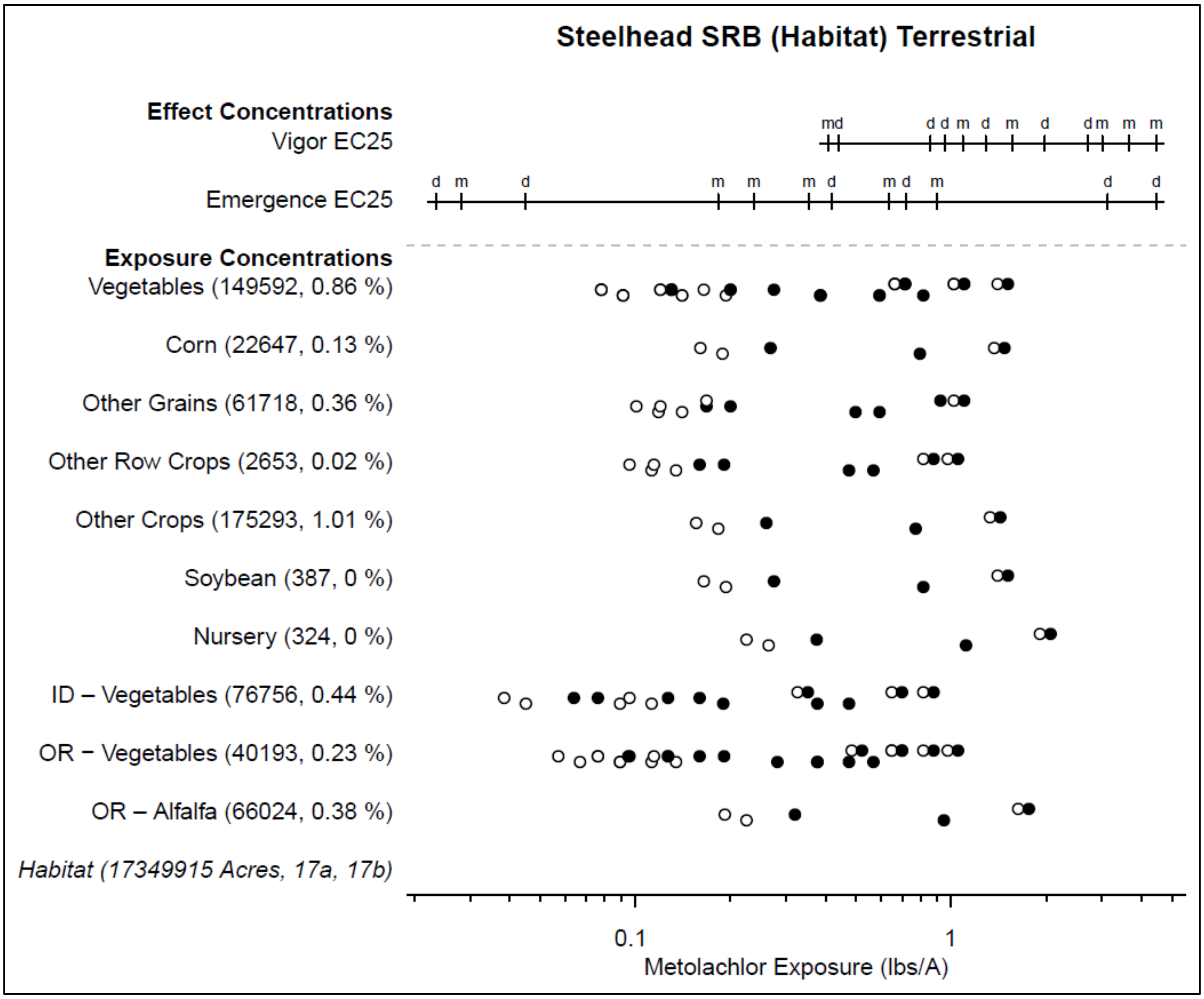


Figure 255. Effects analysis Risk-plot; Steelhead, Snake River Basin DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 771. Likelihood of exposure determination for Steelhead, Snake River Basin DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	2	no	yes	NA	**Medium**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
ID - Vegetables	1	no	yes	yes	**High**
OR - Vegetables	1	no	yes	yes	**High**
OR - Alfalfa	1	no	yes	no	**Low**

Table 772. Prey risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.86	None Expected	High
Corn	0.13	None Expected	High
Other Grains	0.36	None Expected	High
Other Row Crops	0.02	None Expected	Low
Other Crops	1.01	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0	Low	Low
ID – Vegetables	0.44	None Expected	High
OR – Vegetables	0.23	None Expected	High
OR – Alfalfa	0.38	None Expected	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.		
Risk	**Confidence**	
Low	**High**	

Table 773. Vegetative cover risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.86	High	High
Corn	0.13	High	High
Other Grains	0.36	High	High
Other Row Crops	0.02	High	Low
Other Crops	1.01	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low
ID – Vegetables	0.44	High	High
OR – Vegetables	0.23	High	High
OR – Alfalfa	0.38	High	Low
Terrestrial			
Vegetables	0.86	High	High
Corn	0.13	High	High
Other Grains	0.36	High	High
Other Row Crops	0.02	High	Low
Other Crops	1.01	High	Medium
Soybean	0	High	Low
Nursery	0	High	Low

ID – Vegetables	0.44	High	High
OR – Vegetables	0.23	High	High
OR – Alfalfa	0.38	High	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.			
Risk	**Confidence**		
High	**Medium**		

Table 774. Water quality risk hypothesis; Steelhead, Snake River Basin DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Snake River Basin DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

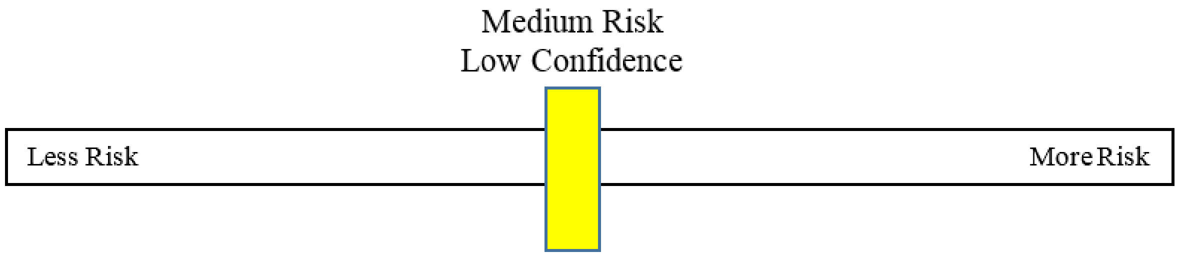
Table 775. Effects analysis summary table; Steelhead, Snake River Basin DPS designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	

Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No
Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Snake River Basin Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Snake River Basin Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.26 South Central California Coast Steelhead Designated Critical Habitat; Metolachlor

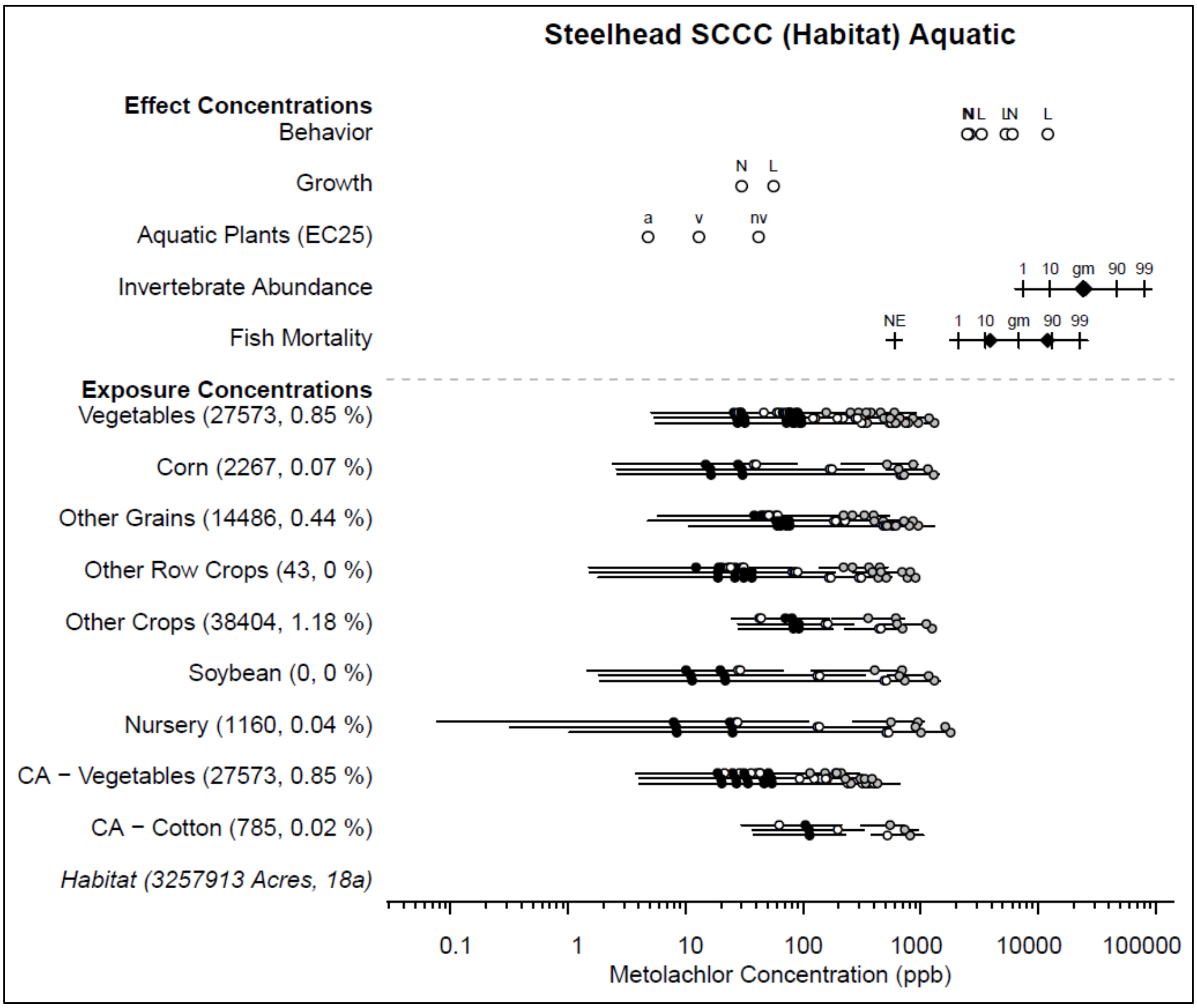


Figure 256. Effects analysis Risk-plot; Steelhead, South Central California Coast DPS designated critical habitat; aquatic plants and Metolachlor

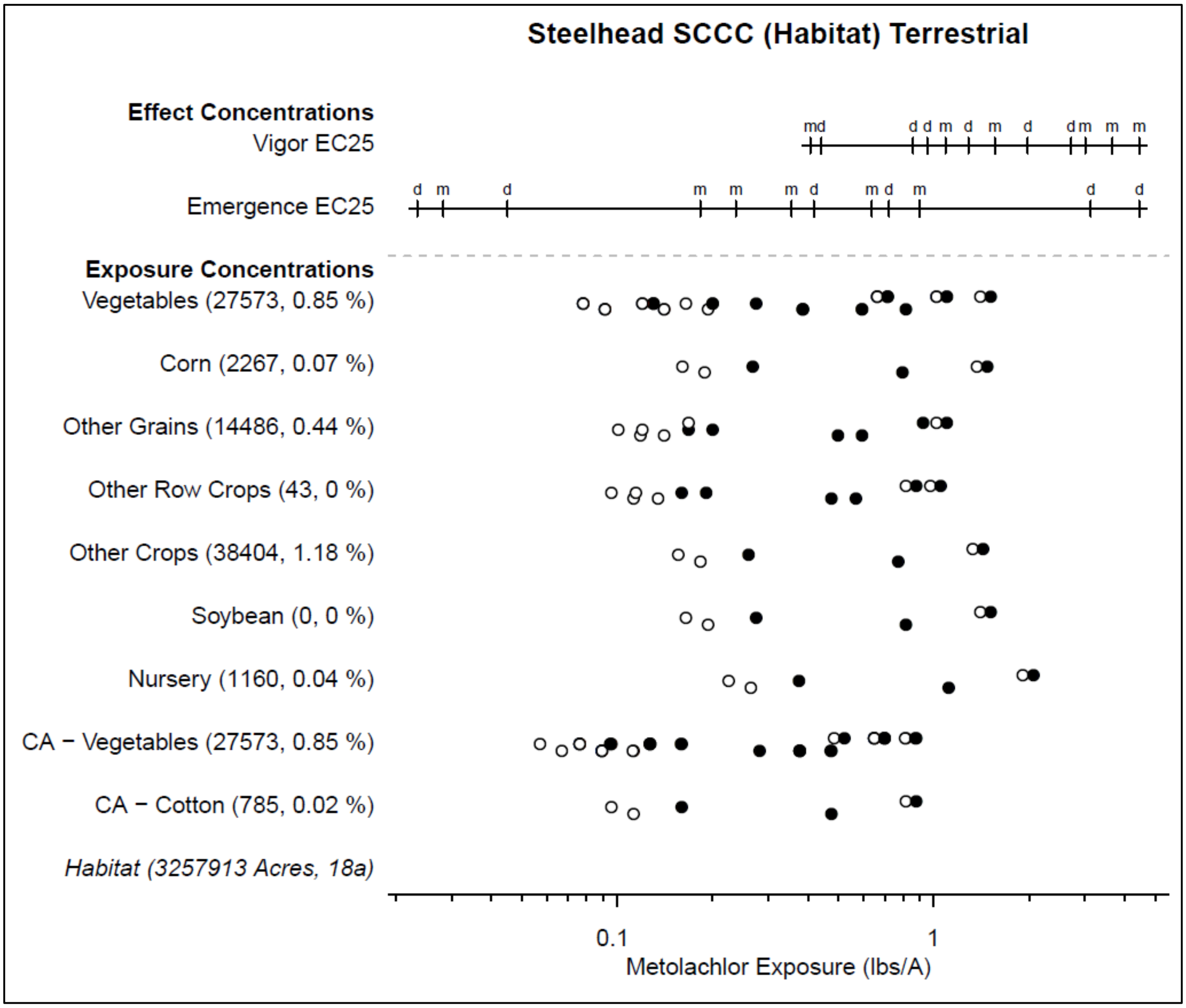


Figure 257. Effects analysis Risk-plot; Steelhead, South Central California Coast DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 776. Likelihood of exposure determination for Steelhead, South Central California Coast DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	2	no	yes	NA	**Medium**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	yes	**High**
CA - Cotton	1	no	yes	no	**Low**

Table 777. Prey risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.85	None Expected	High
Corn	0.07	None Expected	High
Other Grains	0.44	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	1.18	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
CA – Vegetables	0.85	None Expected	High
CA – Cotton	0.02	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 778. Vegetative cover risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.85	High	High
Corn	0.07	High	High
Other Grains	0.44	High	High
Other Row Crops	0	High	Low
Other Crops	1.18	High	Medium
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.85	High	High
CA – Cotton	0.02	High	Low
Terrestrial			
Vegetables	0.85	High	High
Corn	0.07	High	High
Other Grains	0.44	High	High
Other Row Crops	0	High	Low
Other Crops	1.18	High	Medium
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.85	High	High
CA – Cotton	0.02	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 779. Water quality risk hypothesis; Steelhead, South Central California Coast DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, South Central California Coast DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

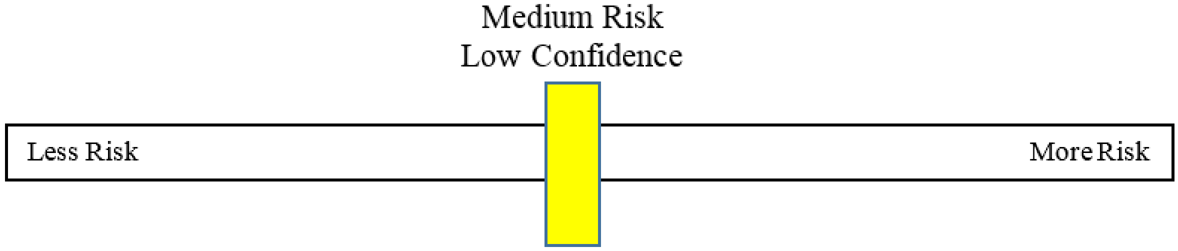
Table 780. Effects analysis summary table; Steelhead, South Central California Coast DPS designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of South Central California Coast Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the South Central California Coast Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.27 Southern California Steelhead Designated Critical Habitat; Metolachlor

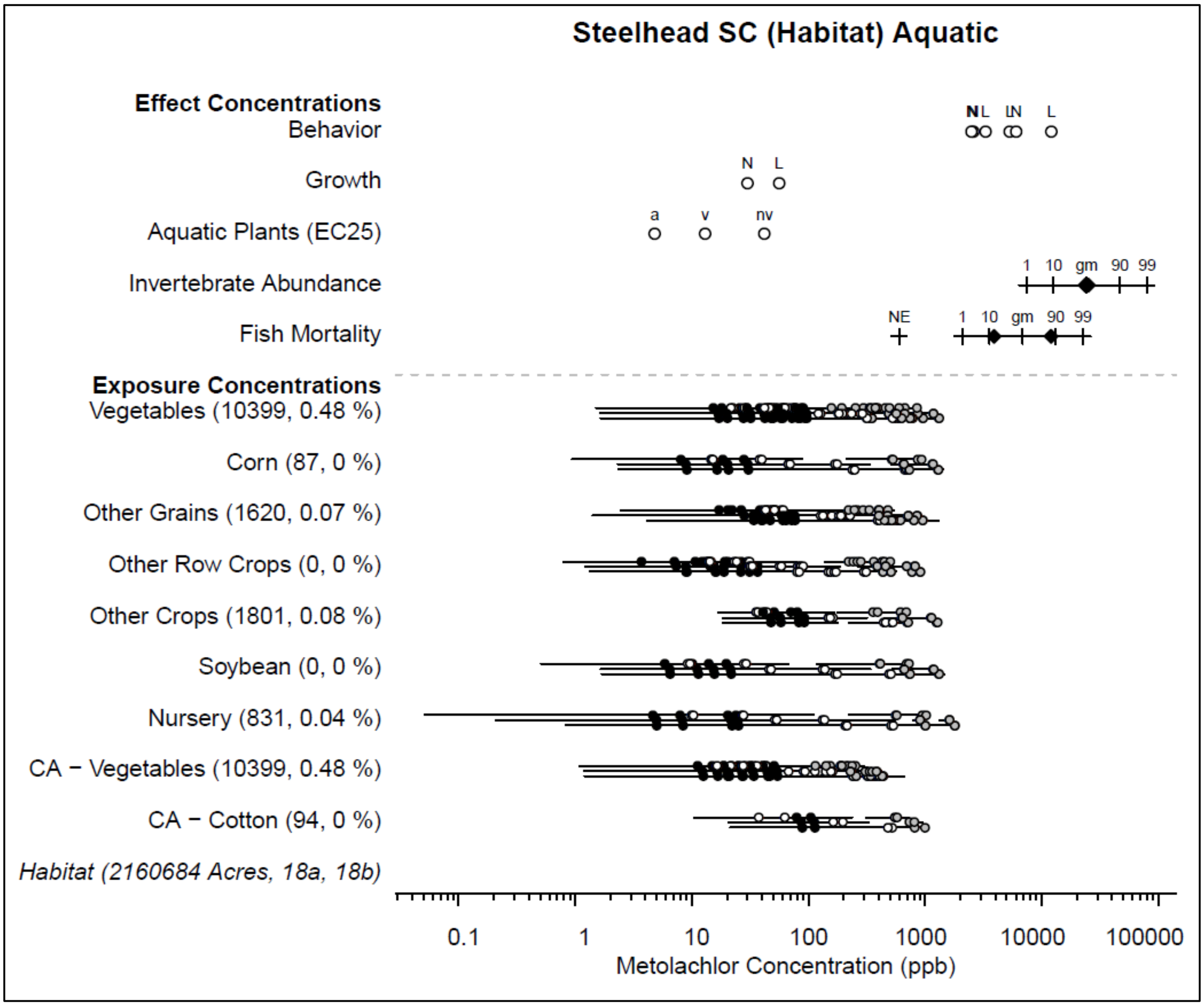


Figure 258. Effects analysis Risk-plot; Steelhead, Southern California DPS designated critical habitat; aquatic plants and Metolachlor

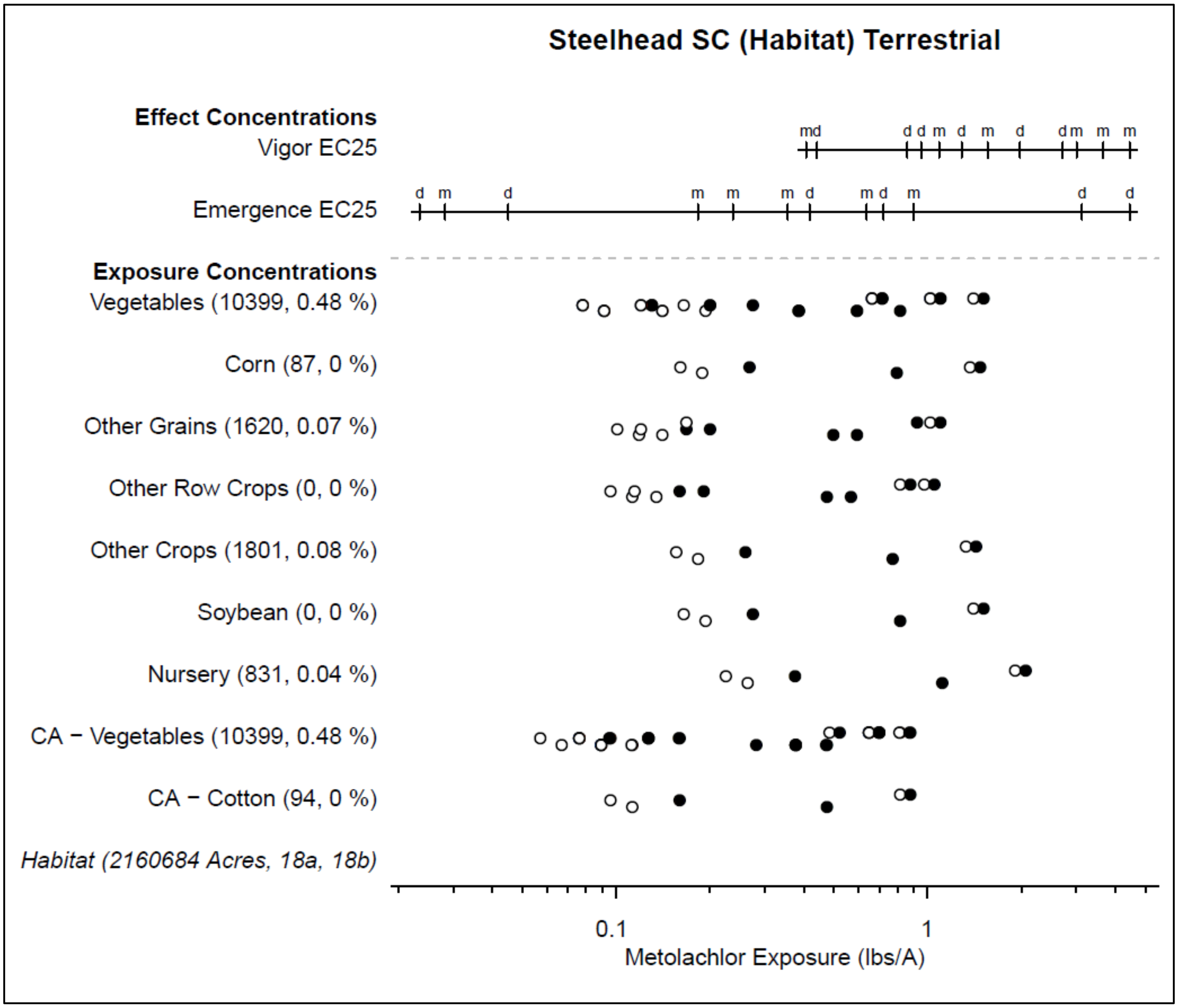


Figure 259. Effects analysis Risk-plot; Steelhead, Southern California DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 781. Likelihood of exposure determination for Steelhead, Southern California DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	1	no	yes	yes	**High**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	1	no	yes	yes	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
CA - Vegetables	1	no	yes	yes	**High**
CA - Cotton	1	no	yes	yes	**High**

Table 782. Prey risk hypothesis; Steelhead, Southern California DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	0.48	None Expected	High
Corn	0	None Expected	High
Other Grains	0.07	None Expected	High
Other Row Crops	0	None Expected	Low
Other Crops	0.08	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.04	Low	Low
CA – Vegetables	0.48	None Expected	High
CA – Cotton	0	None Expected	High
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 783. Vegetative cover risk hypothesis; Steelhead, Southern California DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	0.48	High	High
Corn	0	High	High
Other Grains	0.07	High	High
Other Row Crops	0	High	Low
Other Crops	0.08	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.48	High	High
CA – Cotton	0	High	High
Terrestrial			
Vegetables	0.48	High	High
Corn	0	High	High
Other Grains	0.07	High	High
Other Row Crops	0	High	Low
Other Crops	0.08	High	High
Soybean	0	High	Low
Nursery	0.04	High	Low
CA – Vegetables	0.48	High	High
CA – Cotton	0	High	High

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 784. Water quality risk hypothesis; Steelhead, Southern California DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Southern California DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

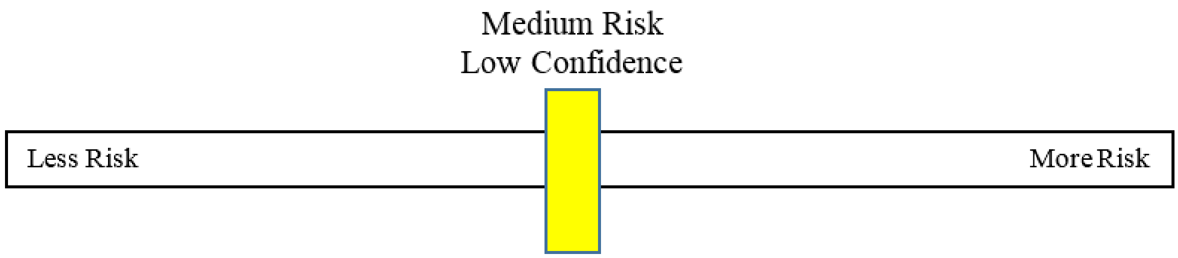
Table 785. Effects analysis summary table; Steelhead, Southern California DPS designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Southern California Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Southern California Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.28 Upper Columbia River Steelhead Designated Critical Habitat; Metolachlor

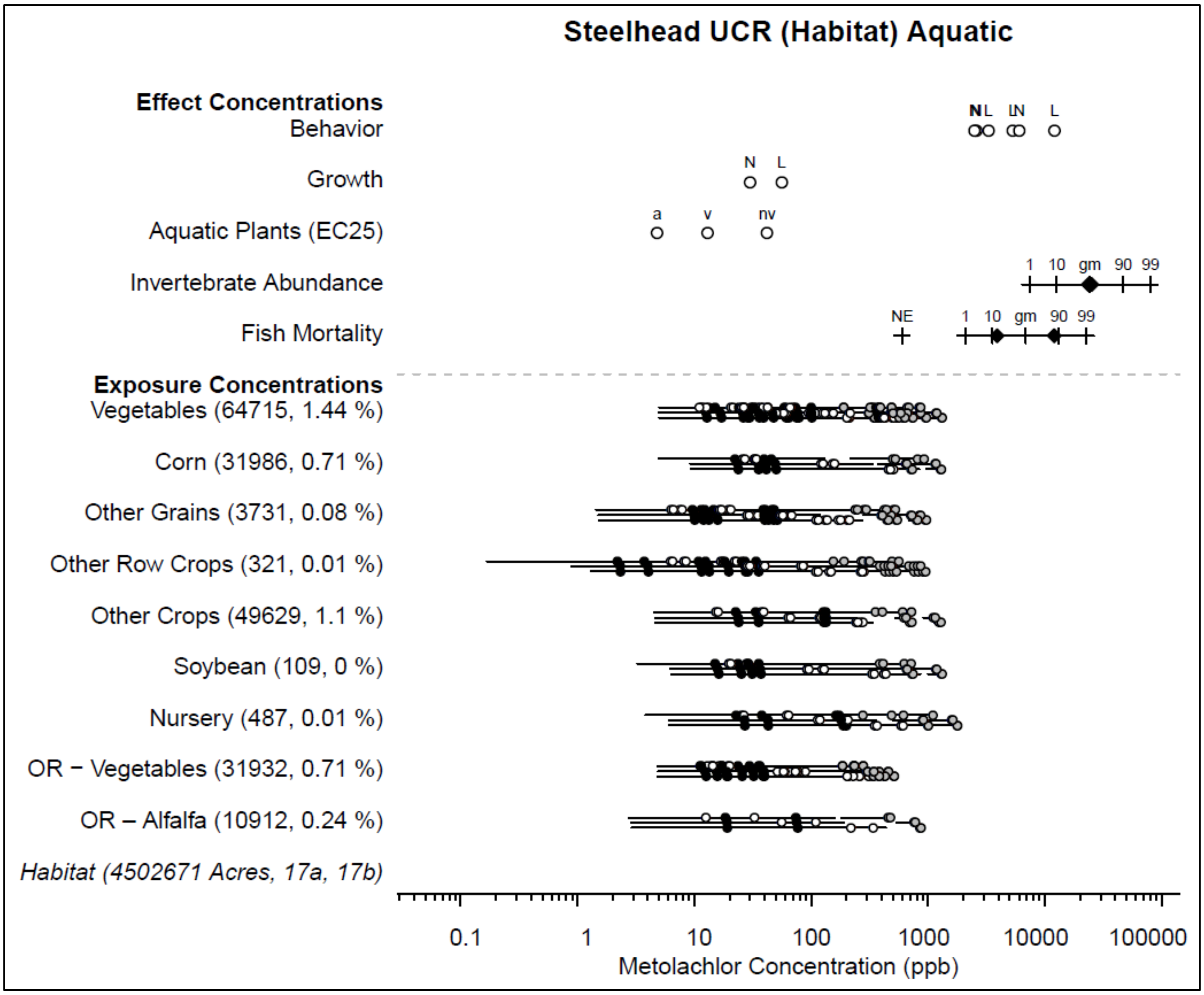


Figure 260. Effects analysis Risk-plot; Steelhead, Upper Columbia River DPS designated critical habitat; aquatic plants and Metolachlor

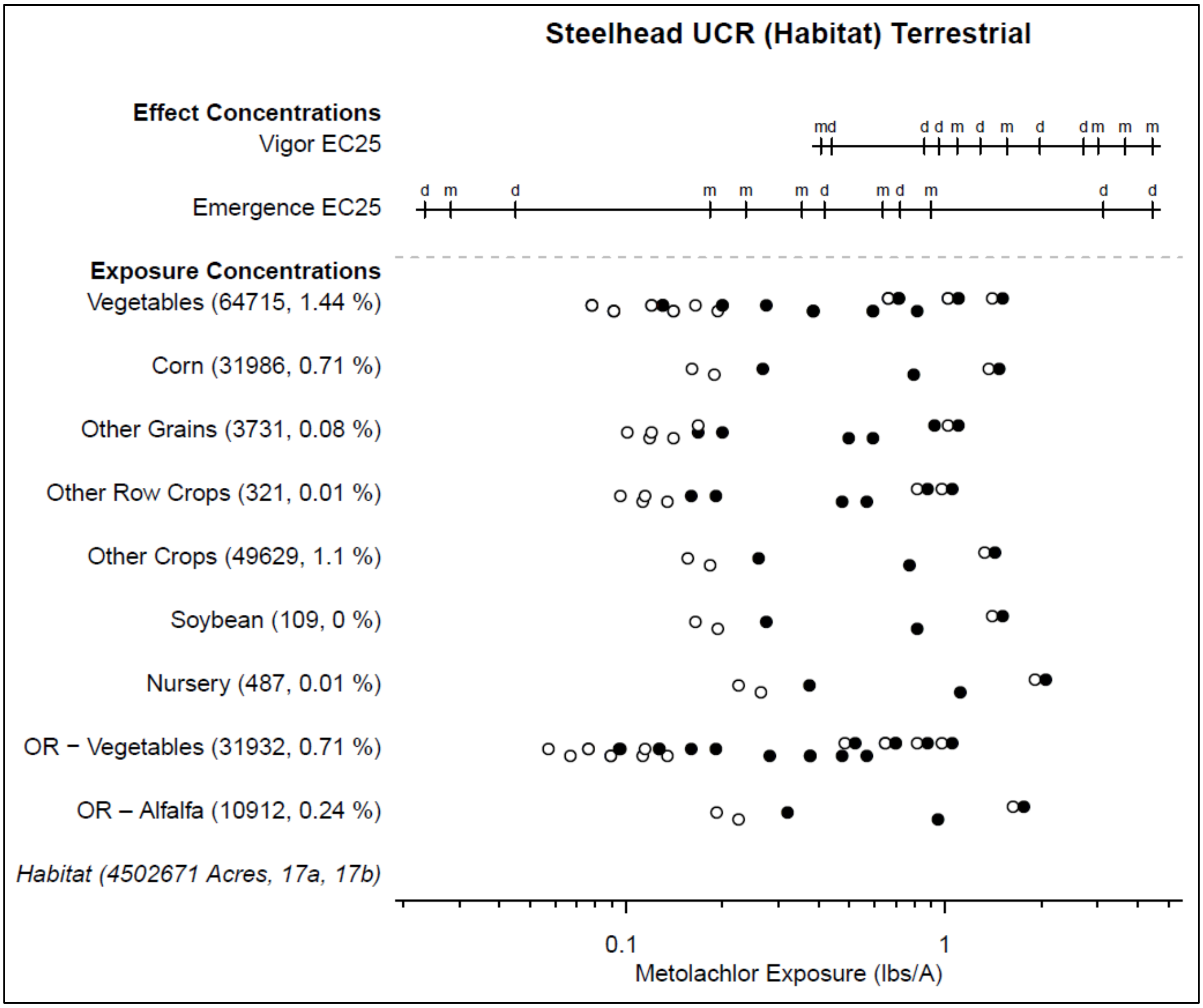


Figure 261. Effects analysis Risk-plot; Steelhead, Upper Columbia River DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 786. Likelihood of exposure determination for Steelhead, Upper Columbia River DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	no	**Low**
Other Row Crops	1	no	yes	no	**Low**
Other Crops	2	no	yes	NA	**Medium**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	1	no	yes	yes	**High**
OR - Alfalfa	1	no	yes	no	**Low**

Table 787. Prey risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.44	None Expected	Medium
Corn	0.71	None Expected	High
Other Grains	0.08	None Expected	Low
Other Row Crops	0.01	None Expected	Low
Other Crops	1.1	None Expected	Medium
Soybean	0	None Expected	Low
Nursery	0.01	Low	Low
OR – Vegetables	0.71	None Expected	High
OR – Alfalfa	0.24	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	**High**	

Table 788. Vegetative cover risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.44	High	Medium
Corn	0.71	High	High
Other Grains	0.08	High	Low
Other Row Crops	0.01	High	Low
Other Crops	1.1	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.71	High	High
OR – Alfalfa	0.24	High	Low
Terrestrial			
Vegetables	1.44	High	Medium
Corn	0.71	High	High
Other Grains	0.08	High	Low
Other Row Crops	0.01	High	Low
Other Crops	1.1	High	Medium
Soybean	0	High	Low
Nursery	0.01	High	Low
OR – Vegetables	0.71	High	High
OR – Alfalfa	0.24	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 789. Water quality risk hypothesis; Steelhead, Upper Columbia River DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Upper Columbia River DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

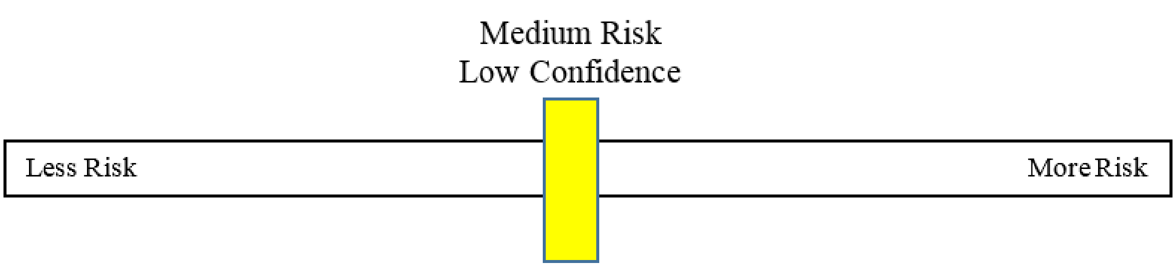
Table 790. Effects analysis summary table; Steelhead, Upper Columbia River DPS designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Columbia River Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Upper Columbia River Steelhead DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.



15.3.29 Upper Willamette River Steelhead Designated Critical Habitat; Metolachlor

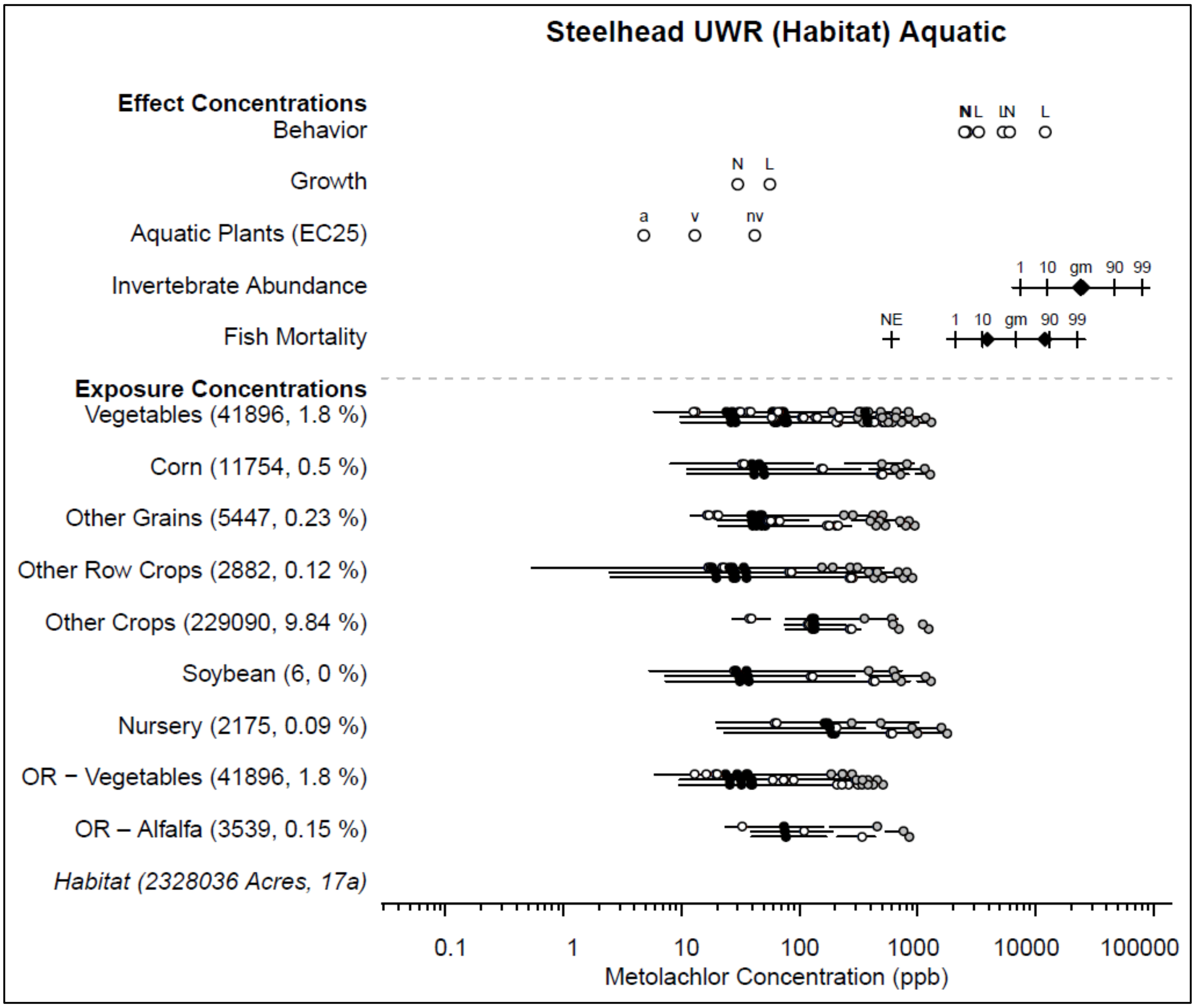


Figure 262. Effects analysis Risk-plot; Steelhead, Upper Willamette River DPS designated critical habitat; aquatic plants and Metolachlor

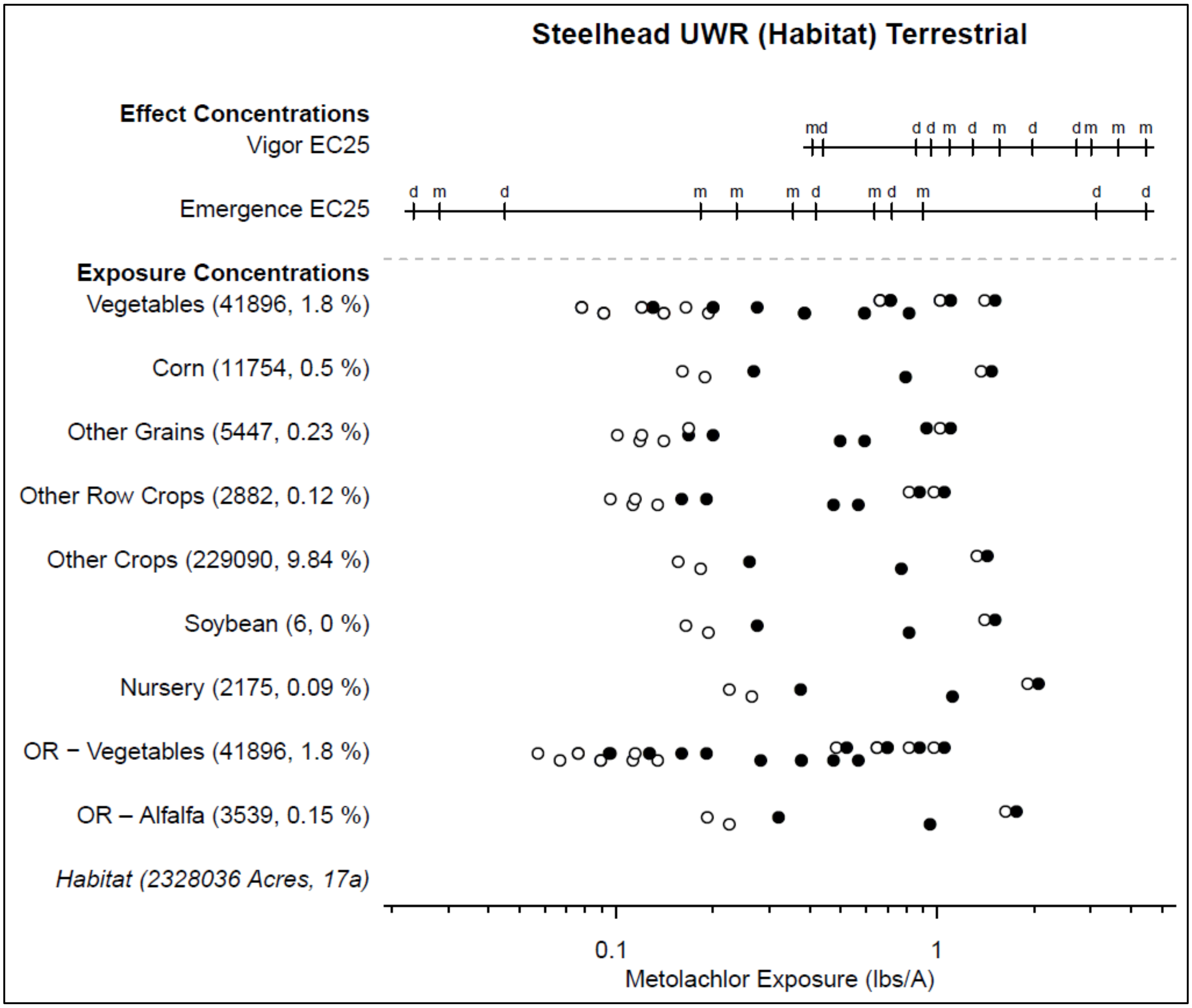


Figure 263. Effects analysis Risk-plot; Steelhead, Upper Willamette River DPS designated critical habitat; terrestrial plants, riparian habitat and Metolachlor

Table 791. Likelihood of exposure determination for Steelhead, Upper Willamette River DPS designated critical habitat and Metolachlor

	Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
Vegetables	2	no	yes	NA	**Medium**
Corn	1	no	yes	yes	**High**
Other Grains	1	no	yes	yes	**High**
Other Row Crops	1	no	yes	yes	**High**
Other Crops	3	no	yes	NA	**High**
Soybean	1	no	yes	no	**Low**
Nursery	1	no	yes	no	**Low**
OR - Vegetables	2	no	yes	NA	**Medium**
OR - Alfalfa	1	no	yes	no	**Low**

Table 792. Prey risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and Metolachlor

Endpoint: Prey			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Vegetables	1.8	None Expected	Medium
Corn	0.5	None Expected	High
Other Grains	0.23	None Expected	High
Other Row Crops	0.12	None Expected	High
Other Crops	9.84	None Expected	High
Soybean	0	None Expected	Low
Nursery	0.09	Low	Low
OR – Vegetables	1.8	None Expected	Medium
OR – Alfalfa	0.15	None Expected	Low
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.			

Risk	Confidence	
Low	High	

Table 793. Vegetative cover risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and Metolachlor

Endpoint: Vegetative Cover (aquatic and terrestrial plants)			
Use Category	**% Overlap**	**Effect of Exposure**	**Likelihood of Exposure**
Aquatic			
Vegetables	1.8	High	Medium
Corn	0.5	High	High
Other Grains	0.23	High	High
Other Row Crops	0.12	High	High
Other Crops	9.84	High	High
Soybean	0	High	Low
Nursery	0.09	High	Low
OR – Vegetables	1.8	High	Medium
OR – Alfalfa	0.15	High	Low
Terrestrial			
Vegetables	1.8	High	Medium
Corn	0.5	High	High
Other Grains	0.23	High	High
Other Row Crops	0.12	High	High
Other Crops	9.84	High	High
Soybean	0	High	Low
Nursery	0.09	High	Low
OR – Vegetables	1.8	High	Medium
OR – Alfalfa	0.15	High	Low

Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.		
Risk	**Confidence**	
High	**Medium**	

Table 794. Water quality risk hypothesis; Steelhead, Upper Willamette River DPS designated critical habitat and Metolachlor

Endpoint: Water Quality		
Compromised water quality occurs when anticipated concentrations of the stressors of the action achieve toxic levels in designated critical habitat. However, the anticipated metolachlor levels within the designated critical habitat of the Steelhead, Upper Willamette River DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. The likelihood of attaining toxic concentrations increases with frequency of application, use of the maximum rates, and the proximity to designated critical habitats. Other chemicals within formulations or added to tank mixes may increase the extent of water quality degradation.		
Risk Hypothesis: Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.		
Risk	**Confidence**	
Medium	**Low**	

Table 795. Effects analysis summary table; Steelhead, Upper Willamette River DPS designated critical habitat and Metolachlor

	R-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration, and rearing sites.	Low	High	No

Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	High	Medium	Yes
Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	Medium	Low	No

Designated Critical Habitat Effects Analysis Summary

We anticipate that the stressors of the action will negatively affect some physical and biological features of Upper Willamette River Steelhead designated critical habitat. The anticipated metolachlor levels within the designated critical habitat of the Upper Willamette River DPS are not expected to substantially impact the overall abundance and therefore availability of aquatic invertebrates. We characterized risk associated with effects to aquatic and terrestrial vegetation as high and our confidence in this risk is medium. Although we anticipate some impacts to riparian vegetation, we expect these impacts to be primarily to the emergence of a subset of species with little impact to the existing vegetation. Adverse effects to aquatic vegetative cover are anticipated in low volume flowing and static habitats, with greater uncertainty of effects in larger habitats with higher flow rates. We did find support for the vegetative cover risk hypothesis due primarily to impacts to aquatic vegetation. However, we did not find support for the other risk hypotheses. Although adverse effects to aquatic vegetation are anticipated, we expect them to be limited in scope. Effects to primary producers (e.g. aquatic plants) may adversely impact the availability of resources for salmonids, either directly or indirectly via food-chain related effects. However, for this species habitat, the scale of these effects are not anticipated to have a significant impact on overall prey availability. Overall the risk is medium and the confidence associated with that risk is low due to the exposures predicted in critical habitats over the 15-year duration of the action.

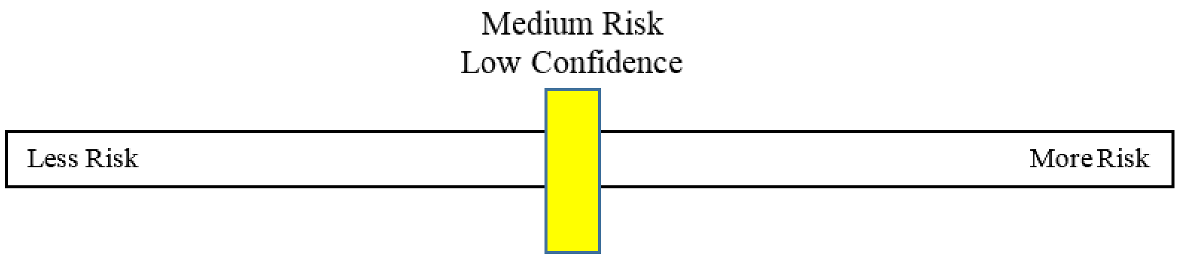


Table 796. Summary of risk and confidence determinations for products containing 1,3-D and designated critical habitats of Pacific Salmonids.

Salmon Type	ESU/DPS	Risk	Confidence
Chum	Columbia River	Medium	Low
Chum	Hood Canal summer-run	Low	Medium
Chinook	California Coastal	Low	Medium
Chinook	CA Central Valley spring-run	Medium	Low
Chinook	Lower Columbia River	Medium	Low
Chinook	Puget Sound	Medium	Low
Chinook	Sacramento River winter-run	Medium	Low
Chinook	Snake River fall-run	Medium	Low
Chinook	Snake River spring/summer-run	Medium	Low
Chinook	Upper Columbia River spring-run	Medium	Low
Chinook	Upper Willamette River	Medium	Low
Coho	Central California Coast	Low	Medium
Coho	Lower Columbia River	Medium	Low
Coho	Oregon Coast	Low	Medium
Coho	S. Oregon N. California Coast	Low	Medium
Sockeye	Ozette Lake	Low	Medium
Sockeye	Snake River	Medium	Low
Steelhead	CA Central Valley	Medium	Low
Steelhead	Central California Coast	Low	Medium
Steelhead	Lower Columbia River	Medium	Low
Steelhead	Middle Columbia River	Medium	Low
Steelhead	Northern California	Low	Medium
Steelhead	Puget Sound	Medium	Low
Steelhead	Snake River Basin	Medium	Low
Steelhead	South-Central California Coast	Medium	Low

Steelhead	Southern California	Medium	Low
Steelhead	Upper Columbia River	Medium	Low
Steelhead	Upper Willamette River	Medium	Low

Table 797. Summary of risk and confidence determinations for metolachlor and desingated critical habitats of Pacific Salmonids.

Salmon Type	ESU/DPS	Risk	Confidence
Chum	Columbia River	Medium	Low
Chum	Hood Canal summer-run	Low	High
Chinook	California Coastal	Low	High
Chinook	CA Central Valley spring-run	Medium	Low
Chinook	Lower Columbia River	Medium	Low
Chinook	Puget Sound	Medium	Low
Chinook	Sacramento River winter-run	Medium	Low
Chinook	Snake River fall-run	Medium	Low
Chinook	Snake River spring/summer-run	Medium	Low
Chinook	Upper Columbia River spring-run	Medium	Low
Chinook	Upper Willamette River	Medium	Low
Coho	Central California Coast	Low	High
Coho	Lower Columbia River	Medium	Low
Coho	Oregon Coast	Low	High
Coho	S. Oregon N. California Coast	Low	High
Sockeye	Ozette Lake	Low	High
Sockeye	Snake River	Low	High
Steelhead	CA Central Valley	Medium	Low
Steelhead	Central California Coast	Medium	Low
Steelhead	Lower Columbia River	Medium	Low

Steelhead	Middle Columbia River	Medium	Low
Steelhead	Northern California	Low	High
Steelhead	Puget Sound	Medium	Low
Steelhead	Snake River Basin	Medium	Low
Steelhead	South-Central California Coast	Medium	Low
Steelhead	Southern California	Medium	Low
Steelhead	Upper Columbia River	Medium	Low
Steelhead	Upper Willamette River	Medium	Low

16 Integration and Synthesis: Designated Critical Habitat

16.1 Introduction

The integration and synthesis section is the final step in our assessment of the risk posed to critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action to the status, baseline and the cumulative effects to formulate the agency's biological opinion as to whether the proposed action is likely to appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species.

The effects analysis (Chapter 16) evaluated the effects of the action on the primary and biological features of the designated critical habitat for each species. This analysis included the evaluation of risk hypotheses. The effects analysis concluded with a determination of risk posed to the primary and biological features by the effects of the action, as well as a characterization of confidence. In this section, these effects analysis conclusions are considered in the context of the status, baseline and cumulative effects to determine whether the effects of the action will appreciably diminish the conservation value as a whole.

We treat the information from the status, environmental baseline, and cumulative effects, as "risk modifiers," in that the effects described in the effects analysis section may be modified by the condition of the environmental baseline, and anticipated cumulative effects. To help guide our risk assessors in making transparent and consistent determinations, we developed several key-questions which were examined for each species and critical habitat (see Chapters 8, 9, 10). However, the ultimate consideration of increased or decreased risk attributable to the status of the species, environmental baseline, or cumulative effects is not restricted to the consideration of the key questions alone. Additional relevant factors were considered depending on the species or critical habitat being assessed.

Once each of the above sections is evaluated, the effects of the action and the risk modifiers are depicted graphically on a "scorecard." The influence of each modifier on the effects of the action is represented by an arrow. The magnitude of influence (low or high) is represented by the length of the arrow (short or long). The direction an arrow is pointed indicates the directionality of the risk modifier, increasing or decreasing risk. For example, an environmental baseline arrow pointing towards more risk may indicate that environmental mixtures and elevated temperatures occur in the Environmental Baseline, which further stresses the species in question. The level of confidence in the magnitude of modification is indicated by bolding (high confidence) or unbolding (low confidence) the arrow.

An additional arrow representing the influence on risk is graphically depicted on each of the designated critical habitat scorecards. The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar ("Effects Analysis") of the scorecard. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the critical habitat, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard (Figure 118), the bar labeled conclusion shows the overall risk and adverse modification determination (the colored bar beginning with green (less risk) to red (more risk)). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The no adverse modification/adverse modification determination for each species designated critical habitat is ultimately an informed best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles (see Chapters 3 and 14).

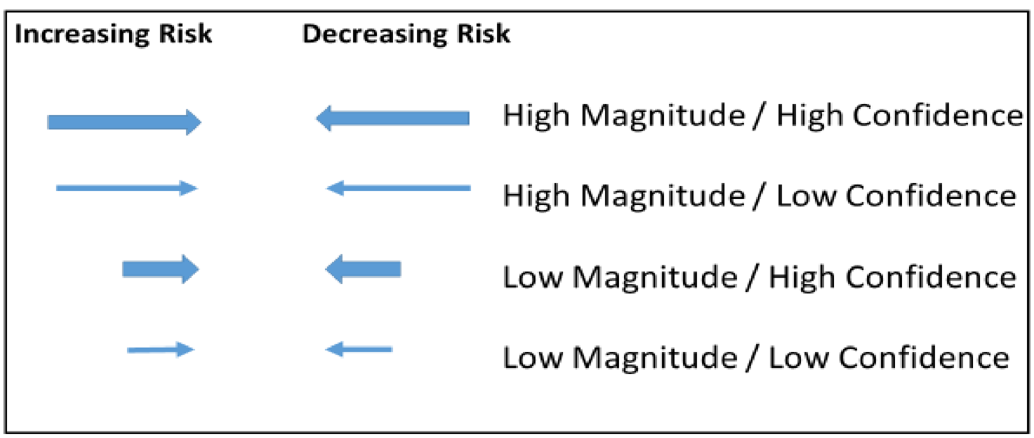


Figure 264. Example of arrows to represent direction, magnitude, and confidence of risk modifiers

Conclusion Section:

We combine the effects analysis conducted in chapters 15 – 17 with the baseline status of the species habitat, and cumulative effects to determine whether the action could reasonably be expected to appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species. We state our conclusion as to whether the action is likely to destroy or adversely modify each of the species designated critical habitats.

A scorecard is generated for each species designated critical habitat. The effects of the proposed action is considered based on the magnitude and confidence of the three arrows. Next, an adverse modification or no adverse modification vertical blue bar is placed on the horizontal risk bar i.e., the colored bar beginning with green (less risk) to red (more risk) (Figure 118) to depict our conclusion.

Figure 265: Example conclusion graphic

16.2 Designated Critical Habitat Scorecards – 1,3-Dichloropropene

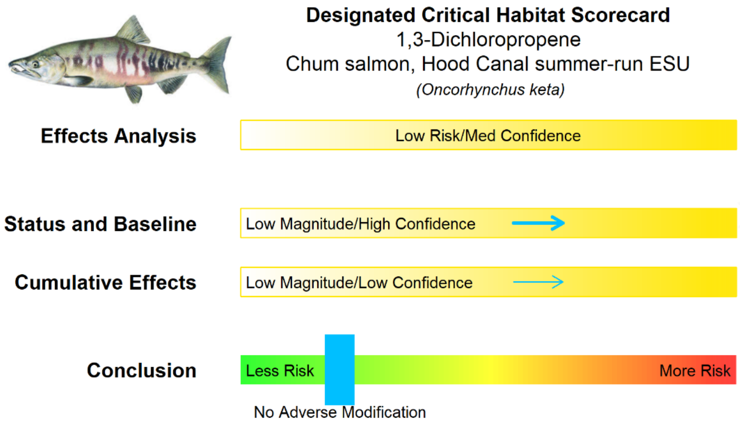


Figure 266. Designated Critical Habitat Scorecard; Chum salmon, Hood Canal summer-run Evolutionarily Significant Unit (ESU); 1,3-Dichloropropene

<u>Effects Analysis: Low risk/Medium confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Minimal increase in risk; Low magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded
- Migration and rearing PBFs are impaired by loss of floodplain habitat necessary for juvenile growth and development
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All 12 watersheds of high or medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

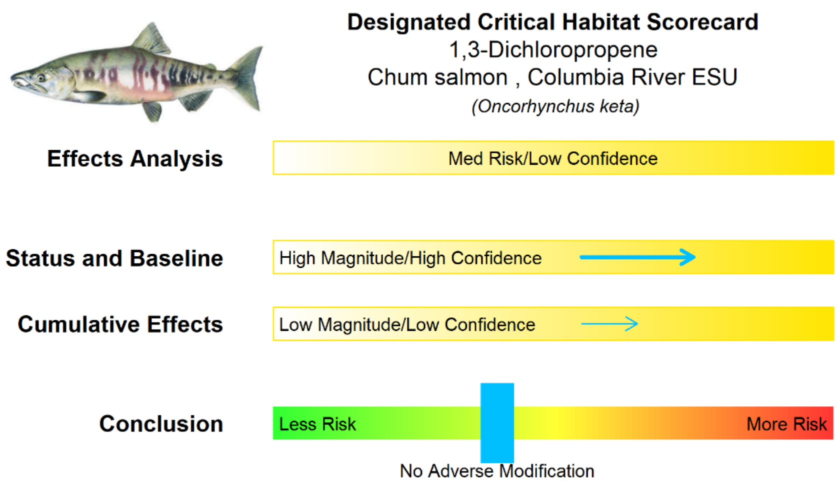


Figure 267. Designated Critical Habitat Scorecard; Chum salmon, Columbia River ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs (water quality and cover) are degraded
- Migration PBFs significantly impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All 19 watersheds of high or medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

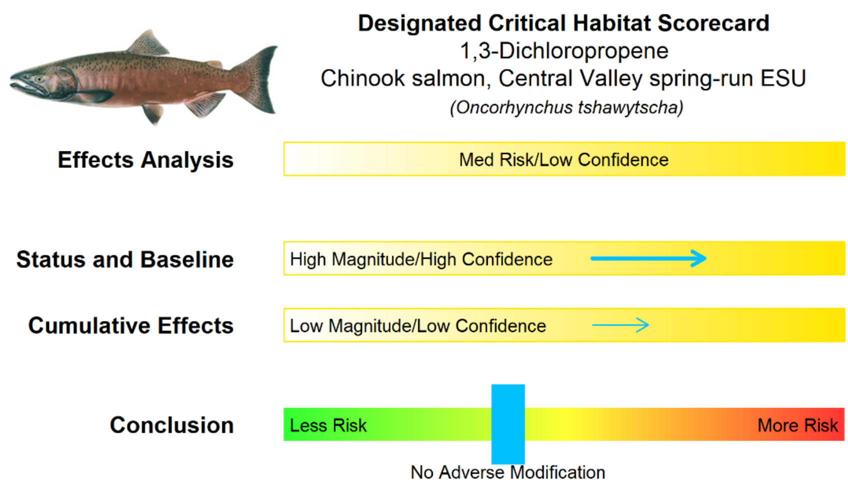


Figure 268. Designated Critical Habitat Scorecard; Chinook salmon, Central Valley spring-run ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by elevated temperatures, lost access to historic spawning sites, and loss of floodplain habitat
- Migration PBFs degraded by loss of cover and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 38 watersheds, 28 are of high and 3 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

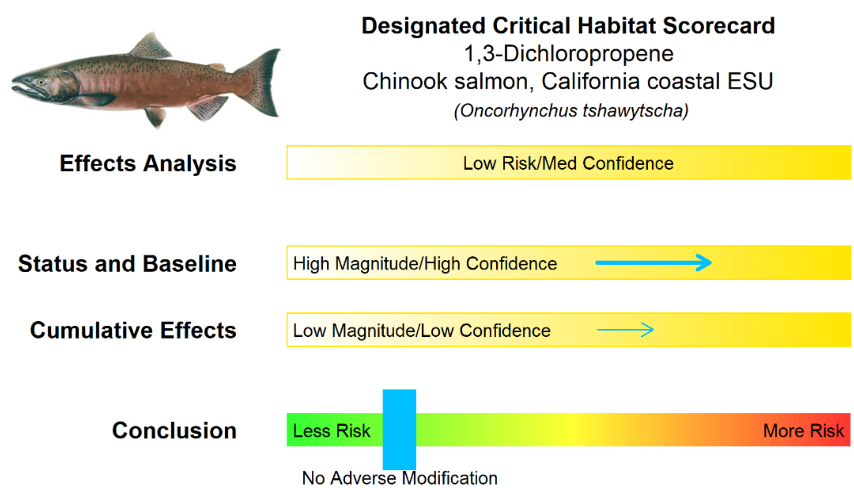


Figure 269. Designated Critical Habitat Scorecard; Chinook salmon, California coastal ESU; 1,3-Dichloropropene

Effects Analysis: Low risk/Medium confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning PBFs are degraded by timber harvest
- Rearing and migration PBFs impacted by dams and invasive species.
- Estuarine PBFs degraded by water quality and saltwater mixing
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 45 watersheds, 27 are of high and 10 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

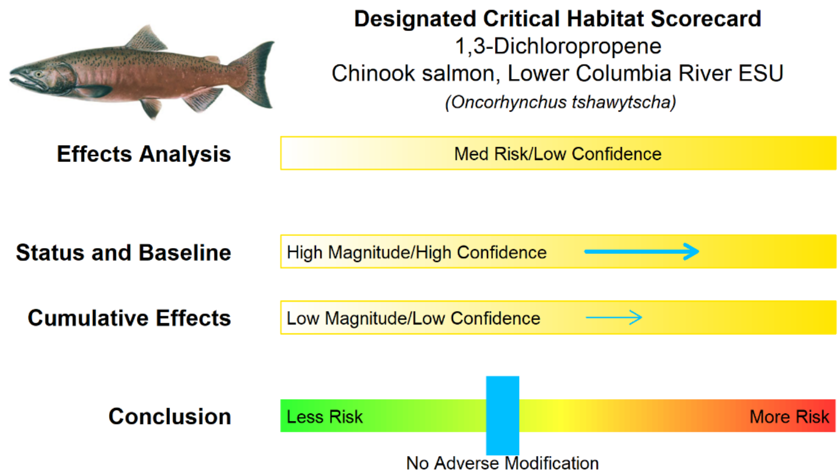


Figure 270. Designated Critical Habitat Scorecard; Chinook salmon, Lower Columbia River ESU; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover
- Migration PBFs impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of occupied watersheds, 31 are of high and 13 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

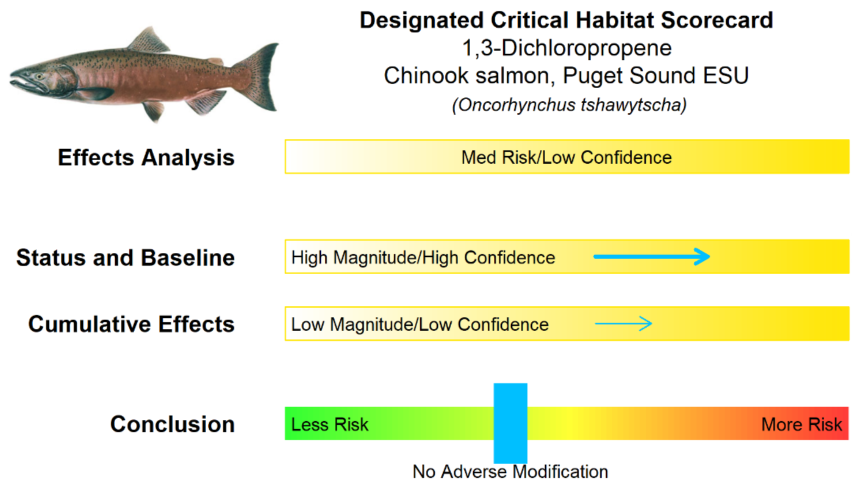


Figure 271. Designated Critical Habitat Scorecard; Chinook salmon, Puget Sound ESU; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning, rearing and migration PBFs are degraded by forestry, agriculture, urbanization, and loss of habitat
- Estuarine PBFs degraded by water quality, altered salinity, and lack of natural cover
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 61 watersheds, 40 are of high and 9 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

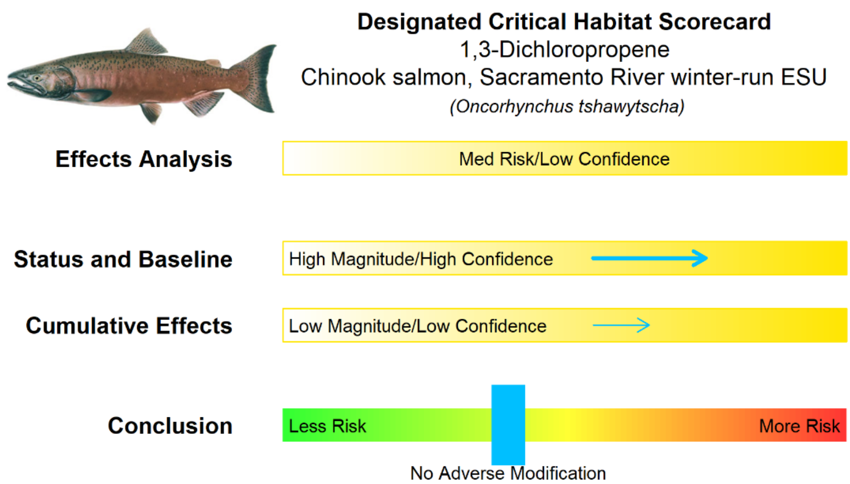


Figure 272. Designated Critical Habitat Scorecard; Chinook salmon, Sacramento River winter-run ESU; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded by elevated temperatures and loss of habitat
- Migration PBFs degraded by lack of natural cover and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire Sacramento river and delta are considered of high conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

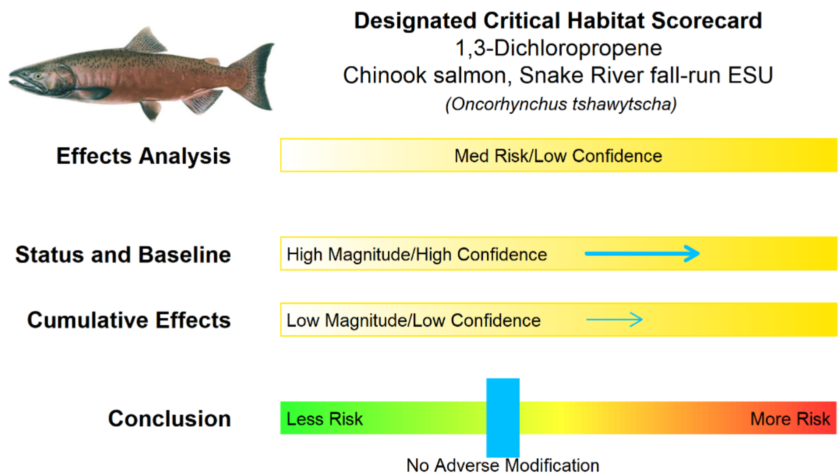


Figure 273. Designated Critical Habitat Scorecard; Chinook salmon, Snake River fall-run ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning, rearing and migration PBFs are degraded by loss of habitat, impaired stream flows, barriers to fish passage, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire river corridor is considered of high conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

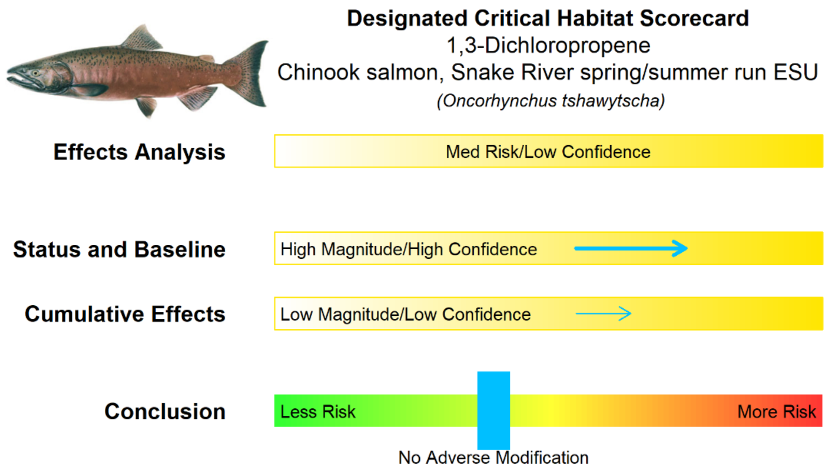


Figure 274. Designated Critical Habitat Scorecard; Chinook salmon, Snake River spring/summer run ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning, rearing and migration PBFs are degraded by loss of habitat, altered stream flows, barriers to fish passage, dams, loss of cover, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire river corridor is considered of high conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

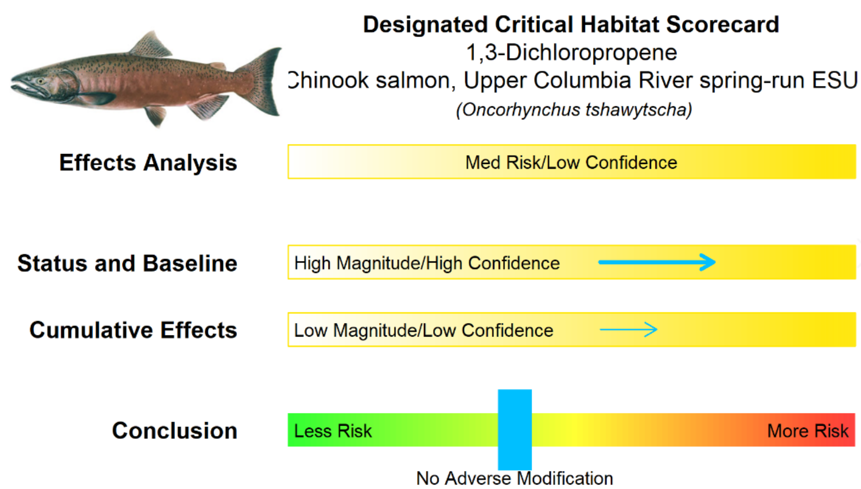


Figure 275. Designated Critical Habitat Scorecard; Chinook salmon, Upper Columbia River spring-run ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by urbanization and irrigation water diversions
- Migration PBFs degraded by numerous dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of occupied watersheds, 26 are of high and 5 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

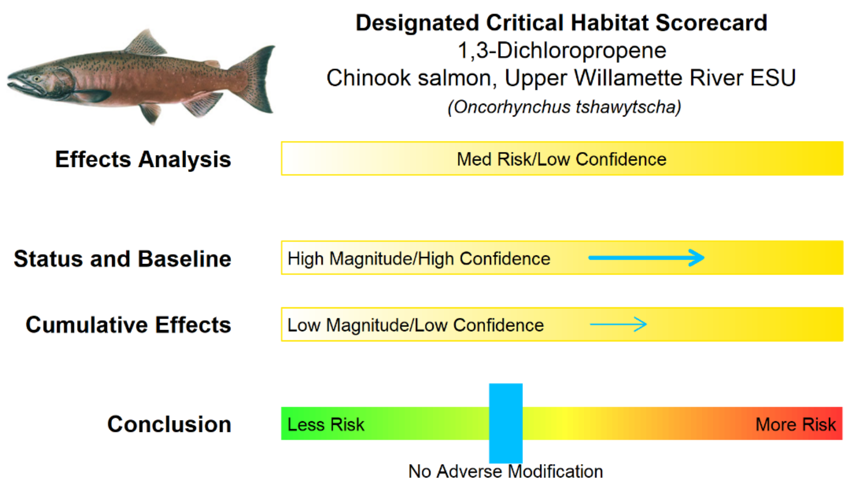


Figure 276. Designated Critical Habitat Scorecard; Chinook salmon, Upper Willamette River ESU; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Migration, rearing, and estuary PBFs are degraded by dams, water management, loss of riparian vegetation, and quality of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 59 assessed watersheds, 22 are of high and 18 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

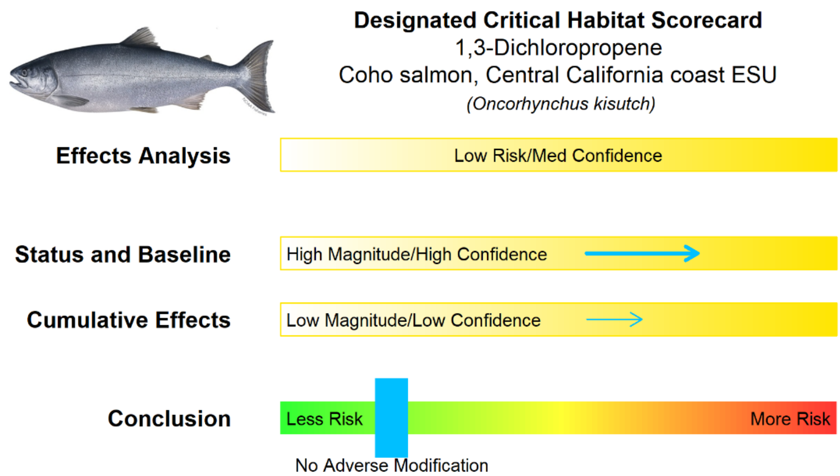


Figure 277. Designated Critical Habitat Scorecard; Coho salmon, Central California coast ESU; 1,3-Dichloropropene

<u>Effects Analysis: Low risk/Medium confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Degradation in quality and quantity of PBFs, especially in southern end of range
- Rearing PBFs degraded by loss of suitable incubation substrate and loss of habitat
- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats may impact PBFs

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

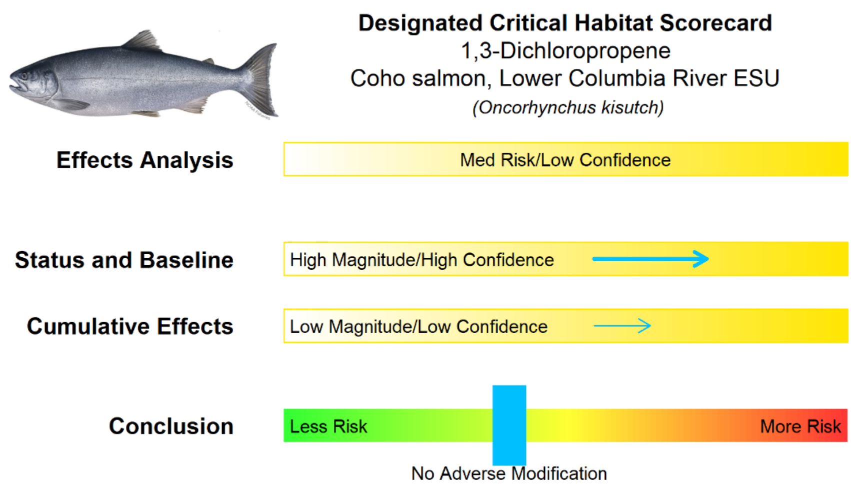


Figure 278. Designated Critical Habitat Scorecard; Coho salmon, Lower Columbia River ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover
- Migration PBFs impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

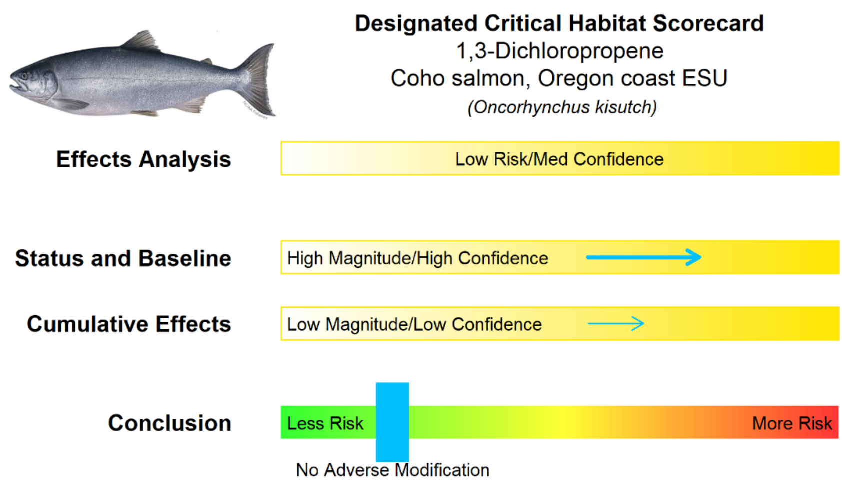


Figure 279. Designated Critical Habitat Scorecard; Coho salmon, Oregon coast ESU; 1,3-Dichloropropene

Effects Analysis: Low risk/Medium confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs are degraded by elevated water temperature
- All PBFs degraded by reduced water quality from contaminants and excess nutrients
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 80 assessed watersheds, 45 are of high and 27 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

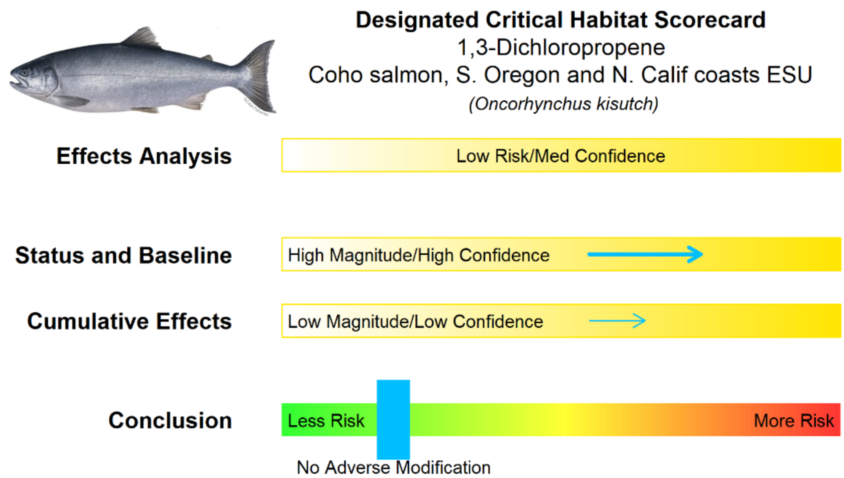


Figure 280. Designated Critical Habitat Scorecard; Coho salmon, S. Oregon and N. Calif coasts ESU; 1,3-Dichloropropene

<u>Effects Analysis: Low risk/Medium confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning PBFs are degraded by logging
- Rearing and migration PBFs degraded by loss of riparian vegetation and loss of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

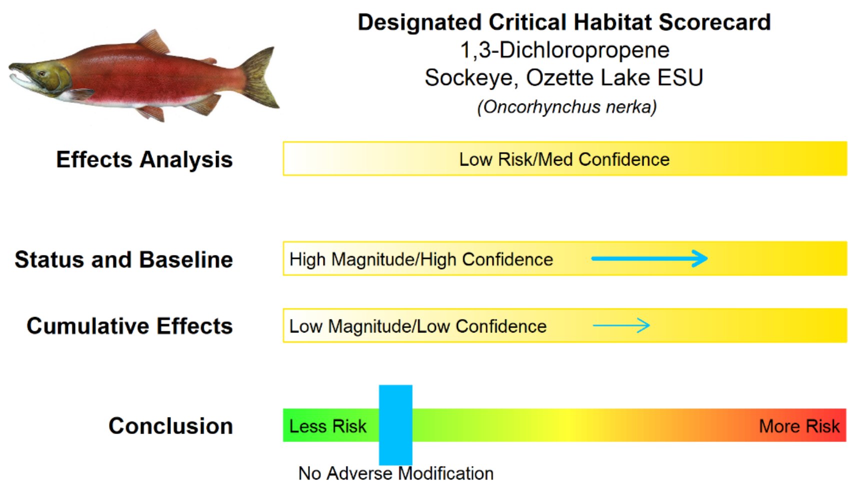


Figure 281. Designated Critical Habitat Scorecard; Sockeye, Ozette Lake ESU; 1,3-Dichloropropene

<u>Effects Analysis: Low risk/Medium confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by excessive predation, invasive species, and loss of habitat
- Spawning and migration PBFs are degraded by low water levels, loss of suitable spawning habitat, and low summer water flows
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire watershed is of high conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

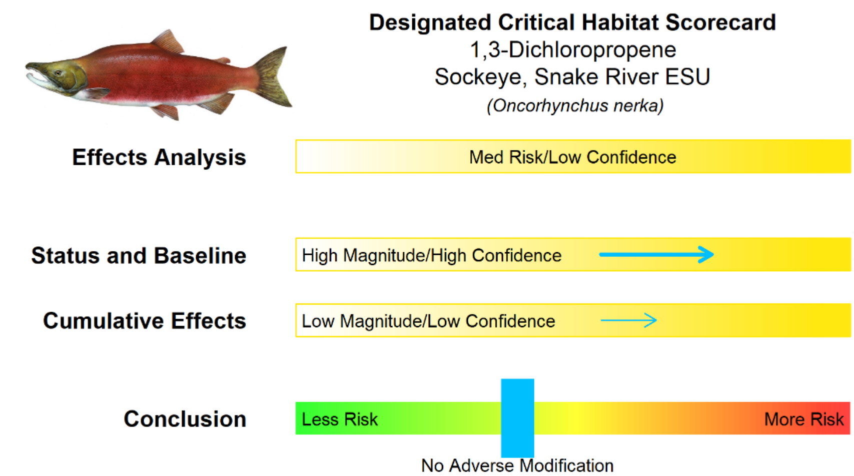


Figure 282. Designated Critical Habitat Scorecard; Sockeye, Snake River ESU; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing and migration PBFs are degraded by impaired water quality from adjacent land uses
- Migration PBFs are degraded by multiple dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All occupied and used areas of the watershed are of high conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

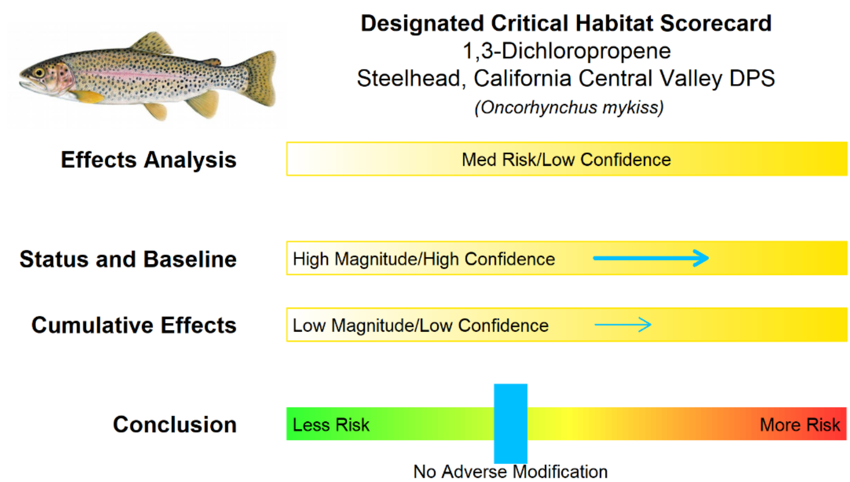


Figure 283. Designated Critical Habitat Scorecard; Steelhead, California Central Valley Distinct Population Segment (DPS); 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning Physical and Biological Features (PBFs) are degraded by altered water flows and temperature
- Rearing and migration PBFs are degraded by altered riverine habitat, dense urbanization and agriculture, poor water quality, and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 67 occupied watersheds, 37 are of high and 18 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

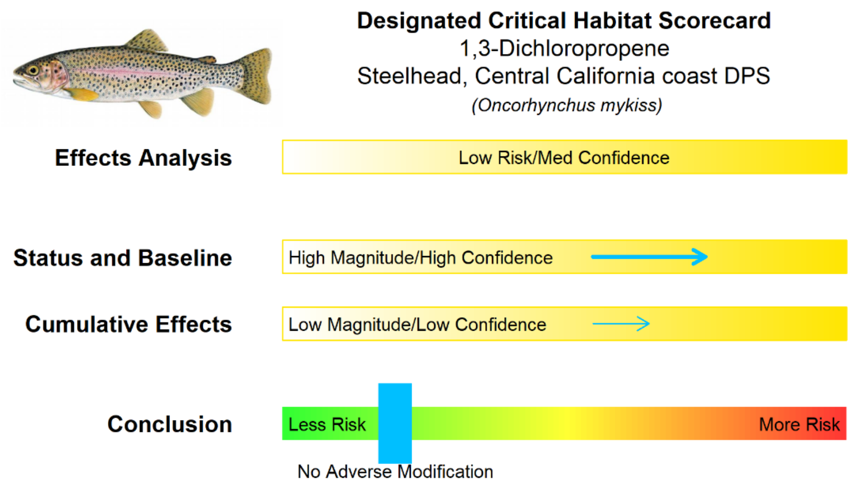


Figure 284. Designated Critical Habitat Scorecard; Steelhead, Central California coast DPS; 1,3-Dichloropropene

Effects Analysis: Low risk/Medium confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by sedimentation and elevated temperature
- All PBFs are degraded by loss of habitat, low summer flows, erosion, and contaminants
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 47 occupied watersheds, 19 are of high and 15 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

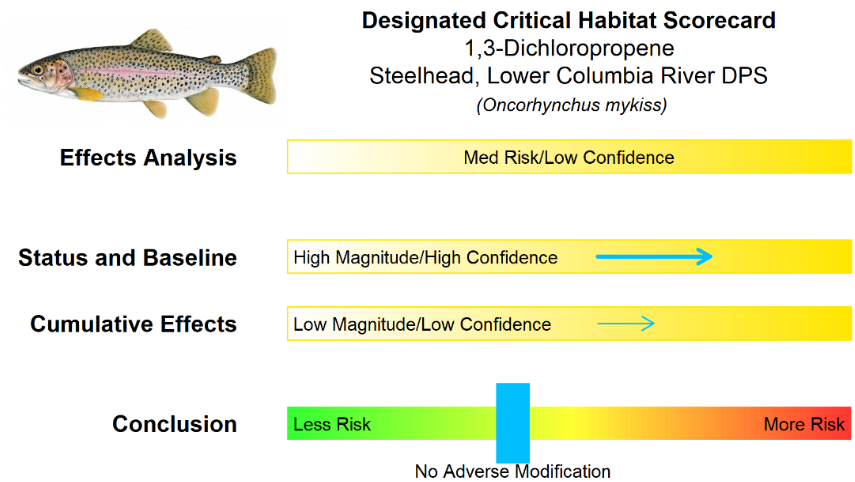


Figure 285. Designated Critical Habitat Scorecard; Steelhead, Lower Columbia River DPS; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Spawning, rearing and migration PBFs are degraded by timber harvests, dams, and loss of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 41 occupied watersheds, 28 are of high and 11 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

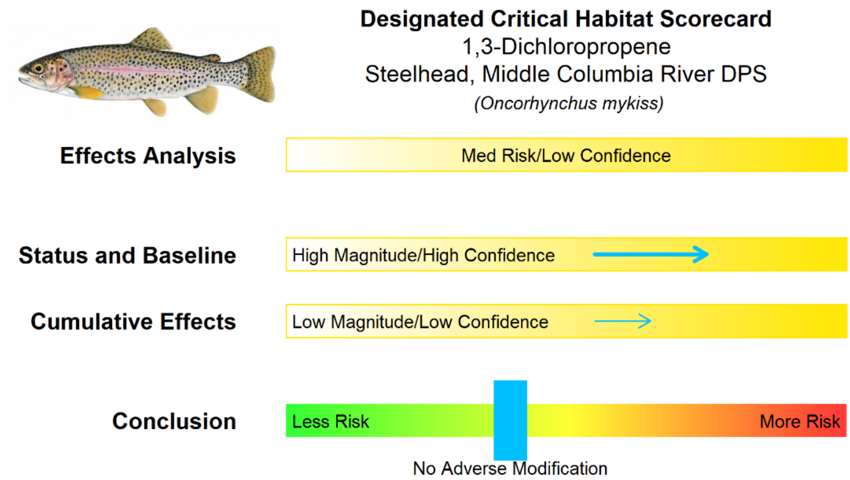


Figure 286. Designated Critical Habitat Scorecard; Steelhead, Middle Columbia River DPS; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by water quality, reduced invertebrate prey, and loss of riparian vegetation
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 106 assessed watersheds, 73 are of high and 24 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

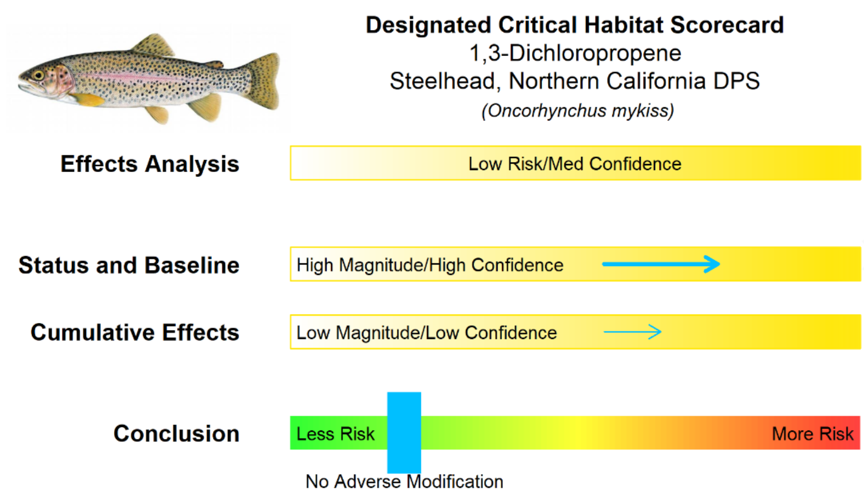


Figure 287. Designated Critical Habitat Scorecard; Steelhead, Northern California DPS; 1,3-Dichloropropene

<u>Effects Analysis: Low risk/Medium confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by loss of riparian vegetation and elevated temperature
- Spawning PBFs are degraded by lack of quality substrate and sedimentation
- Migration PBFs are degraded by bridges, culverts, and forest road construction
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 50 assessed watersheds, 27 are of high and 14 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is medium due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

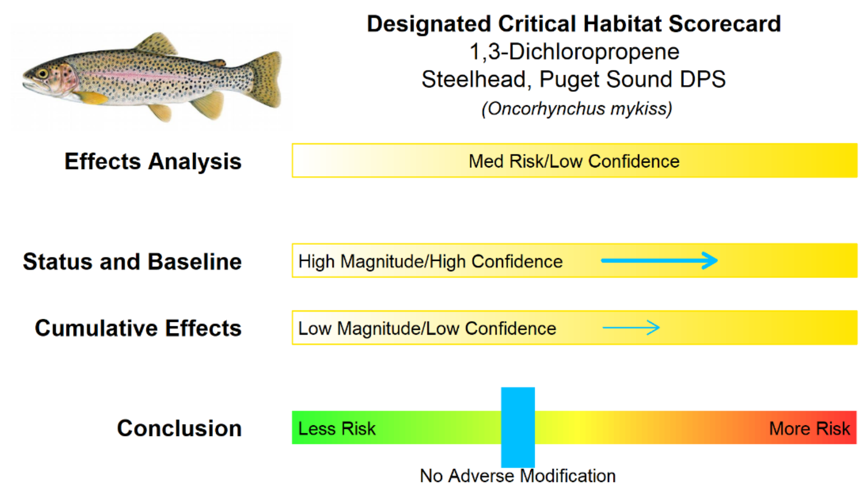


Figure 288. Designated Critical Habitat Scorecard; Steelhead, Puget Sound DPS; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing, migration and spawning PBFs are degraded by forestry, agriculture, urbanization, loss of floodplain habitat, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Most watersheds are of high or medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

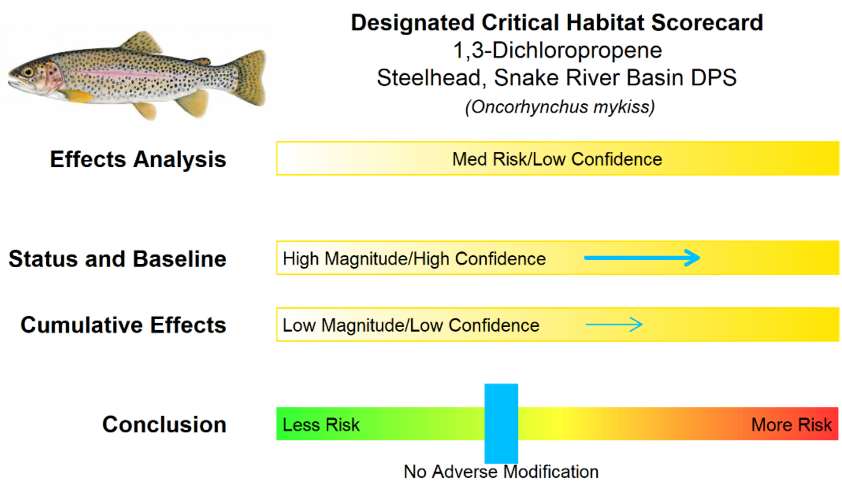


Figure 289. Designated Critical Habitat Scorecard; Steelhead, Snake River Basin DPS; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by agricultural runoff, reduced invertebrate prey, loss of riparian vegetation, and elevated temperature
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of assessed watersheds, 229 are of high and 41 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

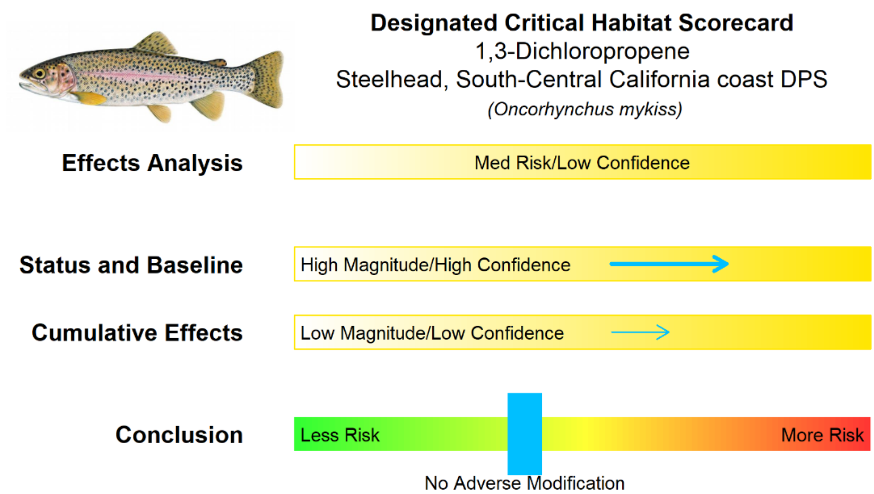


Figure 290. Designated Critical Habitat Scorecard; Steelhead, South-Central California coast DPS; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing and migration PBFs are degraded by elevated temperatures and contaminants from urban and agricultural runoff
- Estuarine PBFs are degraded by altered habitat and contaminated runoff
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 29 occupied watersheds, 12 are of high and 11 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

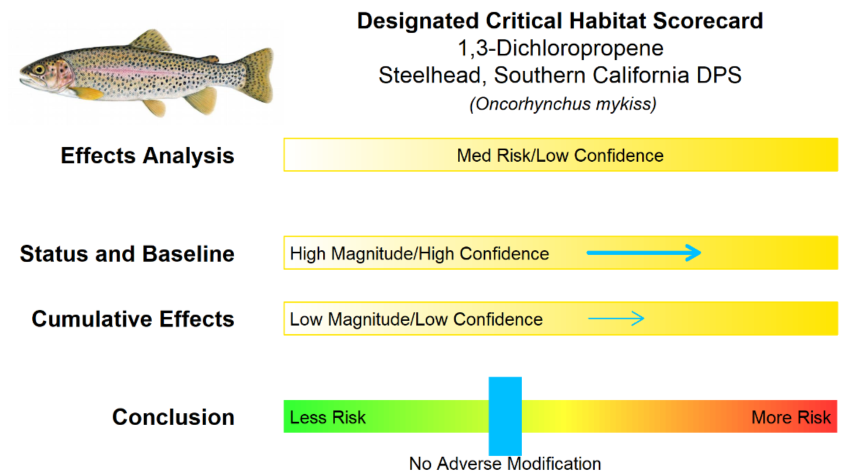


Figure 291. Designated Critical Habitat Scorecard; Steelhead, Southern California DPS; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- All PBFs are degraded by pollutants in urban and agricultural runoff, elevated temperatures, erosion, and low water flows
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 29 freshwater and estuarine watersheds, 21 are of high and 5 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

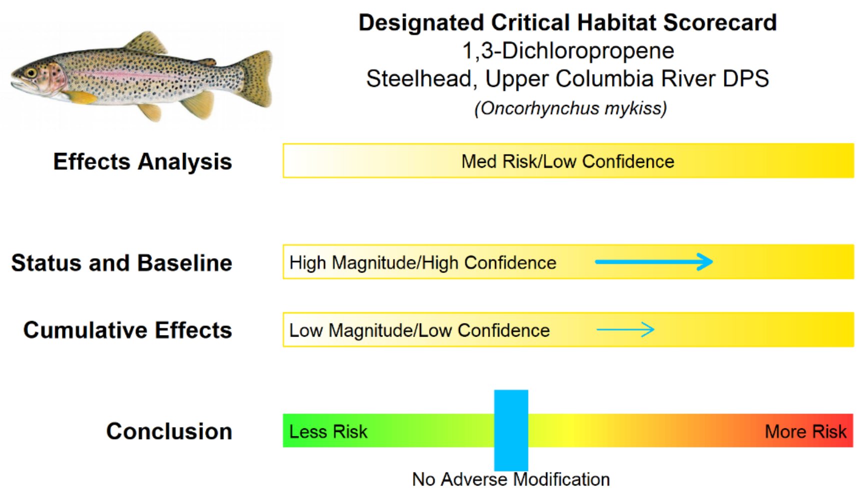


Figure 292. Designated Critical Habitat Scorecard; Steelhead, Upper Columbia River DPS; 1,3-Dichloropropene

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 41 occupied watersheds, 31 are of high and 7 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

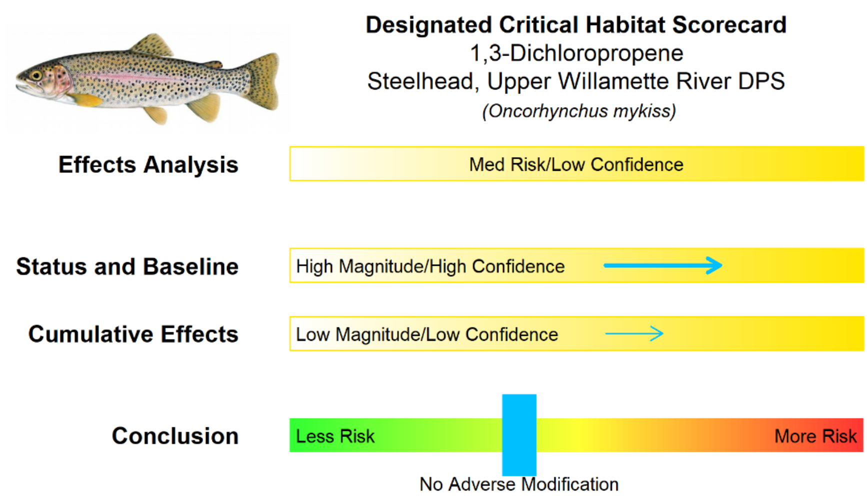


Figure 293. Designated Critical Habitat Scorecard; Steelhead, Upper Willamette River DPS; 1,3-Dichloropropene

Effects Analysis: Medium risk/Low confidence

- Significant reductions in invertebrate prey availability and/or vegetative cover are not expected.
- Degradation of water quality via direct toxicity to fish may occur in some low flow, low volume habitats.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Migration PBFs are degraded by dams and elevated temperatures
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of assessed watersheds, 14 are of high and 6 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in invertebrate prey availability and vegetative cover are not expected. 1,3-D products containing chloropicrin may result in exposures which could degrade water quality in proximity to low flow, low volume species habitats, where take could occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

1,3-Dichloropropene is not likely to adversely modify designated critical habitat: No Adverse Modification

16.3 Designated Critical Habitat Scorecards – Metolachlor

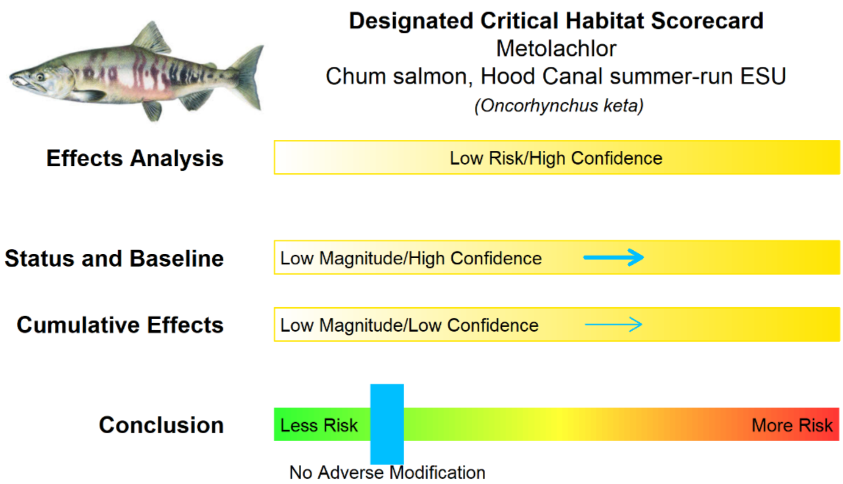


Figure 294. Designated Critical Habitat Scorecard; Chum salmon, Hood Canal summer-run Evolutionarily Significant Unit (ESU); Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Minimal increase in risk; Low magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded
- Migration and rearing PBFs are impaired by loss of floodplain habitat necessary for juvenile growth and development
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All 12 watersheds of high or medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

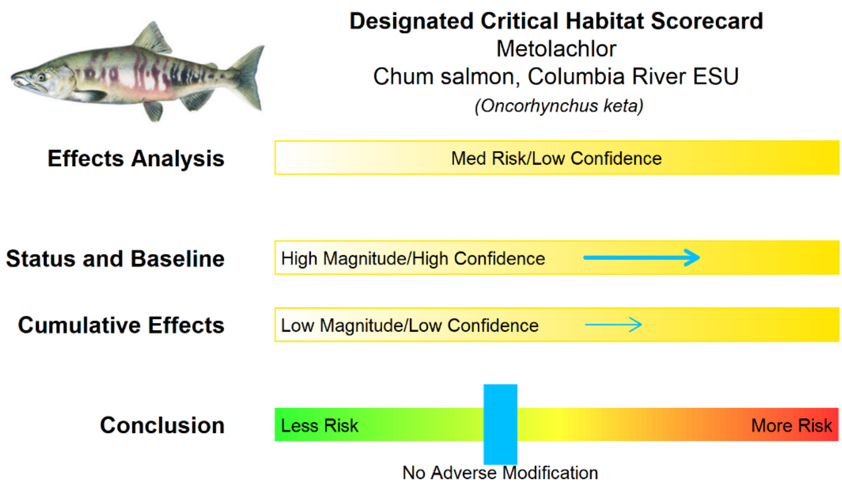


Figure 295. Designated Critical Habitat Scorecard; Chum salmon, Columbia River ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs (water quality and cover) are degraded
- Migration PBFs significantly impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All 19 watersheds of high or medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

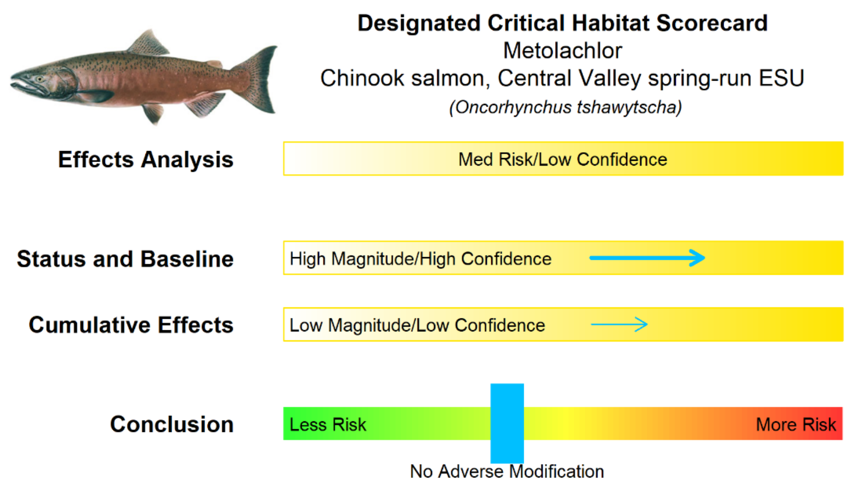


Figure 296. Designated Critical Habitat Scorecard; Chinook salmon, Central Valley spring-run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded by elevated temperatures, lost access to historic spawning sites, and loss of floodplain habitat
- Migration PBFs degraded by loss of cover and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 38 watersheds, 28 are of high and 3 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

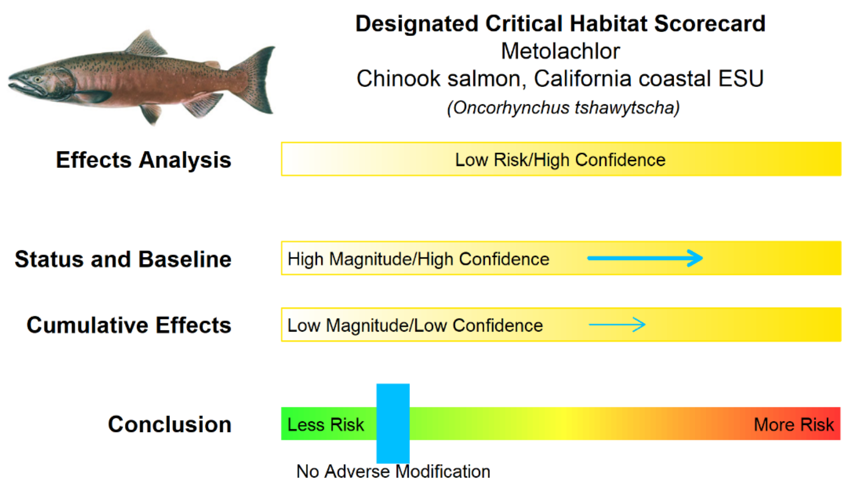


Figure 297. Designated Critical Habitat Scorecard; Chinook salmon, California coastal ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning PBFs are degraded by timber harvest
- Rearing and migration PBFs impacted by dams and invasive species.
- Estuarine PBFs degraded by water quality and saltwater mixing
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 45 watersheds, 27 are of high and 10 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

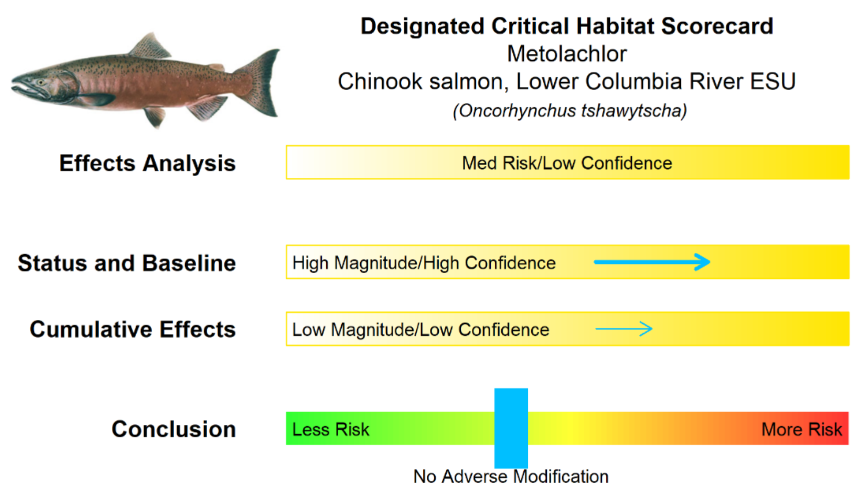


Figure 298. Designated Critical Habitat Scorecard; Chinook salmon, Lower Columbia River ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover
- Migration PBFs impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of occupied watersheds, 31 are of high and 13 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

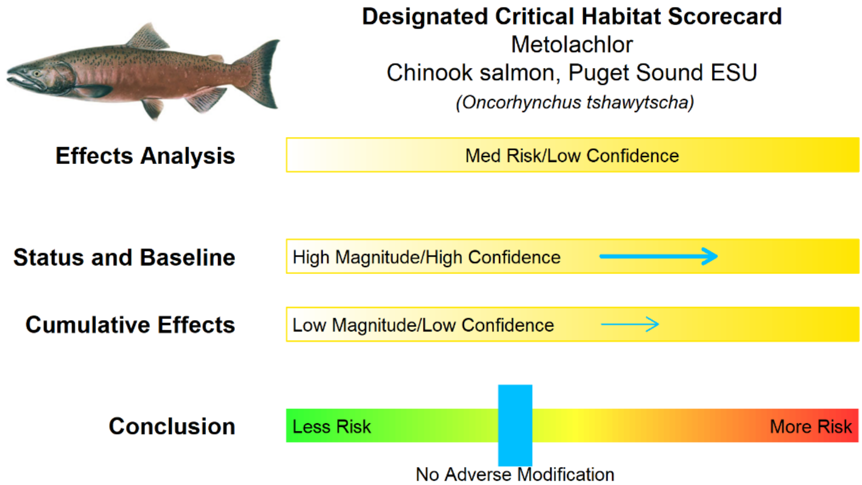


Figure 299. Designated Critical Habitat Scorecard; Chinook salmon, Puget Sound ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning, rearing and migration PBFs are degraded by forestry, agriculture, urbanization, and loss of habitat
- Estuarine PBFs degraded by water quality, altered salinity, and lack of natural cover
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 61 watersheds, 40 are of high and 9 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

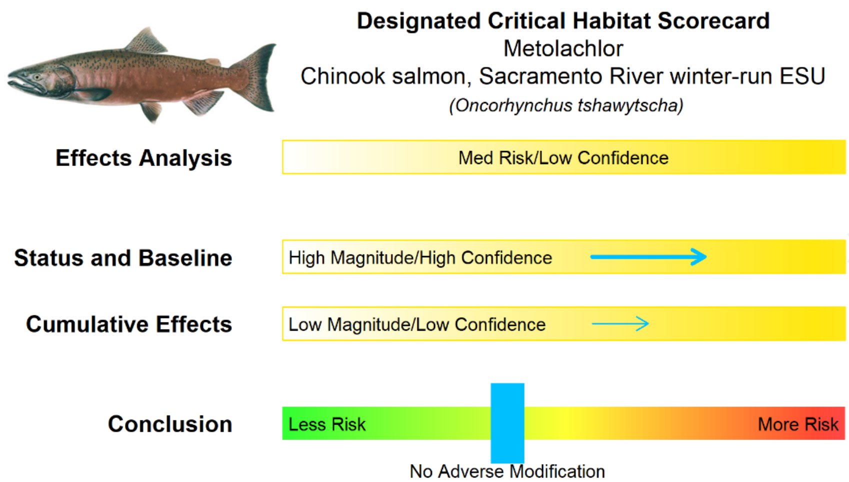


Figure 300. Designated Critical Habitat Scorecard; Chinook salmon, Sacramento River winter-run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning and rearing PBFs are degraded by elevated temperatures and loss of habitat
- Migration PBFs degraded by lack of natural cover and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire Sacramento river and delta are considered of high conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

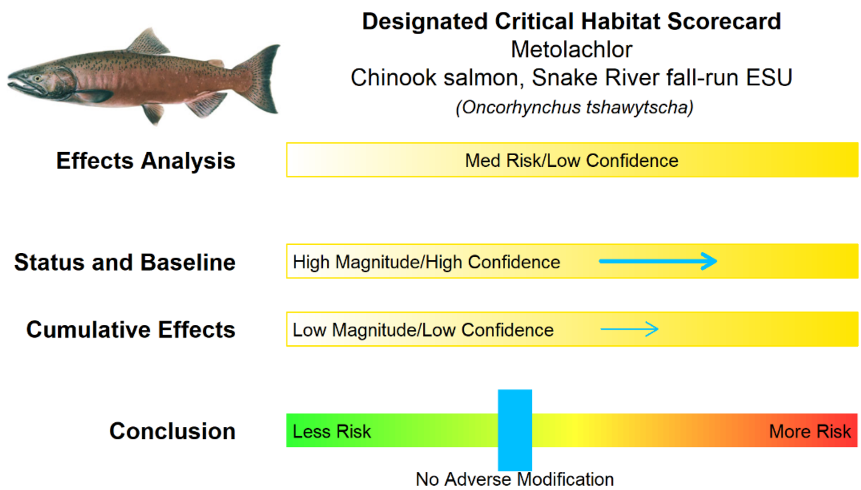


Figure 301. Designated Critical Habitat Scorecard; Chinook salmon, Snake River fall-run ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning, rearing and migration PBFs are degraded by loss of habitat, impaired stream flows, barriers to fish passage, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire river corridor is considered of high conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

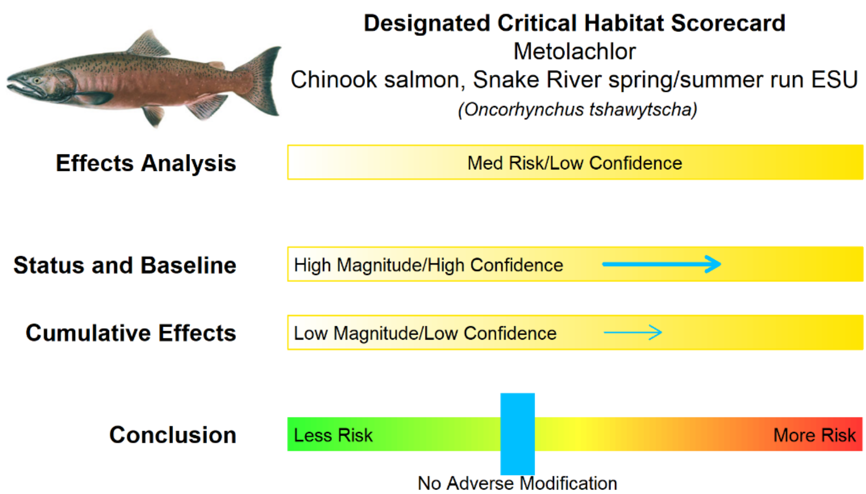


Figure 302. Designated Critical Habitat Scorecard; Chinook salmon, Snake River spring/summer run ESU; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning, rearing and migration PBFs are degraded by loss of habitat, altered stream flows, barriers to fish passage, dams, loss of cover, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire river corridor is considered of high conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

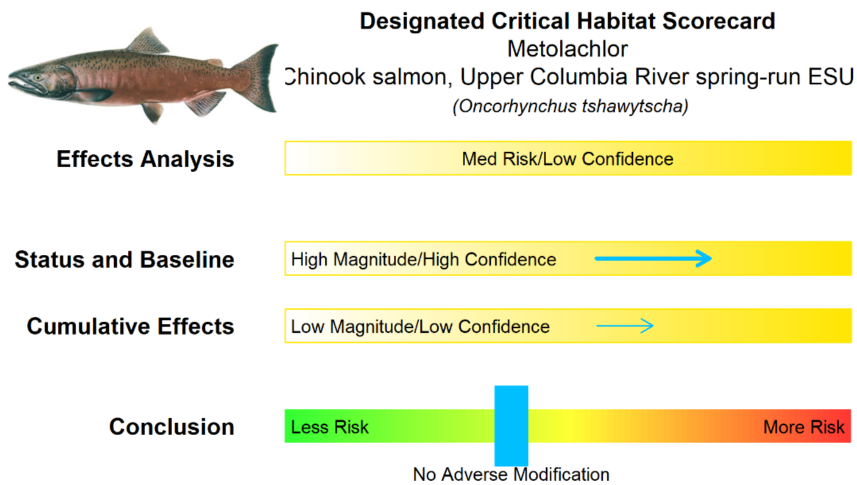


Figure 303. Designated Critical Habitat Scorecard; Chinook salmon, Upper Columbia River spring-run ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by urbanization and irrigation water diversions
- Migration PBFs degraded by numerous dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of occupied watersheds, 26 are of high and 5 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

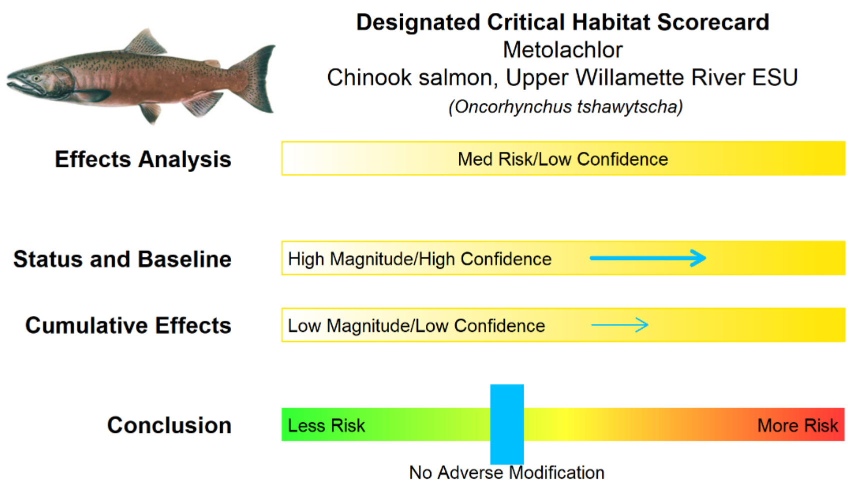


Figure 304. Designated Critical Habitat Scorecard; Chinook salmon, Upper Willamette River ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Migration, rearing, and estuary PBFs are degraded by dams, water management, loss of riparian vegetation, and quality of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 59 assessed watersheds, 22 are of high and 18 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

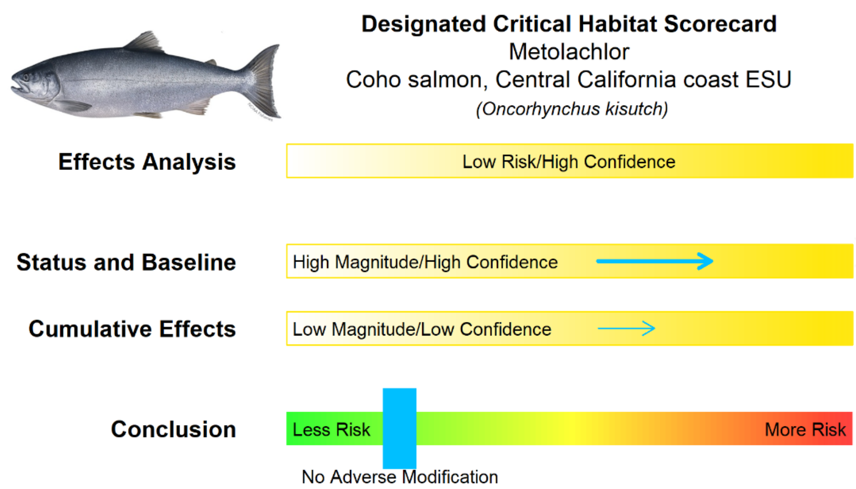


Figure 305. Designated Critical Habitat Scorecard; Coho salmon, Central California coast ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Degradation in quality and quantity of PBFs, especially in southern end of range
- Rearing PBFs degraded by loss of suitable incubation substrate and loss of habitat
- Elevated temperatures anticipated in freshwater habitats
- Environmental mixtures anticipated in freshwater habitats may impact PBFs

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

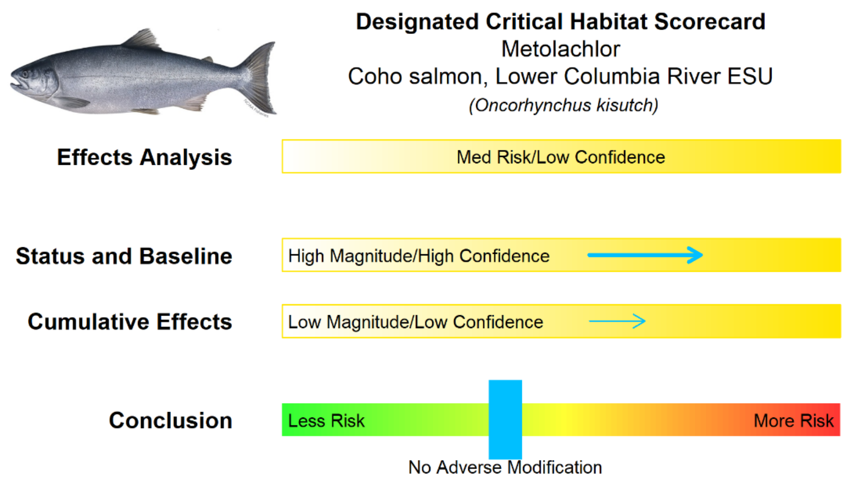


Figure 306. Designated Critical Habitat Scorecard; Coho salmon, Lower Columbia River ESU; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by timber harvest, agriculture, urbanization, loss of floodplain habitat, and reduced natural cover
- Migration PBFs impacted by dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

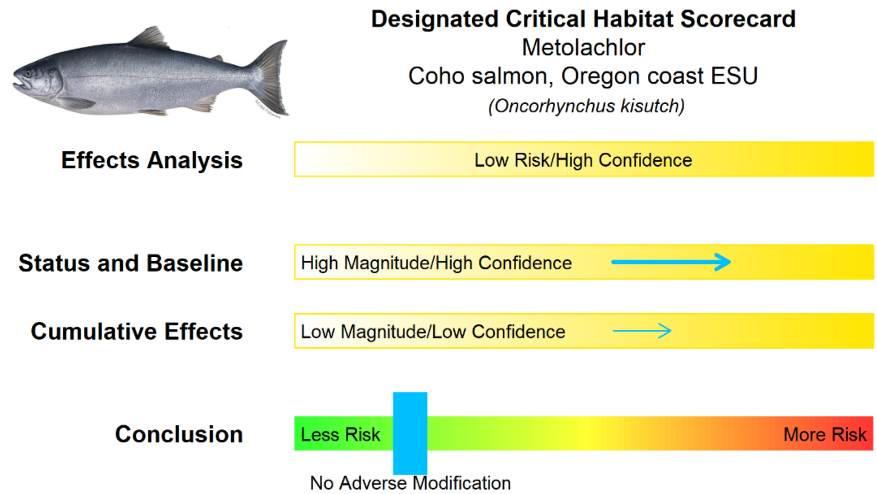


Figure 307. Designated Critical Habitat Scorecard; Coho salmon, Oregon coast ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by elevated water temperature
- All PBFs degraded by reduced water quality from contaminants and excess nutrients
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 80 assessed watersheds, 45 are of high and 27 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

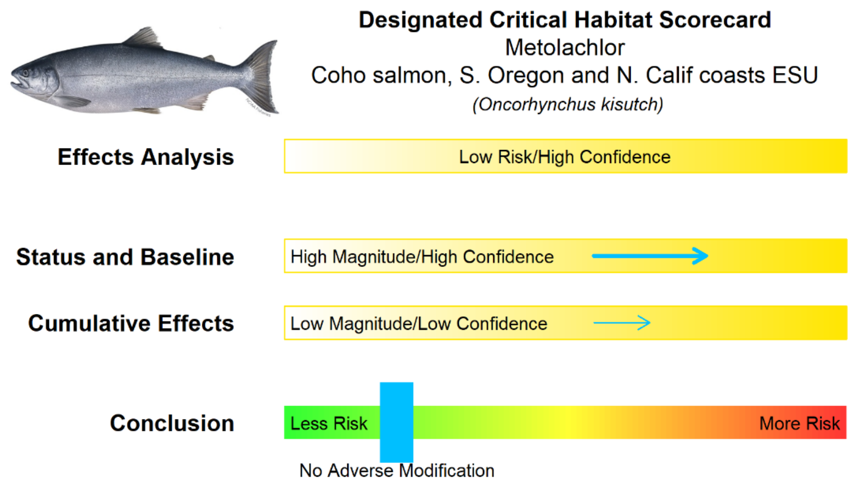


Figure 308. Designated Critical Habitat Scorecard; Coho salmon, S. Oregon and N. Calif coasts ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning PBFs are degraded by logging
- Rearing and migration PBFs degraded by loss of riparian vegetation and loss of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

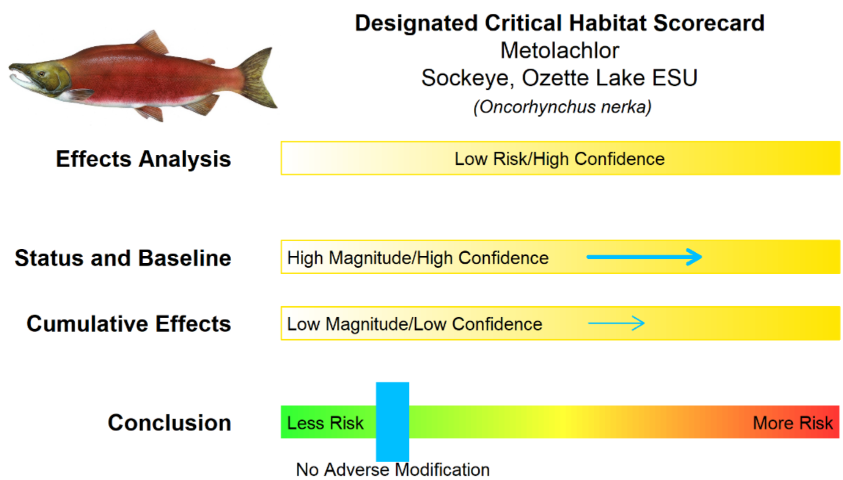


Figure 309. Designated Critical Habitat Scorecard; Sockeye, Ozette Lake ESU; Metolachlor

<u>Effects Analysis: Low risk/High confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by excessive predation, invasive species, and loss of habitat
- Spawning and migration PBFs are degraded by low water levels, loss of suitable spawning habitat, and low summer water flows
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- The entire watershed is of high conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

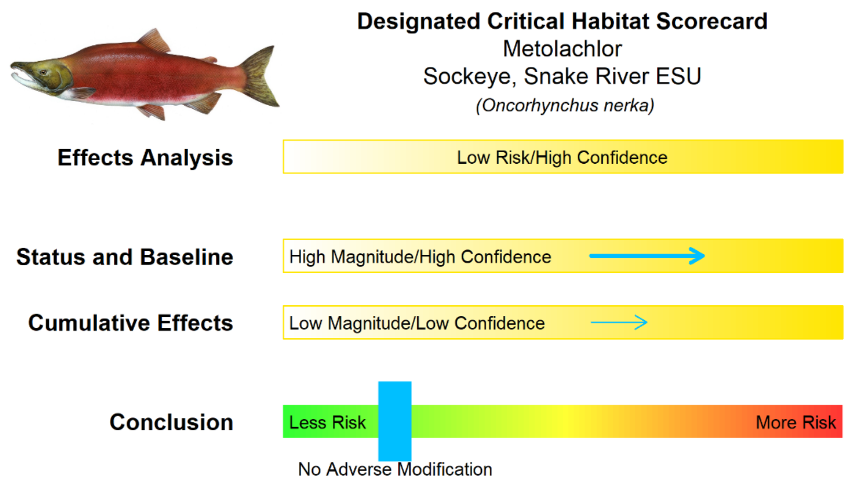


Figure 310. Designated Critical Habitat Scorecard; Sockeye, Snake River ESU; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing and migration PBFs are degraded by impaired water quality from adjacent land uses
- Migration PBFs are degraded by multiple dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- All occupied and used areas of the watershed are of high conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

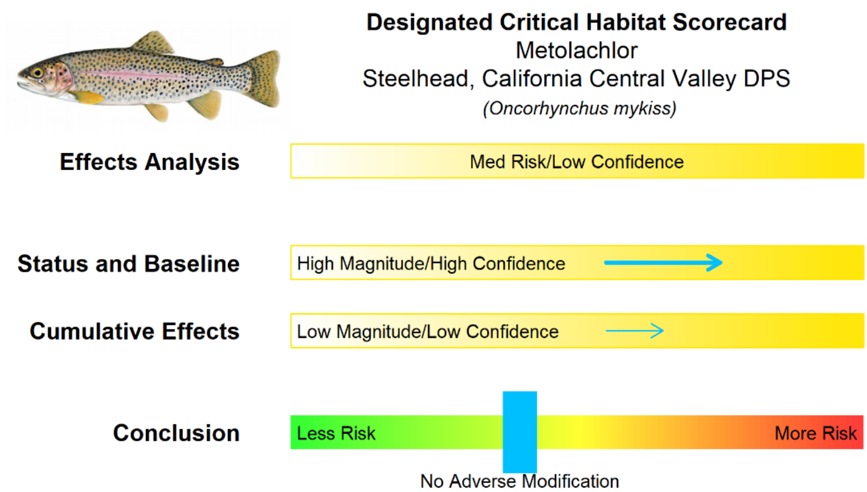


Figure 311. Designated Critical Habitat Scorecard; Steelhead, California Central Valley Distinct Population Segment (DPS); Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Spawning Physical and Biological Features (PBFs) are degraded by altered water flows and temperature
- Rearing and migration PBFs are degraded by altered riverine habitat, dense urbanization and agriculture, poor water quality, and water diversions
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 67 occupied watersheds, 37 are of high and 18 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

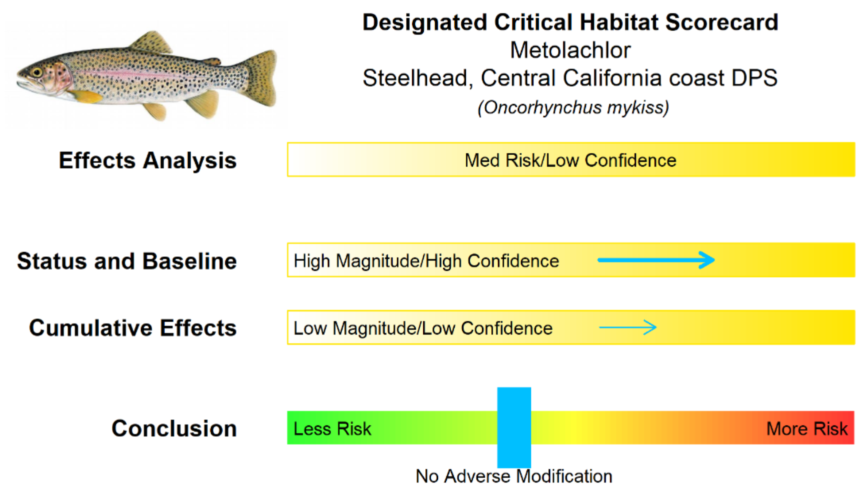


Figure 312. Designated Critical Habitat Scorecard; Steelhead, Central California coast DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Spawning and rearing PBFs are degraded by sedimentation and elevated temperature
- All PBFs are degraded by loss of habitat, low summer flows, erosion, and contaminants
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 47 occupied watersheds, 19 are of high and 15 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

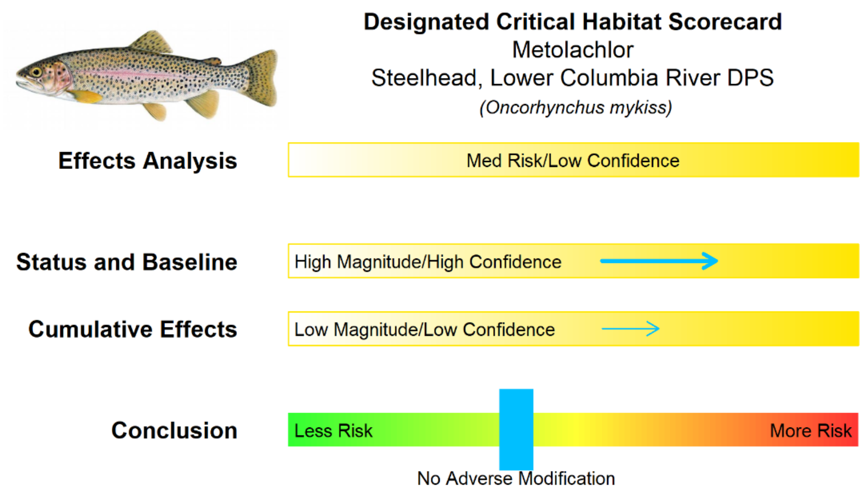


Figure 313. Designated Critical Habitat Scorecard; Steelhead, Lower Columbia River DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Spawning, rearing and migration PBFs are degraded by timber harvests, dams, and loss of floodplain habitat
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 41 occupied watersheds, 28 are of high and 11 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification</u>

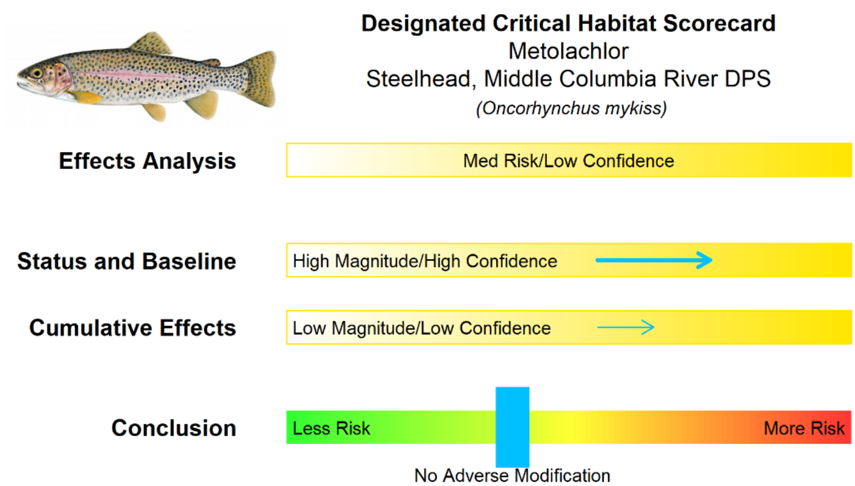


Figure 314. Designated Critical Habitat Scorecard; Steelhead, Middle Columbia River DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by water quality, reduced invertebrate prey, and loss of riparian vegetation
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 106 assessed watersheds, 73 are of high and 24 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

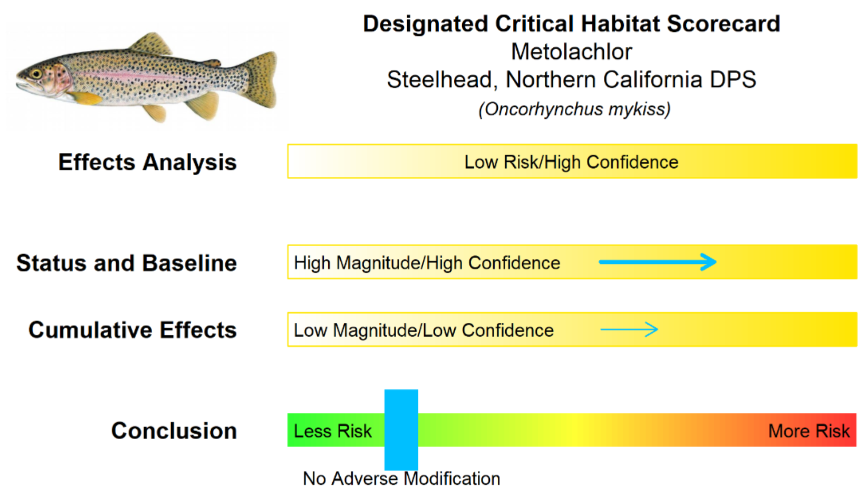


Figure 315. Designated Critical Habitat Scorecard; Steelhead, Northern California DPS; Metolachlor

Effects Analysis: Low risk/High confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs are degraded by loss of riparian vegetation and elevated temperature
- Spawning PBFs are degraded by lack of quality substrate and sedimentation
- Migration PBFs are degraded by bridges, culverts, and forest road construction
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 50 assessed watersheds, 27 are of high and 14 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is low and the confidence associated with that risk is high due to the minimal extent of authorized use sites and resulting exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

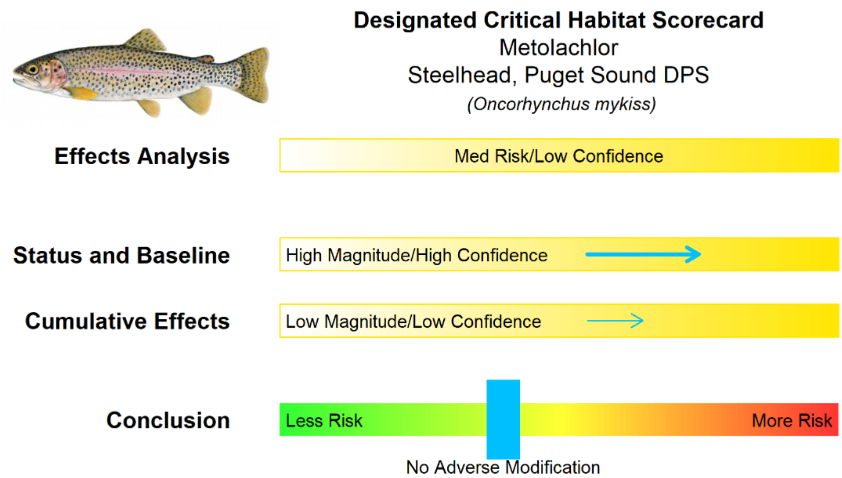


Figure 316. Designated Critical Habitat Scorecard; Steelhead, Puget Sound DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing, migration and spawning PBFs are degraded by forestry, agriculture, urbanization, loss of floodplain habitat, and poor water quality
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Most watersheds are of high or medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

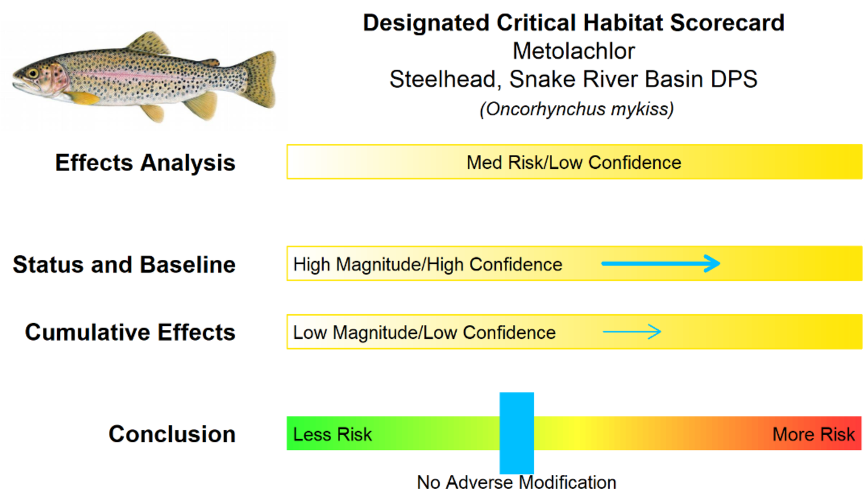


Figure 317. Designated Critical Habitat Scorecard; Steelhead, Snake River Basin DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- Rearing PBFs are degraded by agricultural runoff, reduced invertebrate prey, loss of riparian vegetation, and elevated temperature
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of assessed watersheds, 229 are of high and 41 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

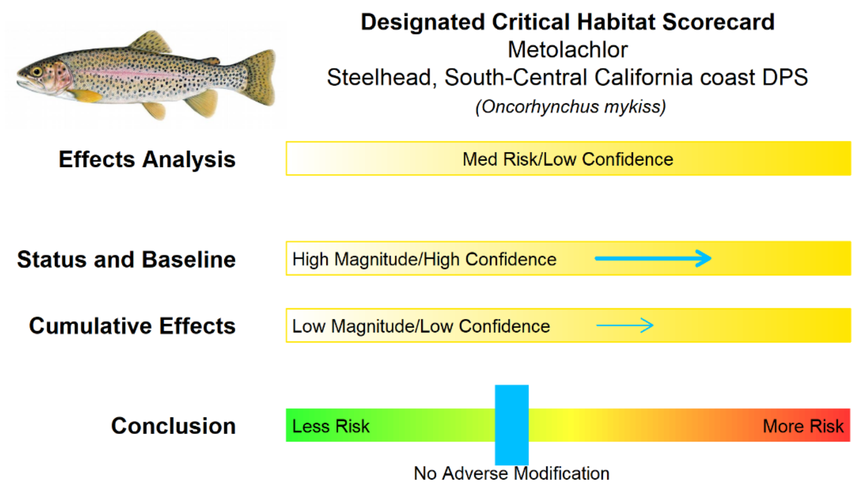


Figure 318. Designated Critical Habitat Scorecard; Steelhead, South-Central California coast DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing and migration PBFs are degraded by elevated temperatures and contaminants from urban and agricultural runoff
- Estuarine PBFs are degraded by altered habitat and contaminated runoff
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 29 occupied watersheds, 12 are of high and 11 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

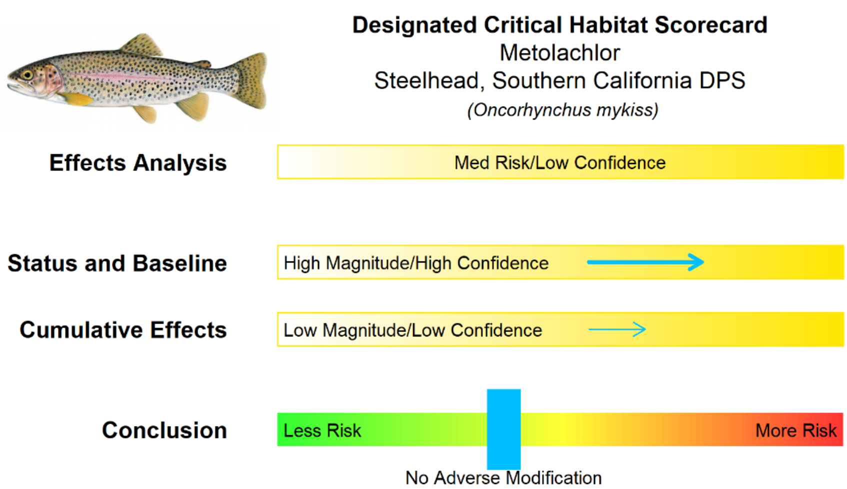


Figure 319. Designated Critical Habitat Scorecard; Steelhead, Southern California DPS; Metolachlor

<u>Effects Analysis: Medium risk/Low confidence</u>

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

<u>Status and Baseline: Increased risk; High magnitude/High confidence</u>

- All PBFs are degraded by pollutants in urban and agricultural runoff, elevated temperatures, erosion, and low water flows
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 29 freshwater and estuarine watersheds, 21 are of high and 5 are of medium conservation value

<u>Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence</u>

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

<u>Conclusion:</u> We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

<u>**Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification**</u>

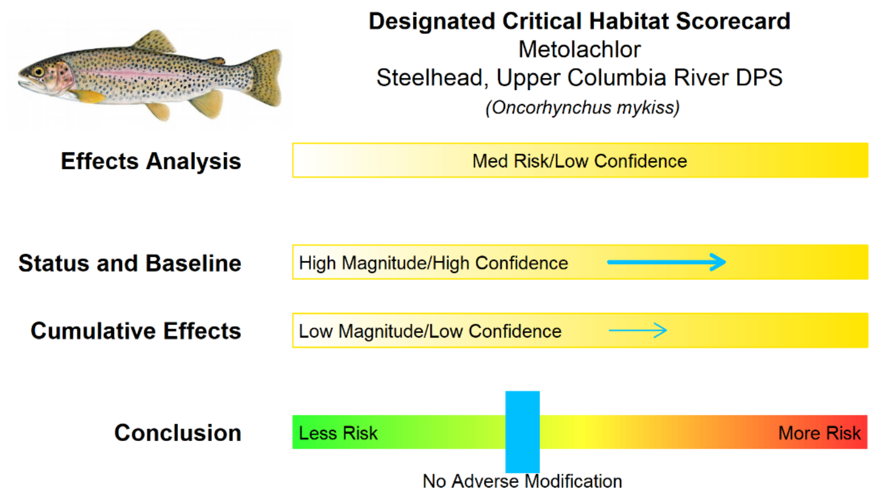


Figure 320. Designated Critical Habitat Scorecard; Steelhead, Upper Columbia River DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Migration PBFs are degraded by several dams
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of 41 occupied watersheds, 31 are of high and 7 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

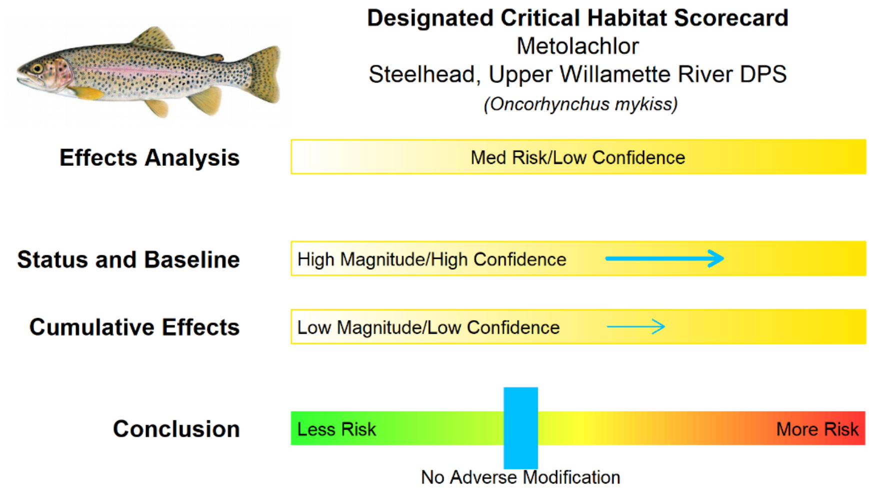


Figure 321. Designated Critical Habitat Scorecard; Steelhead, Upper Willamette River DPS; Metolachlor

Effects Analysis: Medium risk/Low confidence

- Significant reductions in prey availability and/or overall water quality are not expected.
- Adverse effects to aquatic and terrestrial vegetation may occur, but are anticipated to be limited by the minimal extent of authorized use sites.

Status and Baseline: Increased risk; High magnitude/High confidence

- Rearing PBFs are degraded by agricultural runoff and lack of available prey
- Migration PBFs are degraded by dams and elevated temperatures
- Elevated temperatures and environmental mixtures anticipated in freshwater habitats
- Of assessed watersheds, 14 are of high and 6 are of medium conservation value

Cumulative Effects: Minimal increase in risk; Low magnitude/Low confidence

- Future elevated temperatures likely; global climate change may threaten PBFs
- Anticipated hydrologic effects in freshwater areas may impact PBFs

Conclusion: We find the overall risk to this species' designated critical habitat is medium and the confidence associated with that risk is low due to exposures predicted over the 15-year duration of the action. Reductions in prey availability and overall water quality are not expected. Adverse effects to aquatic and terrestrial vegetation may occur, however, the conservation value of designated critical habitat, taken as a whole, is not anticipated to decrease over the 15-year action.

Metolachlor is not likely to adversely modify designated critical habitat: No Adverse Modification

Table 798. Summary of designated critical habitat determinations for 1,3-D and Metolachlor

Salmon Type	ESU/DPS	1,3-D (Telone)		Metolachlor	
		Adverse Modification	No Adverse Modification	Adverse Modification	No Adverse Modification
Chum	Columbia River		X		X
Chum	Hood Canal summer-run		X		X
Chinook	California Coastal		X		X
Chinook	CA Central Valley spring-run		X		X
Chinook	Lower Columbia River		X		X
Chinook	Puget Sound		X		X
Chinook	Sacramento River winter-run		X		X
Chinook	Snake River fall-run		X		X
Chinook	Snake River spring/summer-run		X		X
Chinook	Upper Columbia River spring-run		X		X
Chinook	Upper Willamette River		X		X
Coho	Central California Coast		X		X
Coho	Lower Columbia River		X		X
Coho	Oregon Coast		X		X

Coho	S. Oregon N. California Coast		X		X
Sockeye	Ozette Lake		X		X
Sockeye	Snake River	X	X		X
Steelhead	CA Central Valley		X		X
Steelhead	Central California Coast		X		X
Steelhead	Lower Columbia River		X		X
Steelhead	Middle Columbia River		X		X
Steelhead	Northern California		X		X
Steelhead	Puget Sound		X		X
Steelhead	Snake River Basin		X		X
Steelhead	South-Central California Coast		X		X
Steelhead	Southern California		X		X
Steelhead	Upper Columbia River		X		X
Steelhead	Upper Willamette River		X		X

17 CONCLUSION

17.1 1,3-Dichloropropene

After reviewing the current status of salmonid species listed under the ESA, their environmental baseline within the action area, the effects of the proposed action and cumulative effects, it is the NMFS' biological opinion that the EPA's action in the registration of the authorized uses, as specified by approved product labels, of all pesticide products containing 1,3-Dichloropropene is not likely to jeopardize the continued existence of twenty-eight Pacific Salmonid species and not likely to destroy or adversely modify the designated critical habitat of those twenty-eight listed species (Table 799,Table 800).

17.2 Metolachlor

After reviewing the current status of salmonid species listed under the ESA, their environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the EPA's action in the registration of the authorized uses, as specified by approved product labels, of all pesticide products containing Metolachlor is not likely to jeopardize the continued existence of twenty-eight Pacific Salmonid species and not likely to destroy or adversely modify the designated critical habitat of those twenty-eight listed species (Table 799, Table 800).

Table 799. Jeopardy conclusions for ESA-listed Pacific Salmonids; 1,3-D and Metolachlor.

Species Name	1,3-D	Metolachlor
Chum salmon , Columbia River ESU	No Jeopardy	No Jeopardy
Chum salmon, Hood Canal summer-run ESU	No Jeopardy	No Jeopardy
Chinook salmon, California coastal ESU	No Jeopardy	No Jeopardy
Chinook salmon, Central Valley spring-run ESU	No Jeopardy	No Jeopardy
Chinook salmon, Lower Columbia River ESU	No Jeopardy	No Jeopardy
Chinook salmon, Puget Sound ESU	No Jeopardy	No Jeopardy
Chinook salmon, Sacramento River winter-run ESU	No Jeopardy	No Jeopardy
Chinook salmon, Snake River fall-run ESU	No Jeopardy	No Jeopardy
Chinook salmon, Snake River spring/summer run ESU	No Jeopardy	No Jeopardy
Chinook salmon, Upper Columbia River spring-run ESU	No Jeopardy	No Jeopardy
Chinook salmon, Upper Willamette River ESU	No Jeopardy	No Jeopardy
Coho salmon, Central California coast ESU	No Jeopardy	No Jeopardy
Coho salmon, Lower Columbia River ESU	No Jeopardy	No Jeopardy
Coho salmon, Oregon coast ESU	No Jeopardy	No Jeopardy
Coho salmon, S. Oregon and N. Calif coasts ESU	No Jeopardy	No Jeopardy
Sockeye, Ozette Lake ESU	No Jeopardy	No Jeopardy
Sockeye, Snake River ESU	No Jeopardy	No Jeopardy
Steelhead, California Central Valley ESU	No Jeopardy	No Jeopardy
Steelhead, Central California coast ESU	No Jeopardy	No Jeopardy
Steelhead, Lower Columbia River ESU	No Jeopardy	No Jeopardy
Steelhead, Middle Columbia River ESU	No Jeopardy	No Jeopardy
Steelhead, Northern California ESU	No Jeopardy	No Jeopardy
Steelhead, Puget Sound ESU	No Jeopardy	No Jeopardy
Steelhead, Snake River Basin ESU	No Jeopardy	No Jeopardy
Steelhead, South-Central California coast ESU	No Jeopardy	No Jeopardy
Steelhead, Southern California ESU	No Jeopardy	No Jeopardy

Steelhead, Upper Columbia River ESU	No Jeopardy	No Jeopardy
Steelhead, Upper Willamette River ESU	No Jeopardy	No Jeopardy
Totals (Jeopardy determinations / total species)	**0 / 28**	**0 / 28**

Table 800. Adverse Modification conclusions for designated critical habitat of listed Pacific Salmon ESUs/DPS; 1,3-D and Metolachlor.

Species Name	1,3-D	Metolachlor
Chum salmon , Columbia River ESU	No Adverse Modification	No Adverse Modification
Chum salmon, Hood Canal summer-run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, California coastal ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Central Valley spring-run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Lower Columbia River ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Puget Sound ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Sacramento River winter-run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Snake River fall-run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Snake River spring/summer run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Upper Columbia River spring-run ESU	No Adverse Modification	No Adverse Modification
Chinook salmon, Upper Willamette River ESU	No Adverse Modification	No Adverse Modification
Coho salmon, Central California coast ESU	No Adverse Modification	No Adverse Modification
Coho salmon, Lower Columbia River ESU	No Adverse Modification	No Adverse Modification
Coho salmon, Oregon coast ESU	No Adverse Modification	No Adverse Modification
Coho salmon, S. Oregon and N. Calif coasts ESU	No Adverse Modification	No Adverse Modification
Sockeye, Ozette Lake ESU	No Adverse Modification	No Adverse Modification
Sockeye, Snake River ESU	No Adverse Modification	No Adverse Modification
Steelhead, California Central Valley ESU	No Adverse Modification	No Adverse Modification
Steelhead, Central California coast ESU	No Adverse Modification	No Adverse Modification
Steelhead, Lower Columbia River ESU	No Adverse Modification	No Adverse Modification
Steelhead, Middle Columbia River ESU	No Adverse Modification	No Adverse Modification
Steelhead, Northern California ESU	No Adverse Modification	No Adverse Modification
Steelhead, Puget Sound ESU	No Adverse Modification	No Adverse Modification
Steelhead, Snake River Basin ESU	No Adverse Modification	No Adverse Modification
Steelhead, South-Central California coast ESU	No Adverse Modification	No Adverse Modification
Steelhead, Southern California ESU	No Adverse Modification	No Adverse Modification
Steelhead, Upper Columbia River ESU	No Adverse Modification	No Adverse Modification
Steelhead, Upper Willamette River ESU	No Adverse Modification	No Adverse Modification
Totals (Adverse Modification determinations / total designated critical habits)	**0 / 28**	**0 / 28**

18 INCIDENTAL TAKE STATEMENT

18.1 Introduction

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, either as proposed by the action agency or modified by a RPA, and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species (incidental take statement). To minimize such impacts, NMFS provides RPMs, and terms and conditions that must be complied with by the Federal agency or any applicant in order to be exempt from the prohibitions against "take" of listed species. Only incidental take resulting from the agency actions and any specified RPMs, and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA. NMFS believes the RPMs described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species. The measures described below must be undertaken by the U.S. Environmental Protection Agency and applicants so that they become binding conditions for the exemption in section 7(o)(2) to apply.[22]

Section 9(a)(1) of the ESA prohibits the taking of the five endangered Pacific salmonids without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) of the ESA extend the prohibition to all 23 threatened Pacific salmonid species. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (50 CFR 222.102). We interpret "harass" as meaning to create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (Wieting 2016). Harm is defined by NMFS as an act which actually kills or injures fish or wildlife, and may also include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). Incidental take is defined as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

18.2 Amount or Extent & Effects of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50

[22] EPA has identified the companies that hold registrations of technical products to be the applicants for this consultation. Technical products are defined as those products that are used solely to manufacture or formulate other pesticide products, which are referred to as end-use products. RPMs that describe label changes in this Opinion apply to technical registrants. As indicated below, those label changes for technical products will in turn require changes in labels of end-use products that are formulated with those technical products.

C.F.R. §402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by actions while the extent of take specifies the impact, i.e., the amount or extent of such incidental taking on the species, which may be used if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (see 80 FR 26832). As described earlier in this Opinion, the proposed action for this consultation is EPA's registrations of all pesticides containing 1,3-D or metolachlor for use as described on product labels. The proposed action includes (1) approved product labels containing 1,3-D or metolachlor, (2) degradates and metabolites of 1,3-D or metolachlor, (3) formulations, including other ingredients within formulations, (4) adjuvants, and (5) tank mixtures. EPA is required to reassess currently registered pesticide active ingredients every 15 years (FQPA; Public Law 104-170). The EPA authorizes use of these pesticide products for pest control purposes across multiple landscapes. The goal of this Opinion is to evaluate the impacts to NMFS' listed resources from the EPA's broad authorization of applied pesticide products. This Opinion is a partial consultation because pursuant to the court's order, in 2002 and 2004, EPA sought consultation on only 26 listed Pacific salmonids under NMFS' jurisdiction[23]. However, even though the court's order did not address the two more recently listed ESUs and DPSs, NMFS analyzed the impacts of EPA's actions to them because they belong to the same taxon and the analysis requires consideration of the same information. Consultation with NMFS on the registration of products containing 1,3-D and metolachlor is completed as to the above-referenced species with this Opinion. This Opinion does not address any other species for which EPA may need to complete additional BEs and, where appropriate, initiate consultation.

For this Opinion, NMFS anticipates the general effects that would occur from EPA's registration of pesticide products to 28 listed Pacific salmonids under NMFS' jurisdiction during the 15-year duration of the proposed action. Pesticide runoff and drift are the predominant pathways in which pesticides, including these a.i.s, could reach streams and other aquatic sites when they are applied to areas located adjacent to wetlands, riparian areas, ditches, floodplain habitats, intermittent streams, and nearshore estuarine and marine habitats. The likelihood for these inputs into aquatic habitats are especially high when rainfall immediately follows applications, or if wind conditions exacerbate inputs from drift. The effects of pesticides and other contaminants found in urban runoff, especially from areas with a high degree of impervious surfaces, may also exacerbate degraded water quality conditions of receiving waters. Urban runoff is also generally warmer in temperature, and elevated water temperature poses negative effects to many listed species. The range of effects of the two a.i.s on listed species includes killing species directly and impacts to salmonid habitat including reduced cover from the pesticides herbicidal activity, and reductions in prey from acute lethality, or reductions in aquatic and riparian vegetation upon which certain prey rely. Reductions in prey can impair growth and fitness. For example, impaired growth extends the time juveniles remain prone to becoming prey to predators, and starvation may make species more susceptible to disease or render them unable to smolt. These results are not the purpose of the proposed action. Therefore, incidental take of listed species is reasonably certain to occur over the 15-year duration of the proposed action.

Given the variability of real-life conditions, the broad nature and scope of the proposed action, and the wide-ranging distributions of individuals of listed species, the best scientific and commercial data available are not sufficient to enable NMFS to directly estimate a specific

[23] Two species have been listed since the 2004 and 2006 BE's were submitted to NMFS from EPA.

amount of incidental take associated with the proposed action. As explained in the Description of the Proposed Action and the Effects of the Proposed Action sections, NMFS identified multiple uncertainties associated with the proposed action. Areas of uncertainty include:

1. Limited information on use and exposure data on stressors of the action for non-agricultural uses of these pesticides;
2. Minimal information on exposure and toxicity for pesticide formulations, adjuvants, and other/inert ingredients within registered formulations;
3. Minimal information on tank mixtures and associated exposure estimates;
4. Limited data on toxicity and composition of environmental mixtures;
5. Variability in annual land use, crop cover, and pest pressure;
6. Temporal and spatial variability of individuals;
7. Pesticide concentrations in nearshore estuarine and marine habitats
8. Pesticide concentrations resulting from non-agricultural uses

Additionally, NMFS recognizes there are multiple impediments that reduce the likelihood of detecting take to listed species from the use of pesticides. It is important to place the significance of mortality incidents in the proper context. Vyas (1999) concluded that most wildlife mortality is unaccounted for, as only a small fraction are likely observed, reported, and confirmed. The likelihood of detecting impacts becomes even more difficult in species with limited abundance.

NMFS therefore identifies, as a surrogate for the allowable extent of take, the ability of this action to proceed without any fish mortality reported to EPA within the action area attributable to the legal use of 1,3-D or metolachlor, or any associated compounds, degradates, or mixtures affecting aquatic habitats containing listed species. Because of the difficulty of detecting mortality of listed species, individuals killed do not have to be listed species in order for their death to be considered a relevant surrogate for take. For example, salmonids are relatively sensitive to pesticides compared to other species of fish, so that if there is mortality of other freshwater fishes attributable to use of these pesticides within the listed species range, it is likely that salmonids have also died, even if no dead salmonids can be located. In addition, if stream conditions due to pesticide use kill less sensitive fishes in certain areas, the potential for lethal and non-lethal takes in downstream areas increases. Because fish mortalities can easily go unobserved or unaccounted for, an exceedance of take occurs when any fish mortality is reported to EPA and attributed to the use of these active ingredients by EPA. Both "minor" and "major" incidents involving fish kills are considered attributable to one of these active ingredients, its metabolites, or degradates, if the available information suggests a certainty index of "probable" or "highly probable" as defined in EPA's guidance for using incident data (EPA October 13, 2011; https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-using-incident-data-evaluating-listed-and#guidance).

18.3 Reasonable and prudent measures

RPMs are measures to minimize the amount or extent of incidental take (50 C.F.R. §402.02). Only incidental take resulting from the agency actions and any specified RPMs, and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

NMFS believes the RPMs described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species:

- RPM 1. Revise and approve product labels and develop relevant EPA Endangered Species Protection Plan Bulletins to conserve listed species.
- RPM 2. Improve ecological incident reporting, develop ESA educational materials, and report label compliance.

18.4 Terms and Conditions

In order for any incidental take to be exempt from the prohibitions of section 9 of the ESA, EPA and applicants must comply with the following terms and conditions that are applicable to them, which implement the RPMs described above. These include the take minimization, monitoring and reporting measures required by the section 7 regulations (50 C.F.R. §402.14(i)). If EPA or applicants fail to ensure compliance with the applicable terms and conditions to implement the RPMs, the protective coverage of section 7(o)(2) may lapse.

RPM 1: Revise product labels and develop relevant EPA Endangered Species Protection Plan Bulletins to conserve listed species

1. **Terms and Conditions for Applicants**

To address RPM number one, applicants with registrations for products containing 1,3-dichloropropene or metolachlor shall submit to EPA the following label amendments. Label amendments shall be submitted to EPA within 60 days of the issuance date of this Biological Opinion.

1. **Amendments according to the risk mitigation procedures outlined in EPA's Proposed Interim Registration Review Decision for products containing dichloropropene (1,3-D) (Docket Number EPA-HQ-OPP-2013-0154) and Interim Registration Review Decision for products containing metolachlor (Docket Number EPA-HQ-OPP-2014-0772).**

2. **Additional Amendments.** Applicants shall submit to EPA the following label amendments for all technical and manufacturing use products:
   The following statement shall be placed at the beginning of the Directions for Use section:
   "This product may only be formulated into end-use products that contain the following language on their labeling when they are released for shipment:
   "ENDANGERED SPECIES PROTECTION REQUIREMENTS" (to be placed at the beginning of the Directions for Use section of all end-use product labels):

It is a Federal offense to use any pesticide in a manner that results in an unauthorized "take" (e.g., kill or otherwise harm) of an endangered species, and certain threatened species, under the Endangered Species Act section 9. When using this product, you must follow the measures contained in the Endangered Species Protection Bulletin for the area in which you are applying the product. You must obtain a Bulletin no earlier than six months before using this product. To obtain Bulletins, consult http://www.epa.gov/espp/, call 1-844-447-3813, or email ESPP@epa.gov. You must use the Bulletin valid for the month in which you will apply the product.""

2. Terms and Conditions for EPA

To address RPM number one, EPA shall:

Within 10 business days of the issuance date of this Biological Opinion,

1. **Notify all end-use product registrants of products containing 1,3-D or metalochlor of the need to submit label amendments**.

   EPA shall notify all end-use product registrants to submit, within 60-days of EPA's notification, the necessary amendments to their end-use product labels, to be consistent with the technical/manufacturing use product label amendments described in RPM 1, Terms and Conditions for Applicants. Specifically, EPA shall notify end-use product registrants of the following necessary label language to be added to the beginning of the "*Directions for Use*" section of all end-use product labels:

   "*Endangered Species Protection Requirements*:

   > *It is a Federal offense to use any pesticide in a manner that results in an unauthorized "take" (e.g., kill or otherwise harm) of an endangered species, and certain threatened species, under the Endangered Species Act section 9. When using this product, you must follow the measures contained in the Endangered Species Protection Bulletin for the area in which you are applying the product. You must obtain a Bulletin no earlier than six months before using this product. To obtain Bulletins, consult http://www.epa.gov/espp/, call 1-844-447-3813, or email ESPP@epa.gov. You must use the Bulletin valid for the month in which you will apply the product."*

Within 18 months of the issuance date of this Biological Opinion,

2. **Review and act on all of the registrants' request to amend labels**.

3. **Develop Endangered Species Protection Bulletins** (https://www.epa.gov/endangered-species/endangered-species-protection-bulletins).

EPA shall develop Endangered Species Protection Bulletins that include the following geographically specific use limitations:

When applying 1,3-D products within 30 meters of listed Pacific salmonid habitat:

i. Do not apply this product when soil is saturated, or when a storm event likely to produce runoff from the treated area is forecasted (by NOAA/National Weather Service, or other similar forecasting service) to occur within 48 hours following application; AND,
ii. When 1,3-D is co-applied with chloropicrin, AND chloropicrin application rates exceed 145 lbs chloropicrin/acre, implement one of the following additional measures:
   - Presence and maintenance of riparian plantings (e.g., hedgerows) or functional riparian system (e.g., CRP riparian buffers)
   - Participation in recognized stewardship program
   - Vegetative filter strip ≥ 5 m wide
   - Vegetated ditches
   - Run-off retention pond
   - Deep application – injection of the fumigant at a depth ≥18 inches below the soil surface
   - Low permeability (high barrier) tarp:
     1. Installed immediately (≤ 30 minutes) after application
     2. Tarp must be left intact (unperforated) for a minimum of 5 days
     3. Tarp removal must not begin until at least 2 hours after tarp perforation is complete
     4. Planting or transplanting must not begin until at least 48 hours after the tarp perforation is complete
     5. Minimum distance from injection point to soil/air interface of 8 inches

When applying metolachlor products within 50 meters of listed Pacific salmonid habitat:

i. Do not apply this product when soil is saturated, or when a storm event likely to produce runoff from the treated area is forecasted (by NOAA/National Weather Service, or other similar forecasting service) to occur within 48 hours following application.

RPM 2: Improve ecological incident reporting, develop ESA educational materials, report label compliance

A. Terms and Conditions for Applicants

To address RPM number two, applicants shall submit to EPA the following label amendments for all technical and manufacturing use products containing 1,3-D or metolachlor. Label amendments shall be submitted to EPA within 60 days of the issuance date of this Biological Opinion.

The following statements shall be placed in the Directions for Use section of the label:

> *"This product may only be formulated into end-use products that contain the following language on their labeling when they are released for shipment: "Reporting Ecological Incidents (to be placed in the Environmental Hazards section of all end-use product labels):*
>
> *To report ecological incidents, including mortality, injury, or harm to plants and animals, call [registrant phone number].""*

The goal of this term and condition is to increase the probability that ecological incidents that may be associated with a pesticide application, if observed, will be reported to the pesticide registrant and thus captured within the existing FIFRA 6(a)(2) framework.

B. Terms and Conditions for EPA

To address RPM number two:

1. **Label Amendments.**
   a. **Within 10 business days of the issuance date of this biological opinion, EPA shall notify all end-use product registrants of products containing 1,3-D or metolachlor of the need to submit label amendments.**

   EPA shall notify all end-use product registrants to submit, within 60-days of EPA's notification, the necessary amendments to their end-use product labels, to be consistent with the technical/manufacturing use product label amendments described in RPM 2, Terms and Conditions for Applicants. Specifically, EPA shall notify end-use product registrants of the following necessary label language to be added to the "Environmental Hazards" section of all end-use product labels:

   > *"Reporting Ecological Incidents:*
   >
   > *To report ecological incidents, including mortality, injury, or harm to plants and animals, call [registrant phone number]."*

   b. **Within 18 months of the issuance date of this Biological Opinion, EPA shall review and act on the registrants' requests to amend labels as described above**.

2. **Reporting of Ecological Incidents.** Within two years of this Biological Opinion, EPA shall commence annual reporting to NMFS the occurrence of all minor and

major ecological incidents involving fish kills attributable to the use of products containing 1,3-D or metolachlor.

3. **ESA Conservation Educational Materials.** EPA shall amend the Endangered Species Protection Bulletin to include a link to generic ESA conservation educational materials. This material is to be jointly developed by NMFS and EPA and maintained on either a NMFS or EPA website. In addition to providing a link, the Endangered Species Protection Bulletins should include an advisory note encouraging applicators to review the information. This information should be provided to users who make inquiries regarding the geographic area associated with range and/or designated critical habitat of ESA-listed Pacific salmonid habitat. EPA shall work with NMFS to further develop these materials with the goal of amending the Endangered Species Protection Bulletin within one year of the date of this Biological Opinion. At a minimum, the information made available should include:
    i. how to assess which listed species may be within the area of application (the reviewer could be directed to the Bulletins Live for this and other pertinent requirements and information)
    ii. information on risks to those species
    iii. risk reduction measures
    iv. other best management practices
    v. ways to develop or enroll into watershed stewardship programs

4. **Label Compliance Monitoring.** EPA shall work with NMFS to determine a feasible means by which EPA will report to NMFS a summary of relevant compliance data on an annual basis. The goal of this term and condition is to establish a process by which NMFS can better access information regarding label compliance for pesticides subject to ESA Section 7 consultations. EPA shall work with NMFS to develop a process of effectiveness monitoring which utilizes existing FIFRA compliance monitoring strategies.

18.5 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

The following conservation recommendations would provide information for future consultations involving future authorizations of pesticide active ingredients that may affect ESA-listed species:

1. Develop models that more accurately quantify pesticide exposure in estuarine and near-shore ocean environments.
2. Work with other appropriate federal, state, and local partners to determine efficacy of riparian area management methods in reducing pesticide loading from authorized uses, especially the types of vegetation and width of riparian areas needed; and to encourage the development of watershed stewardship programs involving stakeholders within local watersheds.
3. Encourage adoption of stewardship programs, responsible pesticide handling, use of IPM practices, and other programs that reduce pesticide loading into species' habitats.
4. Carryout educational outreach on pesticide risks to threatened and endangered species.
5. Develop improved methods for characterizing exposure from non-agricultural uses.

In order for NMFS' Office of Protected Resources Endangered Species Act Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the EPA should notify the Endangered Species Act Interagency Cooperation Division of any conservation recommendations they implement in their final action.

18.6 Reinitiation Notice

This concludes formal consultation for the Environmental Protection Agency's proposed registration of pesticide products containing 1,3-D and metolachlor to ESA-listed salmonids under the jurisdiction of the NMFS. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

1. The amount or extent of taking specified in the incidental take statement is exceeded.
2. New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
3. The identified action is subsequently modified in a manner that causes an effect to ESA-listed species or designated critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated under the ESA that may be affected by the action.

NMFS' analysis and conclusions are based on EPA's action. If changes to product labeling result in modifications to the action that were not considered in this Opinion, including but not limited to label modifications authorizing pesticide application to new locations, additional application methods, or increased application rates or numbers of applications, EPA must contact NMFS to discuss potential reinitiation. If reinitiation of consultation appears warranted due to one or more of the above circumstances, EPA must contact NMFS Office of Protected Resources, ESA Interagency Cooperation Division. In the event reinitiation condition (1), (2), or (3) is met, reinitiation will be only for the a.i.(s) which meet that condition, not for all a.i.s considered in the Opinion. If none of these reinitiation triggers are met within the next 15 years, then reinitiation will be required because the Opinion only covers the action for 15 years. It is recommended that EPA request reinitiation with sufficient time prior to reaching 15 years to allow sufficient time to consult and to prevent lapse of coverage for the active ingredients in this Opinion.

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A. Appendix: Pacific Salmon Population Modeling

Introduction

To assess the potential for adverse impacts of the pesticides on Pacific salmon populations, a model was developed that explicitly links mortality due to exposure of young of the year to the productivity of salmon populations. We did this by constructing and analyzing general life-history matrix models for coho salmon (*Oncorhynchus kisutch*), sockeye salmon (*O. nerka*) and ocean-type and stream-type Chinook salmon (*O. tshawytscha*). The basic salmonid life history modeled consisted of hatching and rearing in freshwater, smoltification in estuaries, migration to the ocean, maturation at sea, and returning to the natal freshwater stream for spawning followed shortly by death. Differences between the modeled strategies are lifespan of the female, time to reproductive maturity, and the number and relative contribution of the reproductive age classes (Figure A1-1). The coho females we modeled reach reproductive maturity at age 3 and provide all of the reproductive contribution. Sockeye females reach maturity at age 4 or 5, but the majority of reproductive contributions are provided by age 4 females. Chinook females can mature at age 3, 4 or 5, with the majority of the reproductive contribution from ages 4 and 5. The primary difference between the ocean-type and stream-type Chinook is the juvenile freshwater residence with ocean-type juveniles migrating to the ocean as subyearlings and stream-type overwintering in freshwater and migrating to the ocean as yearlings. The models depicted general listed populations representing each life-history strategy and were constructed based upon literature data described below. Specific populations were not modeled due to the lack of sufficient demographic and reproductive data for a single population.

The acute toxicity model estimated the population-level impacts of juvenile mortality resulting from exposure to lethal concentrations of contaminants. These models excluded sublethal and indirect effects of the exposures and focused on the population-level outcomes resulting from an annual exposure of juveniles to a pesticide. The lethal impact was implemented as a change in first year survival for each of the salmon life-history strategies.

The overall model endpoint used to assess population-level impacts for the acute lethality models was the percent change in the intrinsic population growth rate (lambda, λ) resulting from the pesticide exposure. Change in λ is an accepted population parameter often used in evaluating population productivity, status, and viability. The National Marine Fisheries Service uses changes in λ when estimating the status of species, conducting risk and viability assessments, developing Endangered Species Recovery Plans, composing Biological Opinions, and communicating with other federal, state and local agencies (McClure et al. 2003). While values of $\lambda<1.0$ indicate a declining population, negative changes in lambda greater than the natural variability for the population indicate a loss of productivity. This can be a cause for concern since the decline could make a population more susceptible to dropping below 1.0 due to impacts from multiple stressors.

Assessing the results from different pesticide exposure scenarios relative to a control (i.e. unexposed) scenario can indicate the potential for pesticide exposures to lead to changes in the first year survival. Consequently, subsequent changes in salmon population dynamics as indicated by percent change in a population's intrinsic rate of increase assists in forecasting the potential population-level impacts to listed populations. The model conveys the potential influence of life-history strategies that might explain differential results within the species modeled.

Methods

In order to understand the relative impacts of a short-term pesticide exposure on exposed vs. unexposed fish, we used parameters for an idealized baseline population that exhibits an increasing population growth rate. All characteristics exhibit density independent dynamics. There were no definitive data available on the populations to support specific density dependent relationships, so rather than assign an unsupported relationship, the National Research Council recommendation was followed to utilize density independent parameters (NAS NRC 2013). The models assume closed systems, allowing no migration impact on population size. No stochastic impacts are included beyond natural variability reported in the literature as represented by selecting parameter values from a normal distribution about a mean each model iteration (year). Ocean conditions, freshwater habitat, fishing pressure, and marine resource availability were assumed constant and density independent so that they remain in the range they occupied during the period when demographic data were collected.

In the model an individual fish experiences an exposure scenario once as a subyearling (during its first spring) and never again. The pesticide exposure is assumed to occur to the population annually. All individuals in one cohort within a given population are assumed to be exposed to the pesticide during their subyearling spring-summer growth period. No other age classes experience the exposure.

A prospective analysis of the transition matrix, A, (Caswell 2001) explored the intrinsic population growth rate as a function of the vital rates. The intrinsic population growth rate, λ, equals the dominant eigenvalue of A and was calculated using matrix analysis software (MATLAB version 7.7.0 by The Math Works Inc., Natick, MA). Therefore λ is calculated directly from the matrix and running projections of abundances over time is redundant and unnecessary. The stable age distribution, the proportional distribution of individuals among the ages when the population is at equilibrium, is calculated as the right normalized eigenvector corresponding to the dominant eigenvalue λ. Variability was integrated by repeating the calculation of λ 2000 times selecting the values in the transition matrix from their normal distribution defined by the mean standard deviation. The influence of each matrix element, a_{ij}, on λ was assessed by calculating the sensitivity values for A. The sensitivity of matrix element a_{ij} equals the rate of change in λ with respect to a_{ij}, defined by $\delta\lambda / \delta a_{ij}$. Higher sensitivity values indicate greater influence on λ. The elasticity of matrix element a_{ij} is defined as the proportional change in λ relative to the proportional change in a_{ij} and equals (a_{ij}/λ) times the sensitivity of a_{ij}. One characteristic of elasticity analysis is that the elasticity values for a transition matrix sum to unity (one). The unity characteristic also allows comparison of the influence of transition elements and comparison across matrices.

Due to differences in the life-history strategies, specifically lifespan, age at reproduction and first year residence and migration habits, four life-history models were constructed. The differences in life history may result in different freshwater pesticide exposure profiles which can translate into potentially different population-level responses. Separate models were constructed for coho salmon, sockeye salmon, ocean-type and stream-type Chinook salmon. In all cases, transition values were determined from literature data on survival and reproductive characteristics of each species for populations that exhibit the life history strategy and were listed as endangered, threatened, or a species of concern under the ESA. All transition values are listed in Table A1-1.

A life-history transition matrix was constructed for coho salmon (*O. kisutch*) with a maximum age of 3. Spawning occurs in late fall and early winter with emergence from March to May. Fry spend 14-18 months in freshwater, smolt and spend 16-20 months in the saltwater before returning to spawn (Pess et al. 2002). Survival numbers were summarized in Knudsen et al. (2002) as follows. The average fecundity of each female is 4500 with a standard deviation of 500. The observed number of males:females was 1:1. Survival from spawning to emergence is 0.3 (0.07). Survival from emergence to smolt is 0.0296 (0.00029) and marine survival is 0.05 (0.01). All parameters followed a normal distribution (Knudson et al. 2002). The calculated values used in the matrix are listed in Table A1-1. The growth period for first year coho was set at 180 days to represent the time from mid-spring to mid-fall when the temperatures and resources drop and somatic growth slows (Knudson et al. 2002).

The life-history matrix for sockeye salmon (*O. nerka*) were based upon the lake wintering populations of Lake Washington, Washington, USA. These female sockeye salmon spend one winter in freshwater, then migrate to the ocean to spend three to four winters before returning to spawn at ages 4 or 5. Jacks return at age 2 after only one winter in the ocean. The age proportion of returning adults is 0.03, 0.82, and 0.15 for ages 3, 4 and 5, respectively (Gustafson et al.1997). All age 3 returning adults are males. Hatch rate and first year survival were calculated from brood year data on escapement, resulting presmolts and returning adults (Pauley et al. 1989) and fecundity (McGurk 2000). Fecundity values for age 4 females were 3374 (473) and for age 5 females were 4058 (557) (McGurk 2000). First year survival rates were 0.737/month (Gustafson et al. 1997). Ocean survival rates were calculated based upon brood data and the findings that 90% of ocean mortality occurs during the first 4 months of ocean residence (Pauley et al. 1989). Matrix values used in the sockeye baseline model are listed in Table A1-1. The 168 day growth period represents the time from lake entry to early fall when the temperature drops and somatic growth slows (Gustafson et al. 1997).

A life-history matrix was constructed for ocean-type Chinook salmon (*O. tshawytscha*) with a maximum female age of 5 and reproductive maturity at ages 3, 4 or 5. Ocean-type Chinook migrate from their natal stream within a couple months of hatching and spend several months rearing in estuary and nearshore habitats before continuing on to the open ocean. Transition values were determined from literature data on survival and reproductive characteristics from several ocean-type Chinook populations in the Columbia River system (Healey and Heard 1984, Howell et al. 1985, Roni and Quinn 1995, Ratner et al. 1997, PSCCTC 2002, Greene and Beechie 2004). The sex ratio of spawners was approximately 1:1. Estimated size-based fecundity of 4511(65), 5184(89), and 5812(102) was calculated based on data from Howell et al., 1985, using length-fecundity relationships from Healy and Heard (1984). Control matrix values for the Chinook model are listed in Table A1-1. The growth period of 140 days encompasses the time the fish rear in freshwater prior to entering the estuary and open ocean. The first three months of estuary/ocean survival are the size-dependent stage. Size data for determining subyearling Chinook condition indices came from data collected in the lower Columbia River and estuary (Johnson et al. 2007).

An age-structured life-history matrix for stream-type Chinook salmon with a maximum age of 5 was defined based upon literature data on Yakima River spring Chinook from Knudsen et al. (2006) and Fast et al. (1988), with sex ratios of 0.035, 0.62 and 0.62 for females spawning at ages 3, 4, and 5, respectively. Length data from Fast et al. (1988) was used to calculate fecundity from the length-fecundity relationships in Healy and Heard (1984). The 184-day growth period produces control fish with a mean size of 96mm, within the observed range documented in the fall prior to the first winter (Beckman et al. 2000). The size-dependent survival encompasses the 4 early winter months, up until the fish are 12 months old.

Acute Toxicity Model

In order to estimate the population-level responses of exposure to lethal pesticide concentrations, acute mortality models were constructed based upon the control life-history matrices described above. The acute responses are modeled as direct reduction in the first year survival rate (S1). Two options are available to run, direct mortality estimates and exposure scenarios. Direct mortality can be input as percent mortality and is multiplied by the first-year survival rate in the transition matrix. Calculated EEC values can be assessed in the Risk-Plots to identify the appropriate level of mortality. In contrast, modelling exposure scenarios results in a cumulative reduction in survival as defined by the concentration and the dose-response curve (the LC_{50} and slope for each pesticide). A sigmoid dose-response relationship is used to accurately handle responses well away from LC_{50} and to be consistent with other does-response relationships. The model inputs for each scenario are the exposure concentration and acute fish LC_{50}, as well as the sigmoid slope for the LC_{50}. For a given concentration, a pesticide survival rate (1-mortality) is calculated and is multiplied by the control first-year survival rate, producing an exposed scenario first-year survival for the life-history matrix. The model allows for a specified percentage of the population (0-100%) to experience the exposure.

Demographic variability is incorporated as described above using mean and standard deviation of normally distributed survival and reproductive rates and model output consists of the percent change in lambda from unexposed control populations derived from the mean of 10000 calculations of both the unexposed control population and the pesticide exposed population. For the purposes of this assessment, the percent change in lambda is defined as different from control when the difference between the mean percent change is greater than the percent of one standard deviation from the control lambda.

For this exercise only direct mortality was used as inputs for the models. Exposure scenarios were not modeled. Mortality rates from 5% to 100% were run in 5% increments. The mortality values were assessed across a combination of percent overlap values (10%, 25%, 50%, 80%, and 100%) to estimate population productivity across differences in pesticide use area overlap with the species distribution.

Results

Sensitivity Analysis

The sensitivity analysis of all four of the control population matrices predicted the greatest changes in population growth rate (λ) result from changes in first-year survival. Parameter values and their corresponding sensitivity values are listed in Table A1-1. The elasticity values for the transition matrices also corresponded to the driving influence of first-year survival, with contributions to lambda of 0.33 for coho, 0.29 for ocean-type Chinook, 0.25 for stream-type Chinook, and 0.24 for sockeye.

Model Output

While trends in effects were seen for each pesticide across all four life-history strategies modeled, some slight differences were apparent. The similarity in patterns likely stems from using the same toxicity values for all four salmon, while the differences are consequences of distinctions between the life-history matrices. The stream-type Chinook and sockeye models produced very similar results as measured as the percent change in population growth rate. The ocean-type Chinook and coho models output produced the greatest changes in lambda resulting from the pesticide exposures. When looking for similarities in parameters to explain the ranking, no single life history parameter or characteristic, such as lifespan, reproductive ages, age distribution, lambda and standard deviation, or first-year survival show a pattern that matches this consistent output. Combining these factors into the transition matrix for each life-history and conducting the sensitivity and elasticity analyses revealed that changes in first-year survival produced the greatest changes in lambda. In addition, the elasticity analysis can be used to predict relative contribution to lambda from changes in first-year survival on a per unit basis. As detailed by the elasticity values reported above, the same change in first-year survival will produce a slightly greater change in the population growth rate for coho and ocean-type Chinook than for stream-type Chinook and sockeye. While some life-history characteristics may lead a population to be more vulnerable to an impact, the culmination of age structure, survival and reproductive rates as a whole strongly influences the population-level response.

Shifts in population growth rate occurred across mortality levels and increased with the percentage of the population exposed (Tables A1 2-5 and Figures A1 2-5). Percent changes in lambda were considered significant if they were outside of one standard deviation from the unexposed population. The tables can be used to estimate losses in productivity due to mortality resulting from expected environmental concentrations in habitat utilized by juvenile salmonids. The likelihood of population effects from death of juveniles increases for those populations that spend longer periods in freshwaters such as stream-type Chinook, sockeye, and coho salmon.

For those populations with lambdas greater than one, reductions in lambda from death of subyearlings can lead to consequences to abundance and productivity. Attainment of recovery and time-associated goals would be delayed for populations with reduced lambdas. For those natural populations with current lambdas of less than one, risk of extinction would increase. Many of the populations that are categorized as core populations or are important to individual strata, have lambdas just above one and are essential to survival and recovery goals. Slight changes in lambda, even as small as 3-4%, would result in reduced abundances and increased time to meet population recovery goals.

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Table A1-1. Matrix transition element (standard deviation) and sensitivity (S) and elasticity (E) values for each model species. These control values are listed by the transition element taken from the life-history graphs as depicted in Figure A1-1 and the literature data described in the method text. Blank cells indicate elements that are not in the transition matrix for a particular species. The influence of each matrix element on λ was assessed by calculating the sensitivity (S) and elasticity (E) values for A. The sensitivity of matrix element a_{ij} equals the rate of change in λ with respect to the transition element, defined by $\delta\lambda/\ \delta a$. The elasticity of transition element a_{ij} is defined as the proportional change in λ relative to the proportional change in a_{ij}, and equals (a_{ij}/λ) times the sensitivity of a_{ij}. Elasticity values allow comparison of the influence of individual transition elements and comparison across matrices.

Transition Element	Chinook Stream-type			Chinook Ocean-type			Coho			Sockeye		
	Value[1] (std)	S	E	Value[2] (std)	S	E	Value[3] (std)	S	E	Value[4]	S	E
S1	0.0643 (0.003)	3.844	0.247	0.0056 (0.001)	57.13	0.292	0.0296 (0.002)	11.59	0.333	0.0257 (0.003)	9.441	0.239
S2	0.1160 (0.002)	2.132	0.247	0.48 (0.097)	0.670	0.292	0.0505 (0.005)	6.809	0.333	0.183 (0.003)	1.326	0.239
S3	0.17006 (0.004)	1.448	0.246	0.246 (0.050)	0.476	0.106				0.499 (0.003)	0.486	0.239
S4	0.04 (0.002)	0.319	0.0127	0.136 (0.023)	0.136	0.0168				0.1377 (0.003)	0.322	0.0437
R3	0.5807 (0.089)	0.00184	0.0011	313.8 (38.1)	0.0006	0.186	732.8 (75.0)	0.000469	0.333			
R4	746.73 (86.62)	0.000313	0.233	677.1 (80.7)	0.000146	0.0896				379.57 (53.2)	0.000537	0.195
R5	1020.36 (101.33)	1.25E-05	0.0127	1028 (117.5)	1.80E-05	0.0168				608.7 (83.0)	7.28E-05	0.0437

[1] Value calculated from data in Healey and Heard 1984, Fast et al. 1988, Beckman et al. 2000, Knudsen et al. 2006

[2] Value calculated from data in Healey and Heard 1984, Howell et al. 1985, Roni and Quinn 1995, Ratner et al. 1997, PSCCTC 2002, Green and Beechie 2004, Johnson et al. 2007

[3] Value calculated from data in Pess et al. 2002, Knudsen et al. 2002

[4] Value calculated from data in Pauley et al. 1989, Gustafson et al. 1997, McGurk 2000

Table A1-2. Acute mortality model output for ocean-type Chinook. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rage of greater than one standard deviation from control values. The baseline values for ocean-type Chinook are: lambda=1.09, standard deviation of 0.1, standard deviation as a percent of lambda is 9, and first year survival S1=5.64E-03. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (12.9)	0 (12.9)	-1 (12.8)	-1 (12.8)	-1 (12.7)
10	0 (130)	-1 (12.9)	-1 (12.8)	-3 (12.6)	-3 (12.4)
15	0 (12.9)	-1 (12.9)	-2 (12.8)	-4 (12.5)	-5 (12.2)
20	-1 (13.0)	-2 (13.0)	-3 (12.9)	-5 (12.5)	-6 (12.1)
25	-1 (13.1)	-2 (13.0)	-4 (13.3)	-6 (12.7)	-8 (11.8)
30	-1 (13.0)	-2 (13.3)	-5 (13.4)	-8 (12.7)	**-10 (11.5)**
35	-1 (13.3)	-3 (13.8)	-6 (13.9)	**-9 (13.0)**	**-12 (11.4)**
40	-1 (13.4)	-3 (14.0)	-7 (14.3)	**-11 (13.5)**	**-14 (11.1)**
45	-1 (133.6)	-4 (14.3)	-8 (15.4)	**-13 (14.1)**	**-16 (10.7)**
50	-2 (13.6)	-5 (14.9)	**-9 (16.0)**	**-15 (15.3)**	**-18 (10.5)**
55	-2 (14.0)	-5 (15.5)	**-11 (17.5)**	**-17 (16.5)**	**-21 (10.2)**
60	-2 (14.2)	-6 (16.9)	**-12 (18.6)**	**-20 (17.9)**	**-23 (9.7)**
65	-2 (14.3)	-7 (16.9)	**-14 (19.8)**	**-22 (19.1)**	**-26 (9.5)**
70	-3 (14.6)	-7 (17.8)	**-16 (21)**	**-24 (20.3)**	**-29 (8.9)**
75	-3 (15.2)	-8 (18.4)	**-17 (22.1)**	**-27 (21.6)**	**-33 (8.5)**
80	-3 (15.3)	**-9 (19.7)**	**-18 (23.2)**	**-30 (22.3)**	**-37 (8.1)**
85	-4 (15.8)	**-10 (20.4)**	**-20 (24)**	**-32 (23.1)**	**-42 (7.3)**
90	-4 (16.1)	**-10 (21.5)**	**-21 (24.9)**	**-34 (23.4)**	**-48 (6.6)**
95	-4 (16.5)	**-11 (22.7)**	**-22 (25.3)**	**-36 (23.2)**	**-56 (5.5)**
100	-4 (17.1)	**-12 (23.0)**	**-23 (25.9)**	**-38 (23.6)**	**-100 (NA)**

Table A1-3. Acute mortality model output for stream-type Chinook. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rage of greater than one standard deviation from control values. The baseline values for stream-type Chinook are: lambda=1.00, standard deviation of 0.03, standard deviation as a percent of lambda is 3, and first year survival S1=6.43E-03. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (4.4)	0 (4.4)	-1 (4.4)	-1 (4.4)	-1 (4.3)
10	0 (4.5)	-1 (4.5)	-1 (4.5)	-2 (4.4)	**-3 (4.3)**
15	0 (4.6)	-1 (4.7)	-2 (4.7)	**-3 (4.6)**	**-4 (4.2)**
20	-1 (4.7)	-1 (4.9)	**-3 (5.1)**	**-4 (4.8)**	**-5 (4.1)**
25	-1 (4.8)	-2 (5.1)	**-3 (5.5)**	**-6 (5.1)**	**-7 (4.1)**
30	-1 (4.9)	-2 (5.6)	**-4 (6.0)**	**-7 (5.6)**	**-8 (4.0)**
35	-1 (5.1)	-2 (6.0)	**-5 (6.8)**	**-8 (6.1)**	**-10 (4.0)**
40	-1 (5.4)	**-3 (6.5)**	**-6 (7.5)**	**-10 (6.9)**	**-12 (3.9)**
45	-1 (5.6)	**-3 (7.0)**	**-7 (8.5)**	**-11 (7.8)**	**-14 (3.7)**
50	-2 (5.8)	**-4 (7.5)**	**-8 (9.8)**	**-13 (9.3)**	**-16 (3.7)**
55	-2 (6.2)	**-4 (8.3)**	**-9 (11.1)**	**-15 (10.9)**	**-18 (3.6)**
60	-2 (6.5)	**-5 (9.3)**	**-11 (13.0)**	**-17 (13.1)**	**-20 (3.5)**
65	-2 (6.9)	**-6 (10.1)**	**-12 (14.7)**	**-19 (14.7)**	**-23 (3.4)**
70	-2 (7.2)	**-6 (11.1)**	**-13 (15.7)**	**-22 (16.7)**	**-26 (3.2)**
75	**-3 (7.7)**	**-7 (12.4)**	**-15 (17.5)**	**-24 (17.9)**	**-29 (3.1)**
80	**-3 (8.1)**	**-8 (13.5)**	**-15 (18.3)**	**-27 (18.8)**	**-33 (2.9)**
85	**-3 (8.6)**	**-8 (14.6)**	**-17 (19.3)**	**-29 (19.7)**	**-37 (2.7)**
90	**-3 (9.1)**	**-9 (15.4)**	**-18 (20.2)**	**-30 (20.0)**	**-43 (2.4)**
95	**-4 (9.5)**	**-10 (16.4)**	**-20 (21.1)**	**-32 (20.2)**	**-52 (2.0)**
100	**-4 (10.3)**	**-11 (17.6)**	**-21 (21.4)**	**-33 (20.0)**	**-100 (NA)**

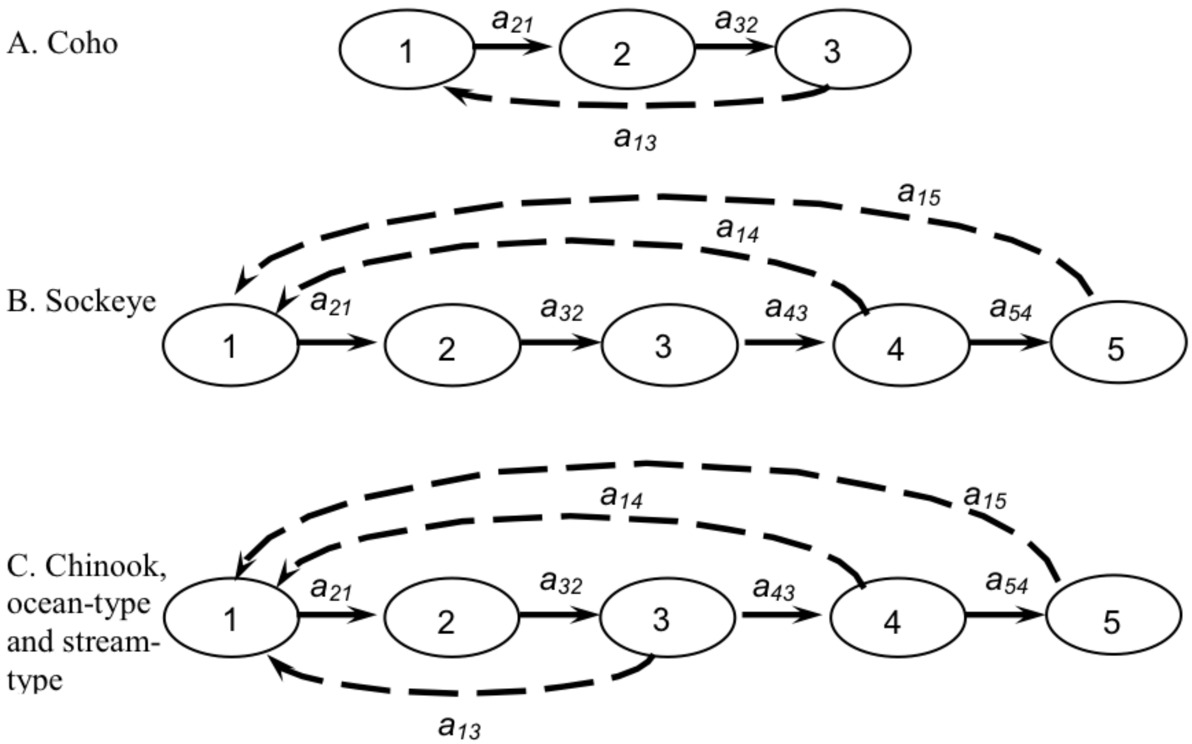
Table A1-4. Acute mortality model output for sockeye. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rage of greater than one standard deviation from control values. The baseline values for sockeye are: lambda=1.01, standard deviation of 0.06, standard deviation as a percent of lambda is 6, and first year survival S1=2.57E-02. Bold indicates values greater than or equal to one standard deviation away from baseline.

% mortality	% population experiencing mortality				
	10	**25**	**50**	**80**	**100**
5	0 (8.0)	0 (7.9)	-1 (7.9)	-1 (7.8)	-1 (7.8)
10	0 (8.0)	-1 (8.0)	-1 (8.0)	-2 (7.9)	-3 (7.7)
15	0 (8.0)	-1 (8.0)	-2 (8.1)	-3 (7.9)	-4 (7.7)
20	-1 (8.0)	-1 (8.2)	-3 (8.2)	-4 (8.1)	-5 (7.5)
25	-1 (8.1)	-2 (8.4)	-3 (8.5)	-5 (8.2)	**-7 (7.4)**
30	-1 (8.2)	-2 (8.8)	-4 (9.0)	**-7 (8.4)**	**-8 (7.3)**
35	-1 (8.4)	-2 (8.9)	-5 (9.6)	**-8 (8.8)**	**-10 (7.1)**
40	-1 (8.6)	-3 (9.2)	**-6 (10.1)**	**-9 (9.6)**	**-11 (7.0)**
45	-1 (8.7)	-3 (9.7)	**-7 (10.9)**	**-11 (10.4)**	**-13 (6.9)**
50	-1 (9.0)	-4 (10.4)	**-8 (12.0)**	**-13 (11.2)**	**-15 (6.7)**
55	-2 (9.2)	-4 (10.9)	**-9 (13.4)**	**-15 (12.9)**	**-17 (6.5)**
60	-2 (9.4)	-5 (11.9)	**-10 (14.4)**	**-17 (14.4)**	**-19 (6.4)**
65	-2 (9.7)	-5 (12.3)	**-12 (16.1)**	**-19 (15.7)**	**-22 (6.2)**
70	-2 (10.0)	**-6 (13.4)**	**-13 (16.9)**	**-21 (17.3)**	**-25 (5.9)**
75	-3 (10.4)	**-7 (14.3)**	**-14 (18.2)**	**-23 (18.1)**	**-28 (5.6)**
80	-3 (10.9)	**-8 (15.6)**	**-16 (19.0)**	**-26 (19.1)**	**-32 (5.4)**
85	-3 (11.3)	**-8 (16.3)**	**-17 (19.9)**	**-28 (19.7)**	**-39 (5.0)**
90	-3 (11.6)	**-9 (17.0)**	**-18 (20.8)**	**-29 (19.8)**	**-42 (4.5)**
95	-3 (12.3)	**-10 (17.7)**	**-19 (20.9)**	**-30 (19.9)**	**-51 (3.8)**
100	-4 (12.7)	**-10 (18.3)**	**-20 (21.5)**	**-32 (19.8)**	**-100 (NA)**

Table A1- 5. Acute mortality model output for coho. Shown are the percent changes in population growth rate (lambda, λ) with the standard deviations in parentheses. The toxicity values were applied as direct mortality on first year survival (left column). The percent of the population exposed was also varied (top row). Bold indicates a percent change in population growth rage of greater than one standard deviation from control values. The baseline values for coho are: lambda=1.03, standard deviation of 0.05, standard deviation as a percent of lambda is 5, and first year survival S1=2.97E-02. Bold indicates values greater than or equal to one standard deviation away from baseline.

	% population experiencing mortality				
% mortality	**10**	**25**	**50**	**80**	**100**
5	0 (7.4)	0 (7.5)	-1 (7.5)	-1 (7.4)	-2 (7.4)
10	0 (7.5)	-1 (7.6)	-2 (7.6)	-3 (7.4)	-3 (7.2)
15	0 (7.6)	-1 (7.7)	-3 (7.8)	-4 (7.5)	**-5 (7.1)**
20	-1 (7.7)	-2 (8.0)	-4 (8.1)	**-6 (7.7)**	**-7 (7.0)**
25	-1 (7.9)	-2 (8.4)	**-5 (8.5)**	**-7 (8.0)**	**-9 (6.9)**
30	-1 (7.9)	-3 (8.5)	**-6 (9.1)**	**-9 (8.4)**	**-11 (6.6)**
35	-1 (8.2)	-3 (9.2)	**-7 (9.9)**	**-11 (8.9)**	**-13 (6.5)**
40	-1 (8.5)	-4 (9.7)	**-8 (10.7)**	**-13 (9.8)**	**-16 (6.4)**
45	-2 (8.8)	-4 (10.3)	**-9 (11.8)**	**-14 (11.0)**	**-18 (6.1)**
50	-2 (9.1)	**-5 (11.1)**	**-10 (13.4)**	**-17 (12.2)**	**-21 (5.9)**
55	-2 (9.5)	**-6 (11.7)**	**-12 (14.9)**	**-20 (14.2)**	**-23 (5.8)**
60	-3 (9.9)	**-6 (12.6)**	**-14 (17.0)**	**-23 (16.5)**	**-26 (5.5)**
65	-3 (10.3)	**-7 (14.1)**	**-15 (18.5)**	**-25 (18.7)**	**-30 (5.3)**
70	-3 (10.7)	**-8 (15.1)**	**-17 (20.6)**	**-28 (20.6)**	**-33 (5.0)**
75	-3 (11.2)	**-9 (16.4)**	**-19 (22.3)**	**-31 (22.4)**	**-37 (4.7)**
80	-4 (11.6)	**-9 (17.7)**	**-20 (23.6)**	**-34 (23.7)**	**-42 (4.4)**
85	-4 (12.3)	**-11 (19.3)**	**-22 (25.0)**	**-37 (24.5)**	**-47 (4.0)**
90	-4 (12.9)	**-12 (20.4)**	**-24 (26.0)**	**-39 (25.2)**	**-54 (3.4)**
95	-4 (13.4)	**-13 (21.6)**	**-25 (27.3)**	**-42 (25.2)**	**-63 (2.8)**
100	**-5 (14.1)**	**-14 (22.9)**	**-27 (27.6)**	**-43 (25.7)**	**-100 (NA)**

Figure A1-1: Life-History Graphs and Transition Matrix for coho (A), sockeye (B) and Chinook (C) salmon. The life-history graph for a population labeled by age, with each transition element labeled according to the matrix position, a_{ij}, i row and j column. Dashed lines represent reproductive contribution and solid lines represent survival transitions. D) The transition matrix for the life-history graph depicted in C.



D. Transition Matrix

$$A = \begin{bmatrix} 0 & 0 & R3=a_{13} & R4=a_{14} & R5=a_{15} \\ S1=a_{21} & 0 & 0 & 0 & 0 \\ 0 & S2=a_{32} & 0 & 0 & 0 \\ 0 & 0 & S3=a_{43} & 0 & 0 \\ 0 & 0 & 0 & S4=a_{54} & 0 \end{bmatrix}$$

Figure A1-2: Percent change in population growth rate (lambda) for ocean-type Chinook for acute mortality rates from 5% to 100%. Solid lines indicate the percent of the population exposed and experiencing the acute mortality. The dotted line indicates 1 standard deviation from the baseline.

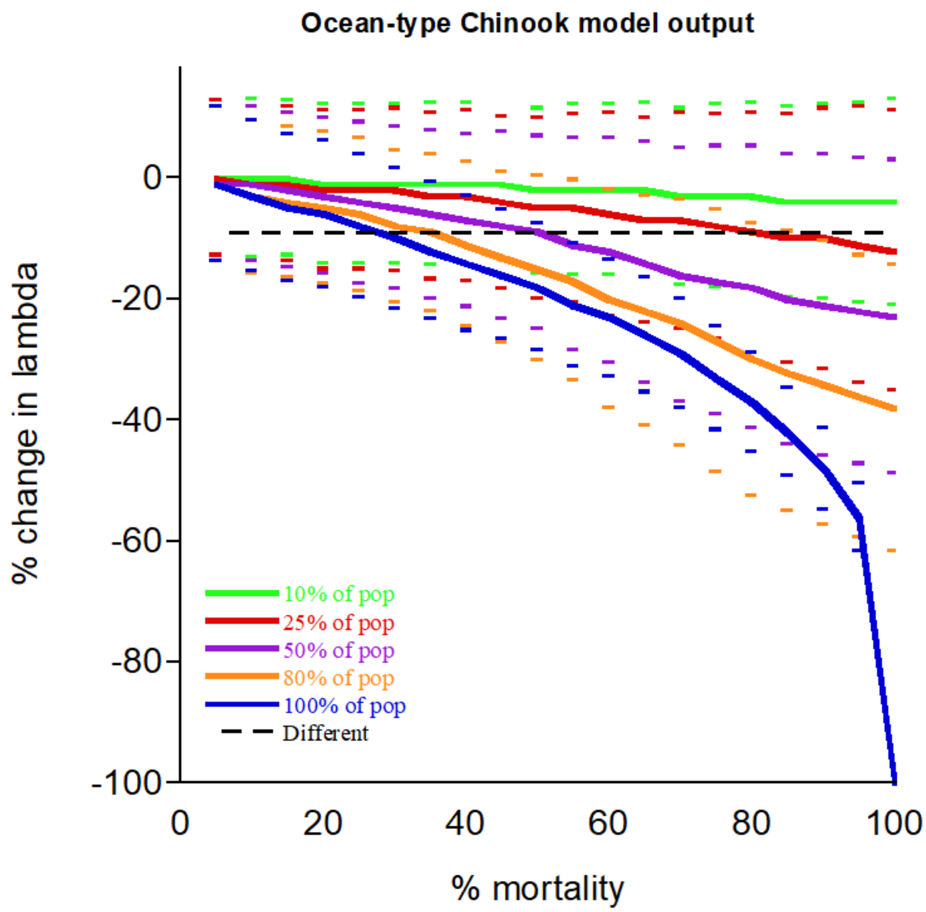


Figure A1-3: Percent change in population growth rate (lambda) for stream-type Chinook for acute mortality rates from 5% to 100%. Solid lines indicate the percent of the population exposed and experiencing the acute mortality. The dotted line indicates 1 standard deviation from the baseline.

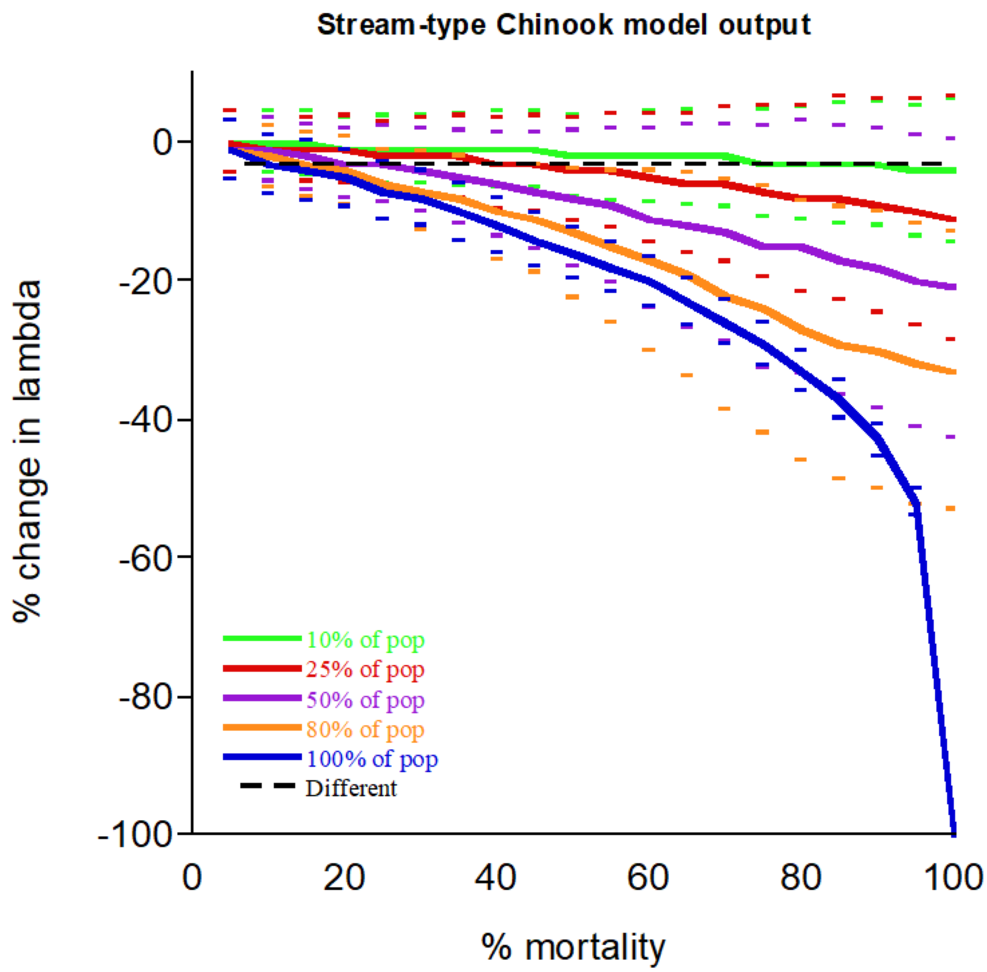


Figure A1-4: Percent change in population growth rate (lambda) for sockeye for acute mortality rates from 5% to 100%. Solid lines indicate the percent of the population exposed and experiencing the acute mortality. The dotted line indicates 1 standard deviation from the baseline.

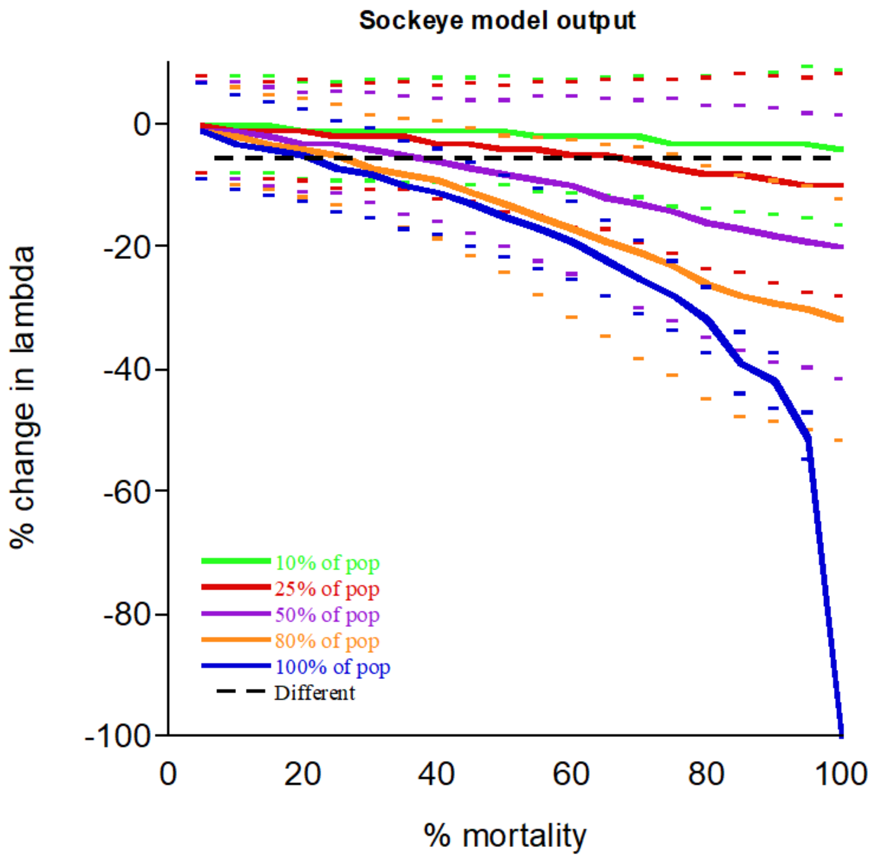
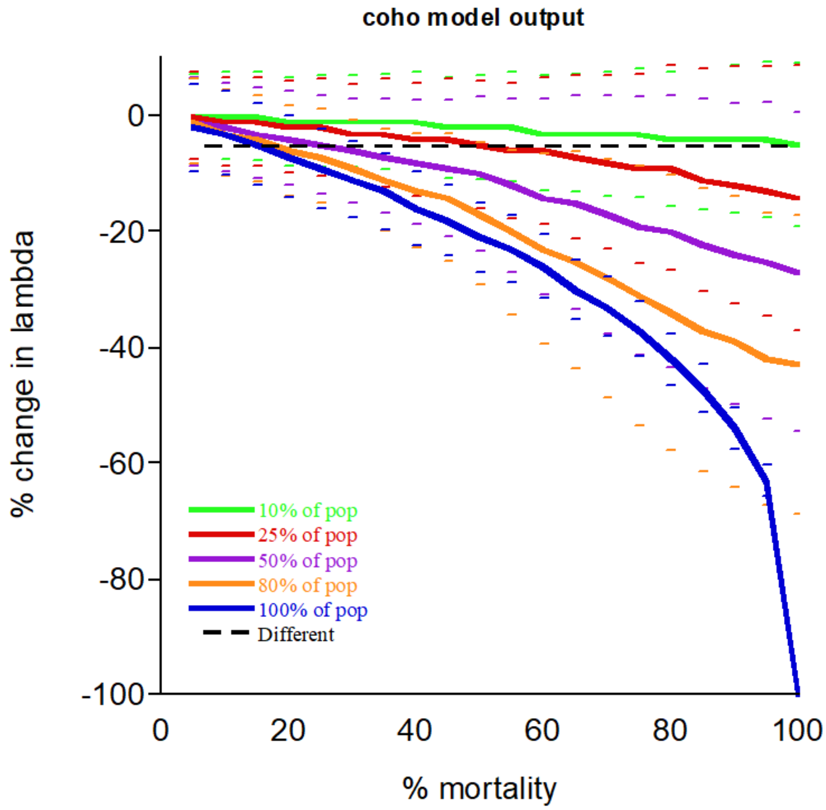


Figure A1-5: Percent change in population growth rate (lambda) for coho for acute mortality rates from 5% to 100%. Solid lines indicate the percent of the population exposed and experiencing the acute mortality. The dotted line indicates 1 standard deviation from the baseline.



B. Appendix: Toxicity of Formulated Products

Toxicity of formulated products containing the active ingredient 1,3-D to non-target fish and aquatic invertebrates is as important part of the action considered in this Opinion. Most of the formulated products containing 1,3-D also contain the active ingredient chloropicrin. Due to this large number of formulated products containing the same two active ingredients, as well as the reported toxicity of chloropicrin, a robust prediction of the toxicity of these formulated products to both fish and aquatic invertebrates was conducted and is described here. The data utilized in this mixtures analysis includes labeled use rates, expected environmental concentrations (EECs), and taxa-specific toxicity values. These same data are used throughout this Opinion.

Usage specifications on product labels were used to calculate expected environmental concentrations occurring in aquatic habitat. Information supplied on product labels include the proportion of each active ingredient in the formulated product, maximum use rates, and maximum product use amounts. This information was used to calculate concentrations in a bin 2 aquatic habitat scenario, which represents shallow flowing streams common throughout the action area. Expected environmental concentration (i.e., EEC) of formulated products were calculated using data reported in a field study of 1,3-D (Heim, 2002). In this study, single chemical application rates of 327.43 lbs a.i./A for 1,3-D produced measured runoff (bin 0) concentrations of 17.2 ppb. In order to make this measured bin 0 concentration applicable to an aquatic habitat, a conversion factor of 0.435 was used to convert these bin 0 concentrations to bin 2 EECs. The derivation of the conversion factor is discussed in Chapter 11 and Appendix C. As described in Chapter 11, equivalent EECs are not available for chloropicrin and NMFS assumes that 1,3-D concentrations are adequate surrogates for chloropicrin EECs. Therefore, EECs of each of the active ingredients in each formulated product were calculated using the following equation:

*EEC = ((maximum use rate)(field study EEC)/(field study application rate))*bin conversion*

Therefore, the equation for calculating the EEC for 1,3-D resulting from use of the formulated product Telone C-35 becomes:

*EEC = ((255.6 lbs a.i./A)(17.2 ppb)/(327.43 lbs a.i./A)) * 0.435 = 5.84 ppb*

The following tables show the resulting Bin 2 EECs for both 1,3-D and chloropicrin in all formulated products registered for use on vegetable crops (Table 1), field crops (Table 2), fruit and nut crops (Table 3), nursery crops (Table 4) and mint (Table 5).

Table 1. Calculated Bin 2 EECs of each active ingredient in formulated products registered for use on vegetable crops.

Formulated Product	Amount 1,3-D (lbs/gallon product)	Amount chloropicrin (lbs/gallon product)	Maximum product use (gal/A)*	Maximum use rate 1,3-D (lbs/A)	Maximum use rate chloropicrin (lbs/A)	1,3-D EEC (ppb)	Chloropicrin EEC (ppb)
Telone C-35	7.10	3.89	36	255.6	140.04	5.84	3.20
In-Line	6.81	3.73	30.8	209.75	114.88	4.79	2.63
Pic-Clor 15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Pic-Clor 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Pic-Clor 40 EC	6.20	4.23	53.25	330.15	225.25	7.54	5.15
Pic-Clor 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Pic-Clor 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Telone C-15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Tri-form 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Tri-form 35	7.10	3.90	62.5	443.75	243.75	10.14	5.57
Tri-form 40	6.70	4.50	77.3	517.91	347.85	11.83	7.95
Tri-form 40 EC	6.20	4.23	53.25	330.16	225.25	7.54	5.15
Tri-form 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Tri-form 70 EC	3.40	8.10	27.75	94.35	224.78	2.16	5.14
Tri-form 80 EC	2.30	9.50	23.63	54.34	224.44	1.24	5.13
Tri-form 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Tri-form 70	3.70	8.70	40	148	348	3.38	7.95
Tri-form 80	2.50	10.30	34	85	350.2	1.94	8.00

*Factor of 0.75 applied to in-furrow rate of emulsifiable concentrate (EC) formulations to estimate average rate applied to entire field

Table 2. Calculated Bin 2 EECs of each active ingredient in formulated products registered for use on field crops.

Formulated Product	Amount 1,3-D (lbs/gallon product)	Amount chloropicrin (lbs/gallon product)	Maximum product use (gal/A)*	Maximum use rate 1,3-D (lbs/A)	Maximum use rate chloropicrin (lbs/A)	1,3-D EEC (ppb)	Chloropicrin EEC (ppb)
Telone C-35	7.10	3.89	26	184.6	101.14	4.22	2.31
In-Line	6.81	3.73	30.8	209.75	114.88	4.79	2.63
Pic-Clor 15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Pic-Clor 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Pic-Clor 40 EC	6.20	4.23	53.25	330.15	225.25	7.54	5.15
Pic-Clor 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Pic-Clor 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Telone C-15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Tri-form 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Tri-form 35	7.10	3.90	62.5	443.75	243.75	10.14	5.57
Tri-form 40	6.70	4.50	77.3	517.91	347.85	11.83	7.95
Tri-form 40 EC	6.20	4.23	53.25	330.16	225.25	7.54	5.15
Tri-form 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Tri-form 70 EC	3.40	8.10	27.75	94.35	224.78	2.16	5.14
Tri-form 80 EC	2.30	9.50	23.63	54.34	224.44	1.24	5.13
Tri-form 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Tri-form 70	3.70	8.70	40	148	348	3.38	7.95
Tri-form 80	2.50	10.30	34	85	350.2	1.94	8.00

*Factor of 0.75 applied to in-furrow rate of emulsifiable concentrate (EC) formulations to estimate average rate applied to entire field

Table 3. Calculated Bin 2 EECs of each active ingredient in formulated products registered for use on fruit and nut crops.

Formulated Product	Amount 1,3-D (lbs/gallon product)	Amount chloropicrin (lbs/gallon product)	Maximum product use (gal/A)*	Maximum use rate 1,3-D (lbs/A)	Maximum use rate chloropicrin (lbs/A)	1,3-D EEC (ppb)	Chloropicrin EEC (ppb)
Telone C-35	7.10	3.89	50	355	194.5	8.11	4.44
In-Line	6.81	3.73	84	572.04	313.32	13.07	7.16
Pic-Clor 15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Pic-Clor 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Pic-Clor 40 EC	6.20	4.23	53.25	330.15	225.25	7.54	5.15
Pic-Clor 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Pic-Clor 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Telone C-15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Tri-form 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Tri-form 35	7.10	3.90	62.5	443.75	243.75	10.14	5.57
Tri-form 40	6.70	4.50	77.3	517.91	347.85	11.83	7.95
Tri-form 40 EC	6.20	4.23	53.25	330.16	225.25	7.54	5.15
Tri-form 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Tri-form 70 EC	3.40	8.10	27.75	94.35	224.78	2.16	5.14
Tri-form 80 EC	2.30	9.50	23.63	54.34	224.44	1.24	5.13
Tri-form 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Tri-form 70	3.70	8.70	40	148	348	3.38	7.95
Tri-form 80	2.50	10.30	34	85	350.2	1.94	8.00

*Factor of 0.75 applied to in-furrow rate of emulsifiable concentrate (EC) formulations to estimate average rate applied to entire field

Table 4. Calculated Bin 2 EECs of each active ingredient in formulated products registered for use on nursery crops.

Formulated Product	Amount 1,3-D (lbs/gallon product)	Amount chloropicrin (lbs/gallon product)	Maximum product use (gal/A)*	Maximum use rate 1,3-D (lbs/A)	Maximum use rate chloropicrin (lbs/A)	1,3-D EEC (ppb)	Chloropicrin EEC (ppb)
Telone C-35	7.10	3.89	79	560.9	307.31	12.82	7.02
In-Line	6.81	3.73	84	572.04	313.32	13.07	7.16
Pic-Clor 15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Pic-Clor 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Pic-Clor 40 EC	6.20	4.23	53.25	330.15	225.25	7.54	5.15
Pic-Clor 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Pic-Clor 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Telone C-15	8.70	1.60	66.7	580.29	106.72	13.26	2.44
Tri-form 30	7.50	3.30	66.7	500.25	220.11	11.43	5.03
Tri-form 35	7.10	3.90	62.5	443.75	243.75	10.14	5.57
Tri-form 40	6.70	4.50	77.3	517.91	347.85	11.83	7.95
Tri-form 40 EC	6.20	4.23	53.25	330.16	225.25	7.54	5.15
Tri-form 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Tri-form 70 EC	3.40	8.10	27.75	94.35	224.78	2.16	5.14
Tri-form 80 EC	2.30	9.50	23.63	54.34	224.44	1.24	5.13
Tri-form 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Tri-form 70	3.70	8.70	40	148	348	3.38	7.95
Tri-form 80	2.50	10.30	34	85	350.2	1.94	8.00

*Factor of 0.75 applied to in-furrow rate of emulsifiable concentrate (EC) formulations to estimate average rate applied to entire field

Table 5. Calculated Bin 2 EECs of each active ingredient in formulated products registered for use on mint.

Formulated Product	Amount 1,3-D (lbs/gallon product)	Amount chloropicrin (lbs/gallon product)	Maximum product use (gal/A)*	Maximum use rate 1,3-D (lbs/A)	Maximum use rate chloropicrin (lbs/A)	1,3-D EEC (ppb)	Chloropicrin EEC (ppb)
Telone C-35	7.10	3.89	33	234.3	128.37	5.35	2.93
In-Line	6.81	3.73	not specified	N/A	N/A	N/A	N/A
Pic-Clor 15	8.70	1.60	26.5	230.55	42.4	5.27	0.97
Pic-Clor 30	7.50	3.30	30.5	228.75	100.65	5.23	2.30
Pic-Clor 40 EC	6.20	4.23	not specified	N/A	N/A	N/A	N/A
Pic-Clor 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Pic-Clor 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Telone C-15	8.70	1.60	26.5	230.55	42.4	5.27	0.97
Tri-form 30	7.50	3.30	30.5	228.75	100.65	5.23	2.30
Tri-form 35	7.10	3.90	33	234.3	128.7	5.35	2.94
Tri-form 40	6.70	4.50	35	234.5	157.5	5.36	3.60
Tri-form 40 EC	6.20	4.23	not specified	N/A	N/A	N/A	N/A
Tri-form 60 EC	4.49	6.73	31.95	143.46	215.02	3.28	4.91
Tri-form 70 EC	3.40	8.10	27.75	94.35	224.78	2.16	5.14
Tri-form 80 EC	2.30	9.50	23.63	54.34	224.44	1.24	5.13
Tri-form 60	4.70	7.20	48.6	228.42	349.92	5.22	8.00
Tri-form 70	3.70	8.70	40	148	348	3.38	7.95
Tri-form 80	2.50	10.30	34	85	350.2	1.94	8.00

*Factor of 0.75 applied to in-furrow rate of emulsifiable concentrate (EC) formulations to estimate average rate applied to entire field

These calculated EECs were used with taxa-specific toxicity values to predict toxicity resulting from the formulated product. These toxicity predictions used mortality as the endpoint. Reported 96-hr LC_{50} values (i.e., the concentration killing 50% of the test organisms) for rainbow trout are 2780 ppb for 1,3-D and 11 ppb for chloropicrin. For both chemicals, a standard probit slope of 4.5 was used to describe the concentration-response relationship. Reported 48-hr LC_{50} values for Daphnia are 6200 ppb for 1,3-D and 120 ppb for chloropicrin, and a standard probit slope of 4.5 was also used. Using calculated EECs, standard slope, and reported LC_{50} values, the %mortality resulting from each ingredient of the formulated product was calculated using the following equation (in Microsoft Excel):

$$\%\ mortality\ single\ chemical = NORMDIST((slope * (log(EEC)-log(LC_{50})))$$

Since 1,3-D and chloropicrin elicit toxicity in exposed animals via different mechanisms of toxicity, cumulative toxicity was calculated using response-addition. Calculations of response-addition of chemicals A and B (i.e., TOXmix), or the sum of the toxic response, were done using the following equation:

$$TOXmix = 100 * ((mortality\ A + mortality\ B) - (mortality\ A * mortality\ B))$$

Where mortality is a function of taxa-specific 48-hr or 96-hr LC_{50} values, product-specific EECs, and the standard probit slope of 4.5 for mortality.

Formulated products are predicted to show no mortality in Daphnia, and those calculations are not shown here. In fish, the resulting toxicity (Cumulative Mortality %) of formulated products is driven solely by chloropicrin. Predicted toxicities of all formulated products are shown here for registered uses on vegetable crops (Table 6), field crops (Table 7), fruit and nut crops (Table 8), nursery crops (Table 9), and mint (Table 10).

Table 6. Predicted cumulative toxicity (% mortality) in fish from formulated products registered for use on vegetable crops.

Formulated Product	Active Ingredient	LC50 (ppb)	Slope	EEC (ppb)	Mortality (%)	Cumulative Mortality (%)
Telone C-35	1,3-D	2780	4.5	5.84	0.0%	0.8%
	chloropicrin	11	4.5	3.20	0.8%	
In-Line	1,3-D	2780	4.5	4.79	0.0%	0.3%

	chloropicrin	11	4.5	2.63	0.3%	
Pic-Clor 15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Pic-Clor 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Pic-Clor 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Pic-Clor 60	1,3-D	2780	4.5	5.22	0.0%	26.7&
	chloropicrin	11	4.5	8.00	26.7%	
Pic-Clor 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Telone C-15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Tri-form 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Tri-form 35	1,3-D	2780	4.5	10.14	0.0%	9.2%
	chloropicrin	11	4.5	5.57	9.2%	
Tri-form 40	1,3-D	2780	4.5	11.83	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Tri-form 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Tri-form 70 EC	1,3-D	2780	4.5	2.16	0.0%	6.8%
	chloropicrin	11	4.5	5.14	6.83%	
Tri-form 80 EC	1,3-D	2780	4.5	1.24	0.0%	6.8%
	chloropicrin	11	4.5	5.13	6.79%	
Tri-form 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Tri-form 70	1,3-D	2780	4.5	3.38	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 80	1,3-D	2780	4.5	1.94	0.0%	26.7%

	chloropicrin	11	4.5	8.00	26.7%	

Table 7. Predicted cumulative toxicity (% mortality) in fish from formulated products registered for use on field crops.

Formulated Product	Active Ingredient	LC50 (ppb)	Slope	EEC (ppb)	Mortality (%)	Cumulative Mortality (%)
Telone C-35	1,3-D	2780	4.5	4.22	0.0%	0.1%
	chloropicrin	11	4.5	2.31	0.1%	
In-Line	1,3-D	2780	4.5	4.79	0.0%	0.3%
	chloropicrin	11	4.5	2.63	0.3%	
Pic-Clor 15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Pic-Clor 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Pic-Clor 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Pic-Clor 60	1,3-D	2780	4.5	5.22	0.0%	26.7&
	chloropicrin	11	4.5	8.00	26.7%	
Pic-Clor 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Telone C-15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Tri-form 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Tri-form 35	1,3-D	2780	4.5	10.14	0.0%	9.2%
	chloropicrin	11	4.5	5.57	9.2%	
Tri-form 40	1,3-D	2780	4.5	11.83	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Tri-form 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	

Tri-form 70 EC	1,3-D	2780	4.5	2.16	0.0%	6.8%
	chloropicrin	11	4.5	5.14	6.83%	
Tri-form 80 EC	1,3-D	2780	4.5	1.24	0.0%	6.8%
	chloropicrin	11	4.5	5.13	6.79%	
Tri-form 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Tri-form 70	1,3-D	2780	4.5	3.38	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 80	1,3-D	2780	4.5	1.94	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	

Table 8. Predicted cumulative toxicity (% mortality) in fish from formulated products registered for use on fruit and nut crops.

Formulated Product	Active Ingredient	LC50 (ppb)	Slope	EEC (ppb)	Mortality (%)	Cumulative Mortality (%)
Telone C-35	1,3-D	2780	4.5	8.11	0.0%	3.8%
	chloropicrin	11	4.5	4.44	3.8%	
In-Line	1,3-D	2780	4.5	13.07	0.0%	20.1%
	chloropicrin	11	4.5	7.16	20.1%	
Pic-Clor 15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Pic-Clor 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Pic-Clor 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Pic-Clor 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Pic-Clor 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Telone C-15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Tri-form 30	1,3-D	2780	4.5	11.43	0.0%	6.3%

	chloropicrin	11	4.5	5.03	6.3%	
Tri-form 35	1,3-D	2780	4.5	10.14	0.0%	9.2%
	chloropicrin	11	4.5	5.57	9.2%	
Tri-form 40	1,3-D	2780	4.5	11.83	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Tri-form 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Tri-form 70 EC	1,3-D	2780	4.5	2.16	0.0%	6.8%
	chloropicrin	11	4.5	5.14	6.83%	
Tri-form 80 EC	1,3-D	2780	4.5	1.24	0.0%	6.8%
	chloropicrin	11	4.5	5.13	6.79%	
Tri-form 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Tri-form 70	1,3-D	2780	4.5	3.38	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 80	1,3-D	2780	4.5	1.94	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	

Table 9. Predicted cumulative toxicity (% mortality) in fish from formulated products registered for use on nursery crops.

Formulated Product	Active Ingredient	LC50 (ppb)	Slope	EEC (ppb)	Mortality (%)	Cumulative Mortality (%)
Telone C-35	1,3-D	2780	4.5	12.82	0.0%	19.0%
	chloropicrin	11	4.5	7.02	19.0%	
In-Line	1,3-D	2780	4.5	13.07	0.0%	20.1%
	chloropicrin	11	4.5	7.16	20.1%	
Pic-Clor 15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Pic-Clor 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	

Pic-Clor 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Pic-Clor 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Pic-Clor 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Telone C-15	1,3-D	2780	4.5	13.26	0.0%	0.2%
	chloropicrin	11	4.5	2.44	0.2%	
Tri-form 30	1,3-D	2780	4.5	11.43	0.0%	6.3%
	chloropicrin	11	4.5	5.03	6.3%	
Tri-form 35	1,3-D	2780	4.5	10.14	0.0%	9.2%
	chloropicrin	11	4.5	5.57	9.2%	
Tri-form 40	1,3-D	2780	4.5	11.83	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 40 EC	1,3-D	2780	4.5	7.54	0.0%	6.9%
	chloropicrin	11	4.5	5.15	6.89%	
Tri-form 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Tri-form 70 EC	1,3-D	2780	4.5	2.16	0.0%	6.8%
	chloropicrin	11	4.5	5.14	6.83%	
Tri-form 80 EC	1,3-D	2780	4.5	1.24	0.0%	6.8%
	chloropicrin	11	4.5	5.13	6.79%	
Tri-form 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Tri-form 70	1,3-D	2780	4.5	3.38	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 80	1,3-D	2780	4.5	1.94	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	

Table 10. Predicted cumulative toxicity (% mortality) in fish from formulated products registered for used on mint.

Formulated Product	Active Ingredient	LC50 (ppb)	Slope	EEC (ppb)	Mortality (%)	Cumulative Mortality (%)
Telone C-35	1,3-D	2780	4.5	5.35	0.0%	0.5%
	chloropicrin	11	4.5	2.93	0.5%	
In-Line	1,3-D	2780	4.5	N/A	N/A	N/A
	chloropicrin	11	4.5	N/A	N/A	
Pic-Clor 15	1,3-D	2780	4.5	5.27	0.0%	0.0%
	chloropicrin	11	4.5	0.97	0.0%	
Pic-Clor 30	1,3-D	2780	4.5	5.23	0.0%	0.1%
	chloropicrin	11	4.5	2.30	0.1%	
Pic-Clor 40 EC	1,3-D	2780	4.5	N/A	N/A	N/A
	chloropicrin	11	4.5	N/A	N/A	
Pic-Clor 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Pic-Clor 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Telone C-15	1,3-D	2780	4.5	5.27	0.0%	0.0%
	chloropicrin	11	4.5	0.97	0.0%	
Tri-form 30	1,3-D	2780	4.5	5.23	0.0%	0.1%
	chloropicrin	11	4.5	2.30	0.1%	
Tri-form 35	1,3-D	2780	4.5	5.35	0.0%	0.5%
	chloropicrin	11	4.5	2.94	0.5%	
Tri-form 40	1,3-D	2780	4.5	5.36	0.0%	1.5%
	chloropicrin	11	4.5	3.60	1.5%	
Tri-form 40 EC	1,3-D	2780	4.5	N/A	N/A	N/A
	chloropicrin	11	4.5	N/A	N/A	
Tri-form 60 EC	1,3-D	2780	4.5	3.28	0.0%	5.8%
	chloropicrin	11	4.5	4.91	5.76%	
Tri-form 70 EC	1,3-D	2780	4.5	2.16	0.0%	6.8%
	chloropicrin	11	4.5	5.14	6.83%	
Tri-form 80 EC	1,3-D	2780	4.5	1.24	0.0%	6.8%
	chloropicrin	11	4.5	5.13	6.79%	

Tri-form 60	1,3-D	2780	4.5	5.22	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	
Tri-form 70	1,3-D	2780	4.5	3.38	0.0%	26.3%
	chloropicrin	11	4.5	7.95	26.3%	
Tri-form 80	1,3-D	2780	4.5	1.94	0.0%	26.7%
	chloropicrin	11	4.5	8.00	26.7%	

N/A indicates that no use rates were specified on product labels, so formulated product toxicity was not calculated.

C. APPENDIX: EEC CONVERSION FACTORS FOR 1,3-D AND CHLOROPICRIN

As described in Chapter 11, for estimating exposure concentrations following 1,3-D and chloropicrin NMFS relied on measures of direct runoff from field (considered to be a 1-day bin 0) reported in a field study (Heim, 2002). NMFS recognizes that exposures in aquatic habitats (e.g. bin 2) will be reduced due to factors such as dilution in the water body, degradation processes such as hydrolysis, and time (e.g. a 4-day time-weighted average in bin 2 will be less than the 1-day bin 0 EEC). To estimate reduction factors that could be applied to the initial 1-d bin 0 EEC described in Chapter 11 to estimate other EECs NMFS did use the PWC. A small set of PWC runs were done specifically to compare the 1-d bin 0 EECs to other EECs from the same application. The PWC batch file is provided in Appendix E (*1. 13D batch input file_DRAFT.csv*). PWC inputs were based on EPA's draft risk assessment for 1,3-D (2019) and information in Attachment A. The bin 0 estimates were based on the *.zts files. The Bin 2 and Bin 7 EECs are based on PWC runs using the appropriate water body parameters as PWC inputs. Additional information on the post-processing of the PWC outputs can be found in Chapter 11 and Appendix D. Summaries of the outputs are provided in Appendix E (*13D_withVol_eec.csv* and *13D_withVol_eec.csv_aggregated.csv*). The median annual peak EECs from the batch of PWC runs for different aquatic bins and time-weighted-averages are shown in Table 1.

Table 1. Median annual peak EEC over 30 years for each time-weighted average from 1,3-D PWC runs

			Median Annual Peak EEC (ppb)								
			Bin 0			Bin 2			Bin 7		
HUC2	**Use**	**Crop**	**1-day**	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**
17a	Corn	FieldCrops	231.8	67.6	14.8	96.6	33.4	7.6	13.1	9.6	4.3
17b	Corn	FieldCrops	275.5	77.8	16.7	92.2	27.7	7.3	11.8	9.3	4.0
18a	Corn	FieldCrops	124.9	31.2	6.6	34.8	11.4	2.5	1.4	1.1	0.5
18b	Corn	FieldCrops	84.4	23.2	4.4	27.5	9.6	1.8	1.1	0.8	0.4
18a	Cotton	FieldCrops	161.7	47.1	11.2	87.7	33.5	6.9	5.4	4.6	2.0
18b	Cotton	FieldCrops	158.6	40.3	7.9	50.8	14.9	3.3	4.2	3.2	1.2

17a	Other Grains	FieldCrops	105.0	31.8	7.9	45.7	13.4	3.2	4.0	3.4	1.7
17b	Other Grains	FieldCrops	55.6	13.9	2.9	19.1	6.9	1.7	0.8	0.7	0.3
18a	Other Grains	FieldCrops	151.2	48.5	21.1	93.5	36.9	12.8	12.2	12.6	5.1
18b	Other Grains	FieldCrops	219.4	75.4	20.4	83.6	33.0	8.4	7.9	6.7	2.7
17a	Pasture	FieldCrops	105.0	31.8	7.9	45.7	13.4	3.2	4.0	3.4	1.7
17b	Pasture	FieldCrops	55.6	13.9	2.9	19.1	6.9	1.7	0.8	0.7	0.3
18a	Pasture	FieldCrops	121.6	36.9	8.6	64.8	19.2	4.4	4.2	3.5	1.9
18b	Pasture	FieldCrops	158.6	41.6	10.6	59.5	16.1	3.9	4.6	3.9	1.7
17a	Soybeans	FieldCrops	231.8	67.6	14.8	96.6	33.4	7.6	13.1	9.6	4.3
17b	Soybeans	FieldCrops	275.5	77.8	16.7	92.2	27.7	7.3	11.8	9.3	4.0
18a	Soybeans	FieldCrops	124.9	31.2	6.6	34.8	11.4	2.5	1.4	1.1	0.5
18b	Soybeans	FieldCrops	84.4	23.2	4.4	27.5	9.6	1.8	1.1	0.8	0.4
17a	Wheat	FieldCrops	105.0	31.8	7.9	45.7	13.4	3.2	4.0	3.4	1.7
17b	Wheat	FieldCrops	55.6	13.9	2.9	19.1	6.9	1.7	0.8	0.7	0.3
18a	Wheat	FieldCrops	151.2	48.5	21.1	93.5	36.9	12.8	12.2	12.6	5.1
18b	Wheat	FieldCrops	219.4	75.4	20.4	83.6	33.0	8.4	7.9	6.7	2.7
17a	Orchards and Vineyards	FruitNut	211.5	63.9	13.3	128.9	38.6	8.1	11.4	9.1	4.5
17b	Orchards and Vineyards	FruitNut	311.1	82.3	16.7	105.9	34.5	7.8	4.9	3.8	1.3
18a	Orchards and Vineyards	FruitNut	153.5	45.2	9.2	66.6	24.3	4.8	3.3	3.0	1.6
18b	Orchards and Vineyards	FruitNut	97.0	24.2	6.1	24.3	6.1	2.2	1.3	1.0	0.4
17a	Vegetables and Ground Fruit	MintVeg	411.1	122.0	28.7	190.9	72.8	16.4	30.7	24.3	12.0
17b	Vegetables and Ground Fruit	MintVeg	495.5	166.8	38.4	201.4	65.0	15.5	24.7	21.6	9.4
18a	Vegetables and Ground Fruit	MintVeg	282.4	89.2	19.2	153.8	53.4	11.4	7.8	6.6	3.6

18b	Vegetables and Ground Fruit	MintVeg	300.1	85.6	19.4	82.1	26.1	5.5	5.3	4.3	1.8
17a	Other Crops	Nursery	319.1	96.6	23.9	139.0	40.8	9.7	12.0	10.2	5.3
17b	Other Crops	Nursery	169.1	42.3	8.8	58.0	20.9	5.2	2.4	2.0	0.8
18a	Other Crops	Nursery	369.7	112.3	26.2	197.0	58.3	13.5	12.7	10.5	5.7
18b	Other Crops	Nursery	482.2	126.3	32.2	180.9	48.9	11.9	14.0	12.0	5.2
17a	Vegetables and Ground Fruit	PotatoID	781.7	293.9	71.8	397.7	137.8	36.6	83.8	66.3	34.5
17b	Vegetables and Ground Fruit	PotatoID	865.8	302.7	67.6	444.1	149.5	51.0	48.5	39.7	21.9
17a	Corn	UnspecifiedID	438.8	136.2	32.0	214.1	74.3	17.5	30.8	25.7	11.9
17b	Corn	UnspecifiedID	487.3	144.6	37.7	185.6	59.1	15.2	24.3	18.9	8.4
17a	Orchards and Vineyards	UnspecifiedID	191.8	58.8	15.1	117.1	45.9	10.9	16.2	14.1	6.6
17b	Orchards and Vineyards	UnspecifiedID	297.7	81.1	17.0	111.9	36.9	8.7	5.3	4.1	1.7
17a	Other Crops	UnspecifiedID	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Other Crops	UnspecifiedID	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8
17a	Other Grains	UnspecifiedID	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Other Grains	UnspecifiedID	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8
17a	Other RowCrops	UnspecifiedID	195.1	60.2	13.5	94.9	36.6	9.2	11.0	9.4	4.4
17b	Other RowCrops	UnspecifiedID	166.4	41.6	10.0	62.2	18.3	5.2	3.6	2.9	1.1
17a	Pasture	UnspecifiedID	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Pasture	UnspecifiedID	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8
17a	Soybeans	UnspecifiedID	438.8	136.2	32.0	214.1	74.3	17.5	30.8	25.7	11.9
17b	Soybeans	UnspecifiedID	487.3	144.6	37.7	185.6	59.1	15.2	24.3	18.9	8.4
17a	Vegetables and Ground Fruit	UnspecifiedID	481.9	184.0	46.7	268.1	93.0	21.2	42.7	36.1	16.7

17b	Vegetables and Ground Fruit	UnspecifiedID	688.3	207.1	51.8	258.5	83.3	20.1	29.3	24.4	10.5
17a	Corn	UnspecifiedOR	603.3	198.0	45.6	322.0	108.2	24.6	40.5	34.4	16.7
17b	Corn	UnspecifiedOR	665.9	208.0	52.2	253.4	86.1	21.1	33.2	25.8	11.4
17a	Orchards and Vineyards	UnspecifiedOR	287.1	90.8	21.5	183.4	65.9	15.8	24.9	21.3	9.6
17b	Orchards and Vineyards	UnspecifiedOR	396.4	104.8	23.2	152.6	55.3	12.8	7.2	5.7	2.4
17a	Other Crops	UnspecifiedOR	283.6	91.7	22.5	153.6	43.6	9.9	20.3	17.1	7.0
17b	Other Crops	UnspecifiedOR	200.2	50.1	10.6	70.1	20.0	5.0	2.8	2.3	1.1
17a	Other Grains	UnspecifiedOR	283.6	91.7	22.5	153.6	43.6	9.9	20.3	17.1	7.0
17b	Other Grains	UnspecifiedOR	200.2	50.1	10.6	70.1	20.0	5.0	2.8	2.3	1.1
17a	Other RowCrops	UnspecifiedOR	307.4	89.5	19.2	130.2	54.2	13.9	15.8	13.6	6.3
17b	Other RowCrops	UnspecifiedOR	227.9	57.0	13.7	85.0	24.2	7.1	5.0	3.9	1.5
17a	Pasture	UnspecifiedOR	283.6	91.7	22.5	153.6	43.6	9.9	20.3	17.1	7.0
17b	Pasture	UnspecifiedOR	200.2	50.1	10.6	70.1	20.0	5.0	2.8	2.3	1.1
17a	Soybeans	UnspecifiedOR	603.3	198.0	45.6	322.0	108.2	24.6	40.5	34.4	16.7
17b	Soybeans	UnspecifiedOR	665.9	208.0	52.2	253.4	86.1	21.1	33.2	25.8	11.4
17a	Vegetables and Ground Fruit	UnspecifiedOR	661.6	255.4	68.3	365.9	127.0	30.1	58.7	49.6	22.8
17b	Vegetables and Ground Fruit	UnspecifiedOR	943.5	286.6	71.4	359.1	109.8	27.5	40.1	33.4	14.0
17a	Corn	UnspecifiedWA	438.8	136.2	32.0	214.1	74.3	17.5	30.8	25.7	11.9
17b	Corn	UnspecifiedWA	487.3	144.6	37.7	185.6	59.1	15.2	24.3	18.9	8.4
17a	Orchards and Vineyards	UnspecifiedWA	191.8	58.8	15.1	117.1	45.9	10.9	16.2	14.1	6.6
17b	Orchards and Vineyards	UnspecifiedWA	297.7	81.1	17.0	111.9	36.9	8.7	5.3	4.1	1.7
17a	Other Crops	UnspecifiedWA	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Other Crops	UnspecifiedWA	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8

17a	Other Grains	UnspecifiedWA	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Other Grains	UnspecifiedWA	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8
17a	Other RowCrops	UnspecifiedWA	195.1	60.2	13.5	94.9	36.6	9.2	11.0	9.4	4.4
17b	Other RowCrops	UnspecifiedWA	166.4	41.6	10.0	62.2	18.3	5.2	3.6	2.9	1.1
17a	Pasture	UnspecifiedWA	202.7	64.3	16.2	112.0	30.2	6.9	15.0	12.7	5.2
17b	Pasture	UnspecifiedWA	141.6	35.4	7.2	49.6	14.6	3.7	2.1	1.6	0.8
17a	Soybeans	UnspecifiedWA	438.8	136.2	32.0	214.1	74.3	17.5	30.8	25.7	11.9
17b	Soybeans	UnspecifiedWA	487.3	144.6	37.7	185.6	59.1	15.2	24.3	18.9	8.4
17a	Vegetables and Ground Fruit	UnspecifiedWA	481.9	184.0	46.7	268.1	93.0	21.2	42.7	36.1	16.7
17b	Vegetables and Ground Fruit	UnspecifiedWA	688.3	207.1	51.8	258.5	83.3	20.1	29.3	24.4	10.5
17a	Vegetables and Ground Fruit	VegVeg	355.5	105.5	24.8	165.1	63.0	14.1	26.6	21.0	10.4
17b	Vegetables and Ground Fruit	VegVeg	428.6	144.3	33.2	174.2	56.2	13.4	21.4	18.7	8.1
18a	Vegetables and Ground Fruit	VegVeg	244.3	77.2	16.6	133.1	46.2	9.8	6.8	5.7	3.1
18b	Vegetables and Ground Fruit	VegVeg	259.6	74.0	16.8	71.0	22.6	4.8	4.6	3.8	1.5

As explained in Chapter 11, NMFS determined that is not appropriate to rely on the absolute values of PWC EECs to assess exposures. Rather, these values were used to derive reduction factors to account for decreases in exposures that would occur due to processes reasonably captured by the PWC (e.g. dilution and degradation of the pesticide after entering aquatic habitats). These factors were calculated for each PWC run by dividing the EECs by the 1-day bin 0 EEC. The resulting reduction factors are shown in Table 2.

Table 2. PWC EECs relative to the 1-day bin 0 EEC for each run.

			EEC relative to the 1-day bin 0 EEC (direct runoff)								
			Bin 0			Bin 2			Bin 7		
HUC2	**Use**	**Crop**	**1-day**	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**
17a	Corn	FieldCrops	1	0.292	0.064	0.417	0.144	0.033	0.056	0.042	0.019
17b	Corn	FieldCrops	1	0.282	0.061	0.335	0.100	0.026	0.043	0.034	0.015
18a	Corn	FieldCrops	1	0.250	0.053	0.279	0.091	0.020	0.011	0.009	0.004
18b	Corn	FieldCrops	1	0.275	0.052	0.325	0.114	0.022	0.013	0.010	0.004
18a	Cotton	FieldCrops	1	0.291	0.070	0.542	0.207	0.042	0.033	0.028	0.013
18b	Cotton	FieldCrops	1	0.254	0.050	0.320	0.094	0.021	0.026	0.020	0.007
17a	Other Grains	FieldCrops	1	0.303	0.075	0.436	0.128	0.030	0.038	0.032	0.016
17b	Other Grains	FieldCrops	1	0.250	0.052	0.343	0.124	0.031	0.014	0.012	0.005
18a	Other Grains	FieldCrops	1	0.321	0.140	0.618	0.244	0.085	0.080	0.083	0.034
18b	Other Grains	FieldCrops	1	0.344	0.093	0.381	0.151	0.038	0.036	0.031	0.012
17a	Pasture	FieldCrops	1	0.303	0.075	0.436	0.128	0.030	0.038	0.032	0.016
17b	Pasture	FieldCrops	1	0.250	0.052	0.343	0.124	0.031	0.014	0.012	0.005
18a	Pasture	FieldCrops	1	0.304	0.071	0.533	0.158	0.037	0.034	0.028	0.016
18b	Pasture	FieldCrops	1	0.262	0.067	0.375	0.101	0.025	0.029	0.025	0.011
17a	Soybeans	FieldCrops	1	0.292	0.064	0.417	0.144	0.033	0.056	0.042	0.019
17b	Soybeans	FieldCrops	1	0.282	0.061	0.335	0.100	0.026	0.043	0.034	0.015
18a	Soybeans	FieldCrops	1	0.250	0.053	0.279	0.091	0.020	0.011	0.009	0.004
18b	Soybeans	FieldCrops	1	0.275	0.052	0.325	0.114	0.022	0.013	0.010	0.004
17a	Wheat	FieldCrops	1	0.303	0.075	0.436	0.128	0.030	0.038	0.032	0.016
17b	Wheat	FieldCrops	1	0.250	0.052	0.343	0.124	0.031	0.014	0.012	0.005
18a	Wheat	FieldCrops	1	0.321	0.140	0.618	0.244	0.085	0.080	0.083	0.034

18b	Wheat	FieldCrops	1	0.344	0.093	0.381	0.151	0.038	0.036	0.031	0.012
17a	Orchards and Vineyards	FruitNut	1	0.302	0.063	0.610	0.182	0.038	0.054	0.043	0.021
17b	Orchards and Vineyards	FruitNut	1	0.265	0.054	0.340	0.111	0.025	0.016	0.012	0.004
18a	Orchards and Vineyards	FruitNut	1	0.294	0.060	0.434	0.158	0.031	0.021	0.019	0.010
18b	Orchards and Vineyards	FruitNut	1	0.250	0.063	0.250	0.063	0.023	0.013	0.010	0.004
17a	Vegetables and Ground Fruit	MintVeg	1	0.297	0.070	0.464	0.177	0.040	0.075	0.059	0.029
17b	Vegetables and Ground Fruit	MintVeg	1	0.337	0.077	0.406	0.131	0.031	0.050	0.044	0.019
18a	Vegetables and Ground Fruit	MintVeg	1	0.316	0.068	0.545	0.189	0.040	0.028	0.023	0.013
18b	Vegetables and Ground Fruit	MintVeg	1	0.285	0.065	0.274	0.087	0.018	0.018	0.014	0.006
17a	Other Crops	Nursery	1	0.303	0.075	0.436	0.128	0.030	0.038	0.032	0.016
17b	Other Crops	Nursery	1	0.250	0.052	0.343	0.124	0.031	0.014	0.012	0.005
18a	Other Crops	Nursery	1	0.304	0.071	0.533	0.158	0.037	0.034	0.028	0.016
18b	Other Crops	Nursery	1	0.262	0.067	0.375	0.101	0.025	0.029	0.025	0.011
17a	Vegetables and Ground Fruit	PotatoID	1	0.376	0.092	0.509	0.176	0.047	0.107	0.085	0.044
17b	Vegetables and Ground Fruit	PotatoID	1	0.350	0.078	0.513	0.173	0.059	0.056	0.046	0.025
17a	Corn	UnspecifiedID	1	0.310	0.073	0.488	0.169	0.040	0.070	0.059	0.027
17b	Corn	UnspecifiedID	1	0.297	0.077	0.381	0.121	0.031	0.050	0.039	0.017
17a	Orchards and Vineyards	UnspecifiedID	1	0.306	0.079	0.610	0.239	0.057	0.084	0.073	0.034
17b	Orchards and Vineyards	UnspecifiedID	1	0.272	0.057	0.376	0.124	0.029	0.018	0.014	0.006
17a	Other Crops	UnspecifiedID	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Other Crops	UnspecifiedID	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005

17a	Other Grains	UnspecifiedID	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Other Grains	UnspecifiedID	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005
17a	Other RowCrops	UnspecifiedID	1	0.309	0.069	0.486	0.188	0.047	0.056	0.048	0.022
17b	Other RowCrops	UnspecifiedID	1	0.250	0.060	0.374	0.110	0.031	0.022	0.017	0.007
17a	Pasture	UnspecifiedID	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Pasture	UnspecifiedID	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005
17a	Soybeans	UnspecifiedID	1	0.310	0.073	0.488	0.169	0.040	0.070	0.059	0.027
17b	Soybeans	UnspecifiedID	1	0.297	0.077	0.381	0.121	0.031	0.050	0.039	0.017
17a	Vegetables and Ground Fruit	UnspecifiedID	1	0.382	0.097	0.556	0.193	0.044	0.089	0.075	0.035
17b	Vegetables and Ground Fruit	UnspecifiedID	1	0.301	0.075	0.376	0.121	0.029	0.043	0.036	0.015
17a	Corn	UnspecifiedOR	1	0.328	0.076	0.534	0.179	0.041	0.067	0.057	0.028
17b	Corn	UnspecifiedOR	1	0.312	0.078	0.381	0.129	0.032	0.050	0.039	0.017
17a	Orchards and Vineyards	UnspecifiedOR	1	0.316	0.075	0.639	0.229	0.055	0.087	0.074	0.033
17b	Orchards and Vineyards	UnspecifiedOR	1	0.264	0.059	0.385	0.140	0.032	0.018	0.014	0.006
17a	Other Crops	UnspecifiedOR	1	0.323	0.079	0.542	0.154	0.035	0.071	0.060	0.025
17b	Other Crops	UnspecifiedOR	1	0.250	0.053	0.350	0.100	0.025	0.014	0.011	0.005
17a	Other Grains	UnspecifiedOR	1	0.323	0.079	0.542	0.154	0.035	0.071	0.060	0.025
17b	Other Grains	UnspecifiedOR	1	0.250	0.053	0.350	0.100	0.025	0.014	0.011	0.005
17a	Other RowCrops	UnspecifiedOR	1	0.291	0.062	0.423	0.176	0.045	0.052	0.044	0.021
17b	Other RowCrops	UnspecifiedOR	1	0.250	0.060	0.373	0.106	0.031	0.022	0.017	0.007
17a	Pasture	UnspecifiedOR	1	0.323	0.079	0.542	0.154	0.035	0.071	0.060	0.025
17b	Pasture	UnspecifiedOR	1	0.250	0.053	0.350	0.100	0.025	0.014	0.011	0.005
17a	Soybeans	UnspecifiedOR	1	0.328	0.076	0.534	0.179	0.041	0.067	0.057	0.028

17b	Soybeans	UnspecifiedOR	1	0.312	0.078	0.381	0.129	0.032	0.050	0.039	0.017
17a	Vegetables and Ground Fruit	UnspecifiedOR	1	0.386	0.103	0.553	0.192	0.045	0.089	0.075	0.034
17b	Vegetables and Ground Fruit	UnspecifiedOR	1	0.304	0.076	0.381	0.116	0.029	0.042	0.035	0.015
17a	Corn	UnspecifiedWA	1	0.310	0.073	0.488	0.169	0.040	0.070	0.059	0.027
17b	Corn	UnspecifiedWA	1	0.297	0.077	0.381	0.121	0.031	0.050	0.039	0.017
17a	Orchards and Vineyards	UnspecifiedWA	1	0.306	0.079	0.610	0.239	0.057	0.084	0.073	0.034
17b	Orchards and Vineyards	UnspecifiedWA	1	0.272	0.057	0.376	0.124	0.029	0.018	0.014	0.006
17a	Other Crops	UnspecifiedWA	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Other Crops	UnspecifiedWA	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005
17a	Other Grains	UnspecifiedWA	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Other Grains	UnspecifiedWA	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005
17a	Other RowCrops	UnspecifiedWA	1	0.309	0.069	0.486	0.188	0.047	0.056	0.048	0.022
17b	Other RowCrops	UnspecifiedWA	1	0.250	0.060	0.374	0.110	0.031	0.022	0.017	0.007
17a	Pasture	UnspecifiedWA	1	0.317	0.080	0.553	0.149	0.034	0.074	0.063	0.025
17b	Pasture	UnspecifiedWA	1	0.250	0.051	0.350	0.103	0.026	0.015	0.011	0.005
17a	Soybeans	UnspecifiedWA	1	0.310	0.073	0.488	0.169	0.040	0.070	0.059	0.027
17b	Soybeans	UnspecifiedWA	1	0.297	0.077	0.381	0.121	0.031	0.050	0.039	0.017
17a	Vegetables and Ground Fruit	UnspecifiedWA	1	0.382	0.097	0.556	0.193	0.044	0.089	0.075	0.035
17b	Vegetables and Ground Fruit	UnspecifiedWA	1	0.301	0.075	0.376	0.121	0.029	0.043	0.036	0.015
17a	Vegetables and Ground Fruit	VegVeg	1	0.297	0.070	0.464	0.177	0.040	0.075	0.059	0.029
17b	Vegetables and Ground Fruit	VegVeg	1	0.337	0.077	0.406	0.131	0.031	0.050	0.044	0.019

18a	Vegetables and Ground Fruit	VegVeg	1	0.316	0.068	0.545	0.189	0.040	0.028	0.023	0.013
18b	Vegetables and Ground Fruit	VegVeg	1	0.285	0.065	0.273	0.087	0.018	0.018	0.014	0.006

NMFS used these values to derive single conversion factors to apply to all applications of both 1,3-D and chloropicrin. NMFS recognizes that applying these conversion factors to data on runoff from a single field study for 1,3-D (Heim, 2002) to estimate EECs for both a.i.s across all uses and all aquatic habitats and time-weighted averaging periods introduces uncertainty. The resulting conversion factors for the bins and time-weighted-averages are shown in Table 3, found in Chapter 11, and used in the Risk Characterization (e.g. in the Risk Plots).

Table 3. Means of the relative EECs across all PWC runs.

	EEC relative to bin 0 1-day EEC (mean of all PWC runs)								
	Bin 0			**Bin 2**			**Bin 7**		
	1-day	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**	**1-day**	**4-day**	**21-day**
mean	1	0.296	0.070	0.435	0.142	0.035	0.044	0.037	0.017

D. Appendix: Risk-Plot Generation

To provide an aid in the Risk Characterization section, NMFS developed a plot (referred to as a 'Risk-plot' or 'R-plot') displaying the various sources of data (i.e. exposure, response, and use) available as part of the consultation (e.g. EPA's BEs and risk assessments and NMFS's analyses). The R-plots are generated using the R programming language:

R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

This Appendix consists of several sections with information on the R-plot process:

- **R-plot Process Overview:** An overview of the R-plot process
- **Example R-plot:** An example of an R-plot
- **Files:** A list of the files used by the R-plot process
- **Format of R-plot data file:** Description of the format of a R-plot data table

R-plot Process Overview
The following is a brief overview of the R-plot process. The overview assumes an understanding of the data and some knowledge of the R programming environment. The data displayed on the R-plots comes from several sources. A summary of the sources is detailed here:

1) Toxicity information for a species gathered from the available literature. For sublethal endpoints, such as growth, this is typically a range of LOECs or EC25s across the available studies. For endpoints such as mortality, this is can be a range of percent mortalities using an LC50 and slope chosen based on a species sensitivity distribution.
2) Data on the overlaps of species range and critical habitat (e.g. a list of HUC-12s) and the uses of the pesticide (e.g. the Vegetable and Ground Fruit UDL). This information is from GIS analyses provided to NMFS by EPA (EPA 2017a; 2017b; 2017c).
3) Exposure estimates generated using existing data for each crop and use category (e.g. lettuce crop within the Vegetable and Ground Fruit use category). See Chapter 11 for details of generating EECs for the a.i.s associated with this Biological Opinion. For example, the Pesticide Water Calculator (PWC) can be used to generate thirty years of EECs for each HUC-2 and aquatic bin. For the R-plot process the resulting EECs for each use can be summarized as the distribution of annual peak EECs (e.g. median and range).

The user collects all the data into a single table as either a csv file or an Excel worksheet. Additional information in the table specifies how the data is plotted and any additional annotations (see **Format of R-plot data file** below). The R code then uses the information in the table to into a single plot. An example of an R-plot is shown in **Example R-plot**. The plot consists of five parts.

1) The upper portion displays the toxicity information in terms of the effects concentrations (e.g. ppb). This consists of multiple rows of endpoints each with a set of labeled markers.

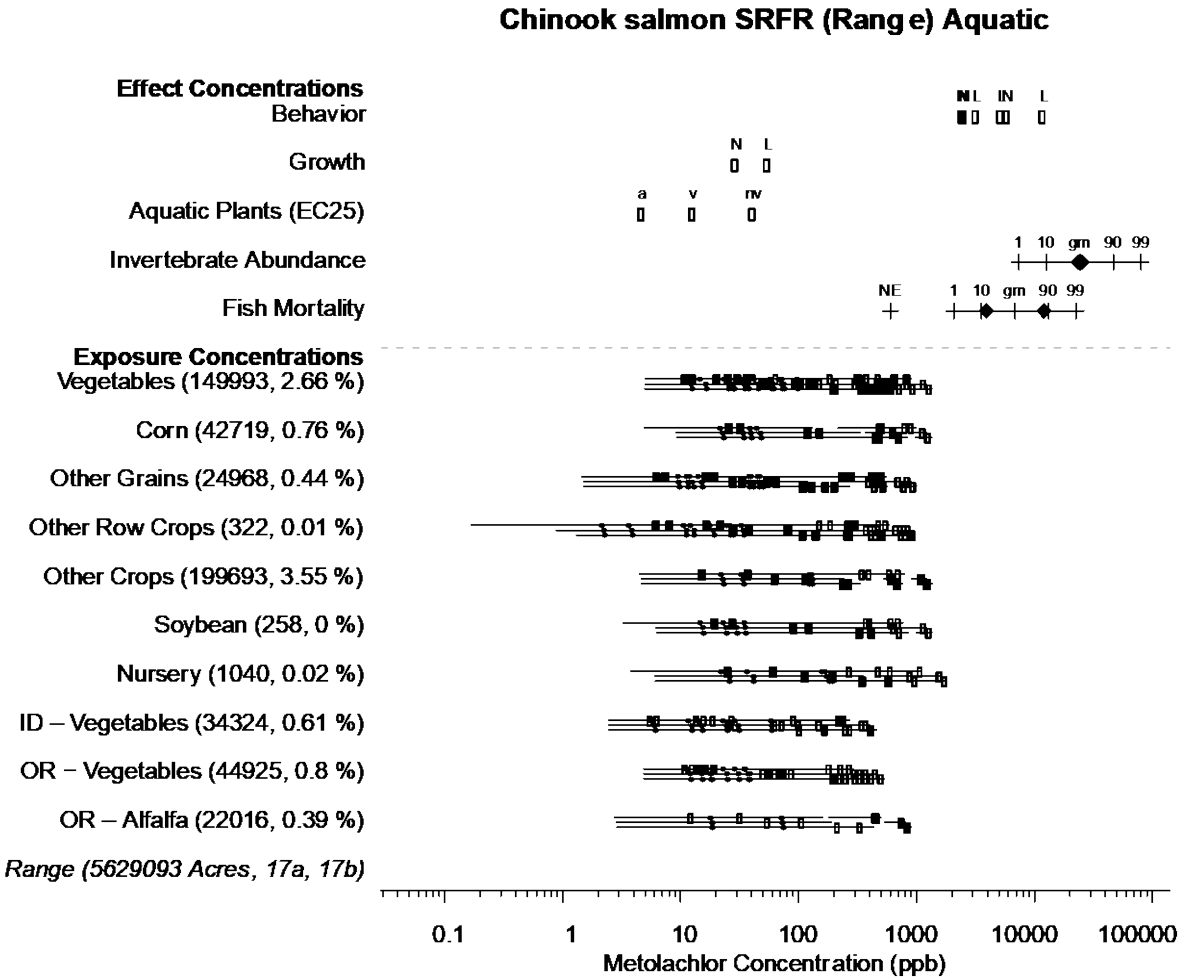
The meaning of each marker is up to the user (e.g. a LOEC, percent morality, etc.). The markers are positioned along the concentration axis below.

2) The center of the plot displays all the EEC data associated with the selected chemical and relevant scenarios that produce the potential exposure concentrations. Typically, for each crop (e.g. lettuce) of a use category (e.g. Corn) there will be a point for each averaging period and each aquatic bin (for aquatic R-plots) or exposure model and application method (for terrestrial R-plots). For aquatic EECs, each point represents the median peak annual EEC for several averaging periods (1-day, 4-day, and 21-day as different sub-rows in this example) and aquatic bins (bins 0, 2, and 7 as different symbols in this example) for a specific PWC scenario (a separate row in this example). For EECs based on the PWC, error bars around the point can indicate the 5% and 95%tile of the distribution of thirty years of data. The EEC data is positioned using the same concentration axis as the toxicity data to allow direct comparison of exposure and effects.
3) The left side of the plot (i.e. the left Y-axis labels) lists the use categories associated with the species range or habitat. The portion of the species range or habitat associated with each use category is denoted in the parentheses (the area of the use category within the range or habitat in acres and as a percent of the species total acres).

Generating an R-plot involves building a table with the desired information either as a csv file or the second worksheet in an Excel file. The table provides all the information needed to generate an R-plot using the R script *Rplotting2A.R*. NMFS used two additional R scripts (*ExtractYearlyPkEECsB.R* and *AggregateEECs.R*) to gather aquatic EEC data from the files generated by PWC batch runs (e.g. the *.zts and *.daily.csv files) into a single file that can form part of the R-plot data table. Some information on the table format is described below and examples are provided in Appendix E. An R-plot is generated by running *Rplotting2A.R* and specifying the desired table as the input.

Example R-plot

Example of an aquatic R-plot. This R-plot is the result of using *Chinook salmon SRFR (Range) Aquatic_Rdata.csv* as the data file input when running the *Rplotting2A.R* R Script.



Files

Annotated list of files associated with running the R-plot process. These files are provided as part of Appendix E. The first four are R Script files that need to be in the same directory. Additional files listed are supporting files and examples of data files that can serve as inputs for the R-plot process.

R Scripts

Rplotting2A.R	Main R code run generate an R-plot Uses a csv or Excel file as input Can generates a pdf as output
ExtractYearlyPkEECsB.R	R code run to collect data from a folder of PWC batch runs Creates a singe file with yearly peak EECs for all uses e.g. *Metolachlor_PWC_Runs_eec.csv*
AggregateEECs.R	R code used to summarize all years of EECs for each use Uses the output of *ExtractYearlyPkEECsB.R* Creates a single file with means and ranges of EECs e.g. *Metolachlor_PWC_Runs_eec.csv_aggregated.csv*
AqEECsFunctionsB.R	Utility functions needed by other R Scripts

Other files

useList.df	R dataframe with crosswalk of crops (PWC) and uses (UDL)
Chloropicrin_Rplot_112720.xlsx *Metolachlor_Rplot_010921.xlsx* *Telone_Rplot_010921.xlsx*	Excel data files used in the R-plot process Various Worksheets in the file gather information The second worksheet is the input for *Rplotting2A.R*
Chinook salmon SRFR (Range) Aquatic_Rdata.csv	Example of a csv file formatted for input to the R-plot process Used as input for *Rplotting2A.R*

Format of R-plot data file

The R-plot generated by *Rplotting2A.R* is based on information present in a file selected when the R code is run. The information is in a table that can be either a csv file or the second Worksheet in an Excel file. The table provides all the information used by the R script to generate the R-plot. Each row specifies an element in the figure. Rows can be added to the spreadsheet. Order of elements does not matter (i.e. *row* does not need to be in increasing order). Blank rows in the spreadsheet are allowed. For Excel files, values in a cell can be a formula (i.e. the result of a calculation and/or from another worksheet). The data needed in the table is described below. An example csv file (*Chinook salmon SRFR (Range) Aquatic_Rdata.csv)* is provided in Appendix E. Excel files used for the Biological Opinion are also included in Appendix E.

Cells in Bold or Italics need to remain the same.	
plot title	Text in the cell below specifies the plot title at the top.
plot axis	Text in the cell below specifies the X-axis title.
plot labels	The columns below specify the labels along the Y-axis. Rows can be added as desired.
label	Specifies the text to use to label the row in the figure
row	Specifies the row where the label should be located. Numbers start from the X-axis and work upwards.
font	Options include 1 for regular, 2 for bold, and 3 for italic.
plot data	The columns below specify all the components within the plot. Each row specifies one component.
row	Specifies the row where the component should be located. Numbers start from the X-axis and work upwards. Ignored for a vertical line.
type	The component type; p for a point, v for a vertical line, or h for a horizontal line.
conc	Specifies the concentration (initial X position) associated with the component.
end	Species the end of the component. For a horizontal line this is the end concentration. For a vertical line this can be the row where the line ends. Ignored for a point.
note	The text to use to annotate the component.
pch	The point style. R has many options; e.g. 21 is a filled circle and 22 is a filled square.
cex	The point size relative to the default (i.e. 1).
bg	The fill color for a point. Numerous colors can be specified by name (e.g. "blue").
col	The color for the line or point border.
lty	The line type; e.g. 1 for solid or 2 for dashed. R has additional options.
lwd	The line width.
comment	For user comments. Not part of the plot.

E. Appendix: Supplemental Files

1. **PWC Batch Files**: A folder with batch files used to generate data with the PWC.
   1.Metolachlor_batch_draft_FINAL.csv
   1.13D batch input file_DRAFT.csv

2. **EEC Files**: A folder with summaries of data generated using the PWC.
   Metolachlor_PWC_Runs_eec.csv
   13D_withVol_eec.csv

   Metolachlor_PWC_Runs_eec.csv_aggregated.csv
   13D_withVol_eec.csv_aggregated.csv

3. **R Plot Files**: A folder with files associated with generating R-Plots.
   R Code: Folder with R code files.
      AggregateEECs.R
      AqEECsFunctionsB.R
      ExtractYearlyPkEECsB.R
      Rplotting2A.R

   Excel Data Files: Folder with Excel files with data used in generating R-Plots.
      Chloropicrin_Rplot_112720.xlsx
      Metolachlor_Rplot_010921.xlsx
      Telone_Rplot_010921.xlsx

   Overlap Files: Folder with csv files with overlap data used in R-Plots.
      Range Overlaps.csv
      Habitat Overlaps.csv

   Chinook salmon SRFR (Range) Aquatic_Rdata.csv
   useList.df

4. **Chloropicrin Runoff.** Rational for use of the 1,3-D runoff study as a surrogate for chloropicrin runoff. Attachment A.

5. **Usage Reports.** Attachment B.