

PROGRAMMATIC FINAL ENVIRONMENTAL IMPACT STATEMENT

Expenditure of Funds to Increase Prey Availability for Southern Resident Killer Whales



October 2024



U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

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San Juan Islands, WA – Matthew Connolly

Southern Resident Killer Whale – NOAA Fisheries

Adult Chinook Salmon – Lance Kruzic

Alaska salmon troller Bay of Pillars in Chatham Strait – NOAA Fisheries



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region & Alaska Regional Office

September 25, 2024

Dear Recipient:

In accordance with provisions of the National Environmental Policy Act (NEPA), we announce the publication of the Final Programmatic Environmental Impact Statement (FPEIS) for the expenditure of funds to increase the prey availability for endangered Southern Resident Killer Whales (SRKWs).

The proposed action/preferred alternative for the National Marine Fisheries Service (NMFS) is to use federal funds for a hatchery salmon prey increase program for SRKWs to mitigate the effects of U.S. salmon fisheries managed under the 2019 Pacific Salmon Treaty Agreement. The funding would be distributed to hatchery operators to produce juvenile hatchery salmon that will mature into adult salmon for prey of SRKWs in marine waters.

The National Oceanic and Atmospheric Administration's (NOAA)'s Policy and Procedures for Compliance with the NEPA and Related Authorities, Companion Manual for NOAA Administrative Order 216-6A requires that NOAA prepare and publish a Record of Decision (ROD) that concludes the NEPA process for an EIS. NMFS intends to issue the ROD no sooner than 30 days after the publication of the FPEIS (40 C.F.R. §1506.10).

NMFS has made available the FPEIS electronically through the following website at <https://www.fisheries.noaa.gov/action/prey-increase-program-southern-resident-killer-whales>. The Record of Decision (ROD) will also be made available at this website.

Sincerely,

Jennifer Quan
Regional Administrator
West Coast Region

Regional Administrator
Alaska Region



Title of Environmental Review: Programmatic Final Environmental Impact Statement for the Expenditure of Funds to Increase Prey Availability for Southern Resident Killer Whales

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Location of Proposed Activities: Washington, Oregon, Idaho, Puget Sound, Columbia River

Abstract: NMFS evaluates a range of alternatives for the use of federal funding to increase the prey availability for Southern Resident Killer Whales (SRKWs), to mitigate reductions in prey resulting from regional declines in salmon abundances and fisheries managed under the Pacific Salmon Treaty. SRKWs are listed as endangered under the Endangered Species Act and the availability of prey (food) is currently one of several limiting factors inhibiting the recovery of this species. The proposed action/preferred alternative would be to use the funds for the production of hatchery salmon for release into the wild as prey (food) for SRKWs. Other alternative uses for the funding include: discontinuing the funding of the program (No Action), a habitat-based prey increase program to increase naturally produced salmon as prey, and use of the funds to compensate for a further fishery harvest reduction. The effects of these alternatives are evaluated on the specified resources. This EIS is responsive to a recent court order.

EXECUTIVE SUMMARY

Background

In 2005, the National Marine Fisheries Service (NMFS) listed the Southern Resident killer whale (SRKW) distinct population segment as endangered under the Endangered Species Act (ESA; 70 FR 69903, 11/18/05). The ESA recovery plan (NMFS 2008b) identifies the availability of prey, primarily Chinook salmon, as one of several limiting factors in the recovery of SRKW. Declines in the abundance of salmon, and other fish stocks, throughout the region (NMFS 2019) has resulted in fewer fish being available for SRKWs throughout their entire range. In addition to prey availability, other threats such as pollution and contaminants, and effects from vessels and sound are also affecting the recovery of SRKWs (NMFS 2008b). All of these threats are chronic, widespread issues facing SRKWs and difficult and complex to resolve in the short-term (NMFS 2021c).

In 2019, NMFS issued an ESA Biological Opinion (NMFS 2019) analyzing federal actions related to the southeast Alaska (SEAK) salmon fisheries, and a conservation funding program addressing SRKW and threatened Puget Sound Chinook impacted by the salmon fisheries subject to the Pacific Salmon Treaty (PST). The 2019 PST Agreement added to significant reductions associated with the 1999 PST Agreement and again in the 2009 Agreement to further reduce fishery impacts on ESA listed species. However, there was a practical limit to what could be achieved through the bilateral negotiation process. As a consequence, and in addition to the SEAK, Canadian, and southern United States fishery measures identified in the 2019 PST Agreement, the U.S. Section generally recognized that more would be required to mitigate (mitigate, in this instance and hereafter in this document, means to alleviate to the extent possible, but not fully offset) the effects of harvest and other limiting factors that contributed to the reduced status of Puget Sound Chinook salmon and SRKWs that could be addressed through a targeted funding initiative. The funding initiative established a new “prey increase program” for SRKWs to help mitigate the effects of salmon fisheries managed subject to the 2019 PST agreement. The goal of the prey increase program was to provide a meaningful increase in prey for SRKWs in the times and areas most beneficial to them (NMFS 2019).

In 2020, NMFS first received funding to implement this new prey increase program for SRKWs. Additional hatchery production began in 2020 using federal funds designated for the specific purpose of increasing prey availability for SRKWs in marine waters to mitigate fishery harvest effects. Specific criteria were used by NMFS to determine which hatchery programs received funding each year with available funding. NMFS has distributed funds for additional hatchery production according to the annual

spend plans it submits to Congress regarding PST implementation funds for fiscal years 2020 through 2023.

In 2020, the Wild Fish Conservancy, a 501(c)3 nonprofit organization, filed a lawsuit in the U.S. District Court for the Western District of Washington alleging that the issuance of the 2019 opinion (NMFS 2019) violated the ESA and the National Environmental Policy Act (NEPA). On August 8, 2022, the district court found that NMFS violated both the ESA and NEPA. With respect to the ESA, the court determined that NMFS improperly relied on uncertain mitigation (prey increase program) to reach its conclusion that the federal actions related to the SEAK fisheries were not likely to jeopardize ESA listed Chinook salmon and SRKW, and that NMFS failed to evaluate whether the increased hatchery production funded through the prey increase program would jeopardize the continued existence of ESA-listed Chinook salmon. With respect to NEPA, the court concluded NMFS failed to conduct necessary NEPA analysis for the issuance of the incidental take statement (ITS) that exempted the take associated with the SEAK salmon fisheries from liability under the ESA section 9, and for the prey increase program. The court subsequently issued an order on remedy, in which it partially vacated the incidental take statement for the winter and summer seasons of the southeast Alaska commercial troll fishery, and remanded the NMFS (2019) ESA Biological Opinion to NMFS to remedy the flaws it had identified. The Court did not vacate the portions of the NMFS (2019) Biological Opinion regarding the SRKW prey increase program or enjoin that program. The district court's order partially vacating the ITS was stayed by the United States Court of Appeals for the Ninth Circuit on June 21, 2023.

NMFS is conducting this programmatic review under NEPA of the federal funding used to increase prey availability for SRKWs. This Programmatic Environmental Impact Statement (PEIS) analysis addresses this court order. The purpose and need for the action associated with this federal funding, a suite of alternative uses of the funding, and the effects of these alternatives on the specified resources are summarized below.

An EIS for Issuance of an Incidental Take Statement Under the Endangered Species Act for Salmon Fisheries in Southeast Alaska Subject to the 2019 Pacific Salmon Treaty Agreement and Funding to the State of Alaska To Implement the 2019 Pacific Salmon Treaty Agreement was developed by NMFS Alaska Region and the draft EIS for that proposed action underwent public review and comment at the same time as this draft PEIS for the expenditure of funds to increase prey availability for Southern Resident Killer Whales (89 FR 5227). As described above, NMFS' biological opinion on and NEPA compliance for federal actions related to both the SEAK salmon fisheries and the prey increase program for SRKWs were the subject of recent court orders.

NMFS prepared these EISs (prey program and SEAK salmon fisheries) to respond to two specific components of the district court’s orders in the *Wild Fish Conservancy v. NMFS* litigation: (1) that NMFS must comply with NEPA should it issue on remand an ITS for the SEAK salmon fisheries and (2) that NMFS must comply with NEPA should it implement on remand the prey increase program for SRKWs. *See Wild Fish Conservancy v. Thom*, No. C20-417-RAJ-MLP, 2021 WL 8445587, at *16-18 (W.D. Wash. Sept. 27, 2021), *report and recommendation adopted*, No. 20-CV-417-RAJ, 2022 WL 3155784 (W.D. Wash. Aug. 8, 2022). NMFS’s preparation of the two EISs conforms with NEPA, the Council on Environmental Quality (CEQ) regulations, and case law.

Proposed Action

NMFS proposes to continue to distribute appropriated funds consistent with the PST spend plan to hatchery operators for the production of additional hatchery salmon for release into the wild specifically for the benefit of SRKWs, using criteria as follows:

- **Criteria 1:** Increased hatchery production should be for Chinook stocks that are a high priority for SRKW (NMFS and WDFW 2018; Ad-hoc SRKW Workgroup 2020).
- **Criteria 2:** Increased production should be focused on stocks that are a high priority for SRKW (NOAA and WDFW 2018), but funding should be distributed so that hatchery production is increased across an array of Chinook stocks from different geographic areas and run timings (i.e., a portfolio).
- **Criteria 3:** Increased production cannot jeopardize the survival and recovery of any Endangered Species Act (ESA)-listed species, including salmon and steelhead.
- **Criteria 4:** Because of funding and timing constraints, increased production proposals should not require major capital upgrades to hatchery facilities.
- **Criteria 5:** All proposals should have co-manager agreement (agreement among relevant tribal, state, and federal hatchery managers), as applicable.
- **Criteria 6:** All increased production must have been reviewed under the ESA and NEPA, as applicable, before NMFS funding can be used.

Purpose and Need

The purpose of the proposed action is to spend funds appropriated in connection with the implementation of the PST Agreement to increase prey (food) availability for SRKWs to help mitigate the effects of declining Chinook salmon abundances and PST fisheries. The action is needed because prey availability

is currently a factor limiting the recovery of SRKWs, and PST fisheries, while reduced from prior agreements, continue to remove Chinook salmon (harvest) that would otherwise potentially be available as prey (food) in times and areas important to SRKWs.

Congress has appropriated annual funding for activities related to implementation of the PST and NMFS. In consultation with the U.S. Pacific Salmon Commission Commissioners, spend plans have allocated a portion of PST funds to the prey increase program in 2020 through 2024.

Project Area and Analysis Area

The project area is the geographic area where the proposed action would take place. NMFS potentially distributes funds to operators of hatcheries in Washington, Oregon, and Idaho, where hatchery salmon can be produced. This geographic area represents the best opportunity to produce and release juvenile hatchery Chinook salmon (from freshwater areas) that will migrate to marine habitats and be available in the times and areas that benefit SRKWs as these hatchery salmon grow and mature before returning back to freshwater where they were born.

The analysis area varies depending upon the resource being assessed. For SRKWs, it includes the marine habitats where the whales are found. For salmon, it covers both freshwater and marine habitats where both hatchery and natural salmon occur throughout their entire lifecycle. The fisheries analysis focuses on the areas where the tribal, commercial, and recreational fisheries occur in marine waters because this is where the prey available for SRKWs is affected by fishing under consideration here. Additional ESA and NEPA analyses for federal actions related to SEAK salmon fisheries have been conducted separately to address the court order related to fishery impacts. Additional ESA and NEPA analyses for the other U.S. salmon fisheries subject to the PST agreement have already been completed separately. A detailed description of each resource's analysis area is provided in Chapter 3, Affected Environment. In Chapter 4, Environmental Consequences, the direct and indirect effects on various resources are evaluated within the project and analysis areas.

Alternatives Including the Proposed Action

Three alternatives were identified as meeting the purpose and need for the action, and we also evaluate a no action alternative. These alternatives analyze different actions that could be funded by NMFS in the future to increase prey availability for SRKWs. Given this is a PEIS to evaluate our expenditure of funds to increase prey availability, a range of future funding levels for each alternative was considered. That range includes recent levels of federal funding (approximately \$6.2 million annually), but we also

considered and evaluated the potential funding level that could implement actions to attain a 4-5% increase in prey for SRKWs in the times and areas most beneficial to them (the prey increase program goals; Dygert et al. 2018; NMFS 2019). These alternatives are:

Alternative 1 (No Action): No Funding for Prey Increase Program – This alternative would discontinue the expenditure of federal funds to increase the prey availability for SRKWs beginning in fiscal year 2024 and thereafter; after completion of this PEIS and ROD. Prey availability for SRKWs would not be increased in the future from the use of this federal funding.

Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program – A portion of the federal funds appropriated on an annual basis to NMFS for activities related to PST implementation would be distributed to hatchery operators throughout the region to produce additional hatchery salmon for release into the wild for SRKWs. This alternative would continue the prey increase program implemented by NMFS in recent years going forward into the future.

Alternative 3: Habitat-based Prey Increase Program – This alternative assumes a portion of the federal funds appropriated on an annual basis to NMFS for activities related to PST implementation will be used for habitat restoration, enhancement, and protection projects that increase the abundance of naturally-produced Chinook salmon in the wild across the region. Under this alternative, none of the funds would be spent to produce hatchery fish for the benefit of SRKWs.

Alternative 4: Reduced Fishing to Increase Prey – In this alternative we assume a portion of the federal funds appropriated on an annual basis to NMFS for activities related to PST implementation will be used to compensate for a reduction in fishery harvest of Chinook salmon in marine waters. This would increase prey availability for SRKWs by reducing the harvest of Chinook salmon in marine waters. Fishery closures in select areas and times were modeled to determine the effects on identified resources.

Affected Environment

The affected environment is the current state of activities and effects as it relates to the specified resources. The affected environment represents past and present actions throughout the region affecting each of the specified resources below. This represents the best estimate of the current environment to which to compare the effects of the alternatives considered in this PEIS.

Initial scoping identified five resources that are potentially affected by the four alternatives:

- Chinook Salmon and Their Habitats
- Southern Resident Killer Whales
- Other Fish and Wildlife Species
- Socioeconomics
- Environmental Justice

Current conditions include effects of the past and current operation of hatchery programs. This includes hatchery Chinook salmon produced specifically for SRKWs (federal and non-federal funded) and hatchery production that occurs for other purposes. Current conditions also include the current status of species affected, including Chinook salmon and SRKWs and their habitats, and marine fisheries occurring in U.S. waters that impact affected resources.

Environmental Consequences

This PEIS provides a programmatic-level analysis of environmental impacts associated with different uses of NMFS' funding to increase prey availability for SRKWs as described in the alternatives. Each of the specified resources is evaluated for each of the alternatives to provide the expected range of effects (positive and negative) to the natural and human environment. This analysis provides a broad, region wide assessment of NMFS' funding to increase prey availability for SRKWs; applying different funding directives and assessing the effects over the short-term (<5 years) and longer time periods (>5 years).

The relative magnitude and direction of impacts is described using the following terms:

- Undetectable: The impact would not be detectable and not significant.
- Negligible: The impact would be at the lower levels of detection and not significant.
- Low: The impact would be slight, but detectable and not significant.
- Medium: The impact would be readily apparent and considered significant.
- High: The impact would be severe or greatly beneficial and considered significant

Our analysis of the four alternatives evaluates a wide range of impacts associated with the identified resources for the alternatives, with a concluding statement on significance. Table S-1 below provides a summary of the predicted resource effects under each of the four alternatives. The summary reflects the detailed resource discussions in Chapter 4, Environmental Consequences.

Table S-1. Summary of environmental consequences of PST federal funding to increase prey availability for SRKWs for each alternative in this PEIS. Short-term refers to the next 5 years or less and long-term refers to greater than 5 years in the future. “Current funding” refers to the average recent funding NMFS has received for the prey increase program. “Program goals for SRKWs” refers to an approximately 4-5% increase in prey in the times and areas most beneficial for SRKWs (Dygert et al. 2018; NMFS 2019).

Resource	Alternative 1 (No Action): No Funding to Increase Prey for SRKW)	Alternative 2 (Proposed Action/ Preferred Alternative): Hatchery Prey Increase Program)	Alternative 3: Habitat-based Prey Increase Program	Alternative 4: Reduced Fishing to Increase Prey
Chinook Salmon and Their Habitat	Range of effects depending upon the natural population. Low adverse impacts to low benefits over the short term from no prey increase program.	Low to medium adverse impacts from additional hatchery production in existing hatchery facilities at current funding and at program goals for SRKWs (short and long terms).	Low benefits over the short-term from habitat restoration. Greater benefits to salmon and their habitats over the long-term, for all funding assumptions.	Medium benefits from reduced harvest of Chinook salmon in marine waters (short, long terms), at current funding and at program goals for SRKWs.

Resource	Alternative 1 (No Action): No Funding to Increase Prey for SRKW)	Alternative 2 (Proposed Action/ Preferred Alternative): Hatchery Prey Increase Program)	Alternative 3: Habitat-based Prey Increase Program	Alternative 4: Reduced Fishing to Increase Prey
Southern Resident Killer Whales	Medium adverse impact in the near term from reduced Chinook salmon prey availability associated with no federal funding of the prey increase program.	Medium benefits of increased prey at current funding. Medium to high benefits at program goals for SRKWs (short and long terms).	Low benefits over the short-term, with more over the long term from habitat restoration that increases Chinook salmon as prey in marine waters, for all funding assumptions.	Low (at current funding levels) to medium (at minimum of \$25 million/year) benefits from reductions in fishery harvest of Chinook salmon to increase prey for SRKWs
Other Fish and Wildlife Species	Low impact to low benefit depending upon the species over the short and long terms.	Low impact to low benefit depending upon the species over the short and long terms.	Low impact to low benefit depending upon the species over the long term.	Undetectable to low benefit depending upon the species.
Socio- economics	Negligible to low impacts over the short and long terms from no prey increase program funding.	Low to medium benefits over the short term from having production of additional hatchery salmon, at current funding and at program goals for SRKWs.	Negligible to low benefits from habitat restoration activities to increase natural production of Chinook salmon in freshwater, for all funding assumptions.	High negative impacts (immediate, short, and long terms) from reductions in fishery harvest of Chinook salmon, at current funding and at program goals for SRKWs. Some economic impacts would

Resource	Alternative 1 (No Action): No Funding to Increase Prey for SRKW)	Alternative 2 (Proposed Action/ Preferred Alternative): Hatchery Prey Increase Program)	Alternative 3: Habitat-based Prey Increase Program	Alternative 4: Reduced Fishing to Increase Prey
				be offset through compensation but this would not address impacts beyond fishery participants and would not address many social impacts.
Environmental Justice	Negligible to low impacts over the short and long terms from no prey increase program funding.	Negligible to low benefits over the short and long terms from additional hatchery production at current funding and at program goals for SRKWs.	Negligible to low benefits over the long term, for all funding assumptions.	High negative impacts (immediate, short, and long terms) from reductions in fishery harvest of Chinook salmon, at current funding and at program goals for SRKWs.

Summary of Changes Made in Response to Public Comments on the Draft EIS

Below is a summary of the changes made to the draft EIS. Editorial revisions were also made, and these are not listed below. We changed the term “offset” to “mitigate” where used in connection with southeast Alaska fisheries to better describe the purpose of the program, which is not to provide a 1:1 replacement of all fish removed by the fisheries. The location of text modification is denoted by chapter below.

Executive Summary:

1. Edits to clarify the description of “project area” and “analysis areas.”
2. Added new language related to southeast Alaska salmon fisheries EIS.
3. Edits to description of purpose and need to make consistent with description in Chapter 1, and to clarify.
4. Edited table to more closely align with the analysis of effects in the body of the EIS on Alternatives 2 and 4.

Chapter 1:

1. Edits to description of purpose and need for consistency with the Executive Summary and for clarity.
2. Updates to section 1.5 regarding public review of draft EIS, public comments received, tribal coordination, and other updates since draft EIS published in January, 2024. Minor editorial changes.
3. Provided additional explanation of the context for the southeast Alaska salmon fisheries EIS and the prey increase program EIS.
4. Clarifications in description of Alternative 2 to address public comments regarding the role of state-funded hatchery production to increase SRKW prey.

Chapter 2:

1. Additional language provided in Section 2.2 regarding ongoing monitoring of the prey increase program under Alternative 2.
2. Additional language provided in section 2.2.2 regarding National Pollutant Discharge Elimination System permits for hatchery operations.
3. One change to Table 1 (reduction of 500,000 fish for Wells hatchery release) based upon updated information provided by WDFW during public review.
4. Additional clarifying language provided in section 2.4 for Alternative 4 regarding the goals for the fishery harvest reduction scenario.

Chapter 3:

1. In section 3.2.2.2. corrections to WDFW’s hatchery salmon releases tables for years 2019-2022 based upon comments from WDFW during public review.
2. One correction made in Table 4 for Soos Creek hatchery release, based upon comments from

WDFW during public review.

3. In Section 3.3, we clarified the existing information regarding salmon predation by other predators including NRKW. We also included language regarding the current status of priority prey ESUs.
4. In Section 3.5.2, the description of SEAK fisheries was revised to include a description of all salmon fisheries; not just the troll fishery as in the draft.
5. In section 3.6, Environmental Justice, two additional data figures were included summarizing low income and people of color information for affected communities in Washington, Idaho, and Oregon. For southeast Alaska, some revisions were made to the text to better characterize the communities and effects of fisheries.
6. Minor editorial changes, including clarifications regarding “project area” and “analysis areas.”

Chapter 4:

1. Clarifications regarding “project area” and “analysis areas”. Minor editorial corrections.
2. In Section 4.2.2.3, eight populations in the upper Salmon River were included in Table 13. These populations were inadvertently missed in the original table. There are no changes to effects, as these additional populations do not have any prey program hatchery releases (i.e. “negligible”). Also corrected a number cited from Table 12 in the text (64% should have been 120% from table 12).
3. In Section 4.3.2 we clarified how ocean salmon abundance is expected to affect the estimated percent increases in prey. We also clarified the program goal of spatiotemporal overlap between increased Chinook abundance and SRKW.
4. In Sections 4.3.2 and 4.3.4 we clarified how salmon mortality is accounted for in the modeling, but observed that there is uncertainty with respect to how much SRKWs would consume under each scenario.

Chapter 5:

1. In Section 5.4.5, Environmental Justice, some text was revised to better characterize environmental justice concerns for affected communities and the importance of fisheries, especially for southeast Alaska communities.

Appendices:

1. Appendix H added. This is public comments submitted on draft EIS and NMFS’ summary and responses.

ACRONYMS AND ABBREVIATIONS

EIS	Environmental impact statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
HGMP	Hatchery and genetic management plan
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
PEIS	Programmatic Environmental Impact Statement
pHOS	Proportion of hatchery-origin spawners on spawning grounds
PST	Pacific Salmon Treaty
SEAK	Southeast Alaska
SRKWs	Southern Resident Killer Whales
WDFW	Washington Department of Fish and Wildlife

GLOSSARY OF KEY TERMS¹

Abundance: Generally, the number of fish in a defined area or unit. It is also one of four parameters used to describe the viability of natural-origin fish populations (McElhany et al. 2000).

Adipose fin: A small fleshy fin with no rays, located between the dorsal and caudal fins of salmon and steelhead. The adipose fin is often “clipped” on hatchery-origin fish so they can be differentiated from natural-origin fish.

Anadromous: A term used to describe fish that hatch and rear in fresh water, migrate to the ocean to grow and mature, and return to freshwater to spawn.

Analysis area: Within this Environmental Impact Statement (EIS), the analysis area is the geographic extent that is being evaluated for each resource. For some resources (e.g., socioeconomics and environmental justice), the analysis area is larger than the project area. See also **Project area**.

Commercial harvest: The activity of catching fish for commercial profit.

Conservation: Used generally in the EIS as the act or instance of conserving or keeping fish resources from change, loss, or injury, and leading to their protection and preservation. This contrasts with the definition under the United States Endangered Species Act (ESA), which refers to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary.

Distinct Population Segment (DPS): Under the ESA, the term “species” includes any subspecies of fish or wildlife or plants, and any “Distinct Population Segment” of any species or vertebrate fish or wildlife that interbreeds when mature. The ESA thus considers a DPS of vertebrates to be a “species.” The ESA does not however establish how distinctness should be determined. Under NMFS policy for Pacific salmon, a population or group of populations will be considered a DPS if it represents an Evolutionarily Significant Unit (ESU) of the biological species. In contrast to salmon, NMFS lists steelhead runs under the joint NMFS-U.S. Fish and Wildlife Service (USFWS) Policy for recognizing DPSs (DPS Policy: 61 Fed. Reg. 4722, February 7, 1996). This policy adopts criteria similar to those in the ESU policy, but applies to a broader range of animals to include all vertebrates.

Emigration: The downstream migration of salmon and steelhead toward the ocean.

Endangered: The term endangered species means any species that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act (ESA): A United States law that provides for the conservation of endangered and threatened species of fish, wildlife, and plants.

¹ This list of definitions is for informative purposes. To the extent terms are defined by statute or regulation, those definitions apply.

Environmental justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Escapement: Adult salmon and steelhead that survive fisheries and natural mortality, and return to spawn.

Estuary: The area where fresh water of a river meets and mixes with the salt water of the ocean.

Evolutionarily Significant Unit (ESU): A concept NMFS uses to identify Distinct Population Segments of Pacific salmon (but not steelhead) under the ESA. An ESU is a population or group of populations of Pacific salmon that 1) is substantially reproductively isolated from other populations, and 2) contributes substantially to the evolutionary legacy of the biological species. See also **Distinct Population Segment** (pertaining to steelhead).

Federal Register: The United States government's daily publication of Federal agency regulations and documents, including executive orders and documents that must be published per acts of Congress.

Fishery: Harvest by a specific gear type in a specific geographical area during a specific period of time.

Habitat: The physical, biological, and chemical characteristics of a specific unit of the environment occupied by a specific plant or animal; the place where an organism naturally lives.

Hatchery and genetic management plan (HGMP): Technical documents that describe the composition and operation of individual hatchery programs. Under Limit 5 of the 4(d) rule, NMFS uses information in HGMPs to evaluate impacts on salmon and steelhead listed under the ESA.

Hatchery facility: A facility (e.g., hatchery, rearing pond, net pen) that supports one or more hatchery programs.

Hatchery operator: A Federal agency, state agency, or Native American tribe that operates a hatchery program.

Hatchery-origin fish: A fish that originated from a hatchery facility.

Hatchery-origin spawner: A hatchery-origin fish that spawns naturally.

Hatchery program: A program that artificially propagates fish. Most hatchery programs for salmon and steelhead spawn adults in captivity, raise the resulting progeny for a few months or longer, and then release the fish into the natural environment where they will mature.

Limiting factor: A physical, chemical, or biological feature that impedes species and their independent populations from reaching a viable status.

Mitigate: to alleviate to the extent possible, but not fully offset.

National Environmental Policy Act (NEPA): A United States environmental law that is intended to ensure Federal agencies consider the environmental impacts of their actions to support informed decision-making and established the President's Council on Environmental Quality (CEQ).

National Marine Fisheries Service (NMFS): A United States agency within the National Oceanic and Atmospheric Administration and under the Department of Commerce charged with the stewardship of living marine resources through science-based conservation and management, and the promotion of healthy ecosystems.

Natural-origin: A term used to describe fish that are offspring of parents that spawned in the natural environment rather than the hatchery environment, unless specifically explained otherwise in the text. “Naturally spawning” and similar terms refer to fish spawning in the natural environment.

Pacific Salmon Commission: Body of members formed by the governments of Canada and the United States in 1985 to implement the Pacific Salmon Treaty.

Pacific Salmon Treaty: Treaty between the government of Canada and the government of the United States of America concerning Pacific Salmon.

Population: A group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group.

Preferred alternative: The alternative selected or developed from an evaluation of alternatives. Under NEPA, the preferred alternative is the alternative an agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors.

Programmatic Environmental Impact Statement (PEIS): An analysis document conducted under NEPA that assesses the environmental impacts of proposed policies, plans, programs, or projects for which subsequent actions will be implemented either based on the programmatic review, or based on subsequent NEPA reviews tiered to the programmatic review (e.g., a site- or project-specific document). In this case, the PEIS is evaluating a program where NMFS uses federal funds to increase the prey availability for SRKWs.

Project area: Geographic area where the Proposed Action will take place. See also **Proposed Action**.

Proportion of hatchery-origin spawners (pHOS): The proportion of naturally spawning salmon or steelhead that are hatchery-origin fish.

Proposed Action: For this PEIS, the proposed action is NMFS’ continued use of federal funding specified for the prey increase program to be used for the production of hatchery salmon specifically to increase the prey availability for SRKWs in marine waters.

Record of Decision (ROD): The formal NEPA decision document that is recorded for the public. It is announced in a Notice of Availability in the Federal Register.

Recovery: Defined in the ESA as the process by which the decline of an endangered or threatened species is stopped or reversed, or threats to its survival neutralized so that its long-term survival in the wild can be ensured, and it can be removed from the list of threatened and endangered species.

Recovery plan: Under the ESA, a formal plan from NMFS (for listed species) outlining the goals and objectives, management actions, likely costs, and estimated timeline to recover the listed species.

Recreational harvest: The activity of catching fish for non-commercial reasons (e.g., sport or recreation).

Run: The migration of salmon or steelhead from the ocean to fresh water to spawn. Defined by the season they return as adults to the mouths of their home rivers.

Scoping: In NEPA, an early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.9).

Smolts: Juvenile salmon and steelhead that have left their natal streams, are out-migrating downstream, and are physiologically adapting to live in salt water.

Stock: A group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place in a different season.

Straying (of hatchery-origin fish): A term used to describe when hatchery-origin fish return to and/or spawn in areas where they are not intended to return/spawn.

Threat: A human action or natural event that causes or contributes to limiting factors; threats may be caused by past, present, or future actions or events.

Threatened species: As defined by section 4 of the ESA, any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tributary: A stream or river that flows into a larger stream or river.

Watershed: An area of land where all of the water that is under it or drains off of it goes into the same place, e.g. Rogue River watershed or Umpqua River watershed.

Yearling: Juvenile salmon or steelhead that has reared at least one year in the hatchery.

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1. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1. Background

In 2005, NMFS listed the Southern Resident Killer Whale (SRKW) distinct population segment as endangered under the Endangered Species Act (ESA; 70 FR 69903; 11/18/05). The ESA recovery plan (NMFS 2008b) identifies the availability of prey, primarily Chinook salmon, as one of several limiting factors in the recovery of SRKW. Declines in the abundance of salmon, and other fish stocks, throughout the region (NMFS 2019) has resulted in fewer fish being available for SRKWs to eat throughout their entire range. In addition to prey availability, other threats such as pollution and contaminants, and effects from vessel and sound are also limiting factors affecting the recovery of SRKWs (NMFS 2008b). All of these problems are chronic, widespread issues facing SRKWs, acting synergistically, and difficult and complex to resolve in the short-term (NMFS 2021c).

In addition to the poor status of SRKWs, the abundance of most Chinook salmon stocks throughout SEAK, Canada, and the Pacific Northwest has also been trending downward over the last few decades (<https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/report-card-recovery-reviews-assess-28-salmon-and>). Many of these salmon stocks are protected under the federal ESA. Fisheries on all of these Chinook stocks are managed under appropriate U.S. and international fisheries laws and agreements (e.g. Magnuson-Stevens Fishery Conservation and Management Act (MSA), Pacific Salmon Treaty (PST)). In response to the decline in these stocks, all of the fisheries affecting these Chinook salmon stocks have also been reduced; with fishing effort and harvest exhibiting similar long-term declines over the last few decades (NMFS 2019; PFMC 2023).

In 2019, a new PST Agreement was reached between the U.S. and Canada. Included in this new agreement were revised fishing regimes for relevant Chinook salmon stocks. This triggered a new ESA consultation and biological opinion (BiOp) by NMFS on two federal actions related to management of southeast Alaska salmon fisheries (NMFS 2019). The two federal actions for this ESA BiOp were the delegation of management authority of authorized fisheries in the Exclusive Economic Zone (EEZ) of southeast Alaska to the state of Alaska, and federal funding through grants to the State of Alaska for the State's management of commercial and sport salmon fisheries and transboundary river enhancement necessary to implement the 2019 PST Agreement.

The PST Agreement included fishery reductions beyond those in the prior 2009 agreement for Chinook salmon. To mitigate (mitigate, in this instance and hereafter in this document, means to alleviate to the

extent possible, but not fully offset) the impacts of the fisheries on ESA listed species in combination with these new reductions, further actions were funded to help restore critical Chinook salmon stocks in Puget Sound through habitat enhancement/restoration and conservation hatchery programs. These measures were intended to increase specific Puget Sound Chinook populations, which over the long term would be expected to increase prey availability for SRKWs. In addition, a hatchery prey increase program was implemented to produce additional hatchery Chinook salmon to provide more prey availability in the times and areas most beneficial for SRKWs to help mitigate the PST fisheries harvest effects in the short term (NMFS 2019). These funding actions were also analyzed in the 2019 BiOp.

Producing additional hatchery fish for SRKWs to help mitigate prey availability issues for SRKWs was deemed an appropriate mitigation measure because hatchery production has an existing record of producing salmon for stocks of importance as SRKW prey and the productions could be modified to increase prey abundance and availability in the times and areas most important to SRKWs. Throughout the states of Washington, Oregon, and Idaho hatchery salmon and steelhead are produced and released as juveniles to support a wide range of objectives throughout the region, including mitigation for habitat degradation and loss, enhancement of recreational and commercial fisheries, and aid in the conservation and enhancement of salmon and steelhead stocks in the wild. Over the last century, hatchery programs have increased the returns of salmon and steelhead throughout the region. Every year, hundreds of millions of juvenile hatchery salmon and steelhead are released throughout the region's rivers, and in many cases, the majority of adult salmon and steelhead that return originate from hatcheries. This long-established, proven practice has demonstrated producing additional fish via hatcheries result in more fish that thrive in the ocean, survive back to freshwater, and return to their original release areas. Considering the ongoing annual production of hatchery fish in the region's existing facilities, funding can, and has, been used to take immediate action to boost the production of hatchery salmon. This increase in hatchery salmon has provided more prey in the times and areas most beneficial for SRKWs in the short term; helping to reduce their current risk of extinction (NMFS 2019).

In 2020, NMFS received funding for PST implementation, which included an amount to implement the conservation funding measures described above (habitat enhancement/restoration and conservation hatchery programs, in addition to the hatchery prey increase program). A portion of this funding was used by NMFS to fund hatchery operators throughout the region to produce hatchery Chinook salmon specifically for increasing the amount of prey available for SRKWs in the ocean to mitigate declining Chinook salmon abundances and the effects of PST fishery harvest of Chinook salmon. Congress has continued to appropriate increased funds for PST implementation in each subsequent year; a portion of

which NMFS has allocated each year to fund the prey increase program. The funding amount for the prey increase program varied based on annual Congressional appropriations for activities related to implementation of the PST and NMFS' spend plan for these funds, which is developed in conjunction with the U.S. Pacific Salmon Commission commissioners. NMFS has distributed funds for the hatchery prey increase program according to the PST spend plan for fiscal years 2020 through 2023 in the amounts of \$5.6, \$7.3, \$6.3, and \$5.6 million, respectively. Funding for 2024 has not been specified as of the publishing of this PEIS document.

In 2020, the Wild Fish Conservancy, a 501(c)3 nonprofit organization, filed a lawsuit in the U.S. District Court for the Western District of Washington alleging that the issuance of the 2019 BiOp violated the ESA and the National Environmental Policy Act (NEPA). On August 8, 2022, the district court found that NMFS violated both the ESA and NEPA. With respect to the ESA, the court determined that NMFS improperly relied on uncertain mitigation (the prey increase program) to reach its conclusion that the federal actions related to the SEAK fisheries were not likely to jeopardize ESA listed Chinook salmon and SRKW, and that NMFS failed to evaluate whether the increased hatchery production funded through the prey increase program would jeopardize the continued existence of ESA-listed Chinook salmon. With respect to NEPA, the court concluded NMFS failed to conduct necessary NEPA analysis for the issuance of the ITS, which exempted take associated with the SEAK salmon fisheries from ESA section 9, and for the prey increase program. The court subsequently issued an order on remedy, in which it partially vacated the incidental take statement for the winter and summer seasons of the southeast Alaska commercial troll fishery, and remanded the 2019 BiOp to NMFS to remedy the flaws it had identified. The Court did not vacate the portions of the 2019 BiOp regarding the SRKW prey increase program or enjoin that program. The district court's order partially vacating the incidental take statement was stayed by the United States Court of Appeals for the Ninth Circuit on June 21, 2023.

In response to this recent district court order, NMFS is concurrently conducting two reviews under NEPA: the Programmatic Environmental Impact Statement (PEIS) for the expenditure of funds to increase prey availability for SRKWs (this document), and an EIS titled "Environmental Impact Statement for the Issuance of an Incidental Take Statement under the Endangered Species Act for Salmon Fisheries in Southeast Alaska Subject to the Pacific Salmon Treaty and Funding to the State of Alaska to Implement the Pacific Salmon Treaty" (website:

<https://www.fisheries.noaa.gov/resource/document/environmental-impact-statement-issuance-incidental-take-statement-salmon>). These reviews are related because the actions considered in them were analyzed in the 2019 BiOp, and because the prey increase program was developed in connection with the 2019 PST

Agreement. However, these reviews analyze separate federal actions and NMFS is conducting separate reviews under NEPA.

NMFS prepared these EISs (prey program and SEAK salmon fisheries) to respond to two specific components of the district court's orders in the *Wild Fish Conservancy v. NMFS* litigation: (1) that NMFS must comply with NEPA should it issue on remand an ITS for the SEAK salmon fisheries and (2) that NMFS must comply with NEPA should it implement on remand the prey increase program for SRKWs. *See Wild Fish Conservancy v. Thom*, No. C20-417-RAJ-MLP, 2021 WL 8445587, at *16-18 (W.D. Wash. Sept. 27, 2021), *report and recommendation adopted*, No. 20-CV-417-RAJ, 2022 WL 3155784 (W.D. Wash. Aug. 8, 2022). NMFS's preparation of the two EISs conforms with NEPA, the Council on Environmental Quality (CEQ) regulations, and case law.

In 2019, NMFS prepared one BiOp to address the federal actions relating to the SEAK salmon fisheries and the prey increase program for SRKW. At that time, NMFS reinitiated consultation on the federal actions related to the SEAK salmon fisheries in light of the new 2019 PST Agreement and new information on the effects of the SEAK salmon fisheries and the condition of ESA-listed species (consistent with 50 CFR 402.16). NMFS also engaged in ESA Section 7 consultation on Federal funding for conservation activities to benefit ESA-listed species, a proposal that was developed in connection with the 2019 PST Agreement. The conservation funding proposal included three components, one of which is the prey increase program. Although the prey increase program is meant to mitigate all salmon fisheries subject to the 2019 PST Agreement, NMFS determined that consultation on the other U.S. fisheries managed subject to the PST was unnecessary because NMFS had already consulted on fishery-specific plans for those fisheries (PFMC and Puget Sound). Because the re-initiated consultation on federal actions related to the SEAK salmon fisheries and the proposed conservation funding would have effects in similar geographic areas, to some of the same species, and were both connected to the PST Agreement, NMFS decided in 2019 to consider in one BiOp the effects of these actions. NMFS's prior approach did not reflect a decision on the part of NMFS that it was *required* under NEPA or the ESA to consider the effects of those two actions in one EIS and one BiOp.

In responding to the district court's remand order to reassess the impacts of the SEAK salmon fisheries and the prey increase program under the ESA and to prepare NEPA analyses for both the issuance of the ITS for the SEAK salmon fisheries and the implementation of the prey increase program, NMFS determined that it would be more appropriate to prepare two sets of NEPA and ESA analyses for the SEAK salmon fisheries actions and the SRKW prey increase program. NMFS made this decision in light of the different

scope and purposes, and the independent utility, of the federal actions related to the SEAK salmon fisheries and the SRKW prey increase program that mitigates all the PST fisheries. The actions are distinct and serve different purposes, and although there is a relationship between them, the two actions are not connected such that use of one NEPA document or one BiOp is required. The PIP EIS evaluates alternative uses of Federal funding to increase prey availability for SRKWs and mitigate the effects of all of the PST fisheries, and therefore had broader applicability in terms of the scope of effects. Preparing a PIP-specific EIS (and BiOp) allowed NMFS to fully and more holistically analyze the impacts of the prey increase program across all fisheries. It also provides more clarity that the prey increase program mitigates all of the PST fisheries, not just the SEAK fisheries. Finally, NMFS prepared an EIS and BiOp focused on the federal actions related to the SEAK salmon fisheries, which allowed for a robust and detailed analysis of the impacts of those fisheries on ESA-listed and non-listed salmon and marine mammals (among other resource components). This is the same approach NMFS has taken for the other U.S. marine fisheries managed subject to the PST, which have their own specific BiOps (including the PFMC and Puget Sound fisheries). Ultimately, NMFS determined preparing separate NEPA and ESA analyses for the SEAK salmon fisheries actions and the prey increase program would facilitate more robust analyses, improving the substance while also being more practical and less confusing.

For this PEIS related to the prey increase program, “programmatic” reviews under NEPA are broad or high-level reviews that assess the environmental impacts of proposed policies, plans or programs under which subsequent actions may be implemented either based on the programmatic review itself, or based on subsequent NEPA reviews tiered to the programmatic review (e.g., a site- or project-specific review). Programmatic reviews often are undertaken when initiating a regional rulemaking, policy, plan, or program and/or assessing common elements or aspects of a series or suite of similar projects. The federal funding tied specifically to increasing prey availability for SRKWs fits within this programmatic context.

This PEIS assesses implementation of the prey increase funding program and alternative program-level uses of the funding, and the range of potential environmental impacts expected for activities associated with each alternative. The PEIS is based on currently available scientific information, as well as practical experience with existing projects. This PEIS may also inform other future NEPA reviews for individual project proposals that fall within the program, but it does not supplant those reviews.

It is important to highlight this PEIS pertains only to funds NMFS has designated for the prey increase program in PST spend plans for SRKWs. Appropriations for activities related to PST implementation overall are used for a variety of other purposes, including direct implementation of U.S. obligations under

the PST, and conservation hatchery programs for at-risk Chinook salmon stocks in Puget Sound. These other actions are not addressed in this PEIS. The U.S. fisheries managed subject to the PST, for which PST implementation funds are used, have been analyzed in a number of NEPA documents, specifically NEPA documents analyzing the effects of the SEAK, U.S. West Coast, Puget Sound, and Columbia Basin fisheries (NMFS 2018; NMFS 2019; NMFS 2021d; NMFS 2023).

This PEIS does not evaluate site-specific issues and effects associated with site or project-specific implementation of the alternatives. As to the hatchery funding program, a variety of location-specific factors (e.g., specific hatchery facility and location, presence of threatened and endangered species, hatchery practices and capacity, and cultural resources) may vary considerably from site to site, especially over the entirety of the project area. In addition, site-specific details for each hatchery facility and the corresponding operation would greatly influence the magnitude of the environmental impacts from specific hatchery production being funded. A programmatic analysis cannot fully anticipate or address the effects of location specific and project-specific factors. Such effects are analyzed at the project level. Further details on the programmatic funding decision criteria and site-specific information is described in Chapter 2, the alternatives.

This EIS was prepared using the 2020 Council on Environmental Quality (CEQ) NEPA Regulations as modified by the 2022 Phase 1 final rule because review of the proposed actions began in the fall of 2023, which preceded the effective date of CEQ's 2023 Phase 2 final rule (effective July 1, 2024). Citations are to the 2023 version of the regulations that NMFS relied on when drafting the EIS.

1.2. Description of the Proposed Action

As described above, Congress has appropriated annual funding for activities related to implementation of the PST and NMFS. In consultation with the U.S. Pacific Salmon Commission Commissioners, spend plans have allocated a portion of PST funds to the prey increase program in 2020 through 2023. The goal of the additional hatchery production is to provide for an increase the abundance of Chinook salmon in marine waters by 4-5% to help mitigate the effects of the PST fisheries (loss of salmon) on SRKWs (NMFS 2019).

NMFS anticipates continued federal appropriations to increase prey availability for SRKWs, and is proposing to continue funding the prey increase program for SRKWs through at least the end of the current PST agreement (2028). To date, NMFS has funded the production of additional hatchery Chinook salmon in existing hatchery programs in Washington, Oregon, and Idaho. NMFS has focused on

producing additional Chinook salmon for increased prey availability and not on other prey species because the best available information indicates that SRKWs strongly prefer Chinook salmon (as described in more detail in Section 3.3). Specific criteria were developed to guide these funding decisions (see section 2.2.1) to maximize the benefits to SRKWs, while mitigating potential adverse effects to salmon and steelhead listed under the ESA.:

- **Criteria 1:** Increased hatchery production should be for Chinook stocks that are a high priority for SRKW (NMFS and WDFW 2018; Ad-hoc SRKW Workgroup 2020).
- **Criteria 2:** Increased production should be focused on stocks that are a high priority for SRKW (NOAA and WDFW 2018), but funding should be distributed so that hatchery production is increased across an array of Chinook stocks from different geographic areas and run timings (i.e., a portfolio).
- **Criteria 3:** Increased production cannot jeopardize the survival and recovery of any Endangered Species Act (ESA)-listed species, including salmon and steelhead.
- **Criteria 4:** Because of funding and timing constraints, increased production proposals should not require major capital upgrades to hatchery facilities.
- **Criteria 5:** All proposals should have co-manager agreement (agreement among relevant tribal, state, and federal hatchery managers), as applicable.
- **Criteria 6:** All increased production must have been reviewed under the ESA and NEPA, as applicable, before NMFS funding can be used.

NMFS proposes to continue to use these criteria for funding decisions. To date, NMFS has conducted site-specific NEPA analyses for each funding decision or otherwise ensured that effects from funding specific hatcheries were evaluated in existing NEPA analyses.

1.3. Purpose of and Need for the Action

The purpose of the proposed action is to spend funds appropriated in connection with the implementation of the PST Agreement to increase prey (food) availability for SRKWs to help mitigate the effects of declining Chinook salmon abundances and PST fisheries. The action is needed because prey availability is currently a factor limiting the recovery of SRKWs, and PST fisheries, while reduced from prior agreements, continue to remove Chinook salmon (harvest) that would otherwise potentially be available as prey (food) in times and areas important to SRKWs.

1.4. Project Area and Analysis Area

The “project area” is the geographic area where the proposed action would take place. NMFS currently distributes funds to operators of hatcheries in Washington, Oregon, and Idaho, where additional hatchery salmon can be produced. The hatchery facilities are located in freshwater areas, primarily in the Columbia River and Puget Sound regions.

The “analysis area” varies depending upon the resource being assessed. For SRKWs, it includes the marine habitats where the whales are found. For salmon, it covers both freshwater and marine habitats where both hatchery and natural salmon occur. The fisheries analysis focuses on the areas where the tribal, commercial, and recreational fisheries occur in marine waters because these fisheries directly affect the prey available for SRKWs. A detailed description of each resource analysis area is provided in Chapter 3, Affected Environment. In Chapter 4, Environmental Consequences, the direct and indirect effects on various resources are evaluated within the project and analysis areas.

1.5. Scoping and Relevant Issues

This final PEIS is a culmination of activities that included both internal, tribal, public scoping, and public review and comment on the draft PEIS, as described in the following paragraphs.

1.5.1. Tribal Government Scoping

NMFS provided advanced notification to affected tribes prior to the publication of the federal register notice of our intent to prepare an EIS for the expenditure of funds to increase prey availability for SRKWs. This notification was sent to potentially affected tribes in Oregon, Washington, Idaho, and southeast Alaska, asking for feedback on our plan to evaluate the expenditure of funding to increase prey availability for SRKWs. NMFS also held a tribal engagement webinar on October 30, 2023 to explain the proposed action, possible alternatives, and the EIS process for affected tribes. More than 25 tribal representatives from the Pacific Northwest and southeast Alaska participated in the webinar. A letter from Northwest Indian Fisheries Commission was received with comments on the development of the EIS.

After the release of the draft PEIS for review, NMFS received two letters from tribal representatives. These letters were reviewed, with follow up outreach to further discuss their letters. NMFS will continue to engage with interested tribal representatives to discuss and work through their concerns in the future on this EIS and related matters.

1.5.2. Notices of Public Scoping and Public Review and Comment

Public scoping for this PEIS commenced with publication of a Notice of Intent in the Federal Register on August 10, 2023 (88 FR 54301). The comment period was open for 45 days to gather information on the scope of the issues and the range of alternatives to be analyzed in the PEIS. Two webinars were conducted (August 30-31, 2023) during the scoping public comment period to explain the proposed action, possible alternatives, and the EIS process. Many people representing a variety of interests participated and asked questions.

NMFS developed a website for the prey increase program for SRKWs and includes our documents to provide information throughout the entire NEPA process at:

<https://www.fisheries.noaa.gov/action/review-prey-increase-program-southern-resident-killer-whales>

The website for the prey increase program for SRKWs began at the start of the scoping period and will be updated and available throughout the duration of this project.

Sixteen written comments were received by NMFS during the public scoping period. Comments were received from individuals, non-governmental organizations, a fish recovery board, and state and federal government agencies. There were many positions and interests shared through these comment letters with respect to SRKWs, hatchery fish, salmon fisheries, and salmon recovery in the Pacific Northwest and southeast Alaska. All of the comment letters received prior to the release of the PEIS are summarized in section 1.5.5 below.

Of the comments received during scoping, a wide range of issues were identified during the public scoping period and in the tribal engagement session:

- SRKWs – addressing prey availability for SRKWs is a key concern. In addition, addressing the other key limiting factors/threats for SRKWs (e.g. vessel noise, contaminants) is also a concern. All factors affecting the conservation and recovery of SRKWs, including the recovery of wild Chinook salmon, needs to be taken into account and not just prey availability in marine waters.
- Chinook salmon - the recovery of wild salmon and their habitats is a key issue of concern for most commenters. The effects of hatchery salmon on SRKWs as prey is important for the

recovery of this species. The effects of hatchery salmon on the recovery of wild salmon is also a key issue of concern.

- Chinook Fisheries – changes to Chinook fisheries, and effects of those changes on all of the affected communities (tribal and non-tribal) is a key issue of concern. Chinook salmon harvest for all tribal and non-tribal fishers has been declining for decades; with current fisheries a small fraction of what existed historically. The abundance of hatchery and wild salmon, and their recovery, affects fishery harvest in southeast Alaska and the Pacific Northwest. These all are issues of concern for Chinook salmon fisheries and the affected communities.

This section summarizes the alternatives, information, and analyses submitted by tribal, federal, state, and local governments and other public commenters during the scoping process for consideration by the NMFS in developing this PEIS (40 C.F.R. 1502.17).

NMFS invited public comments on this summary of submitted alternatives, information, and analyses during the public review period of the draft PEIS.

SRKW Comments

- provide a summary of NMFS SRKW Recovery Plan and how the proposed hatchery prey production fits within the overall federal efforts to recover this species.
- acknowledge that the U.S. Section of the Pacific Salmon Commission took three actions to address prey availability: a) negotiated harvest reductions; b) funded a Puget Sound salmon habitat restoration project; and c) funded increased hatchery production of Chinook salmon.
- the assessment criteria also should consider the certainty of deliverability of potential benefits, as well as overlap of the spatial/temporary distribution between prey and SRKWs.
- the slate of alternatives for increasing prey availability should not be limited to only those that seek to increase the overall abundance of Chinook salmon, but also include alternatives that seek to increase the abundance of prey availability for SRKWs. Examples include: a) funding of hatchery production of coho and chum salmon.
- an alternative should be added that addresses reduction of vessel effects on SRKWs, which also is an identified factor for decline. Reducing the physical and acoustical disturbance by vessels would increase SRKWs foraging success within Puget Sound and the Salish Sea.
- NMFS should conduct an EIS that considers NMFS's actions related to harvest levels for fisheries managed under the PST and the prey increase program together, so that NMFS can evaluate reasonable alternatives to harvests; reducing or eliminating the need for mitigation.

- encourage a multi-pronged approach that addresses these other factors of SRKW decline.
- request the analysis discuss the other factors that are limiting SRKW recovery, such as chemical pollution, noise pollution, vessel strikes and harassment by whale watchers.
- there are two, much more immediate factors, that have the potential to increase the local spatial-temporal availability of Chinook salmon to foraging SRKWs – reductions in fishing effort and interference/disturbance by vessels.

Chinook Salmon Comments

- NMFS should also propose a strategy to engage Russia and Japan in a joint program to reduce the total numbers of hatchery pink and chum released into the North Pacific with the purpose of reducing density-dependent mortality of wild salmon smolts in the North Pacific ocean.
- a cost-benefit analysis should be conducted that evaluates the opportunity cost of investing in increased hatchery production for a prey increase program against alternative investments in conservation action to benefit ESA-listed Chinook and SRKW, including changes in harvest management.
- NMFS must consider how it can avoid adverse impacts of the prey increase program, including through mitigation of the program, such as by requiring selective fishing gear in terminal fisheries on all hatchery fish from the program and by requiring recipients of the funding to close more harmful hatcheries.
- cumulative impacts of all hatchery programs being considered for expansion to provide prey for SRKWs need to be thoroughly and transparently evaluated.
- NMFS should consider a cost-benefit analysis for the fisheries and the prey increase program.
- for all alternatives developed, an economic analysis must include the cost of all necessary monitoring and evaluation of the prey increase program.
- propose that the following alternatives should be seriously considered in the EIS: 1) No prey increase program and reconfigured harvest management of Chinook in the southeast Alaska PST abundance-based management regime (AABM) fisheries, 2) Should also evaluate an expanded version of Alternative 1 above including reconfigurations in all three AABM fisheries necessary to achieve no jeopardy to SRKWs. A combination of reduced hatchery Chinook production for a prey increase program that meets population-specific pHOS limits, plus reductions to the southeast Alaska PST Chinook harvest that together will increase SRKW encounters with Chinook in key spring to fall foraging areas so as to meet minimal proportions of SRKW daily and seasonal energetic requirements.

- do not believe that re-allocation of the \$5.6 million allotted to the prey increase program to habitat restoration activities will yield commensurate benefits to SRKW as hatchery production.
- evaluate adverse impacts of the existing NOAA hatchery increase program on ESA-listed salmon population viability, including whether the program increased the number of hatchery origin fish on the spawning grounds.
- it is important to include alternatives in the EIS that would provide funding to increase hatchery production and spawning habitat restoration, especially of the high priority stocks for SRKWs.

Chinook Salmon Fishery Comments

- for all alternatives developed, the take of juvenile, sub-adult, and adult Chinook salmon as bycatch in fisheries throughout their range should be quantified and analyzed.
- the purpose and need must be revised to answer the fundamental question at issue: Under what circumstances, if at all, can NOAA approve salmon harvests under the PST in a manner that is not going to result in jeopardizing ESA-listed species?
- NMFS description of the affected environment and the no action alternative should not include ongoing harvest for fisheries managed under the PST levels.
- NMFS must consider the long-term environmental consequences of its actions. In considering environmental impacts, NMFS must assess the impacts of all PST fisheries, combined with all other fisheries, hatcheries, dams, vessel traffic, climate change, and all other actions that adversely affect SRKWs, ESA-listed salmonids, and any other species affected by the proposed action.
- request that NOAA assess the effectiveness, in terms of benefit to SRKW, of decreasing U.S. harvest levels without agreement from Canada to take parallel reductions.
- recommend eliminating the alternative that proposes to reduce fishing impacts, instead of increased hatchery production.
- if NMFS proceeds with an alternative that affects fisheries, request that NMFS propose measures commensurate with impacts to prey availability in terms of when and where SRKWs forage for Chinook salmon.
- recommend to eliminate any alternatives that would further restrict the numerous fisheries that have absorbed disproportionate socio-economic impacts for decades.
- if you proceed with a fishery management alternative, request that you include a social and economic impact analysis given the harm to coastal communities that would accrue from additional and pointless loss of access to Chinook fisheries.

- NMFS should evaluate fisheries impacts on the abundance of Chinook salmon and consider options to reduce those impacts.

1.5.3. Public Review and Comment on the draft PEIS

On January 26, 2024 a notice in the Federal Register (89 FR 5227) announced the public review period of the draft PEIS. The public had the opportunity to review this document for 45 days, with the comment period closing on March 11, 2024. A total of 890 individual comments were submitted during this public review period. A wide variety of comments were received from many agencies, non-governmental organizations, and individuals. The majority of comments came from constituents interested in tribal and non-tribal fisheries, salmon hatcheries, salmon recovery, and SRKW recovery. Most commenters stated their geographic areas of interest were Puget Sound, the Pacific Northwest (Oregon and Washington), and southeast Alaska. Many commenters shared their support for a particular alternative in the draft PEIS, including 78% for alternative 2, 1% for alternative 3, and 5% for alternative 4. Sixteen percent of comments did not express support for a particular alternative, and no commenters supported alternative 1 (discontinuing the prey increase program for SRKWs).

Appendix H includes all the public comments received during this review period of the draft PEIS. In addition, NMFS also provided responses to common “theme” comments. Specific responses to a subset of public comment letters that were not explicitly represented by the common “theme” responses are also included in Appendix H.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

To warrant analysis in this document, an alternative must be reasonable and meet the purpose and need described in Section 1.3. If an alternative was considered but deemed to be 1) not reasonable or 2) not meet the purpose and need, or 3) to not be substantially different in the effects on affected resources among alternatives, it was not evaluated in detail in this document. Section 2.5 describes alternatives that were considered, but are not analyzed in detail.

Four alternatives were developed meeting the above criteria and are evaluated in this PEIS (Figure 1). The context for these four alternatives is the following:

- The United States and Canada have an agreement for the management of Chinook salmon and the fisheries that affect these stocks that is a part of the PST.
- This agreement was renewed in 2019 and is currently in effect through 2028. In association with the renewed agreement, the U.S. section of the Pacific Salmon Commission, the international body that implements the PST, agreed to seek federal funding for activities to conserve certain species listed under the ESA that are affected by fisheries managed under the PST.
- One of those activities is the prey increase program. The goal of the prey increase program is to provide for a meaningful increase in the abundance of Chinook salmon in marine waters to increase prey availability in the times and areas most beneficial to SRKWs (Dygert et al. 2018). NMFS (2019), in an analysis prepared in conjunction with the negotiation of the 2019 PST agreement, described a meaningful increase as a 4-5% increase in hatchery Chinook salmon being available for SRKWs, which was estimated at that time to be achieved through the production of an additional 20 million smolts released throughout a broad geographic area to target prey increases in times and areas of greatest benefit to SRKWs.
- NMFS has funded hatchery production in 2020-2024 specifically for SRKWs, and expects to continue to receive and allocate funding at similar levels or higher in the future to increase prey availability for SRKWs.
- For the alternatives in this PEIS, each alternative considers 1) actions that could be implemented using current funding levels (on average approximately \$6.2 million), and 2) actions that would likely provide for meeting SRKW prey increase program goals of 4-5% in at least some times and areas, and our expectations on the likely funding levels needed for these actions to be implemented.
- Further details on why this context is guiding the four alternatives included in this PEIS is described below.

Congress has appropriated annual funding for activities related to implementation of the PST. NMFS' spend plans for 2020-24 have allocated a portion of these funds to the prey increase program for SRKWs. NMFS' spend plans for fiscal years 2020 through 2023² have allocated \$5.6, \$7.3, \$6.3, and \$5.6 million dollars (average \$6.2 million) annually to increase prey availability for SRKWs, respectively. Based on this history, and the fact that Congress has continued to appropriate similar funding levels and has received NMFS' spend plans each year describing the distribution of funds for the purpose of increasing prey for SRKWs, NMFS anticipates that funding for the remainder of the PST Agreement term will continue at levels similar to past years or higher, and that funds will continue to be available to increase prey availability for SRKW at approximately \$6.2 million per year – the average funding from 2020-2023. This level of funding is evaluated for each alternative and the expected outcomes for the specified resources. An additional level of funding that may allow for the implementation of actions estimated to increase prey availability by approximately 4-5% in the times and areas most beneficial for SRKWs (prey increase program goals; Dygert et al. 2019; NMFS 2019) for each alternative is also evaluated on the specified resources.

Dygert et al. (2018) estimated that 20 million smolts could be produced with approximately \$5 million in funding. Due to the cost of production, hatchery capacity, and other factors, this estimate of the cost of production has proven to be low. In 2023, federal funding of \$5.6 million has resulted in the production of approximately 11 million smolts. Future funding, at similar levels as in the recent past, may increase hatchery production above 11 million smolts as infrastructure projects are completed and efficiencies in implementation are gained. However, with current funding levels in the future, production is not likely to attain 20 million smolts due to rising costs of production. Figure 2 provides an overview of past federal funding of hatchery production. The state of Washington is currently expending funds to increase prey availability for SRKWs through hatchery production. The Washington Legislature has been including funding for this purpose in its biennial budget since 2019 (current biennium is 2023-2025). Production funded by Washington has exceeded 10 million smolts in recent years. In combination with Washington State funding to increase prey availability for SRKW, total increased production for this purpose has approximated 20 million smolts recently (the release originally projected to meet prey increase program goals).

² The funding amount for FY2024 was recently allocated at \$6.05 million, and is within the range of previous years funding and does not change any of the analysis in the EIS.

In light of this background, NMFS has developed four alternatives specified below that evaluate different uses of federal funding to increase prey available for SRKWs, as well as a no action alternative. These four alternatives include:

- Alternative 1 is a no action alternative, in which no funding would be used to increase prey availability for SRKWs.
- Alternative 2, which is NMFS' preferred alternative, would use the available funding to increase prey abundance for SRKWs through the release of salmon from hatcheries.
- Alternatives 3 and 4 would apply the funds to different activities that could increase the prey available for SRKWs. NMFS is analyzing these alternatives in order to evaluate a full range of alternatives and environmental consequences of potential different uses of the federal funding that could increase prey abundance for SRKWs.
- These four alternatives allow for a range of effects to be evaluated on the identified resources, for comparative purposes, in Chapter 4, Environmental Consequences.

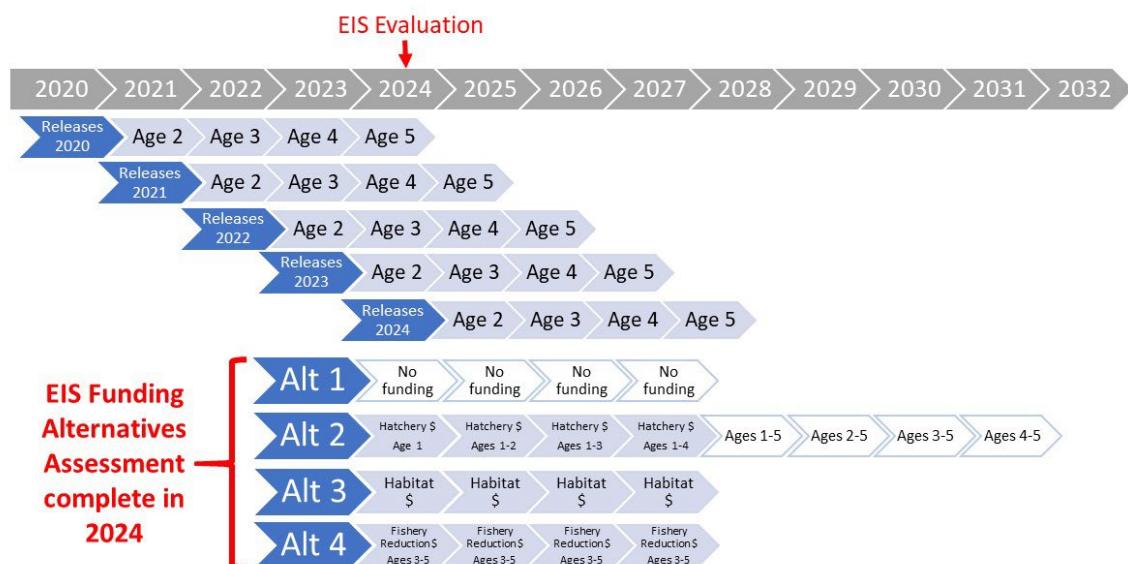


Figure 1. Timeline of the past hatchery prey increase program releases, the new PEIS assessment in 2024, and how each alternative would be implemented in 2024 through at least fiscal year 2028 (the end of current PST agreement). Releases in 2024 are funded by fiscal year funding 2023 and prior.

2.1. Alternative 1 (No Action): No Funding for Prey Increase Program

Under Alternative 1, federal funding to increase prey availability for SRKWs would be discontinued beginning in 2024. Funds have been distributed for fiscal year (FY) 2023, but under this alternative, no funds would be distributed after FY 2023. This alternative is considered the No Action alternative. Alternative 1 assumes no federal funds for activities related to implementation of the PST would be used specifically to increase prey availability for SRKWs.

2.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

For Alternative 2, NMFS would continue to distribute federal funds to hatchery operators for the production of additional hatchery salmon specifically to increase the prey availability for SRKWs in marine areas through at least FY 2028 (the end of the term of the current PST agreement). This alternative evaluates NMFS' distribution of funding on an annual basis to increase the prey available for SRKWs up to the stated goals of the prey increase program in the project area (Dygert et al. 2018; NMFS 2019). In order to accomplish this, we evaluated a range of funding from current funding up to a funding level that is likely to meet SRKW goals, and the anticipated hatchery fish production associated with these funding levels.

The likely level of funding, which we would expect to continue based on 2020-2023 funding levels, is approximately \$6.2 million per year (FY2024 funding finalized after publication of the draft EIS was \$6.05 million). We expect that this level of funding would result in hatchery production levels and locations similar to those federally funded in FY 2023. We also evaluate a possible high level of funding, of approximately \$12 million per year, which would likely achieve a production level that would result in approximately 4-5% increase in prey availability to SRKWs based on our analysis. At this level of funding, we anticipate that federal funding could provide for a similar level of hatchery production as was provided by the combined federal and Washington State funding in 2023. However, all funded programs under this scenario would still need to meet the six funding criteria described in Section 1.2.1 below. We assume for this analysis that this higher level of federal funding could occur if Washington State funding were reduced or discontinued. In other words, we would not expect federal funding to result in the production of hatchery fish greater than the program goals (4-5% increase in prey availability for SRKWs) in combination with Washington state production.

Since this PEIS evaluates the expenditure of funds associated with increasing the prey availability for SRKWs at a program level, considering a range of funding and associated hatchery production is necessary. There is a possibility that additional federal funding may become available for the purpose of increasing prey availability for SRKWs. It is possible that in the future Washington may reduce or eliminate its funding, and that in response, the federal funding for this purpose may be increased. To account for this possibility, this alternative assesses the full range of effects up to prey increase program goals (which are defined for the purposes of this PEIS as an increase in prey of 4-5% in the times and areas most beneficial for SRKWs (Dygert et al. 2018; NMFS 2019)). In 2023, federal and state funded hatchery production produced approximately 20 million smolts, with approximately \$12 million dollars (providing a real-life cost scenario for evaluating increased prey availability meeting SRKW program goals). This type of adaptive management is appropriate for a programmatic NEPA analysis, and considers the potential for varying funding levels in the future. The specific ESA take limits for the release of hatchery salmon are specified in the relevant Incidental Take Statements associated with the hatchery releases (e.g. NMFS 2024a and site-specific ESA authorizations (criteria 6 below)).

Considering the potential for varying funding levels and a range of hatchery facilities that could be funded under the program, this alternative also incorporates annual monitoring of the prey increase program at a programmatic level. Monitoring is important to ensure maximum benefits to SRKWs while minimizing impacts to natural-origin salmon. Regular monitoring would include tracking adherence to the criteria listed below, including that programs receiving funding have been reviewed through site-specific assessments, and have been determined not likely to jeopardize ESA-listed species, and modeling to assess the benefits of hatchery production in terms of increasing SRKW prey (see Appendix F for details)

2.2.1. Proposed Funding Decision Criteria

For Alternative 2, the following criteria are used by NMFS when making funding decisions for hatchery production associated with funding to increase prey availability for SRKWs for each specific hatchery program:

- **Criteria 1:** Increased hatchery production should be for Chinook stocks that are a high priority for SRKW (NMFS and WDFW 2018; Ad-hoc SRKW Workgroup 2020).
- **Criteria 2:** Increased production should be focused on stocks that are a high priority for SRKW (NOAA and WDFW 2018), but funding should be distributed so that hatchery production is increased across an array of Chinook stocks from different geographic areas and run timings (i.e., a portfolio).

- **Criteria 3:** Increased production cannot jeopardize the survival and recovery of any Endangered Species Act (ESA)-listed species, including salmon and steelhead.
- **Criteria 4:** Because of funding and timing constraints, increased production proposals should not require major capital upgrades to hatchery facilities.
- **Criteria 5:** All proposals should have co-manager agreement (agreement among relevant tribal, state, and federal hatchery managers), as applicable.
- **Criteria 6:** All increased production must have been reviewed under the ESA and NEPA, as applicable, before NMFS funding can be used.

2.2.2. Stepwise Approach for Funding Decisions

The process for making funding decisions in this alternative would be as described in Figure 1, and as follows:

- Hatchery operators would submit to NMFS a description of their proposal for additional production of hatchery salmon to benefit SRKWs.
- NMFS would determine whether any particular funding proposal satisfied the six criteria described above. This would ensure funding is distributed so that hatchery production is increased across an array of high priority Chinook stocks from different geographic areas and run timings. Criteria 6 states all hatchery production must be reviewed under the ESA and NEPA before funding can be issued. For programs that received federal funds in 2020-2023, NMFS ensured that the release of fish from these programs were covered by analysis under the ESA (in many cases through NMFS' approval of HGMPs under its 4(d) rule for threatened salmon and steelhead, and/or ESA analysis of NMFS' Mitchell Act funding program) and had been analyzed under NEPA. This coverage and these NEPA analyses, occurred at the site or program-specific, or regional level. NMFS will ensure this pre-existing analysis is still applicable before distributing future funding to these programs. For programs that have not previously received federal funding, NMFS would ensure that any required ESA and NEPA analyses were completed and that the funded production would not jeopardize ESA-listed species prior to allowing the use of funding. In addition, as part of these ESA and NEPA evaluations, the operators must demonstrate to NMFS that they have obtained any required state and federal permits for water use and discharge (e.g. National Pollutant Discharge Elimination System permits). If the site-specific evaluation concluded the hatchery production was appropriately analyzed consistent with the ESA and NEPA under existing and/or newly approved authorization documents, then these criteria would be met.

- If all of the six funding criteria are met for a hatchery production proposal, then NMFS would fund the operator to produce additional hatchery salmon to increase prey availability for SRKWs.

2.2.3. Hatchery Production Funded Using This Criteria

Since NMFS has distributed federal funding to increase the prey availability for SRKWs in FY 2020 through 2024, the six funding criteria have been applied to make funding decisions resulting in the total hatchery production shown in Figure 2. Production increases by individual programs from FY 2020 through FY 2023 are described in section 3.2 below and in Appendix A.

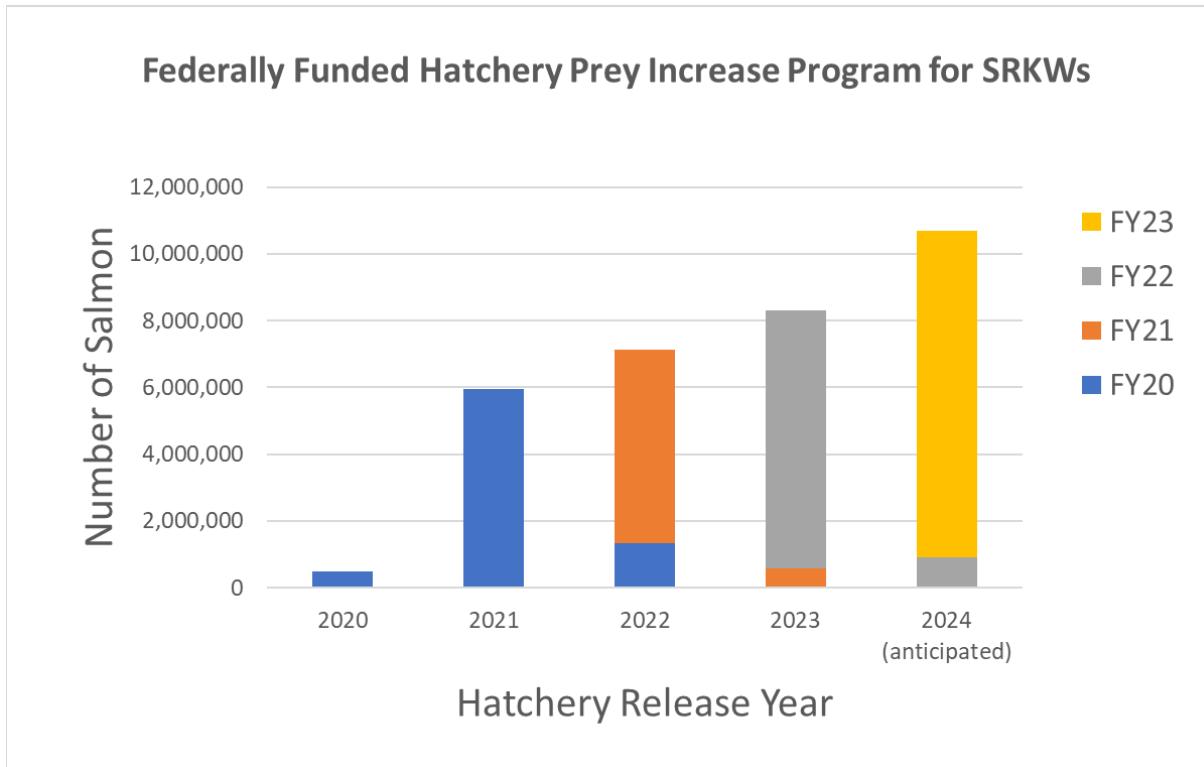


Figure 2. Production and release of juvenile hatchery Chinook salmon federally funded (PST) to increase prey availability for SRKWs.

Table 1. Hatchery production funded in FY2023 by NMFS, and site-specific NEPA and ESA authorizations. Note: depending upon the species, releases could occur in 2024 and/or 2025.

Facility	Region	Species	Entity	Increased Production Proposal	NEPA Coverage	ESA Coverage
Issaquah Hatchery	Puget Sound	Fall Chinook	WDFW	1,000,000	Lake Washington EA	Lake Washington BiOp (WCRO-2021-02104)
Soos Creek-Palmer Pond Hatchery Chinook	Puget Sound	Fall Chinook	WDFW	2,000,000	Duwamish Green River EIS	Duwamish Green BiOp (WCR-2016-00014)
Tulalip Bernie Gobin Hatchery	Puget Sound	Summer Chinook	Tulalip Tribe	2,000,000	Snohomish SEA	Snohomish Reinitiated BiOp 2021 (WCR-2020-02561)
University of Washington Hatchery	Puget Sound	Fall Chinook	Muckleshoot Indian Tribe	180,000	Lake Washington EA	Lake Washington BiOp (WCRO-2021-02104)
Spring Creek NFH	Columbia River	Fall Chinook	USFWS	2,000,000	Mitchell Act EIS	NWR-2004-02625
Little White Salmon NFH	Columbia River	Spring Chinook	USFWS	300,000	Mitchell Act EIS	Memo to file & NWR-2004-02625
Carson NFH	Columbia River	Spring Chinook	USFWS	100,000	Mitchell Act EIS	NWR-2004-02625 Carson SCS is covered in the 2007 Biop.
Wells Hatchery	Columbia River	Summer Chinook	WDFW/DPUD	500,000 ³	Mitchell Act EIS	Wells Summer Chinook BiOp (WCRO-2020-00825)
East Bank and Marion Drain Hatcheries	Columbia River	Summer Chinook	Yakama Nation	100,000	Mitchell Act EIS	Yakima spring Chinook/summer Fall Chinook & Coho BiOp (NWR-2011-06509)

³ This value was updated from one million to half million based upon WDFW updates submitted during the public comment period.

Dworshak NFH	Columbia River	Spring Chinook	Nez Perce Tribe	200,000	Mitchell Act EIS	WCR-2017-7303.
SAFE	Columbia River	Spring Chinook	ODFW	1,500,000	Mitchell Act EIS	SAFE BiOp (WCR-2020-02145)
Bonneville Hatchery	Columbia River	Fall Chinook	ODFW	250,000	Mitchell Act EIS	Mitchell Act WCR-2014-697
Umatilla and Bonneville Hatcheries	Columbia River	Fall Chinook	ODFW	120,000	Mitchell Act EIS	WCRO-2010-06511
Total				11,750,000		

2.3. Alternative 3: Habitat-based Prey Increase Program

Under Alternative 3, the habitat-based prey increase program alternative, NMFS would use funds available for the prey increase program to implement habitat-related projects that would increase the natural production of salmon in the wild. As with Alternative 2, we evaluate this alternative with expected current funding levels moving forward into the future (assumed to be on average \$6.2 million annually). However, due to the nature of the action in this alternative, it is not possible to calculate a funding level that would be needed for habitat restoration in the analysis area to provide for a 4-5% increase in Chinook salmon abundance in marine waters for SRKWs. There are no modeling scenarios we could use to derive the level of funding needed (with any precision) for habitat restoration to increase the capacity and productivity in freshwater habitats across the analysis area that would result in abundance increases of adult Chinook salmon in marine waters of 4-5% that provide for meeting SRKW prey increase program goals. This calculation is extremely complex, involves numerous assumptions, and the modeling tools necessary to perform this are not presently available. Deriving an upper funding level for Alternative 2 is possible because of the recent past federal and Washington hatchery funding in 2023, but not for Alternative 3; given the scale and magnitude of habitat improvement needed to increase salmon abundance in the wild at program goals. Therefore, for purposes of this alternative analysis, we assume the higher program funding level for Alternative 3 to be the same as Alternative 2 (\$12 million annually). We consider this range of funding in order to evaluate the program-level effects of this alternative on specified resources in Chapter 4.

Under Alternative 3, the funding levels specified above would be assessed in terms of the on-the-ground habitat restoration projects that could be funded annually. Habitat restoration projects would be selected and designed to benefit Chinook salmon; the preferred prey species for SRKWs. Habitat projects would be funded throughout Washington, Oregon, and Idaho, and focused on priority prey stocks for SRKW, as in criteria 1 for Alternative 2.

We used previously funded projects to estimate the extent of habitat restoration work that could be achieved with the available prey increase program funds. In order to determine the type, extent, and benefit of habitat restoration projects that could be implemented with the specified level of funding evaluated for this alternative, the data for NOAA's Pacific Coastal Salmon Recovery Fund (PCSRF) was queried ([https://www.webapps.nwfsc.noaa.gov/apex/f?p=309:15:::::\)](https://www.webapps.nwfsc.noaa.gov/apex/f?p=309:15:::::). The PCSRF funds habitat restoration projects throughout the region and provides specific funding amounts for individual projects. The type of habitat restoration project, the amount of funding used, and anticipated wild fish production benefits were assessed for this alternative, using the same funding amounts as described in Alternative 2

(a recent average of \$6.2 million dollars annually, and assumed \$12 million dollars meeting prey increase program goals).

The following criteria were used to identify previously funded habitat restoration projects that could inform our evaluation of the potential effects of similar future projects that could be implemented under this alternative in Chapter 4, Environmental Consequences:

- **Criteria 1:** The most up-to-date funding year in the PCSRF database was 2023, so only projects funded in this fiscal year were queried and used in the analysis.
- **Criteria 2:** Funded projects used in this analysis were from the category “Salmonid Habitat Restoration and Acquisition” with the subcategories “Fish Passage Improvement, Instream Habitat, Riparian Habitat.” Projects not categorized as these were not used in the analysis.
- **Criteria 3:** The project had to be implemented in the project area. The database catalogs projects in the project area according the following recovery domains in the Columbia Basin and Puget Sound: Interior Columbia, Willamette/Lower Columbia, and/or Puget Sound.
- **Criteria 4:** The cost of implementing the habitat project was the total cost of the project specified in the database, including PCSRF funds, state funds, other funds, and in-kind contributions.

Applying the above criteria provided an extensive list of previously funded habitat restoration projects that are used to inform our assessment of this alternative if similar projects were implemented using the available federal funds to increase prey for SRKWs annually. The full description of habitat restoration projects included in our assessment scenario for this alternative is provided in Appendix C.

2.4. Alternative 4: Reduced Fishing to Increase Prey

Alternative 4 would use available funds specified for the prey increase program to reduce the harvest of Chinook salmon in U.S. marine area fisheries with the purpose of increasing the abundance of Chinook salmon available as prey for SRKWs. There is currently no legal mechanism available to use funding to reduce fishing effort and catch for the purpose of increasing prey availability for SRKWs, and programs that might inform an analysis of the amount of fishery reduction achievable with funding levels anticipated are not directly comparable.⁴ However, we are analyzing this alternative in order to provide a

⁴ The MSA provides for two methods of using funding to address reductions in fishing capacity and or opportunity. First, the MSA provides for fishery disaster relief, where a fishery resource disaster exists, defined as “an unexpected large decrease in fish stock biomass or other change

comprehensive evaluation of alternative uses of available funds to increase SRKW prey, that is responsive to the court’s order in *Wild Fish Conservancy v. Quan* and to public comments on scoping. The administration of buyback and disaster relief funding is extremely complex and fact-specific. Because there is no existing statutory authority or detailed program for using funds to reduce fishing to increase prey for SRKWs, and thus a great deal of uncertainty around how such a program would be administered, we used two indirect methods to inform our description and analysis of Alternative 4.

First, we developed fishery reduction scenarios in which \$6.2 million annually (the recent average federal funding level) could be used to directly offset the loss of economic values in different U.S. salmon fisheries managed under the PST. As noted above, there is currently no legal framework under which NMFS could administer such a program, thus we developed these scenarios for analytical purposes.

Secondly, to help inform the comparison between Alternative 4 and Alternative 2, we modeled fishery reductions that would likely achieve a 4-5% increase in prey in the times and areas most beneficial to SRKW. To obtain the same level of benefits through fishery reductions to meet SRKW prey increase goals, an estimated \$25 million dollars annually (minimum) would be needed to help implement these actions. See further explanation of our assumptions and context of this in the following paragraphs.

Both of the fishery reduction scenarios described above provide for an effects analysis on specified resources using expected federal funding in the future and for a scenario that likely meets prey increase goals for SRKWs (Dygert et al. 2018; NMFS 2019). These scenarios are also directly comparable to Alternative 2, the hatchery prey increase program, in terms of using current federal funding to implement actions, and using additional funding to help attain prey increase program goals for SRKWs.

There are numerous approaches that could be taken to evaluate the extent of fishery harvest reductions throughout the analysis area that could be achieved with the range of funding being considered for this alternative in this PEIS. For the current funding level of the prey program analysis, we assume Chinook salmon harvest could be reduced through funding equivalent to an estimate of the value of the salmon harvest in current fishery markets (PFMC 2023; NMFS 2024b). We considered the recent ex-vessel value

that results in significant loss of access to the fishery resource, which may include loss of fishing vessels and gear for a substantial period of time and results in significant revenue loss or negative subsistence impact due to an allowable cause; and (ii) does not include—

- (I) reasonably predictable, foreseeable, and recurrent fishery cyclical variations in species distribution or stock abundance; or
- (II) reductions in fishing opportunities resulting from conservation and management measures taken pursuant to this chapter.”

Second, the MSA provides for fishery capacity reduction through buyback programs. These programs may be initiated by NMFS at the request of a fishery management council, a state, or a majority of permit holders in a fishery. 16 USC section 1861a.

and community level value of Chinook salmon fisheries in the analysis area, (PFMC 2023; NMFS 2024b), and identified example scenarios in which \$6.2 million could be distributed to at least somewhat mitigate for the lost value of fishing seasons in various U.S. salmon fisheries.

For the analysis that reduces Chinook salmon fishery harvest to provide an additional 4-5% Chinook in times and areas important to SRKW, we modeled a series of fishery harvest closures that attained such increases. The value of the fisheries closed in this scenario equates to a minimum of \$25 million dollars annually in current fishery markets (see section 4.5.4 for further details). In this scenario we modeled a Chinook fishing closure throughout all the winter and spring fishing periods and areas of U.S. fisheries subject to the PST agreement (i.e., a total harvest closure in winter and spring). The total closure of Chinook salmon harvest in the winter and spring periods was not sufficient to reach a 4-5% increase in prey availability. We determined that in order to reach the desired goals for prey increase, an additional 15% harvest reduction across all U.S. Chinook fisheries during the summer was necessary each year. This combination of closures and fishery reduction provided a level of prey increase similar to program goals, depending upon the time and area considered.

Benefits in prey increase are not uniform across the analysis area. The closure of Chinook salmon harvest in the winter and spring periods would provide direct and immediate prey increases for SRKWs during a time of potential prey limitation in the southern US waters. However, as described above, this level of harvest reduction was not enough to meet the stated goal for Alternative 4, so additional harvest reductions were modeled in the summer period throughout the entire analysis area (SUS and SEAK waters), which would also provide direct and immediate prey increases for SRKWs in key foraging areas during the summer and fall. We determined this level of fishery reduction to be sufficient for analysis purposes to compare among other alternatives; in particular Alternative 2, the hatchery alternative. Further details of this scenario are discussed below and in Appendix F.

Again, there are numerous scenarios that could be implemented using the available and assumed funding to reduce Chinook salmon harvest across the commercial, sport, and tribal fisheries in the analysis area. NMFS has reduced fishing using funding mechanisms in the past; in particular through buy-back programs. However, the cost of fishery reductions is a fact- and context-specific inquiry and thus choices had to be made on fishery reductions with the limited available funding for these types of actions.⁵

⁵ For context, fishery reduction costs that have occurred in the recent past include the following instances. The Pacific Salmon Treaty monies for the Southeast Alaska Chinook salmon fishery mitigation program, which provided \$22.4 million dollars to the state of Alaska to alleviate the economic impacts from the required annual 7.5% fishery

The results of these fishery scenarios (current funding level and prey increase program goals) on affected resources are evaluated in Chapter 4, Environmental Consequences. Additional analysis related to this alternative can be found in Appendix F.

2.5. Alternatives Considered But Not Analyzed in Detail

There are many alternative actions or combinations of actions that could be taken, and therefore analyzed in this PEIS, but these actions 1) do not meet the purpose and need for the action, 2) are beyond the control of NMFS authorities (non-federal), or decision making (not NMFS discretion), and/or under the authority of existing government to government agreements and treaties (PST), or 3) would not provide information helpful to this analysis and the decision making process. Congress appropriates federal funds for the implementation of the PST to NMFS, who then distributes funds for a prey increase program for SRKWs. That is the responsibility of NMFS and the purpose and need of the action evaluated in this PEIS.

The following alternatives were considered but will not be evaluated in detail:

- Of the federal funds NMFS receives for implementing the PST, use varying proportions of the funds for hatchery production, habitat restoration, and/or fishery harvest reductions. This alternative would essentially combine aspects of the existing alternatives into another alternative, but assumes the same amount of federal funding. This type of alternative was dismissed from further analyses because the benefits/effects of this type of alternative in meeting the goals of the prey increase program would be within the range of effects analyzed in the existing four alternatives. Therefore, this type of alternative does not provide any new information that NMFS deems useful for the decision-making process.

reduction prescribed in the 2019 Agreement (<https://www.adfg.alaska.gov/index.cfm?adfg=fisherymitigation.main>). The Washington Department of Fish and Wildlife's Columbia River commercial salmon fishery provided funding of \$14.4 million to reduce the number of permits from 240 to 67 (<https://wdfw.wa.gov/licenses/commercial/columbia-river-license-reduction>). Canada has announced \$123 million dollars to retire commercial salmon fishery licenses from a potential pool of 1,300 license holders (<https://www.cbc.ca/news/canada/british-columbia/federal-fishing-license-purchases-1.6686192>). In Southeast Alaska, \$13.1 million was available to retire 64 permits to reduce fleet capacity (<https://www.federalregister.gov/documents/2023/06/01/2023-11638/fishing-capacity-reduction-program-for-the-southeast-alaska-purse-seine-salmon-fishery>). Under Alternative 4, the assumed annual funding of \$6.2 million in the future (based upon the recent prey program average) could in fact be used to implement fishery reductions.

- Of the federal funds NMFS receives for implementing the PST, use these funds to enhance existing efforts by governmental and non-governmental entities to reduce predation of salmon by fish, birds, and marine mammals. Some potential examples of these efforts are tern and cormorant depredation of juvenile salmonids in the Lower Columbia River, the northern pikeminnow removal bounty program in the Columbia River, and marine mammal depredation/removal efforts at Bonneville dam and Willamette falls. Some of these predation efforts would certainly provide benefits to juvenile salmon survival, which would in turn, increase the prey availability for SRKWs in marine waters. Other efforts would focus on adult salmon and not provide direct benefits to SRKWs in marine waters. This alternative was dismissed and will not be further evaluated because the four alternatives described above provide an adequate range of alternative uses for the available funding. The potential benefits of reducing predation on salmon is within the scope of potential benefits to salmon production as in alternatives 2 and 3.
- Of the federal funds NMFS receives for implementing the PST, an alternative should be considered to fund the production of other salmon species besides Chinook salmon to increase the prey availability for SRKWs. Coho salmon and chum salmon are preyed upon by SRKWs in specific areas and during certain times that could potentially provide enhanced benefits to SRKWs. This alternative could meet the purpose and need for the action. However, NMFS will not be analyzing another alternative that specifically produces other salmon species. The hatchery prey increase program alternative, using solely Chinook salmon, meets the purpose and need for the action and provides opportunity to produce additional hatchery Chinook salmon meeting the overall goals of the program. Since this is the case, evaluating another alternative using other salmon species was not necessary to fulfil the goals of the prey increase program (as evaluated herein for 2023 Chinook salmon releases). Another alternative evaluated in the PEIS that focuses on the natural production of salmon will provide additional benefits for Chinook salmon, and other salmon species, that naturally reproduce in the wild from habitat restoration and enhancement.
- Of the federal funds NMFS receives for implementing the PST, use these funds to reduce the effects of vessels on SRKWs feeding in critical areas of the Salish Sea during critical time periods, and/or use these funds towards monitoring and enforcing the existing vessel regulations. While vessel measures may increase the ability of SRKWs to locate and capture prey, such an alternative would not increase the amount of prey available to SRKWs in any given area. Washington State recently passed more restrictive vessel distance regulations (1000 yards) to go into effect in 2025, and the Washington Commercial Whale Watch Licensing Program also

reduces vessel effects from the whale watching industry. The Quiet Sound (US waters) and ECHO (Canada waters) programs have implemented large commercial vessel slowdowns in recent years to reduce impacts of noise around SRKWs. Both initiatives have robust monitoring to evaluate the reduction in noise associated with the slowdown measures. NMFS also supports vessel monitoring through the Soundwatch program. This alternative use of the federal funding for vessel impacts was eliminated from further consideration because there would be no expected benefit to prey quantity, and the expected benefit to prey availability is not comparable to the other alternatives, and as such it doesn't meet the purpose and need for the action.

- An additional alternative was considered that essentially combines Alternative 2 (the hatchery prey increase program) and Alternative 4 (the fishery harvest reduction) together. We modeled the cumulative effects of these actions and the results are reported in Appendix F. The effects of this scenario are within the range of effects considered in alternative 2 and alternative 4 in the PEIS and thus no further analysis was conducted.

3. AFFECTED ENVIRONMENT

3.1. Introduction

Chapter 3, Affected Environment, describes current conditions for five resources that may be affected by implementation of the alternatives:

- Chinook Salmon and Their Habitat (Section 3.2)
- Southern Resident Killer Whales (Section 3.3)
- Other Fish and Wildlife Species (Section 3.4)
- Socioeconomics (Section 3.5)
- Environmental Justice (Section 3.6)

Current conditions, depending on the resource, include effects of the past operation of Chinook salmon hatchery programs, fisheries, and habitat conditions and restoration projects in the analysis area. It is important to note the hatchery prey increase program has been funded by NMFS in FY2020 through FY2023 and therefore fish produced with funds distributed in those years are currently a part of the affected environment.

3.2. Chinook Salmon and Their Habitat

Chinook salmon have a complex life cycle that involves a freshwater rearing period (typically 1 year or less) followed by two to four years of ocean feeding and growth prior to their spawning migration. The behavior of Chinook salmon differs substantially, with freshwater rearing going from stream residence to schooling behavior as emigration occurs in mainstem rivers to the marine environments. Chinook salmon considered herein range from the Columbia River and coastal Oregon rivers to as far north as the ocean waters off British Columbia (BC), specifically North/Central British Columbia (NCBC) and SEAK. Other stocks migrate in a less distant but still significantly northerly direction, while still others remain in local waters or range to the south of their natal streams. While there is great diversity in the range and migratory habits among different stock groups of Chinook salmon, there also is a remarkable consistency in the migratory habits within stock groups, which greatly facilitates stock-specific fishery planning (Figure 3).

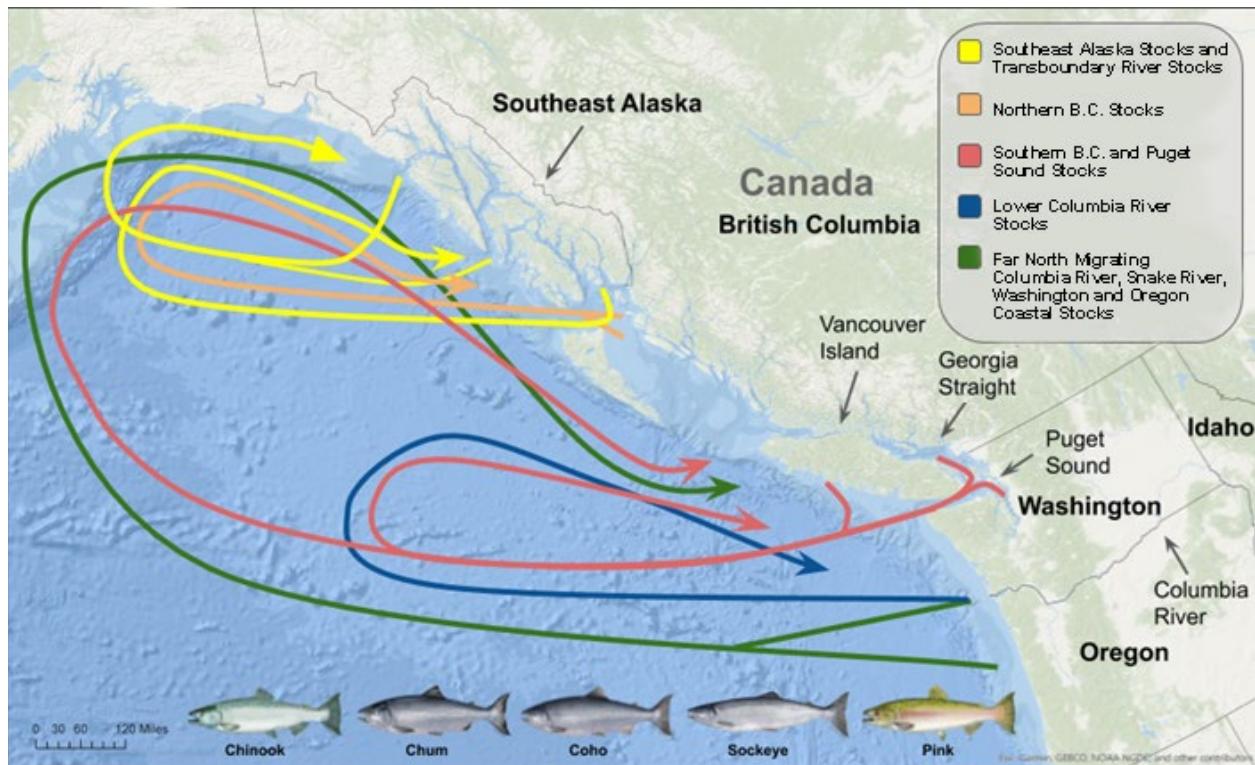


Figure 3. Migratory patterns of major Chinook salmon stock groups. Figure taken from the Pacific Salmon Commission.

Chinook salmon considered in this PEIS include all of the stocks potentially affected by the alternatives described herein. These stocks represent Chinook salmon from the Oregon Coast, Columbia River Basin, Washington Coast, and Puget Sound regions. These stocks represent both ESA-listed and non-listed stocks. A summary of the most recent stock status can be found at the following websites:

- NOAA Fisheries: <https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/report-card-recovery-reviews-assess-28-salmon-and>
- Pacific Fishery Management Council: <https://www.pcouncil.org/salmon-management-documents/>

In general, Chinook salmon stocks throughout the analysis area are currently experiencing short-term and long-term declines in abundance (NWIFC 2023). Recent abundances of nearly every stock of Chinook salmon is less than the most recent 10 year averages and far less than long-term averages (Ford 2022). Recent survivals and productivity in freshwater and marine areas for Chinook salmon are continuing to suffer from droughts, high temperatures, and the warm water blob in the ocean in the recent past, which represented unfavorable ocean conditions for salmon, continues to have effects on the returns of Chinook

salmon throughout the region. Natural-origin stocks and hatchery-origin fish are similarly experiencing lower than average returns in recent years.

3.2.1. Chinook Salmon Habitat

Chinook salmon are found in freshwater streams and rivers, where clean, cool, and well-oxygenated waters with gravel or rocky bottoms are essential for successful spawning. After hatching, juvenile Chinook salmon seek shelter in freshwater habitats with submerged vegetation or woody debris to avoid predators. Downstream migration occurs at age-0 and age-1, with ocean entry commonly in the spring, summer, and fall time periods. In the ocean, Chinook salmon typically spend two to five years before migrating back into freshwater and spawning in their natal habitats. The key habitat requirements for Chinook salmon are described by life stage in Table 2.

Table 2. Primary constituent elements for the habitats of Chinook salmon.

Physical and biological Features		Species Life History Event
Site Type	Site Attribute	
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

Across the analysis area, the current habitat capacity and productivity for Chinook salmon is much reduced from historic levels due to a suite of anthropogenic effects (NWIFC 2023). Much habitat has been eliminated and/or reduced and the remaining habitat is controlled by many factors that affect the physical habitat of streams and rivers, including water quality and quantity, for Chinook salmon populations. Many populations of Chinook salmon throughout the region are at or near historically low abundances.

Restoration efforts are being implemented to help recover Chinook salmon throughout the region including habitat restoration, improvements in juvenile and adult survivals, and other actions. However, there is also continued pressures on habitat from development, continued use of the watersheds in which the salmon live, and worsening environmental conditions including warmer water temperatures, reduced rainfall, and other adverse conditions in recent years.

3.2.2. Hatchery Production

Hatchery Chinook salmon production in Oregon, Washington, and Idaho is a crucial part of fisheries management in the Pacific Northwest. Within these states, a variety of federal, state, tribal, and other entities fund and operate hatcheries to rear young Chinook salmon, which are released into rivers and streams to support recreational and commercial fishing, and in some cases essential conservation and recovery objectives. This practice helps mitigate the decline in natural salmon populations due to factors like habitat loss and degradation. However, it also raises concerns about potential genetic and ecological effects on wild salmon and the need for careful management to maintain healthy populations. Overall, with such careful management hatchery Chinook salmon production plays a vital role in balancing the conservation of wild salmon while still providing for fishing opportunities in the region (including treaty reserved tribal rights).

Hatchery production of salmonids in the Pacific Northwest has occurred for over 100 years. Currently, there are hundreds of hatchery programs in Oregon, Washington, and Idaho that produce juvenile salmon that migrate through the analysis area. Hatcheries can provide benefits by reducing demographic risks and preserving genetic traits for populations at low abundance in degraded habitats. In addition, hatchery production can help to provide harvest opportunity upholding the meaningful exercise of treaty rights for the Northwest tribes (NWIFC 2023). Hatchery-origin fish may also pose risk through genetic, ecological, or harvest effects. For example, hatchery programs can affect ESA-listed salmon and steelhead through competition with natural-origin fish for spawning sites and food, outbreeding depression, and hatchery-influenced selection.

Figure 4 and Figure 5 show existing hatchery facilities located throughout the analysis area. These facilities are funded and operated by state, tribal, and federal organizations for a variety of hatchery purposes. Within the existing hatchery production facilities throughout the region, a few of these facilities (shown as black dots in the figures) have received PST-related prey increase funds in the FY 2020-2023 time period to produce some additional hatchery Chinook salmon. Overall, these facilities have been producing Chinook salmon for decades and the hatchery prey increase program funding has been distributed for additional production at these existing facilities, as described in the sections below.

Because most hatchery programs are ongoing, the effects of each program are reflected in the most recent status of the species (see weblinks and summary above). Most of the existing hatchery programs have also undergone the necessary site-specific evaluations under NEPA and the ESA to determine the effects of this hatchery production.

The history and evolution of hatcheries are important factors in analyzing their past and present effects. From their origin more than 100 years ago, hatchery programs have been tasked to compensate for factors that limit anadromous salmonid viability. The first hatcheries, beginning in the late 19th century, provided fish to supplement harvest levels, as human development and harvest impacted naturally produced salmon and steelhead populations. As development in freshwater systems continued (e.g., in the Columbia River Basin dam construction between 1929 and 1975), hatcheries were used to mitigate for lost salmon and steelhead harvest attributable to reduced salmon and steelhead survival and habitat degradation. Since that time, most hatchery programs have been tasked to maintain fishable returns of adult salmon and steelhead, usually for cultural, social, recreational, or economic purposes, as the capacity of natural habitat to produce salmon and steelhead has been reduced.

A new role for hatcheries emerged during the 1980s and 1990s after naturally produced salmon and steelhead populations declined to unprecedented low levels. Because genetic resources that represent the ecological and genetic diversity of a species can reside in fish spawned in a hatchery, as well as in fish that spawn in the wild, hatcheries began to be used for conservation purposes to conserve genetic resources, reintroduce salmon back into historic habitats, and reduce demographic risks. Such hatchery programs are designed to preserve the salmonid genetic resources until the factors limiting salmon and steelhead viability are addressed. In this role, hatchery programs reduce the risk of extinction (NMFS 2005; Ford 2011). However, hatchery programs that conserve vital genetic resources are not without risk to the natural salmonid populations because the manner in which these programs are implemented can

affect the genetic structure and evolutionary trajectory of the target population (i.e., natural population that the hatchery program aims to conserve) by reducing genetic and phenotypic variability and patterns of local adaptation (HSRG 2014; NMFS 2014).

Population viability and reductions in threats are key measures for salmon and steelhead recovery (NMFS 2013). Beside their role in conserving genetic resources, hatchery programs also are a tool that can be used to help improve viability (i.e., supplementation of natural population abundance through hatchery production). In general, these hatchery programs increase the number and spatial distribution of naturally spawning fish by increasing the natural production with returning hatchery adults. Across the affected environment, there is a range of hatchery programs affecting Chinook salmon. Some hatchery programs are providing a net benefit to natural populations. Other hatchery programs continue to pose varying levels of risk to natural populations from genetic and ecological effects.

Available knowledge and information on the effects of hatchery fish releases on density dependent interactions affecting the growth and survival of other juvenile salmon in the ocean is limited and highly variable in complex physical and biological environments. The preponderance of scientific literature shows the early marine phase when salmon first enter saltwater is the most critical in determining the overall survival rate to adulthood. The conditions affecting this early marine phase for salmon are highly variable and change dramatically both seasonally and annually (Beamish and Neville 2021). Information regarding the mechanisms driving survivals of salmon at this life stage is very limited and not clearly understood (Beamish 2022).

There is no way to predict what the future conditions in the early marine phase may be in advance of a few months. These conditions are important in understanding how hatchery production, and the fish released, will eventually affect all salmon survival in this critical early marine phase when first entering saltwater. Hatchery production is initiated one to two years before the juvenile hatchery fish will enter saltwater, so there is no way to predict what marine conditions may be in advance of production.

High releases of hatchery fish entering the marine environment may affect survival conditions for co-occurring natural-origin salmon. Ruggerone et al. (2022) described the increased abundance of hatchery and natural pink salmon in recent decades being able to change the trophic dynamics in the marine environment and thus potentially affect the survival of other salmon. In the analysis area, hatchery fish may also pose similar risks depending upon the abundances entering marine areas, current environmental conditions, and limitations. It is likely there may be adverse effects at a local level over a period of time

depending upon the productivity of the marine environment in the California current of the eastern Pacific ocean within the analysis area. See <https://ecowatch.noaa.gov/regions/california-current> for further information on the current state of marine waters off the western US and annual fluctuations.

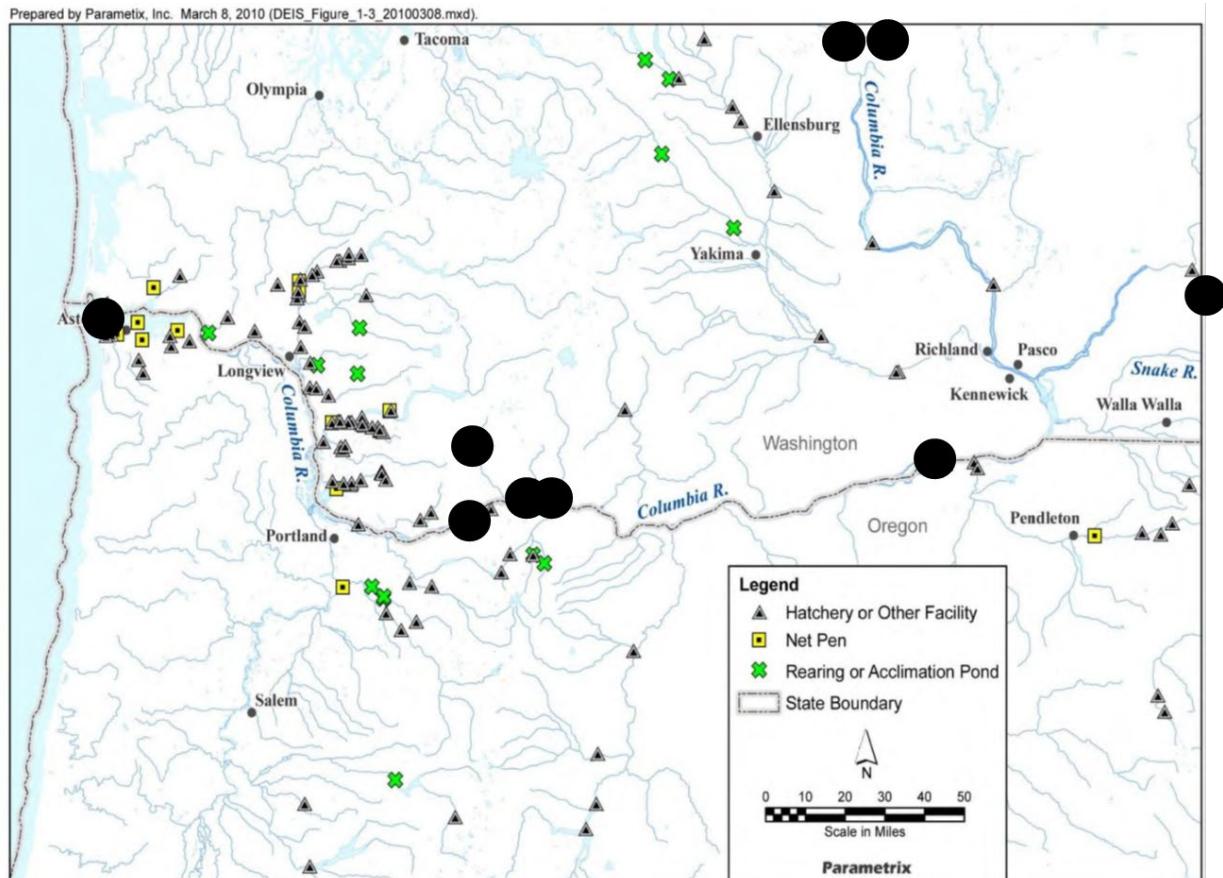


Figure 4. Hatchery facilities in the project area of the Columbia River Basin. The black circles show the general location of facilities used for the hatchery prey increase program production funded by NMFS in 2023. Figure adapted from NMFS (2014).

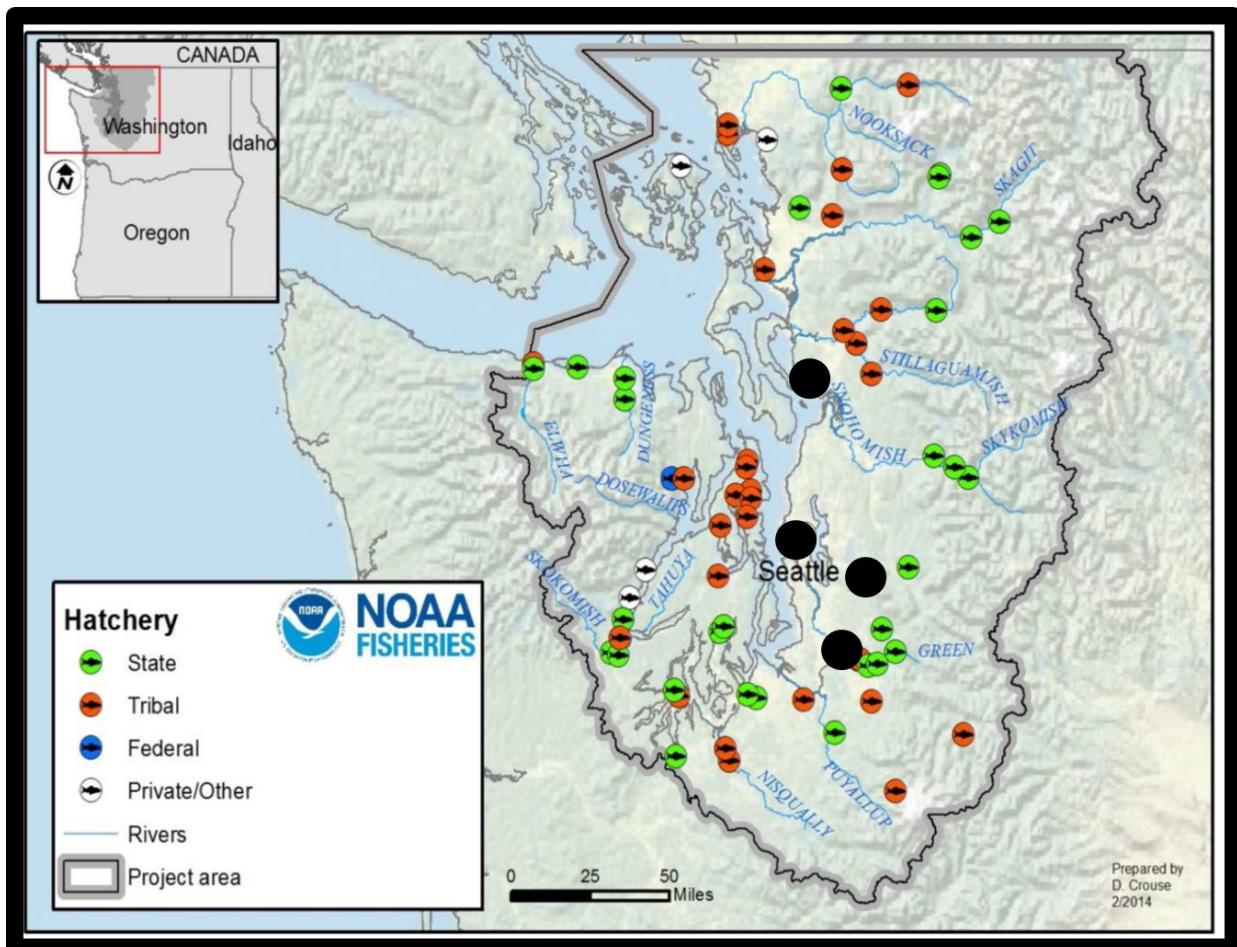


Figure 5. Hatchery facilities in the project area of the Puget Sound region. The black circles show the general location of hatchery prey increase program production funded by NMFS in 2023. Figure adapted from NMFS (2014).

3.2.2.1.Existing Hatchery Production

Regional Hatchery Releases

In the recent past, an average of 158 million juvenile Chinook salmon annually have been released throughout the analysis area over the years of 2008 through 2023 (Table 3). The total number released into each sub-region of the analysis area varies substantially from year to year. In the U.S. Salish Sea, in the 2008-2023 time period, annual releases of hatchery Chinook salmon ranged from 40.6 million in 2021 to a high of 52 million in 2023. In the Columbia River, annual Chinook hatchery releases ranged from 80.0 million in 2023 to 107.8 million in 2010. Across the analysis area, 62% of the Chinook releases occurred in the Columbia River; 28% in the U.S. portion of the Salish Sea. From a longer-term

perspective, total release of hatchery Chinook salmon in the analysis area were typically more than 200 million fish prior to the mid-1990's (Figure 7).

Table 3. Total regional hatchery juvenile Chinook salmon releases from 2008 through 2023. Data from Regional Mark Information System (<https://www.rmpc.org/>).

Release Year	Salish Sea	Washington Coast	Oregon Coast	Columbia River
2008	44,930,915	10,125,788	6,176,199	94,901,003
2009	43,336,852	10,330,852	5,629,442	103,057,567
2010	41,836,569	9,202,126	6,675,993	107,783,568
2011	43,863,472	11,197,030	5,983,922	102,170,533
2012	41,907,618	11,248,489	6,312,472	103,798,265
2013	41,006,628	9,872,485	6,079,183	103,748,801
2014	41,275,967	11,422,843	7,252,409	101,376,847
2015	42,486,682	11,311,230	5,987,165	99,083,861
2016	41,392,329	8,842,142	5,878,639	93,116,623
2017	41,502,620	10,059,269	5,461,163	95,083,272
2018	46,089,539	9,696,522	5,895,970	97,087,901
2019	49,758,060	11,044,692	4,067,665	92,635,747
2020	50,178,052	8,791,100	5,920,781	91,357,510
2021	40,609,889	12,506,266	5,662,594	97,874,041
2022	50,256,589	13,033,163	4,597,875	87,761,462
2023	52,147,431	9,042,426	4,597,875*	76,963,674
Average by Area	44,536,201	10,482,901	5,761,209	96,737,542
Total Average Releases			157,517,854	

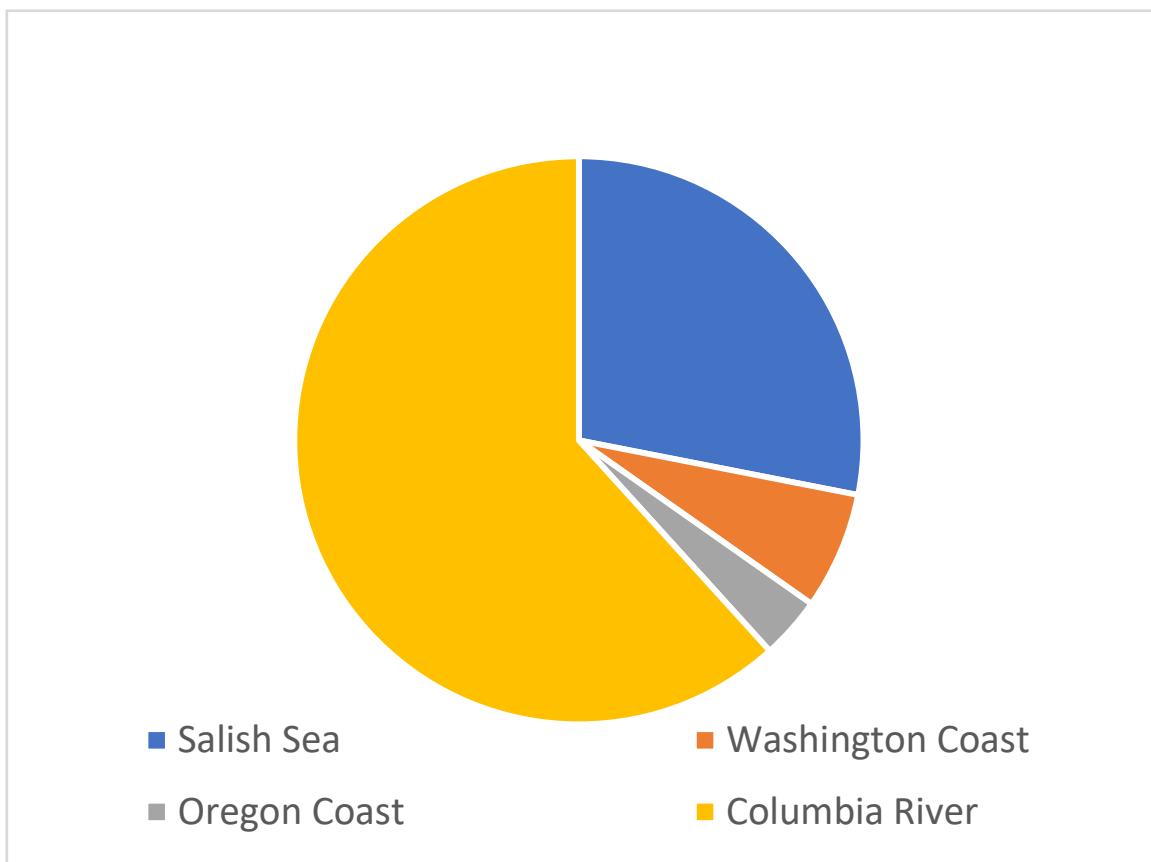


Figure 6. Average proportion of hatchery Chinook salmon releases (2008-2023) by area.
Data from Table 3.

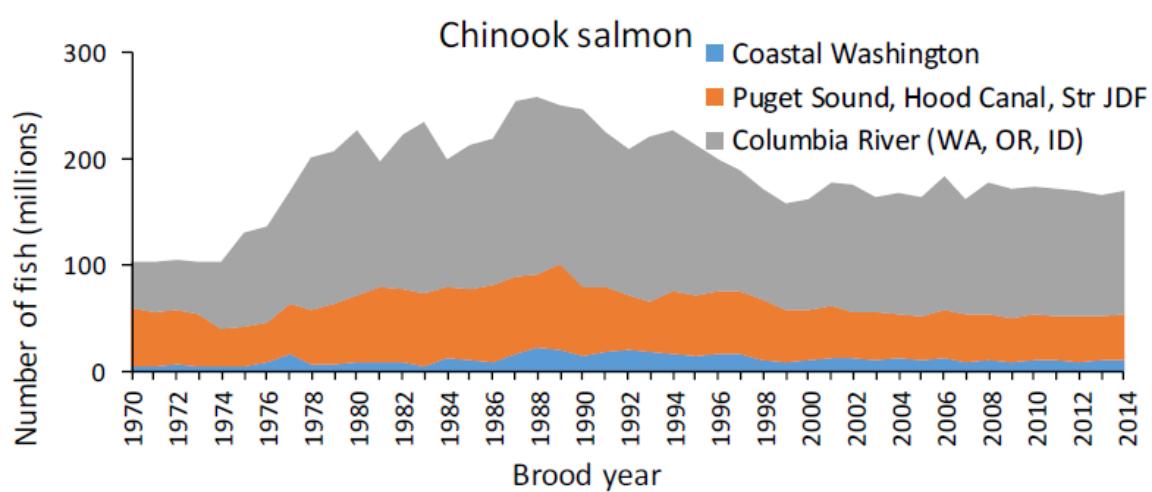


Figure 7. Long-term dataset of hatchery Chinook salmon releases throughout the region.
Taken from WDFW (2020).

NMFS has a long history of evaluating the effects of hatchery programs on Chinook salmon throughout the project area. Extensive analysis of the hatchery operations and production of hatchery fish associated with these facilities has been evaluated by NMFS previously (e.g. NMFS 2014; NMFS 2019). A more detailed discussion of the general effects of hatchery programs on salmonids can be found in the Final Environmental Impact Statement to Inform Columbia River Basin Hatchery Operations and the Funding of Mitchell Act Hatchery Programs (NMFS 2014), and in Appendix C of NMFS (2024b).

Six factors may pose *positive*, *negligible*, or *negative* effects to population viability of naturally-produced salmon and steelhead. These factors are:

- (1) the hatchery program does or does not remove fish from the natural population and use them for hatchery broodstock,
- (2) hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities,
- (3) hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas, the migration corridor, estuary, and ocean,
- (4) research, monitoring, and evaluation that exists because of the hatchery program,
- (5) the operation, maintenance, and construction of hatchery facilities that exist because of the hatchery program, and
- 6) fisheries that exist because of the hatchery program, including terminal fisheries intended to reduce the escapement of hatchery-origin fish to spawning grounds.

The principal mechanisms upon which hatchery programs can affect Chinook salmon are found in Table 15. To summarize, hatchery programs can affect the genetics of natural populations from straying and interbreeding in the wild. Hatchery programs can increase the number of salmon spawning in historical habitats, which may increase the abundance and productivity (in some cases) of the natural population (reintroduction). Hatchery fish can compete and predate upon co-occurring natural-origin fish; particularly at the juvenile life stages. Hatchery fish can transfer diseases and pathogens to natural-origin fish after release from the hatchery. In some circumstances, hatchery programs can benefit salmonid viability by supplementing natural spawning and thereby increasing natural-origin fish abundance and spatial distribution, by serving as a source population for re-populating unoccupied habitat, and by conserving genetic resources.

Table 4. General mechanisms through which hatchery programs can affect natural-origin salmon populations.

Effect Category	Description of Effect
Genetics	<ul style="list-style-type: none"> • Hatchery-origin salmon and steelhead interbreeding with natural-origin fish in the wild can change the genetics of the affected natural population(s). • Hatchery-origin fish can alter the genetic integrity and/or genetic diversity of the affected natural population(s) depending upon the magnitude of interaction. • If natural-origin fish abundance is critically low, the hatchery stock may contain genetic resources valuable for population conservation and recovery.
Competition and predation	<ul style="list-style-type: none"> • Hatchery-origin fish can increase competition for food and space. • Hatchery-origin fish can increase predation on natural-origin salmon and steelhead.
Pathogen transfer	<ul style="list-style-type: none"> • Hatchery fish can have elevated levels of pathogens and bacteria from rearing in the hatchery that can be transferred to the natural-origin population from hatchery fish and/or release of hatchery effluent.

Effect Category	Description of Effect
Hatchery facilities	<ul style="list-style-type: none"> • Hatchery facilities can reduce water quantity or quality in adjacent streams through water withdrawal and discharge of effluent. • Hatchery facilities at weirs and dams to collect broodstock and/or control hatchery fish on the spawning grounds can have the following unintentional consequences: <ul style="list-style-type: none"> ○ Isolation of formerly connected populations ○ Limiting or slowing movement of migrating fish species, which may enable poaching, increase predation, and/or alter spawn timing and distribution ○ Alteration of stream flow ○ Alteration of streambed and riparian habitat ○ Alteration of the distribution of spawning within a population ○ Increased mortality or stress due to capture and handling ○ Impingement of downstream migrating fish
Natural population masking	<ul style="list-style-type: none"> • Hatchery-origin fish spawning naturally can mask the true status of the natural-origin population from hatchery supplementation.
Fishing	<ul style="list-style-type: none"> • Fisheries targeting hatchery-origin fish can have incidental impacts on co-occurring natural-origin fish.

Effect Category	Description of Effect
Population viability benefits	<ul style="list-style-type: none"> • Depending upon the objective of the specific hatchery program, hatchery fish can potentially: <ul style="list-style-type: none"> ○ Increase the abundance of natural-origin fish from additional natural spawning in the wild. ○ Increase the productivity of the natural population from hatchery fish spawning and nutrient enhancement, particularly if abundance of natural-origin fish is low. ○ Preserve and/or increase the genetic and phenotypic diversity of the affected natural population, particularly for severely depressed populations.
Nutrient cycling benefits	<ul style="list-style-type: none"> • Returning hatchery-origin adults can increase the amount of marine-derived nutrients in freshwater systems from natural spawning and/or outplanting of carcasses from the hatchery.

Hatchery Chinook Spawning in the Wild

Hatchery Chinook salmon returning to freshwater areas that are not harvested in fisheries, collected at hatchery facilities, and survive may spawn in the wild. A common metric measuring the extent of hatchery Chinook salmon spawning in the wild is the proportion of hatchery origin salmon (pHOS) spawning in the wild (pHOS; NMFS 2019). pHOS is a function of the number of hatchery-produced and naturally-produced salmon spawning together in a particular area and has been used as a surrogate to help inform potential genetic interactions between hatchery and natural salmon. pHOS would be 100% if no natural-origin salmon are spawning in the specified area; or conversely 0% if no hatchery fish are spawning in the wild.

Some available data on recent pHOS throughout the analysis is summarized in Appendix B. Depending upon the specific location, status of wild Chinook natural population, escapement of hatchery salmon, and the adjacent hatchery facilities, pHOS ranges from near zero to near 100% (Ford 2022). This is the baseline data in the affected environment prior to the return of hatchery production from releases

associated with the prey increase program (see next section). This is an extremely important point that affects our evaluation of Alternative 2, the hatchery prey increase program. See Table 8 for a timeline of adult returns from hatchery releases.

In many geographic locations, such as the lower Columbia River, pHOS in certain natural population areas are high as a result of baseline hatchery releases, without the additional hatchery production associated with the prey increase program. Current (Appendix B) pHOS estimates are based on returns through 2023, prior to returns of any fish produced using prey increase funds (returns of all age classes beginning in 2023 for fall Chinook and 2024 for spring Chinook (see Table 8)). It is important to separate existing hatchery production (in this subsection of the affected environment) from the relatively new, additional hatchery production associated with the prey increase program for SRKWs (next subsection). Otherwise it is easy to assume high pHOS in certain areas is associated with hatchery fish produced specifically for SRKW prey (federal or non-federally funded), and this simply is not the case in most natural populations throughout the analysis area (as explained below).

Returns of hatchery Chinook salmon to freshwater areas is highly variable depending upon survival of salmon in freshwater and marine areas. The variability occurs annually as fluctuations in the survival of salmon at all life stages occurs. Freshwater survival rates of juvenile salmon varies greatly from year to year depending upon environmental factors and other stressors. Survival during freshwater emigration and early marine survival of juvenile salmon fluctuates tremendously. Ocean survivals vary dramatically depending upon seasonal productivity affecting all trophic levels. Returns of hatchery salmon modeled in this assessment can vary as much as twice the mean value within a short amount of time (<10 years; Figure 8). For the most abundant stock in the analysis area (Columbia River upriver brights), the variability in returns over 10 years has been as much as an order of magnitude difference (~34,000 to ~356,000; Appendix F). This variability must be taken into account when assessing the effects of hatchery salmon on pHOS in natural populations.

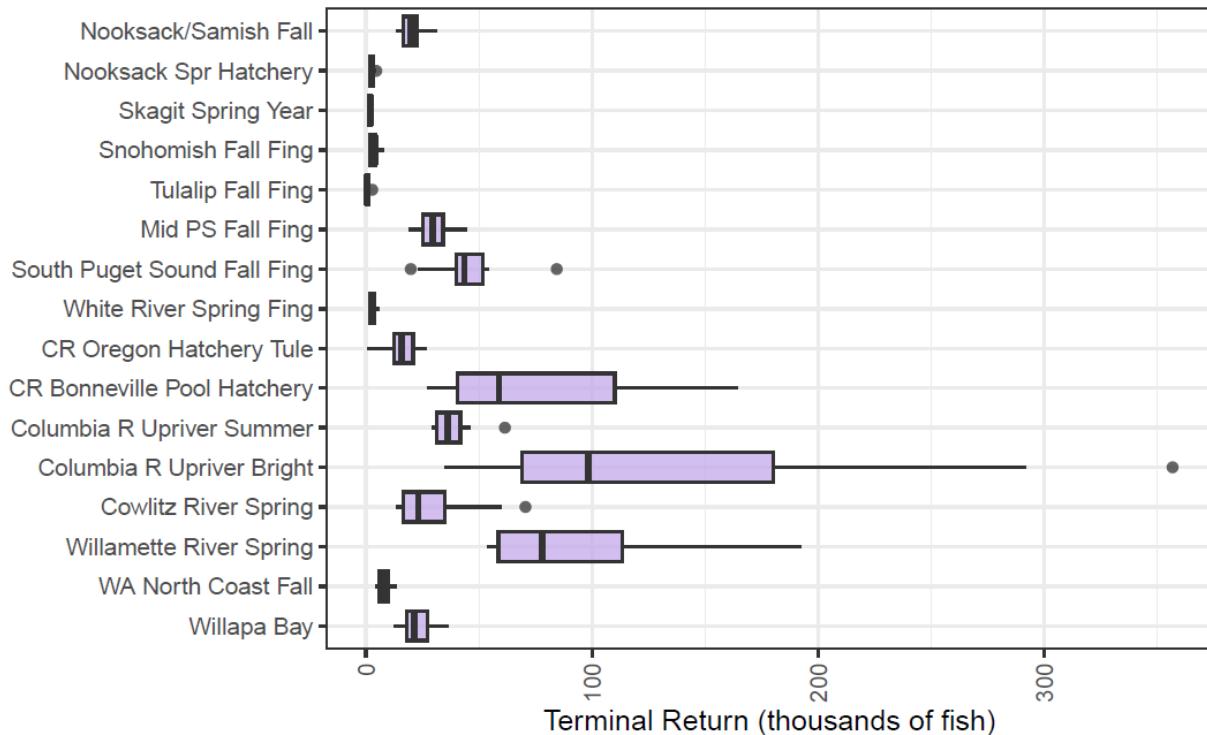


Figure 8. Variability of hatchery Chinook salmon returns to the river for Fishery Regulation Assessment Model (FRAM) stocks associated with the prey increase program (see next section for details). See Appendix F for further details.

3.2.2.2. Hatchery Prey Increase Program Funding

Regional Hatchery Releases

Currently, hatchery production is a significant component of the salmon prey base within the range of SRKWs and very important to meeting the nutritional needs of these whales (Barnett-Johnson et al. 2007). Prey availability has been identified as a threat to SRKW recovery, and so hatchery salmon will continue to provide a significant prey base for SRKWs.

In recent years, hatchery production has been funded by federal and state agencies specifically to provide more prey availability for SRKWs. NMFS has been allocating approximately \$6.2 million (average) of the federal appropriation for PST implementation annually from FY 2020-2023 to increase prey availability for SRKW through hatchery production. For example, 7.2 million Chinook salmon were released in 2022 funded by these appropriations (Table 5). Table 5 shows the releases increasing from 2020 through 2023. For 2023, a total of 8.3 million Chinook salmon were released (Table 5).

Also, in response to recommendations from the Washington State Southern Resident Orca Task Force (2018), the Washington State Legislature provided \$12.5 million of funding “prioritized to increase prey abundance for southern resident orcas” (Engrossed Substitute House Bill 1109) for the 2021-2023 biennium (July 2021 through June 2023). This Washington State funding has resulted in approximately 11.6 million additional Chinook salmon released in 2023 (Table 5). In 2023, the Legislature provided \$12.5 million for the 2023-2025 biennium (July 2023 through June 2025).

These initiatives have produced fish that are currently increasing prey availability of Chinook salmon for SRKWs (Table 7), as fish released from 2019 and 2020, depending on life history, are currently reaching adult age in the ocean (beginning in 2023). Fish funded by these programs through FY 2023 and planned for release as smolts in 2024 are expected to contribute to the prey base through 2028.; as these fish will take a few years to reach maturity in the ocean (within 3-5 years of release based on their type of release and life history; subyearling fall Chinook salmon, for instance, generally return to freshwater after four years of ocean residency (Groot and Margolis 1991)). As these fish exit the ocean after reaching maturity they may contribute to spawning and overall Chinook salmon abundance within the vicinity of their natal release. This will occur at varying intervals, given the various life histories and types of releases listed in Table 5, but as described here, this will continue to occur 3-5 years after FY 2023 funding. NMFS’ spend plan for FY 2024 allocates \$6.05 to the prey increase program. However, fish have not yet been produced using these funds.

Table 5. Number of released fish (release years 2020 through 2023) from Federally funded hatchery programs in FY2020 through FY2023 intended to increase prey availability for SRKWs throughout areas where PST fisheries occur.

Facility	Region	Operating Agency	Life History/ Adjacent Natural Population	Type of Release	2020 Release	2021 Release	2022 Release	2023 Release
Issaquah Hatchery	Puget Sound	WDFW	Fall Chinook/ Cedar, Sammamish	Sub-yearling	-	-	707,026	1,000,000
Tulalip Bernie Gobin Hatchery	Puget Sound	Tulalip Tribe	Summer Chinook/Tulalip, Skykomish	Sub-yearling	-	-	958,415	1,808,692
Soos Creek Hatchery	Puget Sound	WDFW	Fall Chinook/ Green	Sub-yearling	-	2,003,244	2,077,568	2,137,191
East Bank and Marion Drain Hatcheries	Columbia River	Yakama Nation	Fall Chinook/ Toppenish	Yearling	-	-	19,755	109,876
Marion Drain Hatchery	Columbia River	Yakama Nation	Summer Chinook/ Toppenish	Sub-yearling	-	279,594	-	-
Select-Area Fishery Enhancement (SAFE)	Columbia River	ODFW	Spring Chinook/ NA	Yearling	-	1,345,310	1,507,467	1,430,813
Umatilla Hatchery	Columbia River	ODFW	Fall Chinook/ Umatilla	Sub-yearling	-	-	127,931	-
Round Butte Hatchery	Columbia River	ODFW	Spring Chinook/ Deschutes	Sub-yearling	-	167,000	-	-

Facility	Region	Operating Agency	Life History/ Adjacent Natural Population	Type of Release	2020 Release	2021 Release	2022 Release	2023 Release
Bonneville Hatchery	Columbia River	ODFW	Fall Chinook/ Tanner	Sub-yearling	-	344,122	250,000	234,871
Wells Hatchery	Columbia River	Douglas PUD/ WDFW	Summer Chinook/ NA	Sub-yearling	-	482,734	520,239	514,076
Little White/Willard NFH	Columbia River	USFWS	Fall Chinook/Little White Salmon	Sub-yearling	479,694	649,356	-	-
Little White/Willard NFH	Columbia River	USFWS	Spring Chinook/ Little White Salmon	Yearling	-	-	380,578	497,692
Dworshak NFH	Columbia River	Nez Perce Tribe	Spring Chinook/ Clearwater	Yearling	-	-	508,985	493,858
Spring Creek NFH	Columbia River	USFWS	Fall Chinook/ White Salmon	Sub-yearling	-	688,509	66,294	-
Carson NFH	Columbia River	USFWS	Spring Chinook/ Wind	Yearling	-	-	-	74,123
TOTAL					479,694	5,959,869	7,124,258	8,301,192

Table 6. Washington State funded hatchery production for 2019 through 2023 releases (2019-2021 biennium funding) to increase prey for SRKWs (excludes base production).

Facility	Region	Life History/ Adjacent Natural Population	Type of Release	2019 Release	2020 Release	2021 Release	2022 Release	2023 Release
Kendall	Puget Sound	Spring Chinook/ NF Nooksack	Sub-yearling	704,170	449,199	381,725	635,697	532,756
Whatcom Cr.	Puget Sound	Fall Chinook/ Whatcom*	Sub-yearling	200,000	670,000	491,747	543,181	520,964
Hupp Springs	Puget Sound	Spring Chinook/ Minter*	Sub-yearling	259,873	388,909	543,034	515,642	476,501
Samish	Puget Sound	Fall Chinook/ Samish*	Sub-yearling	1,089,148	1,217,867	0	906,459	1,042,500
Wallace River	Puget Sound	Summer Chinook/ Skykomish	Sub-yearling	-	387,761	183,901	1,049,421	1,151,558
Wallace River	Puget Sound	Summer Chinook/ Skykomish	Yearling	10,928	34,938	44,158	0	79,315
Soos/Palmer	Puget Sound	Fall Chinook/ Green	Sub-yearling	2,000,641	2,002,504	-		

Facility	Region	Life History/ Adjacent Natural Population	Type of Release	2019 Release	2020 Release	2021 Release	2022 Release	2023 Release
Marblemount	Puget Sound	Spring Chinook/ Cascade	Sub- yearling	86,500	246,479	159,534	128,022	204,190
Marblemount	Puget Sound	Spring Chinook/ Cascade	Yearling	0	405,000	414,874	0	499,293
Sol Duc	WA Coast	Summer Chinook/ Sol Duc	Sub- yearling	430,143	512,479	409,533	558,969	553,736
Sol Duc	WA Coast	Summer Chinook/ Sol Duc	Yearling	-	-	0	28,588	64,982
Minter	Puget Sound	Fall Chinook/ Minter*	Sub- yearling	763,333	321,497	332,672	291,083	419,058
Naselle	WA Coast	Fall Chinook/ Naselle	Sub- yearling	67,614	-	1,472,258	2,577,982	1,826,352
Forks Creek	WA Coast	Fall Chinook/ Willapa	Sub- yearling	567,560	2,278,497	257,338	108,072	84,308
Wells Hatchery	Col River	Summer Chinook/ Yakima	Sub- yearling	0	541,299	482,734	520,239	514,075

Facility	Region	Life History/ Adjacent Natural Population	Type of Release	2019 Release	2020 Release	2021 Release	2022 Release	2023 Release
Quinault Lake	WA Coast	Fall Chinook/ Quinault	Sub- yearling	-	-	500,000	446,651	500,000
Sol Duc/Bear Springs	WA Coast	Summer Chinook/ Sol Duc	Sub- yearling	-	-	147,913	115,179	73,122
Sol Duc/Bear Springs	WA Coast	Summer Chinook/ Sol Duc	Yearling	-	70,000	70,758	72,651	20,170
Wilkeson Creek	Puget Sound	Fall Chinook/ Puyallup	Sub- yearling	-	404,000	175,614	400,000	386,049
Clarks Creek	Puget Sound	Fall Chinook/ Puyallup	Sub- yearling	-	376,480	196,035	611,685	675,200
White River	Puget Sound	Spring Chinook/ White	Sub- yearling	-	-	167,557	238,335	273,385
Lummi Bay Hatchery	Puget Sound	Spring Chinook/ NF, MF Nooksack	Sub- yearling	-	50,000	222,168	499,193	504,080
Skookum Creek	Puget Sound	Spring Chinook/	Sub- yearling	-	870,000	794,626	0	762,084

Facility	Region	Life History/ Adjacent Natural Population	Type of Release	2019 Release	2020 Release	2021 Release	2022 Release	2023 Release
Klickitat Hatchery	Col River	SF Nooksack Fall Chinook/ Klickitat	Sub- yearling	-				
					1,000,000	-	574,715	154,835
Lewis River	Col River	Spring Chinook/ Lewis	Sub- yearling	965,570	63,915	352,270	268,950	290,165
TOTAL				7,145,480	12,226,909	7,800,449	11,090,714	11,608,678

*Only the productions that have already been released by the end of 2023 are included in this table.

Table 7. Summary of federal and state funded 2020 through 2023 Chinook salmon releases to increase prey availability for SRKWs.

Funding Source	Release Years				
	2019	2020	2021	2022	2023
PST FY20		479,694	5,959,869	1,338,993	-
PST FY21	-	-	-	5,785,265	571,815
PST FY22	-	-	-	-	7,729,377
Washington State Legislature ('19-'21)	5,397,790	11,378,375	7,976,683	-	-
Washington State Legislature ('21-'23)	-	-	-	11,098,233	11,608,870
TOTAL	5,397,790	11,858,069	13,936,552	18,222,491	19,910,062

The percentage of total regional releases funded by federal and state sources to increase prey availability for SRKWs for release years 2020 through 2023 are shown in Figure 9. Over these four years (releases completed for the year), the hatchery releases for SRKWs have averaged 10.85% of the total regional releases for those particular years. For 2023 releases, approximately 14% or less of the regional releases of Chinook salmon in the analysis area were funded by dollars specified for SRKWs (approximately 20 million prey increase program fish out of a total of 157 million throughout the region).

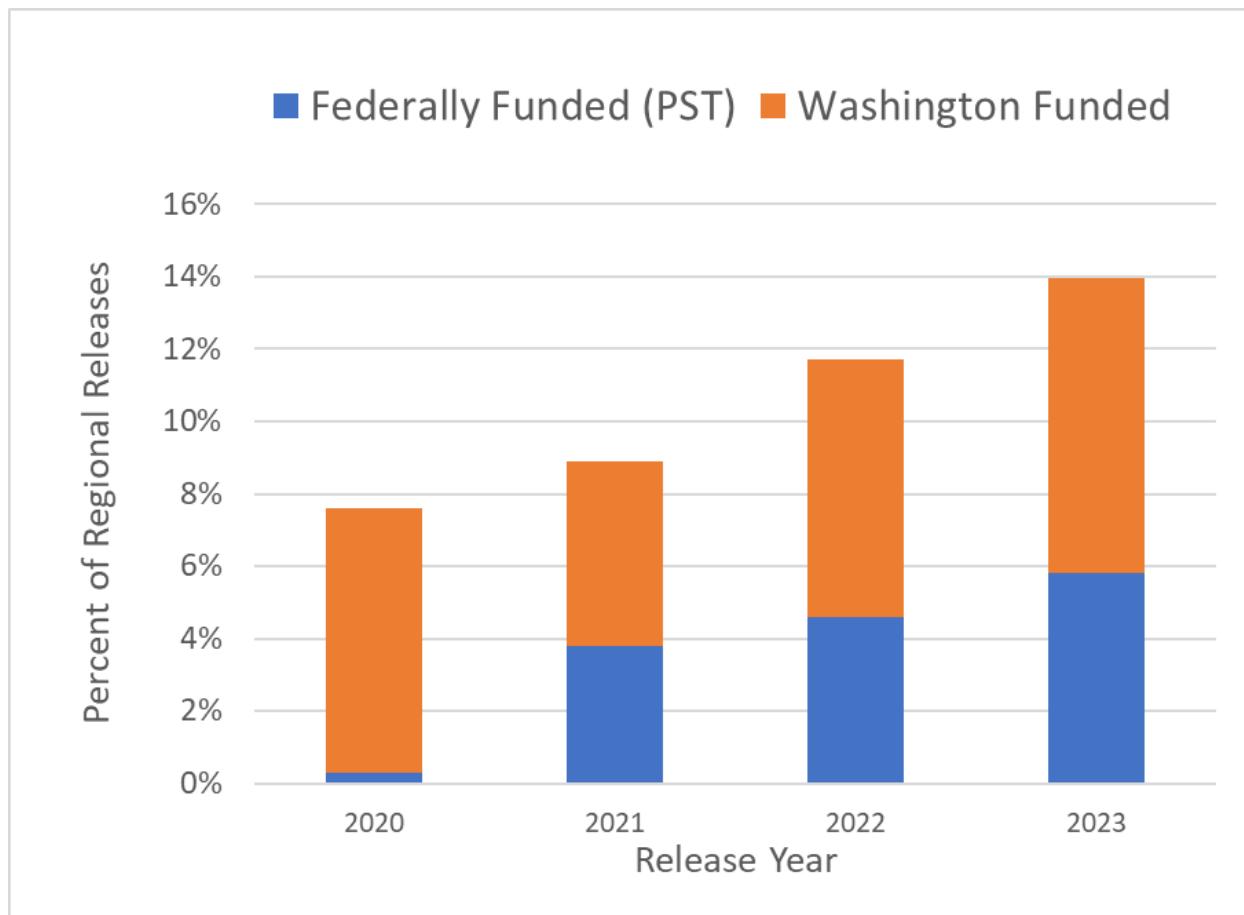


Figure 9. Percent of regional hatchery Chinook salmon juvenile releases funded by federal and state of Washington specifically to increase prey availability for SRKWs. Values calculated from data in previous tables.

Hatchery Chinook Spawning in the Wild

The potential for hatchery Chinook salmon straying into natural spawning areas from the combined federal and state prey increase funding is just beginning as jack and adult life stages mature and return to freshwater. Table 8 shows the returns to freshwater for each age class of hatchery Chinook salmon. 2023 is the first year where all age classes from fall Chinook salmon releases will begin to return, and 2024 for spring Chinook salmon releases.

The incidence of hatchery salmon straying into natural population areas is predominately near the hatchery facilities where the fish were reared and released as juveniles (Appendix B; NMFS 2014). Straying can occur in other natural population areas distant from the point of release, but this level is nearly always very low due to the homing instincts of Chinook salmon (NMFS 2014). Therefore, the

highest degree of straying from hatchery salmon produced as part of the prey increase funding is expected to be the greatest in the adjacent natural population areas where these salmon are produced. For hatchery Chinook production associated with the prey increase funding, the natural population areas are identified in Table 5 and Table 5, respectively for federal and state funded production. For all of these areas, the prey increase funded production is only a small proportion of the total release of hatchery salmon since existing facilities use space to produce salmon for SRKWs. On average in 2020-2023, 14% or less of the regional hatchery Chinook releases were from production intended to increase prey for SRKWs. The highest proportion occurred with 2023 releases, as production continued to increase.

There are no estimates for pHOS available yet for the years that would include prey increase program funded salmon because 2023 and 2024 are the first years when all age classes of fall Chinook and spring Chinook salmon are returning from these releases, respectively (Table 8). This is an important consideration because commonly half of the spawning cohort of salmon in any given year are comprised of age 5 fish. Earlier years, without all age classes returning, would not provide an accurate assessment of what prey increase program funded fish would be contributing to pHOS. It is expected the increase in returns to freshwater will be essentially proportional to the increase in smolt releases (assuming freshwater harvest and collection efficiency at the hatchery remain constant). However, given natural variability in the survival of salmon from juvenile release to adult return (Figure 8), the magnitude of change can be significant. The expected increase in pHOS from the prey increase program funded hatchery production is assessed under Alternative 2 in Chapter 4, Environmental Consequences, because spawning ground data for the fall of 2023 is not yet available (as of September, 2024), and not all age classes of Chinook salmon have returned from the first brood year (in 2019) for prey increase program hatchery fish (Table 8).

Table 8. Return of hatchery salmon to freshwater by brood year of release as juveniles, for fall Chinook and spring Chinook life histories, from hatchery production for SRKWs.

FALL CHINOOK					
	<u>Smolt Release by Brood Year</u>				
	2019	2020	2021	2022	2023
Return Freshwater, by Year					
2021		jack			
2022	age 4		jack		
2023	age 5	age 4	jack		first year all age classes return freshwater
2024		age 5	age 4	jack	
2025			age 5	age 4	jack
2026				age 5	age 4
2027					age 5
2028					
SPRING CHINOOK					
	<u>Smolt Release by Brood Year</u>				
	2019	2020	2021	2022	2023
Return Freshwater, by Year					
2022		jack			
2023	age 4		jack		
2024	age 5	age 4	jack		first year all age classes return freshwater
2025		age 5	age 4	jack	
2026			age 5	age 4	jack
2027				age 5	age 4
2028					age 5

3.2.3. Fisheries

Chinook salmon fisheries occur in freshwater and marine waters throughout the entire analysis area. For purposes of this PEIS, fisheries in marine waters off the coasts of Oregon, Washington, Salish Sea, Puget Sound, and southeast Alaska for Chinook salmon occur in the affected environment and are relevant to the alternatives assessed in this document. Subsequent fisheries also occur on returning salmon to freshwater areas as the salmon migrate upstream back to spawning areas but these fisheries are not applicable to the alternatives assessment. Marine fisheries affect prey availability in marine areas for

SRKWs, and freshwater fisheries have bearing on the return of hatchery salmon back to hatchery facilities and pHOS (hatchery fish spawning in the wild).

All Chinook salmon fisheries (and other fisheries potentially harvesting Chinook salmon) are governed by management plans and agreements that address fishery impacts on aggregates of or specific stocks and ESUs in the US and Canada (e.g. Pacific Salmon Treaty, North Pacific Fishery Management Council's Fishery Management Plan for the Salmon Fisheries in the EEZ off Alaska, PFMC Salmon Fishery Management Plan for the U.S. West Coast, US v. Washington, US v. Oregon). The purposes of these management plans generally are to ensure the conservation of stocks, sustainably manage fisheries on all stocks, provide fishing opportunities both recreationally and commercially, provide for the exercise of tribal fishing rights, and provide economic benefits to local communities from conducting fisheries. A goal of the PST is also to ensure both the US and Canada receive benefits equal to the production of salmon originating in their respective waters. Some of these management plans, including PFMC plans, are implemented annually by the federal government, state agencies, and/or tribes depending upon the stock statuses every season and fishery impact limitations.

A summary of these fisheries management regimes for Chinook salmon can be found at:

- Pacific Fishery Management Council https://www.pfcouncil.org/managed_fishery/salmon/
- North Pacific Fishery Management Council <https://www.npfmc.org/wp-content/PDFdocuments/fmp/Salmon/SalmonFMP.pdf>
- Alaska Department of Fish and Game
https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareasoutheast.salmon_managementplans
- Pacific Salmon Commission <https://www.psc.org/about-us/history-purpose/pacific-salmon-treaty/>
- United States v. Washington <https://www.fisheries.noaa.gov/west-coast/sustainable-fisheries/salmon-and-steelhead-fisheries-west-coast-united-states-v-washington>
- United States v. Oregon <https://www.fisheries.noaa.gov/west-coast/sustainable-fisheries/salmon-and-steelhead-fisheries-west-coast-united-states-v-oregon>

In general, SEAK Chinook fisheries are managed primarily to stay within catch limits set under the PST Agreement, though they may in some years be reduced below these levels. PFMC salmon fisheries off

Washington and northern Oregon are managed consistent with the PST Agreement, but are in most years managed to limit impacts to ESA listed species such that the resulting catch is substantially below what the PST Agreement would allow. Puget Sound salmon fisheries are managed through agreements between the State of Washington and Treaty Tribes, and are constrained to limit impacts to specific populations or groups of populations of threatened Puget Sound Chinook. Fisheries in the Columbia River and tributaries are managed under the U.S. v. Oregon Management Agreement, which is designed to limit impacts to ESA listed Columbia River stocks and to provide for the exercise of treaty rights by Columbia River tribes. Puget Sound and Columbia River fisheries are managed consistent with the PST Agreement, but normally more conservatively in order to protect ESA listed stocks. Generally, fisheries in the southern U.S. (Washington, Oregon, California, Idaho) are managed to keep impacts within certain exploitation rate levels, and/or to ensure that a certain number of a given stock escape the fisheries and return to hatcheries or spawning grounds. Fisheries have been reduced significantly from historic levels and are currently managed to ensure that they do not jeopardize listed salmon and that sufficient numbers of fish escape the fisheries to maximize future generations given existing habitat conditions and other limiting factors.

A variety of fish and wildlife species inhabit the waters where Chinook salmon fisheries can occur. Other salmon species, non-salmonid species, and many wildlife species live in these waters either all, or a significant portion, of their life. SRKWs and other marine mammals such as grey whales, humpback whales, sea lions, and seals are typically found in the waters where Chinook fishing occurs throughout the analysis area.

Implementation of Chinook salmon fisheries can affect the natural environment including many species that may be directly or indirectly affected by fishing. The effects of fisheries on Chinook salmon, other salmon, and other species, varies depending on timing and allowed catch levels. Since there are a variety of fishing methods used to catch Chinook salmon throughout the large analysis area, the interaction with other species also depends upon the gear used in the specific fishery. NMFS (2019), NMFS (2021d), and NMFS (2023) provide an overview of the effects of Chinook salmon fishing on ESA-listed fish and wildlife species under the jurisdiction of NMFS. Commercial troll and recreational fisheries use specific gear that limits interactions with other species, and the prominent catch is salmon with minimal interception of non-targeted species. Net fisheries conducted throughout the region vary in scope and interaction depending upon the location and season, but overall current management regimes are highly effective in managing unintended catch with all gear used.

3.3. Southern Resident Killer Whales

The SRKW population inhabits inland and coastal waters of the analysis area year-round. The DPS, composed of J, K, and L pods, was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). A 5-year review under the ESA completed in 2021 concluded that SRKWs should remain listed as endangered and includes recent information on the population, threats, and new research results and publications (NMFS 2021c). As of the 2023 census, the population numbers 75 individuals (CWR 2023), as compared to 88 individuals when the DPS was listed in 2005, indicating a consistent downward trend.

SRKWs occur throughout the coastal waters off Washington, Oregon, northern California, and Vancouver Island, Canada and are known to travel as far south as central California and as far north as SEAK (Figure 10) (NMFS 2008b; Hanson et al. 2013; Carretta et al. 2023), though there has only been one sighting of a SRKW in SEAK. SRKWs are highly mobile and can travel up to 86 miles (160 km) in a single day (Erickson 1978; Baird 2000), with seasonal movements likely tied to the migration of their primary prey, salmon. During the spring, summer, and fall months, the whales spend a substantial amount of time in the inland waterways of the Strait of Georgia, Strait of Juan de Fuca, and Puget Sound (Ford et al. 2000; Hauser et al. 2007 (Bigg 1982; Krahn et al. 2002; Olson et al. 2018; NMFS 2021b; Ettinger et al. 2022; Thornton et al. 2022)) with Chinook salmon as their preferred prey year-round (Ford et al. 1998; Ford and Ellis 2006; Hanson et al. 2010; Ford et al. 2016; Hanson et al. 2021). During fall and early winter, SRKWs, and J pod in particular, expand their routine movements into Puget Sound, likely to take advantage of chum, coho, and Chinook salmon runs (Osborne 1999; Hanson et al. 2010; Ford et al. 2016; Olson et al. 2018). SRKW are known to focus their foraging efforts along the west side of San Juan Island during the summer months, and along the west side of Vancouver Island at Swiftsure Bank in the spring/early summer months (Thornton et al. 2022). Although seasonal movements are somewhat predictable, there can be large inter-annual variability in arrival time and days present in inland waters from spring through fall (Olson et al. 2018; NMFS 2021b), with late arrivals and fewer days present in recent years (NMFS 2021b; Ettinger et al. 2022).

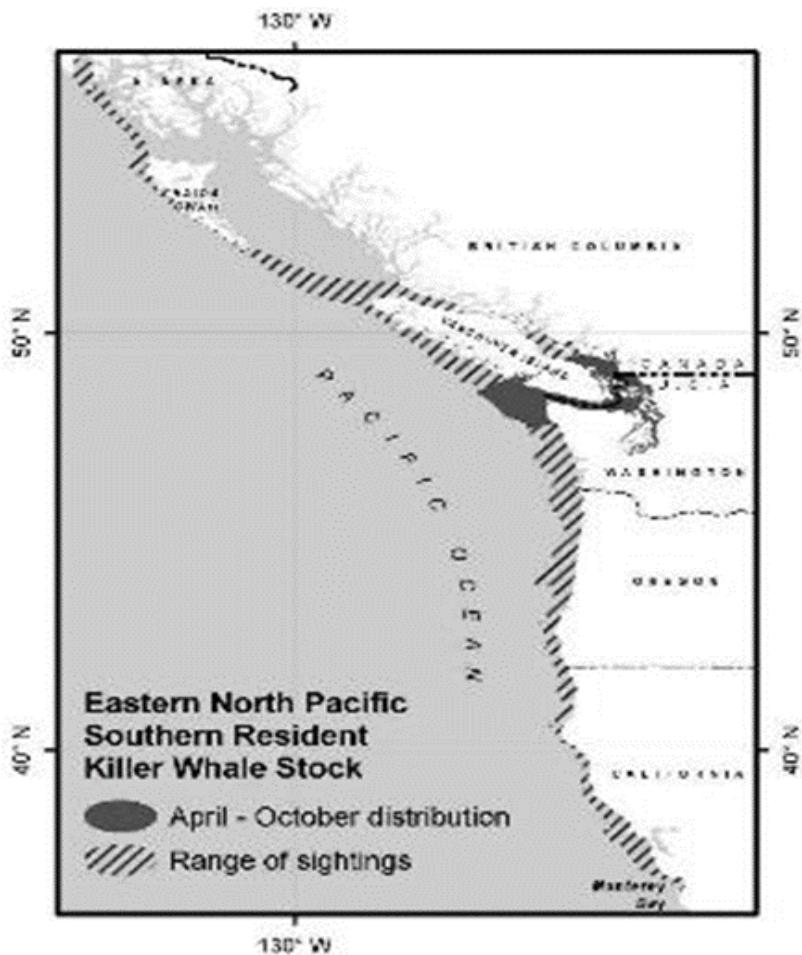


Figure 10. Geographic range of SRKWs (reprinted from Carretta et al. (2023)).

Critical habitat for the SRKW DPS was first designated on November 29, 2006 (71 FR 69054) in inland waters of Washington State and was expanded in 2021 to include six additional coastal critical habitat areas off the coast of Washington, Oregon, and California (additional approximately 15,910 sq. miles) (86 FR 41668, August 2, 2021). Based on the natural history of SRKWs and their habitat needs, NMFS identified the following physical or biological features essential to the conservation of the listed species: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging. See NMFS (2021) for a detailed description of the coastal critical habitat areas. The factors limiting SRKW recovery as described in the final recovery plan and 2021 5-Year Review include reduced prey availability and quality, high levels of contaminants from pollution, and disturbances from vessels and sound (NMFS 2008b; NMFS 2021). Oil spills, disease, and the small population size/inbreeding (Kardos et al. 2023) are also risk

factors. It is likely that multiple threats are acting together to impact the whales. Modeling exercises have attempted to identify which threats are most significant to survival and recovery (e.g. Lacy et al. (2017); Murray et al. (2021); Williams et al. 2024) and available data suggests that all of the threats are potential limiting factors (NMFS 2008b; Murray et al. 2021; NMFS 2021c; Williams et al. 2024).

Despite Chinook salmon being the preferred prey year-round, it has been challenging to establish strong connections between Chinook salmon abundance and SRKW demographics. Historically, some significant, positive relationships have been found between various SRKW demographic metrics (i.e., measures of survival and reproduction) and Chinook salmon (Ford et al. 2005; Ford et al. 2009; Ward et al. 2009; Ward et al. 2013). The assumption that these correlations represent causation has been criticized by a panel of experts (Hilborn et al. 2012). Recent work by a PFMC Ad Hoc Workgroup emphasized these and other limitations to quantifying the relationship between prey and SRKW population demographics (PFMC 2020). The correlations identified by the Workgroup appeared weaker than those from prior analyses. For example, although the average coastwide Chinook salmon abundance in this last decade was higher than the average over the entire time series (1992 – 2016), the SRKW population has experienced a decline in their population (PFMC 2020).

Recent modeling efforts have attempted to describe the relationship between SRKWs and prey in novel ways. Nelson et al. (2024) employed an integrative population model (IPM) whereby SRKW survival and reproduction could be modeled together to understand how they are affected by Chinook salmon abundance. The best model included SRKW and NRKW populations combined, suggesting possible density dependence or competition for prey. After explicitly accounting for several sources of uncertainty in SRKW dynamics, the authors found modest evidence for a correlation between Chinook salmon abundance and SRKW survival, but weak evidence for a correlation with SRKW reproduction (Nelson et al. 2024).

Williams et al. (2024) showed that several factors are affecting the SRKW population growth rate, such as Chinook salmon abundance, PCB accumulation, noise from vessels, and inbreeding, among others. While this work indicates that Chinook salmon abundance may have the largest influence on population growth rate, it is unclear how inbreeding depression (Kardos et al. 2023) may temper this response found by the authors. There are many limitations to interpreting the specific results, and unquantified uncertainty in the model, but in general, the findings by Williams et al. (2024) support the large body of knowledge projecting population decline over the long term (see NMFS 2021c), and the importance of Chinook salmon prey abundance, as well as the impact of other limiting factors, on the recovery of SRKWs.

Many factors are currently contributing to the problem of insufficient prey availability for SRKWs. Long-term declines in the survival and productivity of Chinook salmon throughout the entire region have led to fewer adult salmon being available as prey for SRKWs in critical times and areas. Concomitant with a historical decline in salmon abundance, current activities continue to affect salmon, its habitat, and ultimately prey availability for the whales. Directed and non-directed salmon fisheries catch Chinook salmon (e.g. NMFS 2023), which reduce the available prey to SRKW, along with hydropower operations (e.g. NMFS 2019) and nearshore development (e.g. NMFS 2022). Predation on Chinook salmon by other marine mammals, such as sea lions, seals, and other killer whale populations such as Northern Resident killer whales, may also be a contributing factor in the decline of prey available to SRKWs (Chasco et al. 2017a; Chasco et al. 2017b). Size and age structure in Chinook salmon has substantially changed across the Northeast Pacific Ocean (Ohlberger et al. 2018), likely due to several factors including size-selective removal by marine mammals and evolutionary changes (Ohlberger et al. 2019). Since the late 1970s, adult Chinook salmon (ocean ages 4 and 5) along most of the eastern North Pacific Ocean are becoming smaller, whereas the size of age 2 fish are generally increasing (Ohlberger et al. 2018). Smaller fish have a lower total energy value than larger ones (O'Neill et al. 2014). Therefore, SRKWs need to consume more fish in order to meet their caloric needs as a result of a decrease in average size of older Chinook salmon. Along the West Coast, there has been a reduction in fishery exploitation rates on key ESA-listed and/or overfished stocks through recent fisheries management plans (e.g. NMFS 2019; 2021d; 2023). Hatchery production of salmon provides additional prey for SRKW while also supporting declining salmon stocks and ESUs, and has been used as a tool to mitigate for actions that reduce the amount of prey available to SRKW (e.g. NMFS (2019)).

In an effort to prioritize salmon recovery efforts for increasing prey availability for SRKWs, NMFS and WDFW developed a priority stock report identifying the important Chinook salmon stocks along the West Coast (NOAA Fisheries and WDFW 2018).⁶ The list was created using information on (1) Chinook salmon stocks found in SRKW diet through fecal and prey scale/tissue samples, (2) SRKW body condition over time through aerial photographs, and (3) SRKW spatial and temporal overlap with Chinook salmon stocks ranging from SEAK to California. Extra weight was given to the salmon runs that support SRKWs during times of the year when the whales' body condition is more likely reduced and when Chinook salmon may be less available, i.e., winter months. This priority stock report will be updated over time as new data become available. The report was designed only to prioritize recovery

⁶ https://media.fisheries.noaa.gov/dam-migration/srkw_priority_chinook_stocks_conceptual_model_report_list_22june2018.pdf

actions for SRKW; currently, stock-specific abundance estimates have not been factored into the report, therefore it is not intended to assess fisheries actions or prey availability by area. The first 15 salmon stocks on the priority list include fall, spring, and summer Chinook salmon runs in rivers spanning from British Columbia to California, including the Fraser, Columbia, Snake, and Sacramento Rivers, as well as several rivers in Puget Sound watersheds (NOAA Fisheries and WDFW (2018), also see Table 11 replicated in NMFS (2021c)). Chinook salmon ESUs on this priority list are listed as either threatened or endangered, with the exception of a few U.S. stocks and Canadian-origin stocks.

As described in Section 3.2.2.2 above, funding through NMFS and the State of Washington has been used to increase regional hatchery production with the goal to enhance prey availability for SRKWs. One of the domestic actions associated with the 2019-2028 PST Agreement was to provide federal funding annually for increased hatchery production of SRKW prey (NMFS 2019). Thus far, the federal prey increase program, in fiscal years 2020 through 2023, has been \$5.6, \$7.3, \$6.3, and \$5.6 million dollars, respectively (averaging \$6.2 million per year). Additionally, the Washington State Legislature provided approximately \$13 million “prioritized to increase prey abundance for southern resident orcas” (Engrossed Substitute House Bill 1109) for the 2019-2021 biennium (July 2019 through June 2021) and \$12.5 million for the 2021-2023 biennium (July 2021 through June 2023). These state funds have resulted in an additional 36.3 million Chinook salmon smolts released to date. In 2023, the Legislature provided \$12.5 million for the 2023-2025 biennium (July 2023 through June 2025). Combined, the federal and state prey increase program funding has resulted in the release of an additional >50 million Chinook salmon smolts. The increase in adult salmon from these hatchery releases are assessed in Chapter 3, Affected Environment (Section 3.2.2.2) and Chapter 4, Environmental Consequences.

NMFS considers SRKWs to be currently among nine species at high risk of extinction as part of NMFS’s Species in the Spotlight initiative⁷ because of their endangered status, their declining population trend, and because they are considered high priority for recovery due to conflict with human activities and based on current recovery programs addressing those threats. The population has relatively high mortality and low reproduction, unlike other resident killer whale populations, which have generally been increasing since the 1970s (Carretta et al. 2023). Current management priorities are outlined in the 2021-2025 Species in the Spotlight Action Plan⁸.

⁷ <https://www.fisheries.noaa.gov/feature-story/recovering-threatened-and-endangered-species-report-congress-2019-2020>

⁸ <https://www.fisheries.noaa.gov/resource/document/species-spotlight-priority-actions-2021-2025-southern-resident-killer-whale>

3.4. Other Fish and Wildlife Species

Chinook salmon and SRKWs are the focal species in the proposed action due to the nature of the action. However, other fish and wildlife species may also be affected by the alternatives. Many aquatic and terrestrial species occur in the analysis area and may be potentially affected (beneficial and adverse) by hatchery salmon as prey, predators, or competitors. The most common species identified in the analysis area and considered in the analysis are described in Appendix D and Appendix E. Generally, interactions among these species and hatchery fish would occur (1) through competition for space or food used by hatchery fish, or (2) predation if hatchery fish are prey for other fish species, or vice-versa. These interactions with hatchery fish may differ depending upon the salmon life stage and time of year. Below we describe the species in the analysis area that may be impacted and those expected to interact with hatchery salmon as part of the proposed action.

3.4.1. Marine Mammals

Of all the marine mammals listed and considered in Appendix D, only the Steller sea lion, California sea lion, and harbor seal would be expected to be impacted by the proposed action and other alternatives. Steller sea lions, California sea lions, and harbor seals are predators of natural- and hatchery-origin salmon, and as such we consider them further in this analysis.

Steller sea lion are present in the analysis area. The western DPS is listed under the ESA. The eastern DPS was delisted in 2013. California sea lion and harbor seal are very common in all marine areas and many freshwater areas throughout the entire analysis area. These two species are healthy and near carrying capacity. All of these species are protected under the MMPA.

3.4.2. Fish

Many fish species listed and considered in Appendix D occupy marine and freshwater habitats throughout the analysis area. Many ESUs and DPSs of salmon and steelhead are listed under the federal ESA. Specific species delineations of eulachon, bull trout, green sturgeon, yelloweye rockfish, and bocaccio rockfish are also listed under the federal ESA. Nearly all of these fish species rely upon, or opportunistically prey upon, salmon as food during their life stages. Smaller fish species and early larval life stages may interact with natural- and hatchery-origin salmon during select periods of the year. Ecological interactions, such as competition and predation, may occur between select fish species and

hatchery salmon, primarily at the juvenile life stage of salmon. Due to differences in the behavior, habitat use, and migratory characteristics of salmon at the sub-adult and adult life stages, interactions with other fish species is minimal. The effects of the alternatives on ESA listed rockfish and eulachon are further assessed in Chapter 4.

3.4.3. Birds

There are several species of birds that feed on juvenile salmon, including Caspian terns and cormorants. During the spring when juvenile salmon out-migrate to the Pacific Ocean, salmon may be a major food source for these bird populations within the analysis area, especially more so once the fish enter the lower Columbia River and estuary. Hatchery-produced fish appear to be more vulnerable to bird predation than natural-origin fish (Collis et al. 2001).

Other bird species may feed on salmon during select time periods or life stages in marine areas when Chinook salmon are abundant and available. Marbled murrelet, gulls, and other sea birds feed opportunistically on baitfish in the ocean and this may include juvenile salmon during certain periods of the year.

Bird species that are primarily terrestrial for feeding and rearing are not affected by the alternatives to any meaningful degree.

3.4.4. Terrestrial Animals

Terrestrial animals that spend the majority of their time on land for food and rearing are not affected by the action to any meaningful degree for analysis (Appendix E). Other select species of small mammals, reptiles, and amphibians may interact with the aquatic environment but do not interact with juvenile and/or adult salmon more than opportunistically. The differences in the alternatives analysis for these species is not discernable.

3.5. Socioeconomics

Socioeconomics is defined as the study of the relationship between economics and social interactions with affected regions, communities, and user groups. Additional socioeconomic and demographic information for western U.S. coast fishing communities can be found on the NMFS Northwest Fisheries Science Center website at: <http://www.nwfsc.noaa.gov/research/divisions/sd/communityprofiles/index.cfm> and on and on the Alaska Fisheries Science Center website at: <https://apps-afsc.fisheries.noaa.gov/REFM/Socioeconomics/Projects/communities/profiles.php>. Tourism and

recreation are included in socioeconomics because fisheries (commercial, tribal, and recreational) are important socioeconomic resources and can be affected by the proposed action and the alternatives analyzed in this PEIS.

Native peoples of the Pacific Northwest and SEAK use salmon as an important food for sustenance and salmon are a strong spiritual symbol and central to their traditions and culture. Salmon are also an iconic species of great cultural importance, in addition to economically. Salmon and tribal fisheries form an important part of Native American tribal culture and have been since time immemorial. Salmon provide cultural, ceremonial, and subsistence benefits to tribal communities on the West Coast and in SEAK. There are 151 and 228 Federally-recognized tribes in the Pacific Northwest and Alaska regions, and many other non-Federally-recognized tribes, many of which utilize salmon for occasions including but not limited to ceremonies, celebrations, funerals, and as part of their cultural identity.

3.5.1. Southern US Fisheries

The socioeconomic benefits of Chinook salmon fisheries occur from harvest in ocean, Salish Sea, Puget Sound, nearshore estuaries, and in freshwater by both tribal and non-tribal people. The economic value of southern US non-treaty commercial and recreational ocean salmon fisheries off the coasts of Washington, Oregon, and California in recent years has averaged approximately \$70 million (PFMC 2023). Treaty Indian commercial ocean fisheries off the coast of Washington is around \$1 million in economic benefits and additionally have very strong cultural importance to the tribes. Approximately 99% of the economic value of commercial non-Indian salmon harvest comes from Chinook salmon. Additional salmon harvest occurs in non-ocean fisheries and provides substantial commercial, tribal, and recreational economic benefits to fishers and affected communities, such as in Puget Sound and the Columbia River.

For southern US commercial fisheries, the number of limited entry salmon permits issued by the three states in 2022 was 2,011, and decreased by 51 from the prior year (2,062). This is the lowest number of coastwide salmon permits on record, with declines over the prior year (which had previously been the lowest number) occurring in all three states: California (-20), Oregon (-30) and Washington (-1). For participation in the commercial salmon fishery in 2022, a total of 563 harvesting vessels participated in the non-Indian commercial troll salmon fishery in 2022 (PFMC 2023). In Oregon and Washington, 180 and 79 vessels participated in the commercial salmon fishery.

PFMC (2023) reported commercial landings were made on 36 percent of all permits coastwide in 2022. This was lower than the 10-year (2012-2021) average share of 42 percent. From 1982 to 1993, an average of 5,193 of 7,942 total permits (65 percent) harvested on an annual basis. Harvest opportunity began declining substantially after that time, and some permits were subsequently removed in a buyback program.

PFMC (2023) reported 264,200 recreational angler trips taken on the West Coast in 2022, an increase of six percent from 248,100 taken the prior year, and 75 percent above the 150,600 trips in 2020. The number of recreational angler trips in 2022 was also 26 percent above the 2017-2021 average of 209,100. The community level value of this recreational fishing for salmon exceeded \$21 million dollars in 2022 (based upon the average trip expenditures of \$83 per day; PFMC 2023).

The total socioeconomic impacts associated with commercial and recreational ocean salmon fisheries in 2022 for Washington, Oregon, and California combined were an estimated \$77.5 million (PFMC 2023). This was two percent below the prior year's total of \$79.1 million, 38 percent above the 2020 total of \$56.3 million, and 21 percent above the 2017-2021 average of \$70.1 million (all dollar values adjusted for inflation; PFMC 2023).

3.5.2. Southeast Alaska Fisheries

Chinook salmon fisheries also occur in US waters of southeast Alaska. Fisheries occur for subsistence, commercial, and recreational purposes and provide substantial socioeconomic benefits. NMFS (2024b) provides a comprehensive review of SEAK fisheries, but some key figures are included here.

The commercial troll fishery predominantly targets Chinook and coho salmon, which contribute more than 90% of the annual earnings of the troll fishery in most years. The remaining earnings come from chum salmon harvest not subject to the PST, though chum salmon harvests have been increasing over the past 20 years. The focus of this section is on direct economic impacts of the commercial troll fishery measured primarily as the ex-vessel value of Chinook and coho salmon.

The troll fishery is the smallest salmon fishery by volume in SEAK, but the ex-vessel value of the troll fishery is on average the second highest value commercial fishery in SEAK. The harvest is primarily higher-valued Chinook and coho salmon and fishermen receive premium prices on the high-quality product. Chinook salmon are either frozen at sea or bled and delivered on ice to shoreside processors by

small-boat fishermen. Troll-caught Chinook are marketed at the highest price relative to salmon harvested in all other SEAK fisheries due to the laborious onboard handling practices and resulting high quality of meat, the large size of their filets, and the high fat content of the meat. Chinook salmon filets are sold at a premium in restaurants around the United States. Chinook accounted for 43 percent of the total troll fishery ex-vessel value for 2022, followed by coho with 29 percent and chum with 27 percent. As shown in Table 9, that equates to \$14.5 million in ex-vessel value for Chinook, followed by \$9.6 million for coho, and \$9.0 million for chum. For 2022, the SEAK troll fishery in SEAK was worth \$33.3 million in ex-vessel value (Conrad and Thynes 2023).

Table 9. SEAK troll fishery estimated ex-vessel value and harvest, 2022. Source: Conrad and Thynes (2023).

Troll Fishery	Chinook	Sockeye	Coho	Pink	Chum	Total
Total Ex-vessel Value	\$ 14,464,832	\$ 20,457	\$ 9,639,583	\$ 117,508	\$ 9,036,697	\$ 33,279,077
Total Fish Harvested	196,672	2,214	854,270	79,397	1,045,914	2,178,467

The ex-vessel value has been lower in recent years, which is reflective of decreases in the SEAK catch limits associated with the 2019 PST Agreement, as well as decreases in coastwide Chinook abundance. On average, Chinook salmon harvested in winter and summer fisheries alone comprise over a third (\$11.3 million), and in some years close to half, of the overall ex-vessel value of all salmon in the troll fishery (Table 9). In 2022, the range in income per troll permit holder was from \$4,248 to \$57,335 (Strong 2023).

The troll fishery has landings in more communities than the other salmon fisheries, and the economic impacts are large for those small communities, providing earning potential in an area with otherwise limited opportunities. The SEAK commercial troll fishing fleet is composed of small, family-owned fishing boats that use a hook and line to individually catch every salmon. The largest portion of commercially retained salmon harvested in troll fishery has been delivered directly or by tender to Sitka, with Petersburg, Yakutat, Craig, Pelican, and Hoonah being other primary ports taking deliveries. In addition to being the primary port where deliveries of commercially retained salmon are made, Sitka is also the primary community of residence for troll permit holders. Other main Alaska communities of residence for troll permit holders operating in the fishery include Yakutat, Craig, Wrangell, Juneau, and Petersburg.

There are two types of troll permit issued—hand troll and power troll. In 2022, there were 173 hand troll permits and 608 power troll permits fished, for a total of 781 permits fished for the troll fishery. Eighty-

five percent of the SEAK troll fleet permits are local to SEAK. Since SEAK's troll fishery has the highest level of local ownership of any major Alaska fishery, its ongoing survival is critical to all of SEAK's communities.

The purse seine fishery is the largest harvester of salmon (primarily pink and chum salmon) and has the largest ex-vessel value. The purse seine fishery supports larger processors in the SEAK ports of Ketchikan, Craig, Petersburg, and Sitka. These processing plants employ hundreds of people and contribute substantially to the economy of those communities. As shown in Table 10 that equates to \$28.8 million in ex-vessel value for chum, followed by \$19.1 million for pink, and \$6.6 million for sockeye. For 2022, the SEAK purse seine fishery in SEAK was worth \$56.3 million in ex-vessel value (Conrad and Thynes 2023).

Table 10. SEAK purse seine fishery estimated ex-vessel value and harvest 2022. Source: Conrad and Thynes (2023).

Purse Seine Fishery	Chinook	Jacks	Sockeye	Coho	Pink	Chum	Total
Total Ex-vessel Value	\$ 1,295,244	\$ 1,747	\$ 6,572,553	\$ 526,920	\$ 19,086,029	\$ 28,800,669	\$ 56,283,161
Total Fish Harvested	26,175	1,300	629,374	162,379	14,738,246	3,460,787	19,018,261

In 2022, a total of 194 permits were fished. In 2022, the average income per purse seine permit holder was \$366,102 (Strong 2023).

Alaska has two types of gillnet fishing: drift gillnet and set gillnet. Drift gillnets are lowered off a boat and drift in water as salmon swim into them. Set gillnets are used along the shoreline near river mouths. Yakutat has the only commercial set gillnet fishery in SEAK, but drift gillnet fisheries occur throughout SEAK. The SEAK drift gillnet fishery was historically a sockeye and coho salmon fishery that also caught Chinook salmon in relatively small quantities. In recent years, effort has shifted to harvesting hatchery chum salmon as well. The drift gillnet fishery is typically the second highest harvester by volume but can have lower ex-vessel values than the troll fishery. As shown in Table 11, the drift gillnet fishery equates to \$20.4 million in ex-vessel value for chum, followed by \$5.7 million for sockeye, and \$1.3 million for coho. For 2022, the SEAK drift gillnet fishery in SEAK was worth \$29.0 million in ex-vessel value (Conrad and Thynes 2023). The set gillnet fishery equates to \$549,201 in ex-vessel value for coho, followed by \$454,716 for sockeye, and \$22,798 for chum. For 2022, the SEAK set gillnet fishery in SEAK was worth \$1.03 million in ex-vessel value (Conrad and Thynes 2023).

The harvest of Chinook salmon in gillnet fisheries is subject to the PST Agreement and represents between 2 to 6 percent of the ex-vessel value of the fishery. Gillnet harvest of Chinook salmon is minimal beyond the two terminal harvest areas of Districts 108 and 111 and is mostly harvested in Alaska hatchery terminal harvest areas. The drift gillnet average salmon ex-vessel value from 2017-2021 was \$20 million and \$1 million of that value, or 5 percent, was attributed to Chinook salmon (Thynes et al. 2021).

Table 11. SEAK gillnet fishery estimated ex-vessel value and harvest, 2022. Source: Conrad and Thynes (2023).

	Chinook	Sockeye	Coho	Pink	Chum	Total
Drift Gillnet Fishery						
Total Ex-vessel Value	\$ 849,588	\$ 5,722,196	\$ 1,333,701	\$ 765,177	\$ 20,374,523	\$ 29,045,185
Total Fish Harvested	16,174	479,728	132,522	632,901	2,394,186	3,655,511
Setnet Gillnet Fishery						
Total Ex-vessel Value	\$ 10,888	\$ 454,716	\$ 549,201	\$ 22,798	\$ 170	\$ 1,037,772
Total Fish Harvested	423	48,374	62,888	22,798	97	134,580

In 2022, there were 367 drift gillnet permits and 77 set gillnet permits fished, for a total of 244 permits fished for the gillnet fisheries. In 2022, the average income for a drift gillnet permit holder was \$82,761 and the average income for a setnet gillnet permit holder was \$14,211 (Strong 2023).

Overall, salmon accounted for approximately 60 to 70 percent of SEAK's seafood production value.⁹ Using data from the most recent comprehensive economic study produced by ASMI in 2020, the SEAK salmon fishery produced \$303 million in output, \$165 million in labor income for SEAK, and 7,910 in jobs for the region. Breaking it down, commercial fishing contributed to 4,410 jobs, followed by processing, which contributed to 2,730 jobs, and lastly, management contributed to 770 jobs for salmon-related fisheries. At this time, this is the closest analysts can get to an estimate for 2022 and all salmon-related activity is included in this estimate, not just activity specific to salmon managed under the PST Agreement.

⁹ This would include all economic activity related to the harvest sector, processing sector, and support sectors.

3.6. Environmental Justice

This section was prepared in compliance with Presidential Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898), dated February 11, 1994, and Title VI of the Civil Rights Act of 1964. The EPA defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” See the following website for more information on environmental justice: (<http://www.epa.gov/compliance/basics/ejbackground.html>).

In Executive Order 12898 (59 FR 7629), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, the President directed that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” While there are many economic, social, and cultural elements that influence the viability and location of such populations and their communities, the development, implementation and enforcement of environmental laws, regulations and policies can have impacts. Therefore, Federal agencies, including NMFS, must ensure fair treatment, equal protection, and meaningful involvement for minority populations and low-income populations as they develop and apply the laws under their jurisdiction.

Both EO 12898 and Title VI address persons belonging to the following target populations:

- Minority – all people of the following origins: Black, Asian, American Indian and Alaskan Native, Native Hawaiian or Other Pacific Islander, and Hispanic
- Low income – persons whose household income is at or below the U.S. Department of Health and Human Services poverty guidelines.

Definitions of minority and low income areas were established on the basis of the Council on Environmental Quality’s (CEQ’s) Environmental Justice Guidance under the National Environmental Policy Act of December 10, 1997. CEQ’s Guidance states that “minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.” The CEQ Guidance further adds

that “[t]he selection of the appropriate unit of geographical analysis may be a governing body’s jurisdiction, a neighborhood, a census tract, or other similar unit that is chosen so as not to artificially dilute or inflate the affected minority population.”

The CEQ guidelines do not specifically state the percentage considered meaningful in the case of low-income populations. For this environmental impact statement, the assumptions set forth in the CEQ guidelines for identifying and evaluating impacts on minority populations are used to identify and evaluate impacts on low-income populations. EPA guidance regarding environmental justice extends beyond statistical threshold analyses to consider explicit environmental justice effects on Native American tribes (EPA 1998). Federal duties under the Environmental Justice Executive Order, the presidential directive on government-to-government relations, and the trust responsibility to Indian tribes may merge when the action proposed by another federal agency or the EPA potentially affects the natural or physical environment of a tribe. The natural or physical environment of a tribe may include resources reserved by treaty or lands held in trust; sites of special cultural, religious, or archaeological importance, such as sites protected under the National Historic Preservation Act or the Native American Graves Protection and Repatriation Act; and other areas reserved for hunting, fishing, and gathering (usual and accustomed, which may include “ceded” lands that are not within reservation boundaries). Potential effects of concern may include ecological, cultural, human health, economic, or social impacts when those impacts are interrelated to impacts on the natural or physical environment (EPA 1998).

The United States and Native Americans have committed to and sustained a special trust relationship, which obligates the federal government to promote tribal self-government, support the general well-being of Native American tribes and villages, and to protect their lands and resources. In exchange for the surrender and reduction of tribal lands and removal and resettlement of approximately one-fifth of Native American tribes from their original lands, the United States signed treaties, passed laws, and instituted policies that shape and define the special government-to-government relationship between federal and tribal governments. These responsibilities and obligations are important aspects in environmental justice issues.

The analysis area for environmental justice in this PEIS includes fishing communities in Washington, Oregon, and Alaska as shown below in Figures 11 and 12, and Table 13. Nearly all of the affected communities in southern US and SEAK waters are rural communities with lower than average income

levels. Some communities have a substantial number of people in poverty. All of the tribes in the analysis area are affected by salmon, SRKWs, and the alternatives in the PEIS.

For the analysis area in southern US waters, the percentage of communities in low income and exhibiting people of color, as defined by EPA's Environmental Justice analysis, is shown in Figure 11 and Figure 12.

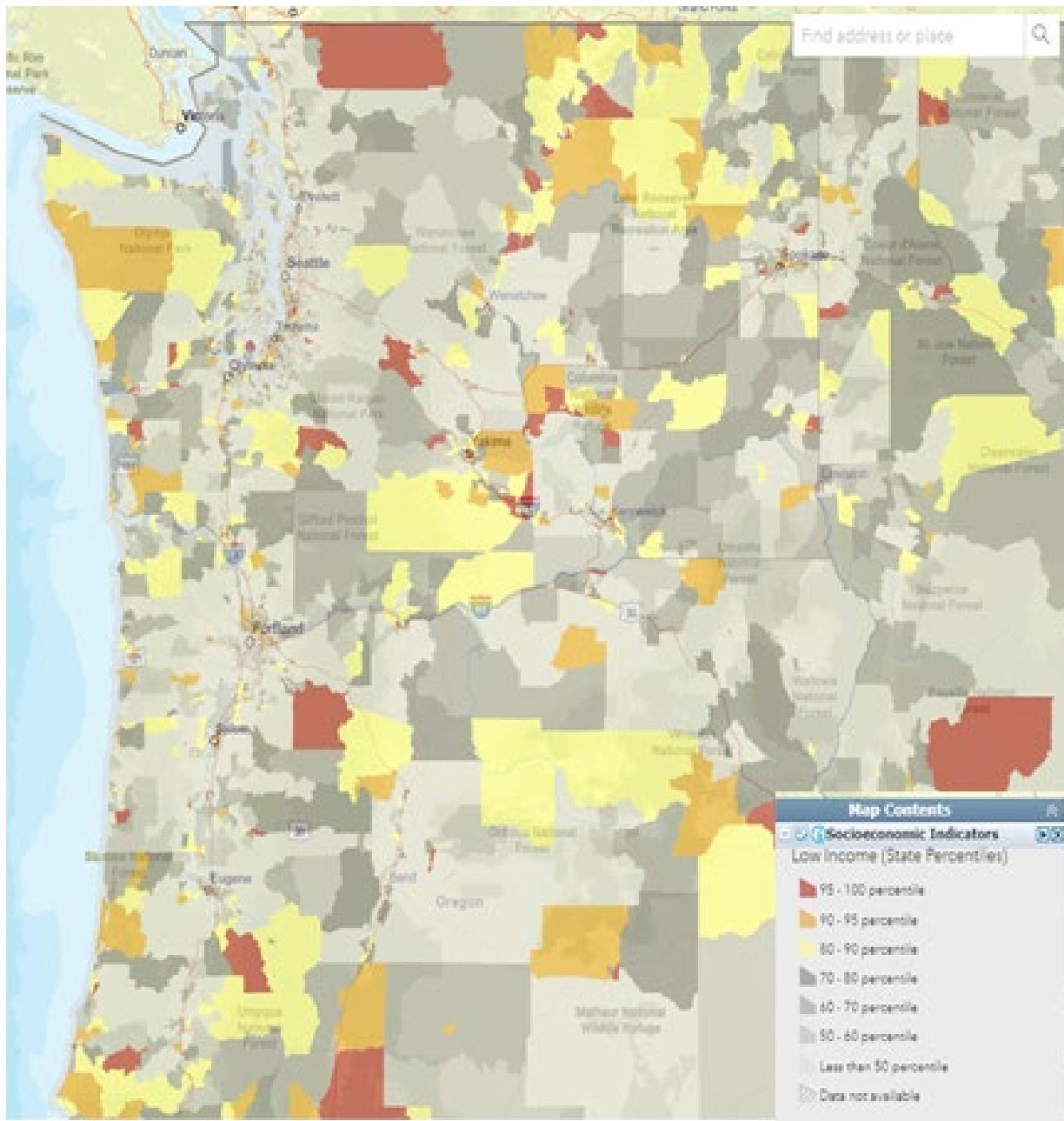


Figure 11. Geographic overview of low income communities in the analysis area of the southern US waters. Low income levels were used as characterized by EPA's Environmental Justice Screening and Mapping Tool (<https://www.epa.gov/ejscreen>) as the percent of the population in households where the household income is less than or equal to twice the federal "poverty level".

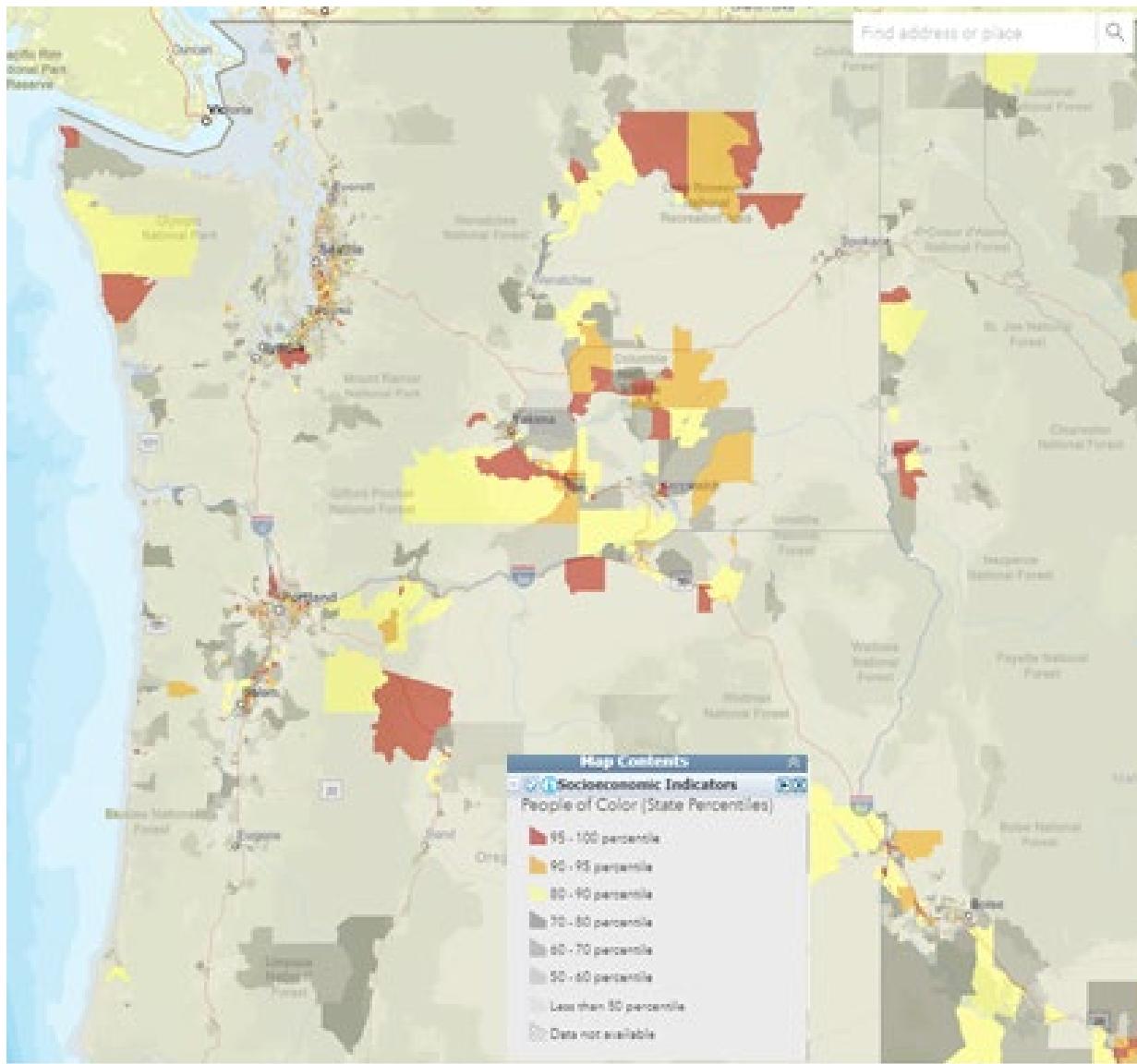


Figure 12. Geographic overview of communities with people of color in the analysis area of the southern US waters. People of color metrics were characterized by EPA's Environmental Justice Screening and Mapping Tool (<https://www.epa.gov/ejscreen>) as the percent of individuals who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino.

For areas in southern US waters, many tribes live, fish, and experience the waters of Puget Sound, the Salish Sea, the Columbia River, and off the coast of Washington and Oregon. Salmon and SRKW are interconnected and are an important part of Native American tribal culture and have been since time immemorial. Billy Frank Jr said: "As the salmon disappear, so do our tribal cultures and treaty rights. We are at a crossroads, and we are running out of time." (NWIFC 2023). Salmon provide cultural, spiritual,

ceremonial, and subsistence benefits to tribal communities on the West Coast. There are 151 Federally-recognized tribes and many other non-Federally-recognized tribes in the southern US waters of the analysis area; many of which utilize salmon for occasions including but not limited to ceremonies, celebrations, funerals, and as part of their cultural identity. Several tribes in the analysis area are party to treaties with the US that reserve to those tribes fishing rights. These tribal treaty-reserved rights have been held by the courts to include the right to half of the harvestable salmon returning to these waters every year.

The tribes in Western Washington have reduced their Chinook salmon harvest by 60-95% since the 1980s as the harvestable numbers of Chinook have declined (NWIFC 2023). The remaining fisheries to this day are just a small fraction of what occurred historically. All fishery opportunities presently are essential and vital to the well-being of all tribes in southern US waters. Fishing is still the essential livelihood for many tribal members throughout the Pacific Northwest.

In Oregon, the major port towns include Astoria, Tillamook, Newport, Coos Bay, Brookings. In recent years, Newport and Coos Bay had the highest landings of Chinook salmon (PFMC 2023). The communities where these ports are located are in lower than average income level counties (Figure 11). In 2021, per capita average personal income for the state of Oregon was \$61,596. All of the affected coastal communities have average income levels less than \$55,000, with exception of Coos County which was less than \$60,000. As shown in Table 12, landings of Chinook salmon have declined significantly over the last few decades, but the ex-vessel value of the remaining catch is a substantial proportion of the per capita average income in each community.

Table 12. Commercial landings of Chinook salmon in Oregon coastal ports and ex-vessel value per individual fisher. Table from PFMC (2023).

Year	Dressed Pounds Landed (thousands)	National Exvessel Value (\$ thousands)	Vessels Landing Salmon	Vessels with Permits	Nominal Average Exvessel Value/Vessel (dollars)	Real Average Exvessel Value/Vessel (2022 dollars)
1974	-	7,937	2,253	-	3,523	16,464
1975	-	5,808	2,304	-	2,521	10,782
1976-1980 ^{b/}	6,679	8,185	3,875	4,314	2,112	6,379
1981-1985 ^{c/d/}	2,969	5,774	2,050	2,993	2,817	6,589
1986-1990	5,688	6,641	1,557	2,528	4,265	8,552
1991-1995 ^{e/}	1,265	3,294	476	1,465	6,920	12,293
1996-2000	1,428	3,063	399	1,062	7,677	12,553
2001 ^{f/}	2,949	4,721	449	1,175	10,515	16,815
2002 ^{f/}	3,498	5,391	468	1,175	11,519	18,139
2003 ^{f/}	3,681	7,222	494	1,178	14,620	22,576
2004 ^{f/}	2,920	9,919	595	1,181	16,670	25,069
2005 ^{f/}	2,691	8,503	565	1,168	15,050	21,944
2006 ^{f/}	499	2,701	357	1,127	7,565	10,700
2007	565	2,822	436	1,009	6,473	8,915
2008	70	494	138	1,092	3,579	4,836
2009	146	345	225	1,062	1,531	2,056
2010	513	2,791	370	1,0(21	7,543	10,007
2011	404	2,401	304	1,003	7,899	10,267
2012	745	4,271	369	990	11,576	14,769
2013	1,293	7,611	399	977	19,075	23,919
2014	2,639	14,760	493	977	29,938	36,851
2015	1,200	7,334	488	980	15,028	18,315
2016	518	4,261	313	972	13,613	16,426
2017	267	2,129	176	956	12,099	14,327
2018	289	2,442	230	945	10,618	12,278
2019	320	2,103	218	925	9,645	10,957
2020	183	1,524	174	907	8,756	9,818
2021	232	2,249	187	883	12,026	12,914
2022 ^{g/}	375	3,201	180	853	17,784	17,784

In Washington, the major coastal port towns include Neah Bay, La Push, Westport, and Ilwaco. Westport has the highest landings of Chinook salmon in recent years (PFMC 2023). In 2021, the Washington state per capita personal income was \$73,775. Pacific county (where Ilwaco is located) had less than \$47,000 income per capita. Grays Harbor county (where Westport is located) had less than \$50,000. Jefferson and Clallam counties has less than \$61,000. All of these communities are below the average income level, and many families are living in poverty (Figure 11). As shown in Table 13 landings of Chinook salmon have declined significantly over the last few decades in Washington, but the ex-vessel value of the remaining catch is a substantial proportion of the per capita average income.

Table 13. Commercial landings of Chinook salmon in Washington coastal ports and ex-vessel value per individual fisher. Table from PFMC (2023).

Year	Dressed Pounds Landed {thousands}	Nominal Exvessel Value (\$ thousands)	Vessels Landing Salmon	Vessels with Permits	Nominal Average Exvessel Value/Vessel (dollars)	Real Average Exvessel Value/Vessel (2022 dollars)
1978	4,746	10,025	3,041	3,291	3,297	11,756
1979	5,262	15,091	2,778	3,068	5,432	17,888
1981)	3,398	7,114	2,626	2,797	2,709	8,182
1981-1985 ^{b/c/}	1,433	3,225	1,675	2,233	1,696	4,365
1986-1990	752	1,670	913	1,349	1,997	4,295
1991-1995 ^{d/e/f/g/}	345	834	397	586	1,607	3,008
1996-2000 ^{h/i/j/}	126	197	54	270	4,188	7,025
2001	29(1	383	57	169	6,718	10,743
2002	679	758	75	165	10,102	15,907
2003	875	991	82	163	12,087	18,664
2004	594	1,185	86	160	13,779	20,720
2005	481	1,290	91	158	14,170	20,662
2006	231	1,045	84	158	12,440	17,596
2007	217	953	79	158	12,062	16,612
2008	114	709	86	158	8,244	11,140
2009	291	1,169	97	158	12,051	16,181
2010	537	3,115	116	158	26,856	35,631
2011	339	1,687	112	158	15,066	19,582
2012	452	2,358	105	158	22,457	28,652
2013	481	2,838	108	157	26,275	32,946
2014	551	2,709	116	156	23,351	28,743
2015	640	3,448	122	153	28,266	34,449
2016	201	1,606	107	151	15,009	18,110
2017	343	2,919	108	155	27,031	32,008
2018	263	2,350	108	155	21,759	25,161
2019	322	1,925	88	155	21,878	24,852
2020	168	1,173	60	153	19,555	22,213
2021	233	2,043	76	153	26,882	28,866
2022	291	1,849	79	152	23,402	23,402

For the analysis area in SEAK waters, there are many small, isolated, rural communities where salmon fishing is crucial to environmental justice target populations and the local economy. Communities such as Craig, Elfin Cove, Hoonah, Meyers Chuck, Pelican, Point Baker, Port Alexander, Tenakee, and Yakutat heavily rely on the troll fishery in particular as a pillar of the local economy as many fishermen stop there weekly to refuel, order groceries, and deliver fish. In a given fishing season, trollers follow the location of fishing openers set by ADF&G and stop in multiple communities. These communities have substantial portions of their populations that rely on trolling as a primary source of income, in many cases, their only source. Shown in Table 10, many of these rural communities report median household incomes below the national median household income of \$70,784. The larger communities (e.g., Juneau, Petersburg,

Ketchikan, and Sitka) have more diverse economies and resources; however, the troll fishery still brings in substantial revenue. For example, only 7% of Sitka residents are directly involved in the troll fishery. Nonetheless, Sitka permit holders brought in \$8.2 million in ex-vessel value to their community in 2021 as well as fish landing taxes that support community infrastructure and basic services.

Table 14. Selected demographic indicators in southeast Alaska communities. See Conrad and Thynes (2022) and NMFS (2024b) for further information.

	Total Salmon Permits	Population Estimates	Pct. Of Population Identifying as Alaska Native or American Indian*	Persons Below Poverty	Median Household Income
ANGOON	9	340	61.0%	85	\$44,167
CRAIG	125	992	15.0%	130	\$61,875
EDNA BAY	4	42	0.0%	26	\$38,500
ELFIN COVE	11	38	0.0%	0	\$194,063
GUSTAVUS	22	657	3.1%	26	\$38,500
HAINES	88	2575	6.7%	347	\$63,355
HOONAH	81	917	47.9%	75	\$64,432
HYDABURG	12	347	69.0%	85	\$45,938
HYDER	1	46	-	-	-
JUNEAU	279	32202	10.1%	2293	\$90,126
KAKE	21	530	56.6%	83	\$64,000
KASAAN	2	49	-	17	\$75,417
KETCHIKAN	258	13762	18.0%	1289	\$77,820
KLAWOCK	28	694	41.6%	182	\$53,750
METLAKATLA	28	1444	81.0%	-	-
MEYERS CHUCK	8	21	-	-	-
NAUKATI BAY	1	131	-	42	-
PELICAN	25	83	31.6%	4	-
PETERSBURG	327	3357	7.8%	160	\$71,696
PORT ALEXANDER	14	57	0.0%	9	\$45,625
SITKA	444	8350	10.3%	573	\$82,083
SKAGWAY	5	1146	-	64	\$75,000
TENAKEE	10	126	0.0%	9	\$45,865
THORNE BAY	18	449	2.8%	67	\$49,583
WRANGELL	176	2084	22.9%	258	\$54,891
YAKUTAT	183	673	31.3%	41	\$72,083

Source: CFEC Permits Database 2023, DOLWD Alaska Population Estimates 2023, DCCED DCRA 2023. Note: table does not include non-resident permit holders.

Salmon are a culturally important food source and economically critical for Tribal members across southeast Alaska. Lingít (Tlingit), Xaadas (Haida), and Ts’msyen (Tsimshian) peoples have called southeast Alaska home since time immemorial, and salmon has been a cultural mainstay for the entirety of that time. Lingít, Xaadas, and Ts’msyen peoples have fished the waters of southeast for 10,000 years and continue to do so as commercial troll fisherman. The tradition of “trolling” pre-dates western contact: Lingít, Xaadas, and Ts’msyen peoples used a hook-and-line (bone hooks) from their canoes when fishing for Chinook salmon.

The commercial troll fishery remains significant for Alaska native communities. In some cases, four generations of one family have supported their household and the southeast economy through a hook-and-line fishery. Many citizens of tribes depend on the commercial troll fishery for their livelihood, with some Alaska Natives earning 60% to 70% of their income from the commercial troll fishery.

Approximately 31% of commercial trollers are Tlingit & Haida Tribal citizens, nearly 20% of the SEAK permits for both the purse seine and drift gillnet salmon fisheries are registered to tribal citizens of Tlingit & Haida, and nine troll permits are held by residents of the Metlakatla Indian Community of Annette Islands Reserve. Of the 1,820 hand-troll and power troll permits active in Alaska, 85% are held by southeast Alaska residents, 14% of which are held in the most rural communities with the highest percentages of Alaska Natives, and approximately 61% of the communities directly supported by the southeast Alaska salmon troll fishery are recognized communities of the Tlingit & Haida Tribes of Alaska.

Salmon fishing remains deeply tied to a traditional way of life for Alaska Natives in southeast, and fishermen rely on the commercial and sport fishery to secure salmon for personal use to feed their families and revenues from fishery taxes to keep schools operating and basic infrastructure up to date. Every fisherman matters in a small community and the stewardship of traditional lands and waters is crucial to maintaining Alaska Native ways of life and is an expression of their sovereignty.

All of SEAK's major commercial salmon fisheries are "limited entry," meaning an interested participant must purchase a permit. Many commercial salmon vessels are smaller, highly specialized, and not easily convertible to a different fishery that requires a larger boat or different gear type such as pots or equipment needed to haul a net. For example, the sale of a troll business will not support investment in another fishery, as the value of a troll business is contingent on the ability to fish for Chinook salmon. Access to other livelihoods, and even different gear types for fishing, is cost prohibitive, requires years of specialized training, or is simply unavailable for Alaska Native peoples who reside in SEAK's small and remote communities.

Overall, the environmental justice target populations of minorities and lower than average income populations throughout the analysis area in southern US and SEAK waters depend and rely upon Chinook salmon, SRKWs, and fisheries as a way of life, for ceremonial and subsistence, and other important cultural and economic aspects.

4. ENVIRONMENTAL CONSEQUENCES

4.1. Introduction

This section evaluates the potential impacts of the four alternatives on the natural and human environment including the biological, physical, and human resources described in Chapter 3, Affected Environment. Under Alternative 1 the funding to increase prey availability for SRKW would not continue in FY 2024 and beyond. Alternative 2 (Proposed Action/Preferred Alternative) is NMFS' continued funding of hatchery production to increase the prey availability for SRKWs. Alternative 3 is NMFS' funding of habitat restoration/enhancement to increase the natural production of Chinook salmon in the wild to increase the prey availability for SRKWs. Alternative 4 is reducing Chinook salmon fishery harvest in marine areas to increase prey availability for SRKWs.

Where applicable, the relative magnitude of impacts is described using the following terms:

- Undetectable: The impact would not be detectable and not significant.
- Negligible: The impact would be at the lower levels of detection and not significant.
- Low: The impact would be slight, but detectable and not significant.
- Medium: The impact would be readily apparent and considered significant.
- High: The impact would be severe or greatly beneficial and considered significant.

The summary of effects of each alternative on the specified resources concludes with a statement of the level of significance in time and space.

4.2. Effects on Chinook Salmon and Their Habitat

The environmental consequences of the four alternatives on Chinook salmon and their habitat is evaluated below according to three distinct life stages: juvenile life stage in freshwater, marine life stage, and the returning adult life stage in freshwater. This provides a complete evaluation of effects throughout the entire life cycle of Chinook salmon and their habitats. This is important given the focus of the alternatives (i.e. hatchery production, natural production, and marine fisheries).

4.2.1. Alternative 1 (No Action): No Funding for Prey Increase Program

4.2.1.1. Juvenile Freshwater Life Stage

Under this alternative, NMFS would not allocate designated PST funds to increase prey availability for SRKWs beginning in 2024 and thereafter. The program that has been operating since 2020, as described in the Affected Environment and Table 5, would be discontinued. No additional funds would be spent to increase SRKW prey availability. The change to the affected environment on juvenile Chinook salmon and their habitat in Alternative 1 (No Funding for Prey Increase Program) would be of the cessation of hatchery Chinook salmon releases that are funded by NMFS using PST-related funds. This would equate to approximately 14% or less total smolt releases of hatchery Chinook salmon throughout the analysis area (~20/157 million fish; Table 3; Table 7) compared to the affected environment (recent past).

The effects of hatchery releases funded through sources other than the PST-related prey increase funding would continue under this alternative similar to levels described in the Affected Environment, Section [add section #]. This includes ecological interactions among natural and hatchery Chinook salmon, that would occur during the period of time as hatchery salmon emigrate downstream through mainstem river and estuaries to marine areas during the smolt life stage. The period of interaction is typically in the range of one to three weeks depending upon where the hatchery fish are released in the watershed. The area of interaction depends upon the river reaches where hatchery and natural fish co-occur. In the Columbia River, the mainstem river is the primary area of co-occurrence as hatchery fish emigrate downstream to the ocean. Most studies on the ecological effects of hatchery Chinook salmon on natural Chinook salmon have observed overlap in space and time during discrete time periods, but have not demonstrated a competitive interaction based upon limited resources (SIWG 1984; Parsons et al. 1994). Predation by hatchery Chinook salmon on natural Chinook salmon is possible, but by primarily older aged hatchery salmon on young of the year natural salmon over discrete periods of time when these different life stages co-occur in space and time (Parsons and Fritts 1999).

Existing hatchery fish releases throughout the analysis area not specifically funded by NMFS or Washington to increase prey availability for SRKWs have incorporated best management practices to minimize the adverse effects of ecological interactions among hatchery and natural fish in the wild. These practices include releasing hatchery fish that are ready to emigrate downstream to marine areas as smolts so that interactions in freshwater are minimized, releasing smolts at the proper size for the specific life stage to minimize predation risks, and not releasing hatchery fish that show residual behaviors that will not likely emigrate in a timely manner. Most hatchery programs have undergone ESA consultations on the effects of the program on listed salmon and steelhead and incorporate these practices into the respective management plans.

4.2.1.2. Marine Life Stage

The effects of Alternative 1 (No Funding of Prey Increase Program) on Chinook salmon in the marine areas would be that fewer hatchery Chinook salmon would reach the marine environment compared to hatchery releases that occurred from 2020-2023 and in Alternative 2. The estimates of the reduction in the number of Chinook salmon under this alternative are shown in Table 18 and Figure 16 (i.e. if the prey program was discontinued, the additional hatchery salmon prey in the affected environment would go away). Cessation of the federal prey increase program beginning in 2024 would mean from a zero to approximately 6% (depending upon the specific marine area and time) fewer Chinook salmon adults in certain marine areas and times, on average, beginning in 2026 and thereafter. See Table 8 for the schematic of salmon age classes.

The discontinuation of the funding to increase prey availability in Alternative 1 and the benefits to natural-origin Chinook salmon of fewer hatchery fish during the marine life stage are expected to be low and are not considered to be significant. The reductions in hatchery Chinook salmon are estimated to be 6% or less in marine areas (depending upon the specific area and time), and given interannual variability in marine productivity, the abundances of salmon (orders of magnitude change over a salmon generation; see Figure 8), and the need for salmon to school for protection equates to an overall low effect from this alternative.

4.2.1.3. Adult Freshwater Life Stage

Under the assumption of no federal funding of the prey increase program beginning in 2024 and beyond, Alternative 1 would result in fewer adult hatchery Chinook salmon returning back to freshwater areas in 2027 and beyond compared to the current affected environment. Under this alternative, once hatchery fish produced using PST-related funds for FY 2020-2023 have returned, hatchery production levels

would be similar to conditions before additional prey production for SRKW began. The difference in hatchery fish returns would be dependent upon the specific hatchery stock and, on average, would range from a 1% to 64% fewer hatchery salmon returns under this alternative (Table 16). These estimates are for returns to the primary freshwater area (i.e. river mouths) and subsequent freshwater commercial and recreational fisheries would occur. Hatchery facilities would continue to collect returning hatchery adults from existing hatchery releases of other programs not funded by the prey increase program. After these collection activities, any remaining hatchery fish could spawn naturally in the wild. For natural populations, pHOS would be expected to continue as reported in Appendix B (current affected environment) for Chinook salmon throughout the region under Alternative 1. The discontinuation of the prey increase program in Alternative 1 and benefits to natural-origin Chinook salmon in relation to impacts from pHOS is expected to be similar to the current affected environment.

4.2.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

NMFS has a long history of evaluating the effects of hatchery programs on Chinook salmon throughout the project area. Extensive analysis of the hatchery operations and production of hatchery fish associated with these facilities has been evaluated by NMFS previously (e.g. NMFS 2014; NMFS 2019). A more detailed discussion of the general effects of hatchery programs on salmonids can be found in the Final Environmental Impact Statement to Inform Columbia River Basin Hatchery Operations and the Funding of Mitchell Act Hatchery Programs (Appendix C of NMFS 2014).

Six factors may pose *positive*, *negligible*, or *negative* effects to population viability of naturally-produced salmon and steelhead. These factors are:

- (1) the hatchery program does or does not remove fish from the natural population and use them for hatchery broodstock,
- (2) hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities,
- (3) hatchery fish and the progeny of naturally spawning hatchery fish in juvenile rearing areas, the migration corridor, estuary, and ocean,
- (4) research, monitoring, and evaluation that exists because of the hatchery program,
- (5) the operation, maintenance, and construction of hatchery facilities that exist because of the hatchery program, and
- (6) fisheries that exist because of the hatchery program, including terminal fisheries intended to reduce the escapement of hatchery-origin fish to spawning grounds.

The principal mechanisms upon which hatchery programs can affect Chinook salmon are found in Table 15. To summarize, hatchery programs can affect the genetics of natural populations from straying and interbreeding in the wild. Hatchery programs can increase the number of salmon spawning in historical habitats, which may increase the abundance and productivity (in some cases) of the natural population (reintroduction). Hatchery fish can compete and predate upon co-occurring natural-origin fish; particularly at the juvenile life stages. Hatchery fish can transfer diseases and pathogens to natural-origin fish after release from the hatchery. In some circumstances, hatchery programs can benefit salmonid viability by supplementing natural spawning and thereby increasing natural-origin fish abundance and spatial distribution, by serving as a source population for re-populating unoccupied habitat, and by conserving genetic resources.

Table 15. General mechanisms through which hatchery programs can affect natural-origin salmon populations.

Effect Category	Description of Effect
Genetics	<ul style="list-style-type: none"> Hatchery-origin salmon and steelhead interbreeding with natural-origin fish in the wild can change the genetics of the affected natural population(s). Hatchery-origin fish can alter the genetic integrity and/or genetic diversity of the affected natural population(s) depending upon the magnitude of interaction. If natural-origin fish abundance is critically low, the hatchery stock may contain genetic resources valuable for population conservation and recovery.
Competition and predation	<ul style="list-style-type: none"> Hatchery-origin fish can increase competition for food and space. Hatchery-origin fish can increase predation on natural-origin salmon and steelhead.
Pathogen transfer	<ul style="list-style-type: none"> Hatchery fish can have elevated levels of pathogens and bacteria from rearing in the hatchery that can be transferred to the natural-origin population from hatchery fish and/or release of hatchery effluent.

Effect Category	Description of Effect
Hatchery facilities	<ul style="list-style-type: none"> • Hatchery facilities can reduce water quantity or quality in adjacent streams through water withdrawal and discharge of effluent. • Hatchery facilities at weirs and dams to collect broodstock and/or control hatchery fish on the spawning grounds can have the following unintentional consequences: <ul style="list-style-type: none"> ○ Isolation of formerly connected populations ○ Limiting or slowing movement of migrating fish species, which may enable poaching, increase predation, and/or alter spawn timing and distribution ○ Alteration of stream flow ○ Alteration of streambed and riparian habitat ○ Alteration of the distribution of spawning within a population ○ Increased mortality or stress due to capture and handling ○ Impingement of downstream migrating fish
Natural population masking	<ul style="list-style-type: none"> • Hatchery-origin fish spawning naturally can mask the true status of the natural-origin population from hatchery supplementation.
Fishing	<ul style="list-style-type: none"> • Fisheries targeting hatchery-origin fish can have incidental impacts on co-occurring natural-origin fish.

Effect Category	Description of Effect
Population viability benefits	<ul style="list-style-type: none"> • Depending upon the objective of the specific hatchery program, hatchery fish can potentially: <ul style="list-style-type: none"> ○ Increase the abundance of natural-origin fish from additional natural spawning in the wild. ○ Increase the productivity of the natural population from hatchery fish spawning and nutrient enhancement, particularly if abundance of natural-origin fish is low. ○ Preserve and/or increase the genetic and phenotypic diversity of the affected natural population, particularly for severely depressed populations.
Nutrient cycling benefits	<ul style="list-style-type: none"> • Returning hatchery-origin adults can increase the amount of marine-derived nutrients in freshwater systems from natural spawning and/or outplanting of carcasses from the hatchery.

The potential effects of hatchery programs on ESA-listed fish are described generally in Section 3.2.2. Short- and long-term risks associated with competition and predation, facility effects, natural population status masking, incidental fishing effects, or disease transfer continuing into the future under Alternative 2 would be similar to the effects described in Section 3.2.2. from federal and Washington state funded hatchery releases to increase prey availability for SRKWs in 2023 (see Table 7; Figure 9). Releases of hatchery Chinook salmon in 2023 produced with federal and state funds specifically for SRKW prey was approximately 20 million smolts (see section 4.3.2 for details; Appendix F). We use information from the discussion of this production above to inform our analysis of the range of production scenarios included in this alternative. The specific effects of this alternative are assessed below by each specific life stage.

Since this PEIS evaluation is programmatic, as described in section 2.2 we assess a range of hatchery production scenarios including 1) the hatchery production that is currently being federally funded (PST in Table 7), and 2) total hatchery production that is estimated to meet prey increase program goals (we

assume given existing hatchery infrastructure and capacity that this would be similar to the combination of federal (PST) and Washington state funded production described in Table 7, except that federal funding would be at a level that would support the production of 20 million juvenile fish). The current federal production using FY 2023 funds is approximately 10.5 million fish (Figure 2), with a maximum program goal of 20 million juvenile fish that would increase prey for SRKWs.

The hatchery programs receiving federal funding under this alternative would continue to pose short- and long-term adverse risks associated with genetic effects, competition and predation, facility effects, masking of natural population status from hatchery fish spawning, incidental fishing effects, and transfer of pathogens from hatchery fish and/or the hatchery facility to the adjacent river or stream. The hatchery programs would continue to provide some benefits to salmon and steelhead from hatchery fish carcasses and nutrient cycling in the ecosystem under Alternative 2. Should federal funding and production levels reach the specified program goals for Alternative 2, this would equate to the maximum impact levels described below. The effects at the federal program goal level would be similar in scope to the releases of federal and state SRWK prey hatchery fish released in 2023 in the current affected environment (Table 7).

4.2.2.1.Juvenile Freshwater Life Stage

Alternative 2 would result in using available federal funding for FY 2024 and beyond of hatchery Chinook salmon releases ranging from current funding levels up to prey increase program goals. At the current funding level of production, hatchery releases into the future would be similar in scope as the releases that occurred in 2023 (see Chapter 3, Affected Environment). At funding levels that attain program goals, we would expect effects similar to those that occur from combined federal and state funded production released in 2023. For the level of production meeting program goals, hatchery Chinook salmon releases would be approximately 14% higher than for Alternative 1 (No Funding of Prey Increase Program). The hatchery programs receiving federal funding under this alternative would continue to be implemented according to the six funding decision criteria (see section 2.2.1) using existing hatchery facilities and locations similar in scope as described in Table 5 and Table 6.

The areas where ecological interaction between natural Chinook salmon and hatchery releases occurs is predominately in the larger mainstem river reaches and estuaries, because released hatchery fish quickly emigrate downstream from the release sites. Smolt releases from the hatcheries occur as age-0 and age-1 Chinook salmon, which are different age classes with different lengths and behaviors (see Table 5 and Table 6 for age classes of hatchery production). Age-1 hatchery Chinook salmon emigrate through freshwater areas rapidly as they are physiologically transforming and adapting for ocean entry. The time of interaction between the hatchery fish and natural fish is short in duration and in most cases less than three weeks until ocean entry. The hatchery releases from all the funded programs do not occur at the same time, but are dispersed throughout the region depending upon the race of fish propagated and the life stage when the fish are released. The net effect is that releases funded by the prey increase program are separated in space and time, so that ecological interactions with natural fish are minimized and are never intense.

One of the largest releases of Chinook salmon (SAFE; Table 5) occurs in the estuary and these fish do not interact at all with natural fish in freshwater. Given the low proportion of prey program releases (2.6%) relative to baseline production levels, and these measures taken to minimize the overlap of fish produced through the prey program with natural fish, the effects of the prey program on juvenile Chinook salmon in fresh water is likely low and not considered to be significant.

Ecological interactions between hatchery and natural Chinook salmon in the form of predation and competition are difficult to quantify. Predation from age-1 hatchery Chinook salmon on age-0 natural Chinook salmon is possible, but unlikely given the timing of hatchery releases relative to natural fish presence, and differences in microhabitat habitat use (NMFS 2014). Competition occurs when a specific resource is limited, and this aspect of interaction is negligible to very low effect because hatchery fish are released as smolts (age 0 and age 1) and are actively emigrating downstream to the ocean. The interaction space is changing continuously, and little if any competition is expected to occur above a minimal level.

In summary, under current federal funding levels, Alternative 2 would increase hatchery Chinook salmon releases in the analysis area by approximately 7% compared to Alternative 1, the No Action alternative. Under federal funding levels that likely attain prey increase program goals for SRKWs, hatchery Chinook salmon releases would be approximately 14% higher than Alternative 1. The negative ecological impacts from Alternative 2 on juvenile Chinook salmon is expected to be low given the widespread distribution of hatchery releases in space and time (Figure 4; Figure 5). Due to these factors, these effects are not considered to be significant compared to Alternative 1 (No Funding of Prey Increase Program).

4.2.2.2. Marine Life Stage

Ecological Interactions Between Hatchery and Natural Chinook Salmon

For Chinook salmon, the early rearing period when salmon first enter marine areas such as Puget Sound and the Columbia River plume is one of the most critical periods impacting their fitness and survival (Greene et al. 2005; Pearsall et al. 2021; Sobocinski et al. 2021). However, assessment of the effects of hatchery fish on natural-origin Chinook salmon in marine areas such as Puget Sound is difficult due to the nature of these ecological conditions and because relevant scientific knowledge is incomplete and rapidly evolving (Pearsall et al. 2021). Based on a comprehensive review of recent science, the Salish Sea Marine Survival Project (SCSSMPS) <https://marinesurvivalproject.com/>) concluded hatcheries contributed a medium effect on the number of Chinook salmon entering the Salish Sea (Figure 13). Figure 13 shows the complex ecological dynamics affecting salmon survival in the early marine phase of rearing for Chinook salmon and all the factors affecting their abundance. Even though this data is reported for marine areas specific to Puget Sound and the Salish Sea, the ecological dynamics and factors affecting salmon survival, as further described below, are also applicable to marine conditions for the Columbia River plume.

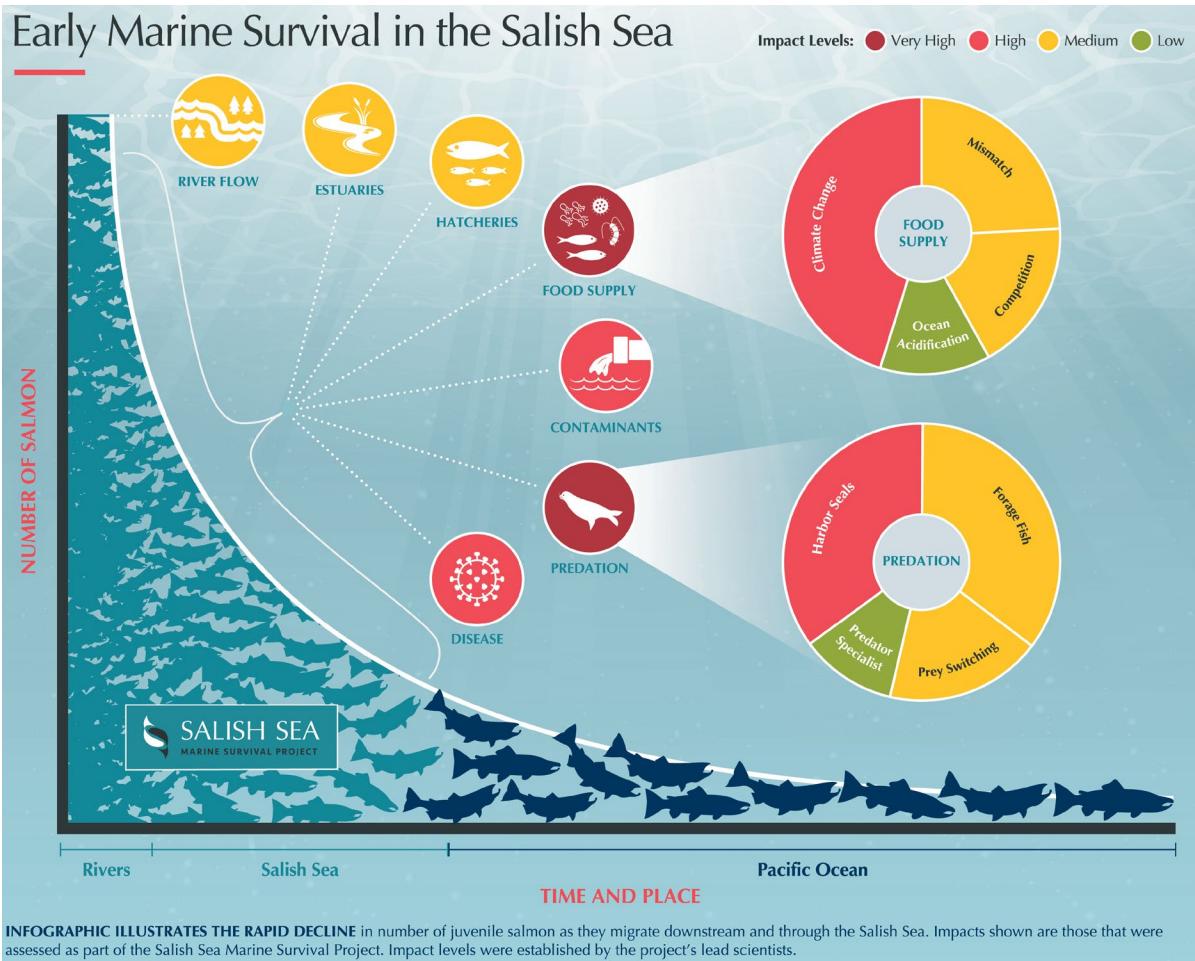


Figure 13. Infographic describing the effects of hatcheries and other factors in the early marine survival in the Salish Sea (figure taken from <https://marinesurvivalproject.com/research-findings/>).

With regards to effects from hatchery fish, competitive interactions that negatively affect natural Chinook salmon (e.g., depleting prey resources and negatively impacting growth) are of particular concern. The SCSSMPS concluded that: 1) there is some evidence that intra- and inter-specific competition during some time periods and in some places of the Salish Sea impacts Chinook salmon marine survival; 2) study results are mixed; and, 3) if competition does occur, it is most likely dictated by factors other than Chinook salmon abundance that deplete or limit prey availability or habitat (e.g., dynamic environmental variables, ecosystem productivity, and food web interactions involving natural-origin species such as pink salmon, herring, and crab) (Pearsall et al. 2021). Therefore, hatchery releases could exacerbate density-dependent effects during years of low ocean productivity.

Kendall et al. (2020) found effects to marine survival from hatchery Chinook release abundances, but only evaluated survival of hatchery-origin fish themselves, not natural-origin Chinook salmon. In contrast, Nelson et al. (2019) found no statistically-significant negative relationships between region-wide hatchery Chinook release abundances and natural-origin productivity for 16 of the 17 Salish Sea Chinook salmon stocks evaluated. One stock (Stillaguamish) showed a positive relationship between hatchery release abundance and natural stock productivity, perhaps due to predator swamping effects, where predators do not affect salmon as much due to their high abundances. Hatchery Chinook releases into Puget Sound occur over a condensed time period, at a larger fish size, and with less fish size variability relative to natural-origin Chinook salmon (Nelson et al. 2019). Thus, intra-specific competitive effects to survival may be more acute among hatchery-origin fish themselves. Sobociński et al. (2021) observed that the release date of hatchery coho and Chinook salmon may influence survival of hatchery-origin Chinook salmon, though the mechanisms for these effects were not clear, and the extent to which these observations apply to natural-origin Chinook salmon are speculative. Hatchery Chinook salmon release abundances were not found to affect marine survival of hatchery Chinook salmon.

While rearing in Puget Sound, juvenile hatchery-origin Chinook salmon are large enough to eat natural-origin salmonid fry and small parr-sized subyearlings (e.g., Keeley and Grant (2001); Duffy et al. (2010)). Juvenile Chinook salmon are opportunistic predators that prey on a wide variety of taxa, including a wide variety of fish species, in the Salish Sea and other marine waters (Beamish 2018). However, based on studies and surveys to date, juvenile salmonids appear to be a very minor dietary component in the Salish Sea. When they eat fish, juvenile Chinook salmon in offshore areas of the Salish Sea eat primarily forage fishes, especially Pacific herring (Duffy et al. 2010; Davis et al. 2020); Sweeting et al. 2007; Riddell et al. 2018, and references therein). There is no evidence that juvenile hatchery-origin Chinook salmon select for natural-origin Chinook salmon in the Salish Sea, or eat quantities that would have a detectable effect at the population or ESU scale.

Hatchery-origin Chinook salmon that remain in Puget Sound as residents (or transients) may prey upon juvenile natural-origin Chinook salmon. However, recent sampling efforts have found that resident Chinook salmon prey largely on forage fish (especially herring and to some extent sand lance), amphipods, and larval crab (Beauchamp et al. 2020; Chamberlin 2021/unpublished data). No evidence of cannibalism by resident Chinook salmon on their younger, smaller conspecifics was found. Beauchamp et al. (2020) found no juvenile Chinook salmon in the stomachs of resident Chinook salmon (n=232) sampled in Puget Sound during May–September, 2018–2019. Similarly, Chamberlin (2021/unpublished data) found no juvenile Chinook salmon in the stomachs of resident Chinook salmon (n=419) sampled in Puget Sound during November–April, 2015–2019. Conversely, previous sampling efforts (Duffy et al. 2010; Beauchamp and Duffy 2011) found some instances of cannibalism by resident Chinook salmon in Puget Sound. These researchers initially estimated that predation rates on juvenile Chinook salmon could be quite high based on these data. However, the later work (i.e., Beauchamp et al. 2020) noted that “...the limited sample sizes, suboptimal timing and temporal resolution of sampling the predators’ diets infused considerable uncertainty into the [2011] predation estimates.” The Beauchamp et al. (2020) study was performed in a more rigorous manner to address these deficiencies. Together, these results suggest that resident hatchery-origin Chinook salmon present a minor predation risk to listed natural-origin juvenile Chinook salmon at the population and ESU scale.

Based on the information summarized above, Alternative 2, with federal funding at the program goal level, would likely contribute an additional 14% across the analysis area of hatchery Chinook salmon smolts (assuming maximum prey increase program goals are met). As noted previously, the abundance of hatchery Chinook salmon entering the marine areas would be far less than released from the hatcheries due to substantial mortality as the fish emigrate into marine areas (Figure 13). However, assuming all things are held constant, there would still be an expected increase of 14% entering marine areas compared to Alternative 1 (No Action). Since the releases of hatchery Chinook salmon at different age classes occurs at different time periods (spring, summer, fall), interactions with hatchery fish would be dispersed across seasons throughout the year. At current funding levels, effects would be lower with an expected increase of approximately 7%. At either funding level, impacts on natural Chinook salmon in marine areas overall would be expected to be low and are not considered to be significant compared to Alternative 1 (No Funding of Prey Increase Program).

4.2.2.3. Adult Freshwater Life Stage

The effects of Alternative 2, the hatchery prey increase program, on Chinook salmon at the adult life stage are primarily related to genetic, demographic, and nutrient cycling effects. The returns of adult salmon from hatchery releases are summarized in Table 8. The full life cycle of adult salmon is typically completed five years after the federal funding is distributed. For this analysis of the effects, we analyze federal funding beginning in 2024 and thereafter up to the maximum prey increase program goals for SRKWs (analysis based on the combined 2023 hatchery releases funded by NMFS and Washington).

All of the hatchery facilities, operations, and existing programs that would receive federal funding under Alternative 2 exist presently and are part of the Affected Environment in Chapter 3. Under Alternative 2, federal funding for production specifically to increase prey for SRKW would continue in 2024 and beyond, and could occur from a range of current production levels to production levels necessary to attain prey increase program goals. Therefore, it is necessary to evaluate what effects the hatchery prey program may have in addition to the pre-existing levels of production throughout the analysis area.

There are two indices that are used to assess the effects of this alternative at the adult return life stage to freshwater: 1) the expected increase in adult salmon to the rivers compared to the current affected environment (see section 3.2.2), and 2) the increase in the number of juvenile hatchery salmon released compared to the current affected environment. Both of these metrics provide the best available

information to assess what the expected increase in adult salmon returns may be to freshwater after accounting for marine survival, marine fisheries, and predation by SRKWs.

The expected increase in adult hatchery Chinook salmon to the rivers are shown in Table 16 for stocks associated with the hatchery prey increase program. The percent increase in returns for the current federally funded SRKW hatchery salmon ranges from 0% to 120% depending upon the salmon stock and river of return (Table 16). It is important to note that these additional returns do not automatically equate to similar increases in pHOS on natural spawning grounds. In freshwater, additional mortality of salmon occurs from commercial and recreational fisheries, natural predation, natural mortality, and collection of salmon returning to hatchery facilities.

The specific details of each hatchery stock are evaluated at the site-specific level (according to the descriptions in section 2.2) to determine the precise effects on pHOS and other hatchery-related effects. The site-specific evaluations under the ESA and NEPA before federal funding is distributed to the operators for additional hatchery production assess the specific situation and determine the effects on pHOS after accounting for fisheries, natural mortality, and hatchery collection efficiency. For example, the largest expected return of hatchery salmon from the federal program is for Willamette spring Chinook salmon (17,931 fish; Table 16). However, this additional production occurs in the lower Columbia River's Select Area Fishery Enhancement (SAFE) program near Astoria, Oregon. This program is located to provide off-channel commercial fisheries in the estuary while minimizing effects to other ESA-listed stocks. Nearly all of the returns to these SAFE areas in the estuary are harvested (NMFS 2021e); and thus the effects to pHOS in lower Columbia River populations are minimal. In addition, no natural stocks of spring Chinook salmon occur in the adjacent areas, further limiting the likelihood of hatchery fish presence on spawning grounds. Therefore, the largest increase in abundance from the federal program, in this example, is not expected to effect pHOS for natural populations from this additional prey production. NMFS (2021e) evaluated the site-specific effects of this additional prey production in accordance with the funding criteria described in section 2.2.1.

Table 16. Mean annual nominal and percent increase in returns to the river mouth by FRAM stock resulting from combined 2023 federal and state funded prey increase production. We are using this to describe the effects of federal funding at program goal levels under Alternative 2. Table taken from Appendix F. The total mean nominal increase is 91,494 Chinook salmon from the table.

FRAM STOCK	MEAN NOMINAL INCREASE			MEAN PERCENT INCREASE		
	FEDERAL	WA STATE	TOTAL	FEDERAL	WA STATE	TOTAL
Nooksack/Samish Fall	0	6,716	6,719	0%	33%	33%
Nooksack Spr Hatchery	0	6,860	6,861	0%	265%	265%
Skagit Spring Year	0	3,786	3,787	0%	203%	203%
Snohomish Fall Fing	0	4,179	4,181	0%	126%	126%
Tulalip Fall Fing	983	0	983	120%	0%	120%
Mid PS Fall Fing	11,769	3,988	15,760	38%	13%	50%
South Puget Sound Fall Fing	0	1,996	2,007	0%	4%	4%
White River Spring Fing	0	1,565	1,566	0%	54%	54%
CR Oregon Hatchery Tule	546	0	548	7%	0%	7%
CR Bonneville Pool Hatchery	0	0	3	0%	0%	0%
Columbia R Upriver Summer	9,066	7,472	16,540	24%	20%	43%
Columbia R Upriver Bright	0	1,567	1,576	0%	1%	1%
Cowlitz River Spring	0	2,849	2,849	0%	10%	10%
Willamette River Spring	17,931	0	17,933	19%	0%	19%
WA North Coast Fall	0	2,896	2,898	0%	39%	39%
Willapa Bay	0	7,283	7,286	0%	33%	33%

Another index for evaluating the effects of this alternative on returns of salmon to freshwater at the programmatic level is to assess the increase in hatchery releases throughout the region. If it is assumed fisheries in marine and freshwater areas will continue in accordance with management plans and agreements (a safe assumption), and other mortality factors occur in similar intensity and variability, the percent increase in hatchery Chinook salmon releases can be measured to determine the likely increases in pHOS at the regional scale. Again, a 10% increase in hatchery production does not automatically translate into an additional 10% increase in pHOS, due to hatchery collection efficiency and many other factors.

Figure 9 shows the additional production of hatchery salmon funded by federal and state sources. For the federal program at current funding levels, an additional release of less than 6% has occurred at the regional scale through past prey increase funding. Under stated goals for the prey increase program, the total increase in hatchery releases in the future could be as high as 14% at the regional scale (Figure 9; section 3.2.2). If the maximum prey increase program of 14% additional hatchery Chinook salmon are released, and it is assumed hatchery fish straying of returning adult salmon also increases by 14% (refer back to section 3.2.2 for an explanation of this increase). The expected increases in pHOS are shown in

Figure 14. The effect of additional hatchery fish returning from the SRKW funded production on pHOS depends upon the conditions in the current affected environment. Additional available data for pHOS throughout the region is shown in Table 17, with further supporting data in Appendix B. The effects of the SRKW funded hatchery production pHOS in a particular area depends upon the hatchery facility releasing fish and the adjacent natural population near the hatchery (Figure 4; Figure 5). At the regional scale, the SRKW hatchery production does not affect the current affected environment in most natural populations because only a low percentage of natural populations are potentially affected by SRKW hatchery returns. Most natural populations are not affected at all by Alternative 2 because hatchery fish are not released in these populations and do not return as adults to these area (Table 17). The affected natural populations are specified in Table 5, Table 6, and Table 17. As a result of implementation of the prey increase program through 2023, as described in the affected environment, fish produced through the program at all age classes of adult fall Chinook salmon will begin returning in 2023 and spring Chinook salmon in 2024 (Table 8). Under Alternative 2 we would expect this to continue.

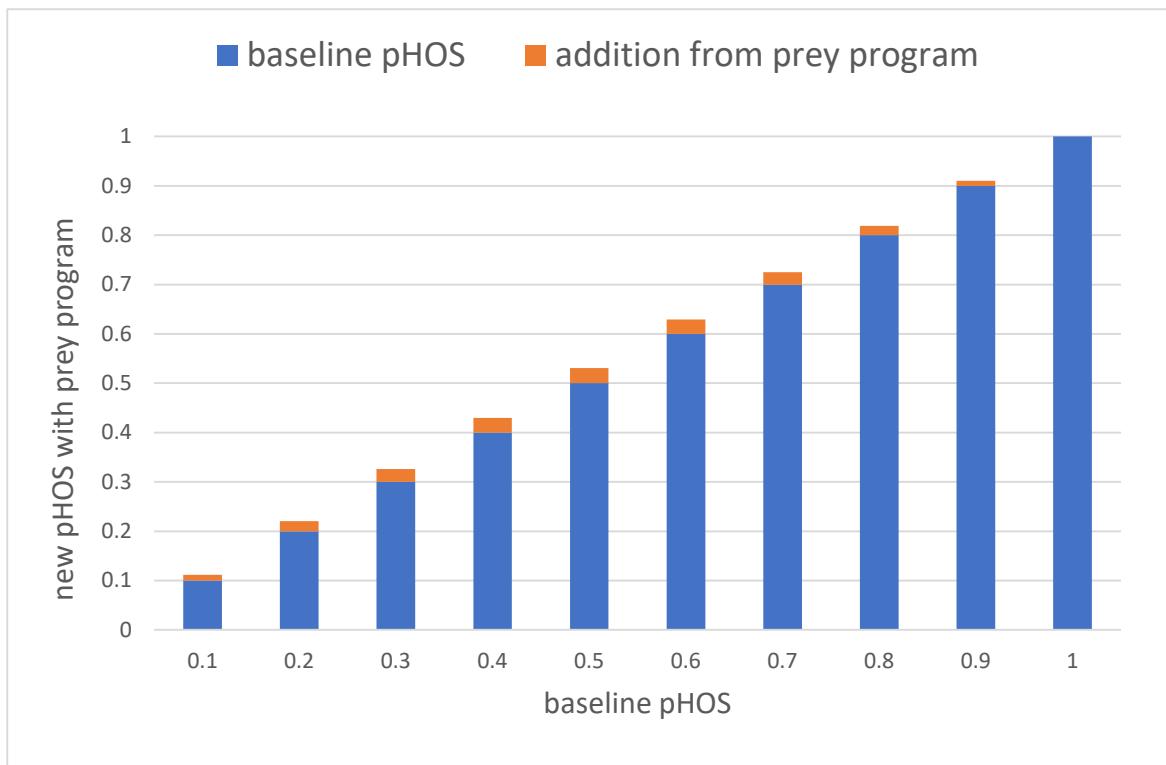


Figure 14. pHOS increases from hatchery production meeting SRKW program goals. This assumes a 14% increase in hatchery strays to the affected natural population. See Appendix B for additional information on baseline pHOS conditions of affected natural populations.

Alternative 2 will increase the return of adult hatchery salmon to freshwater areas and hatchery collection facilities that release these salmon for SRKWs. The increases to pHOS will depend upon the site-specific conditions of the individual hatchery program and natural population and are analyzed in site specific NEPA and ESA analyses. A hypothetical scenario, assuming a 14% increase in pHOS of affected natural populations is included in Table 17.

Alternative 2 will likely result in some level of increase in pHOS for select natural populations throughout the analysis area affected by the release of hatchery salmon for SRKW. Modeling of programmatic assumptions shows pHOS increases ranging from negligible to medium impact depending upon the site-specific circumstances (Figure 14; Table 17). Alternative 2 compared to Alternative 1 (No Funding for Prey Increase Program) will result in impacts that could be considered significant for some natural populations; particularly those populations having low returns of natural-origin salmon and high pHOS levels in the current affected environment.

Table 17. Modeled pHOS increase of 14% for ESA-listed Chinook salmon populations directly affected by Alternative 2 compared to baseline pHOS values in the affected environment (from Ford 2022). “Negligible” indicates natural populations where Alternative 2 is not likely to affect pHOS (based upon the location of hatchery releases).

Domain	ESA-Listed Chinook Salmon Population	pHOS in Affected Environment	Modeled pHOS in Alternative 2
		(most recent baseline conditions)	(assuming a 14% increase from prey program production)
Puget Sound	NF Nooksack R. spring	0.87	0.88
	SF Nooksack R. spring	0.55	0.58
	Low. Skagit R. fall	0.16	negligible
	Up. Skagit R. summer	0.09	negligible
	Cascade R. spring	0.14	0.16
	Low. Sauk R. summer	0.02	negligible
	Up. Sauk R. spring	0.01	negligible
	Suiattle R. spring	0.03	negligible

Domain	ESA-Listed Chinook Salmon Population	pHOS in Affected Environment	Modeled pHOS in Alternative 2
		(most recent baseline conditions)	(assuming a 14% increase from prey program production)
North Fork Columbia River Basin	NF Stillaguamish R. su/fall	0.55	negligible
	SF Stillaguamish R. su/fall	0.54	negligible
	Skykomish R. summer	0.38	0.41
	Snoqualmie R. fall	0.25	0.28
	Sammamish R. fall	0.84	0.86
	Cedar R. fall	0.29	0.32
	Green R. fall	0.7	0.73
	White R. spring	0.85	0.87
	Puyallup R. fall	0.68	0.71
	Nisqually R. fall	0.53	negligible
	Skokomish R. fall	0.84	negligible
	Mid-Hood Canal fall	0.11	negligible
	Dungeness R. summer	0.75	negligible
	Elwha R. fall*	0.95	negligible
Lower Columbia & Willamette	Upper Cowlitz/Cispus Rivers spring	0.94	negligible
	Kalama River spring	0	negligible
	North Fork Lewis River spring	-	14% increase of baseline
	Sandy River spring	0.08	negligible
	Big White Salmon River spring	0.82	negligible
	Grays River Tule fall	0.57	negligible
	Youngs Bay fall	0.86	negligible
	Big Creek fall	0.96	negligible
	Elochoman River/ Skamokawa Tule fall	0.55	negligible

Domain	ESA-Listed Chinook Salmon Population	pHOS in Affected Environment	Modeled pHOS in Alternative 2
		(most recent baseline conditions)	(assuming a 14% increase from prey program production)
Columbia River Basin	Clatskanie River fall	0.95	negligible
	Mill/Abernathy/Germany Creeks Tule fall	0.78	negligible
	Lower Cowlitz River Tule fall	0.23	negligible
	Coweeaman River Tule fall	0.09	negligible
	Toutle River Tule fall	0.45	negligible
	Upper Cowlitz River Tule fall	0.18	negligible
	Kalama River Tule fall	0.43	negligible
	Lewis River Tule fall	0.44	negligible
	Clackamas River fall	0.32	negligible
	Sandy River fall	-	negligible
	Washougal River Tule fall	0.42	negligible
	Lower Gorge Trib Tule fall	0.04	0.05
	Upper Gorge Trib Tule fall	0.42	0.45
	Big White Salmon R Tule fall	0.43	0.46
	Lewis River Bright fall	0	negligible
	Sandy River Bright fall	-	negligible
	Clackamas River spring	0.03	negligible
	North Santiam River spring	0.74	negligible
	South Santiam River spring	0.79	negligible
	McKenzie River spring	0.43	negligible
	MF Willamette River spring	0.93	negligible
Snake River Basin	Tucannon River sp/su	0.73	negligible
	Wenaha River sp/su	0.26	negligible
	Lostine River sp/su	0.58	negligible
	Minam River sp/su	0.06	negligible

Domain	ESA-Listed Chinook Salmon Population	pHOS in Affected Environment	Modeled pHOS in Alternative 2
		(most recent baseline conditions)	(assuming a 14% increase from prey program production)
	Catherine Creek sp/su	0.62	negligible
	Grande Ronde River Upper Mainstem sp/su	0.76	negligible
	Imnaha River Mainstem sp/su	0.59	negligible
	South Fork Salmon River Mainstem sp/su	0.68	negligible
	Secesh River sp/su	0.04	negligible
	East Fork South Fork Salmon River sp/su	0.42	negligible
	Chamberlain Creek sp/su	0	negligible
	MF Salmon River Lower Mainstem sp/su	0	negligible
	Big Creek sp/su	0	negligible
	Camas Creek sp/su	0	negligible
	Loon Creek sp/su	0	negligible
	MF Salmon River Upper Mainstem sp/su	0	negligible
	Sulphur Creek sp/su	0	negligible
	Marsh Creek sp/su	0	negligible
	Bear Valley Creek sp/su	0	negligible
	NF Salmon River	0	negligible
	Lemhi	0	negligible
	Lower MS Salmon	0	negligible
	Pahsimeroi	0.46	negligible
	EF Salmon	0	negligible
	Yankee Fork	0.07	negligible

Domain	ESA-Listed Chinook Salmon Population	pHOS in Affected Environment	Modeled pHOS in Alternative 2
		(most recent baseline conditions)	(assuming a 14% increase from prey program production)
	Upper MS Salmon	0.64	negligible
	Valley Cr	0	negligible
	Lower Snake River fall	0.67	negligible
Upper Columbia	Wenatchee River spring	0.57	negligible
	Entiat River spring	0.3	negligible
	Methow River spring	0.63	negligible

4.2.3. Alternative 3: Habitat-based Prey Increase Program

Alternative 3, the habitat-based prey increase program alternative, directs funding to habitat restoration projects throughout the analysis area to increase the production of Chinook salmon in the wild; instead of hatchery production (Alternative 2). This alternative relies upon improvements in natural conditions in freshwater to bolster the production of juvenile Chinook salmon and therefore available prey for SRKWs.

Survival at the juvenile life stage for salmonids (e.g., egg, alevin, fry, and parr life stages) is highly variable and mortality can be significant due to natural environmental conditions. There are no formal methods established to estimate Chinook salmon production increases in freshwater from actual, site-specific habitat restoration projects implemented on the ground. The best available information indicates there could be two different approaches for evaluating the potential effects of habitat restoration on Chinook salmon abundance and productivity: 1) evaluate total habitat restoration expenditures and trends in salmonid abundances to see if the funding actions made a difference (Jaeger and Scheuerell 2023) and 2) modeling the benefits of large-scale habitat restoration on salmon population lifecycle parameters (Honea et al. 2009); Beechie et al. 2021; Jorgensen et al. 2021; Fogel et al. 2022). For the analyses of effects for this alternative, we applied both of these approaches within the scale of funding available annually for habitat restoration projects included for this alternative beginning in 2024. We considered the effects of habitat restoration that would be possible at both levels of federal funding considered in Alternative 2 – the current level of funding (approximately \$6 million/year) and the level that would

likely result in meeting full program goals through hatchery production (approximately \$12 million/year). Refer to section 2.3 above for more details. A full description of the habitat restoration projects included in this analysis is in Appendix C.

The two scenarios are described below, and then inferences are made to each life stage of Chinook salmon, as it relates to meeting the purpose and need for the alternative on Chinook salmon for SRKWs.

4.2.3.1.Scenario 1: Habitat Restoration Funding Across the Project Area

Appendix C provides the habitat restoration projects evaluated for this alternative scenario at an equivalent funding amounts as for Alternative 2, the hatchery prey increase program. The types of projects funded in this scenario are targeted to improve stream complexity to enhance survival and habitat capacity, fish passage improvements to access habitat, riparian and floodplain habitat restoration to improve survival condition, and others. The projects are scattered across the project area in many different populations of Chinook salmon. Given the complexities of natural survival of Chinook salmon, the influence of environmental conditions, the cost and scale of habitat improvement projects, there is no way to quantify the benefits to Chinook salmon population increase from this habitat restoration spread across the entire project area.

Jaeger and Scheuerell (2023) conducted an extensive analysis of the expenditure of funds towards salmonid restoration in the Columbia River Basin; asking the question “is there evidence of an overall increase in wild fish abundance associated with the totality of these recovery efforts?” They analyzed more than \$9 billion in restoration spending efforts by federal and state agencies, including a substantial amount of habitat restoration projects implemented on the ground in Chinook salmon populations over several decades. Jaeger and Scheuerell (2023) was unable to conclude there was a significant benefit to wild fish from the restoration spending that was above and beyond what was calculated for hatchery fish returns in combination with restoration spending at the very large scale of the Columbia River over many decades. This could be due in part to not implementing habitat restoration projects that benefitted the species, continued habitat degradation co-occurring with habitat restoration, recent dramatic climate change impacts, and other survival challenges salmon face that is outpacing the benefits of localized habitat restoration efforts.

Given the widespread area the funding of the habitat restoration projects included in Alternative 3 (scenario 1), across specific areas of Puget Sound, Washington coast, and the entire Columbia River

Basin, similar results are expected from this alternative, the habitat-based prey increase program, as in Jaeger and Scheuerell (2023). There are certainly benefits of habitat restoration to Chinook salmon, but it is impossible to quantify what the benefits are in terms of meeting the purpose and need of increasing the prey availability of Chinook salmon in marine waters for SRKWs. There is not likely a significant increase in Chinook salmon abundance over the short-term (<5 years), with greater benefits accruing over the long-term as habitat restoration continues and salmon respond to improved survival conditions.

In conclusion, scenario 1 will not likely provide significant increases to natural Chinook salmon abundance throughout the project area.

4.2.3.2.Scenario 2: Habitat Restoration Funding Directed Towards One Chinook Salmon Population/Watershed

Another approach supported by the best available information for habitat restoration project funding to enhance the abundance and productivity of salmonids is to direct all funding to one specific population area in order to better address key limiting factors/threats for habitat (e.g. Jorgensen et al. 2021). For scenario 2 in Alternative 3, instead of spreading habitat restoration project across the entire region, all funding is focused within a high priority Chinook salmon population area so that the likely benefits to natural production may be enhanced compared to scenario 1 above. This scenario provides another measure of increasing natural production in the most meaningful way to help increase Chinook salmon and be available as prey in marine waters for SRKWs.

Jorgensen et al. (2021) modeled potential benefits to Chinook salmon abundance and productivity in the Chehalis River watershed from significant habitat improvements at a scale that would influence habitat capacity and productivity at each life stage of salmon. For Chinook salmon, the model results differed depending upon the adult run timing and the focus of the habitat restoration in the watershed (Figure 15). For spring Chinook production, focused restoration affecting fine sediment, wood, shade, and floodplain issues with habitat capacity and productivity provides the greatest increases in abundance. For fall Chinook salmon, the increases in abundance were not as pronounced, with restoration focused on fine sediment providing the greatest benefits.

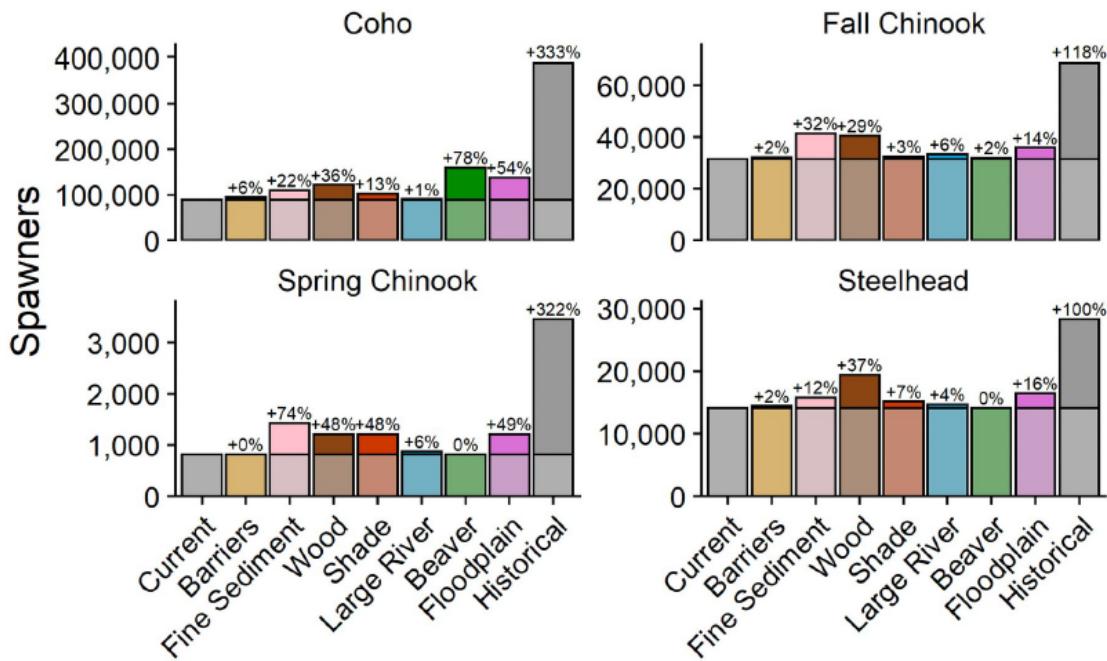


Figure 15. The potential increase in spawner abundances modeled for diagnostic habitat restoration scenarios in freshwater. Figure taken from Jorgensen et al. (2021).

The percent increase in abundance of Chinook salmon ranged from a high of 74% increase for spring Chinook to no increase in abundance from habitat improvements compared to current status (Figure 15). The amount of funding needed to accomplish the modeled diagnostic habitat improvements was not reported in Jorgensen et al. (2021) and is not presently available (personal communication, J. Jorgensen), but it is likely to be a very substantial amount of funding. The habitat restoration projects reported in Appendix C show the types of projects that could be implemented annually with an average of \$6.2 million from the prey increase federal funding. Twice as many projects are assumed to be implemented with \$12 million (the prey increase program goal funding level in Alternative 2). For the scenario modeling reported by Jorgensen et al. (2021) the potential increases in abundance are considerable (i.e. 74% increase), and at a likely order of magnitude greater in scale and benefit than the habitat projects reported in Appendix C. In terms of the number of additional Chinook salmon produced by these scenarios, the highest possible increases are in the range of 10,000-20,000 more salmon.

An unknown is if the amount of annual funding in this Alternative 3 (~\$6.2 million each year currently; \$12 million assumed maximum) is at the scale to accomplish the abundance increases reported in Jorgensen et al. (2021). The best available information suggests it cannot (Appendix B). Therefore, it is reasonable to project the benefits of this scenario would be less than 10,000 additional Chinook salmon;

which is a significant increase at the local population scale, but is a much lower near-term abundance increase than Alternative 2, the hatchery prey increase program (for reference to the scale of Chinook salmon abundance in marine areas, refer to Appendices F and H). Additionally, the focus of the prey increase program was to increase abundance in both coastal and inland marine waters, and by only focusing on one population this would only increase abundance in marine areas where this particular population migrated, which may be limited in overlap with SRKW migration and feeding areas. This would likely not accomplish the stated goal for the prey increase program; which is to provide an increase in prey availability in the times and areas most beneficial for SRKWs (e.g. the portfolio effect of a diversity of Chinook stocks needed to accomplish the stated goals).

4.2.3.3. Juvenile Freshwater Life Stage

As explained in the two habitat restoration scenarios above, there would be some increases in the short-term in juvenile production of Chinook salmon from Alternative 3 under either scenario. However, under both scenarios in Alternative 3, the increase in juveniles emigrating to marine areas as smolts would be more than Alternative 1 (No Funding for Prey Increase Program) but less than expected in Alternative 2 (Hatchery Prey Increase Program). Alternative 3 does not provide the same level of survival benefits from egg to smolt in the wild compared to Alternative 2, which relies upon the high survival from egg to smolt in a hatchery. The expected benefits to natural Chinook salmon from Alternative 3 are likely to be low, under the assumptions used, and are not considered to be significant. More benefits to natural production would accrue over the long-term (> 5 years) as more federal funding is put towards continued habitat restoration of Chinook salmon throughout the analysis area and the benefits of this restoration continue to accrue naturally through time.

4.2.3.4. Marine Life Stage

The benefits of Alternative 3 to Chinook salmon and their habitat occurs primarily by producing more juvenile Chinook salmon that emigrate to marine areas. Since the production of juveniles under the assumptions applied in Alternative 3 are expected to be low in the short-term, the corresponding benefits of increasing adult salmon in marine areas from this increase in juvenile salmon production in freshwater is also expected to be low. Alternative 3 results in higher benefits compared to Alternative 1 but lower benefits compared to Alternative 2. For reference, prey increases in the range of 4-5% in certain time and areas is of the magnitude of hundreds of thousands (100,000's) of adult Chinook salmon in marine areas (Appendix F). Most of the benefits from habitat restoration would occur over the long-term as habitat for Chinook salmon improves and more natural production occurs in time.

4.2.3.5. Adult Freshwater Life Stage

Alternative 3 focuses on increasing the natural production of Chinook salmon. As described in the previous section on expected juvenile Chinook salmon increases, the corresponding adult increases will also be low over the short-term. This alternative has no effects on pHOS, since all of the production occurs in the wild producing natural-origin fish. Alternative 3 would provide more natural Chinook salmon compared to Alternative 1 (No Funding for Prey Increase Program) but would be expected to result in lower total abundances of Chinook salmon in freshwater compared to Alternative 2. Over the long-term, more benefits to adult Chinook salmon would be expected as habitat restoration continues to be implemented across the analysis area.

4.2.4. Alternative 4: Reduced Fishing to Increase Prey

Alternative 4 focuses on using the available federal funds in 2024 and thereafter to reduce the harvest of Chinook salmon in marine waters to increase the prey availability for SRKWs. To inform our analysis of this alternative, we estimated the fishery reductions that would occur with current funding of the prey increase program (\$6.2 million) and further fishery reductions that would help meet the prey increase program goals of 4-5% for SRKWs in marine areas. Further details on this can be found in Appendix F.

4.2.4.1.Juvenile Freshwater Life Stage

Alternative 4 would not affect salmon at the juvenile life stage, because it would involve the reduction of fishery effects to the adult life stage in marine waters. This alternative only affects the adult life stages described below. Subsequent benefits to juvenile salmon production would occur after additional adult spawning at that life stage.

4.2.4.2.Marine Life Stage

Alternative 4 assessed two fishery management scenarios: current funding and prey increase program goals. The program goal scenario provides the greatest benefits to Chinook salmon abundance and is summarized here. To reach the program goal, we considered first, a total harvest closure for Chinook salmon fisheries occurring October through June in all US waters (southeast Alaska and southern US), and second, an additional 15% harvest reduction in all Chinook salmon fisheries occurring in the summer period. This scenario provides harvest reductions of Chinook salmon meeting the stated prey increase goals for SRKWs (see section 2.4 above for further explanation). Alternative 4 would provide benefits to Chinook salmon in the marine life stage by eliminating harvest of a proportion of the fish that would otherwise be caught. For the winter and spring closures (October through June), an additional 0.39% to 2.98% Chinook salmon would remain in marine waters throughout this life stage compared to the affected environment (Appendix F; table Appendix A7). The additional 15% harvest reduction in the summer added to the earlier winter and spring period closures results in a total of 0.51% to 3.81% additional Chinook salmon residing in marine waters from fishery closures (depending upon the region). The greatest abundance increases from these management actions occur in the north of Falcon region in the summer period (Appendix F).

The benefits of Alternative 4 would be more adult Chinook salmon surviving in marine waters. There would be potential advantages for Chinook salmon by having more salmon in schools to help avoid predators and reduce predation by marine mammals such as SRKWs, harbor seals, and sea lions. Most of the other benefits to Chinook salmon are described in the section 4.2.4.3.

Alternative 4 would reduce fishery harvest of Chinook salmon and not increase the release of hatchery fish to increase prey availability for SRKWs. In comparison to Alternative 2 (the hatchery prey increase program), Alternative 4 would equate to similar abundances in marine waters without the risks associated with hatchery fish. The benefits of this alternative to Chinook salmon at these large scales is in the range of zero to 5% (Appendix F), which is a relatively small increase in the abundance of Chinook stocks at the regional level overall, and not considered to be significant. See Figure 8 for an example of the magnitude of change in the abundance of Chinook salmon from year to year.

4.2.4.3. Adult Freshwater Life Stage

Alternative 4 would result in additional returns of Chinook salmon to freshwater from reduced harvest in marine fisheries. For the prey increase program goal scenario, the expected increases in marine waters range from 0.39% to 3.81% depending upon the region and time period (Appendix F). The increases of Chinook salmon returns to freshwater would likely be within this range for all populations throughout the analysis area. After return to freshwater, Chinook salmon would be subject to additional in-river fisheries, but at these relatively small increases, river fisheries would likely be about the same as the No Action alternative. Alternative 4 would result in lower pHOS values on the spawning grounds from additional natural Chinook salmon returning to freshwater compared to Alternative 2; albeit at low levels because hatchery Chinook salmon abundance would also continue from other hatchery fish releases in the current affected environment and not associated with the prey increase program (see Figure 14 for comparative purposes).

4.3. Effects on Southern Resident Killer Whales

The effects of each alternative on SRKW are described below in terms of the effects to Chinook salmon, the primary prey of SRKWs, and the goals of the prey increase program. None of the alternatives are expected to have contaminant exposure impacts beyond that of the status quo in the affected environment. Only Alternative 4 is expected to have effects to vessel, physical, and noise disturbance in the analysis area. We describe the relative impacts (beneficial or negative) that each alternative has on the SRKW population and its habitat. The focus of the SRKW alternatives analysis is for Chinook salmon at the adult life stage (ages 3+) in marine waters where SRKWs reside.

4.3.1. Alternative 1 (No Action): No Funding for Prey Increase Program

Under Alternative 1, there would not be federal funding for the prey increase program for SRKWs (Section 2.1 above). Chinook salmon prey availability for SRKWs would decrease at the levels shown in Figure 16 for the federal hatchery production. Compared to the affected environment, prey availability under Alternative 1 (No Funding for Prey Increase Program) would decrease from zero to over 6%, on average, depending upon the specific area and time (Figure 18).

Given the current status of SRKWs and the PST prey increase program goal for SRKWs of providing an increase in prey availability in the range of 4-5% (NMFS 2019), the negative effects of Alternative 1 on SRKWs are a medium impact and considered significant.

4.3.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

Under Alternative 2, NMFS would continue to fund the production of hatchery Chinook salmon specifically for the purpose of increasing prey availability for SRKWs in marine waters.

See Table 5 and Appendices A and F for a summary of federally funded hatchery Chinook salmon released to date by hatchery stock. Future federal funding is expected to produce a similar, or greater, amount of hatchery fish, potentially up to the goals specified for the prey increase program (assuming reduced or eliminated state funding).

We assessed the impacts of Alternative 2 on SRKW using the following three steps: (1) we assessed the total Chinook salmon abundance in the analysis area by referring to the FRAM-Shelton approach described in the PFMC SRKW Ad Hoc Workgroup Report (PFMC 2020), the Biological Opinion on PFMC-area fisheries (NMFS 2021), and most recently in the 2023 Puget Sound Chinook Salmon Fisheries Biological Opinion (NMFS 2023), (2) we assessed the likely annual total number of adult (age 3+) hatchery Chinook salmon produced and released under Alternative 2 under two scenarios: a) the hatchery production that is currently being federally funded (see PST in Table 7), and b) the total hatchery production that is estimated to meet prey program goals (any combination of federal and Washington state funded production in Table 7), and (3) using the two values derived in steps (1) and (2) we calculated the percent increase in Chinook salmon in the analysis area due to the federally funded program under Alternative 2. This analysis was done assuming baseline Chinook salmon abundances that

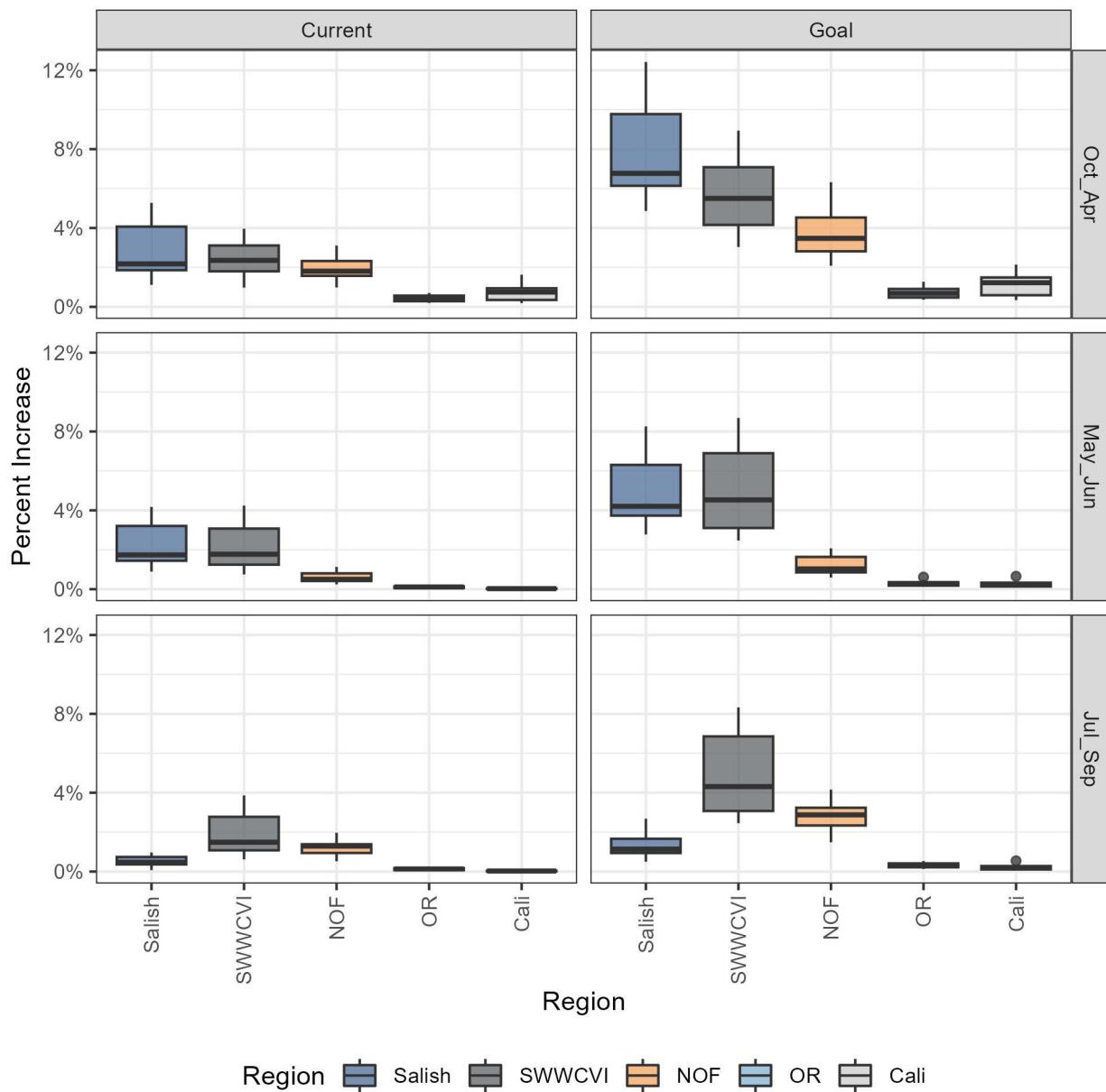
occurred over a 10-year time frame (2009-2018¹⁰) to represent a range of prey abundances in the analysis area and to assess the expected impact to SRKW under different environmental conditions. Please see Appendix F for a detailed description of these methods.

We focused our analysis on specific spatiotemporal strata that are known to be important for SRKW and foraging. As described in Section 3.3, SRKW are found in the Salish Sea primarily during the summer and fall months and in coastal waters (mostly Washington and Oregon, and northern California less often) primarily during the winter months. Additionally, SRKW are known to focus their foraging efforts along the west side of San Juan Island during the summer months, and along the west side of Vancouver Island at Swiftsure Bank in the spring/early summer months (Thornton et al. 2022). As such, we focused especially on the Salish region during the Jul-Sep time period, NOF during the Oct-Apr time period, and the SWWCVI region during the May-June and Jul-Sept time periods. Chinook fisheries south of Cape Falcon are typically closed through April, and thus have negligible effects. Funding is targeted at programs that produce Chinook salmon that will overlap spatially and temporally with SRKW, and to provide a range of stocks and run timings to achieve this goal (see Section 2.2 for a list of funding criteria).

As seen in Figure 14 (also see Table 18), under Alternative 2 (currently federally funded), during the October-April time step, SRKW prey is expected to increase by approximately 1.9%, on average, in the NOF region. During the May-June time step, SRKW prey is expected to increase by over 2%, on average, in the SWWCVI region, and in the July-September time step, prey is expected to increase by 1.9% in the SWWCVI region and 0.5% in the Salish Sea, on average. The ranges of increases presented in Figure 16 and are estimates based on the production that occurred in 2023 as a representation of the current implementation of the program. However, the percent prey increases depend on the overall level of Chinook salmon observed in that year. For example, variable ocean conditions are a major driver of ocean salmon abundances, which can vary widely from year to year (see Table 16). As such, percent prey increases due to the hatchery program may be smaller in years when ocean abundance is high (i.e., marine survival is high for salmon across all stocks). Accordingly, the benefits of the prey increase program (i.e., percent prey increases) may be much higher in low abundance years.

¹⁰ Just prior to publishing this PEIS, Chinook salmon abundance data through 2020 became available. See Appendix H for the pre-fishing starting abundances through 2020 for each region. As we complete NEPA and ESA reviews we will incorporate new abundance information into our analysis where feasible.

When considering hatchery production that would likely meet prey increase program goals for increased prey availability for SRKWs (i.e., a 4-5% increase in prey in marine waters estimated to be produced by a release of 20 million smolts), the results are shown in Figure 14 and Table 18. For this scenario of 20 million smolts released, on average, SRKW prey is expected to increase annually by 3.6% in the NOF region during the October-April time step. In the May-June time step, SRKW prey is expected to increase annually, on average, by approximately 4.8% in the SWWCVI region. In the July-September time step, SRKW prey is expected to increase annually, on average, by 4.6% in the SWWCVI region and 1.2% in the Salish Sea.



Note: box-and-whisker plots display a box representing the first quartile, median, and third quartile as the lower bound, midline, and upper bound of the box, respectively, the whiskers representing the minimum and maximum values, and the dots representing outliers which are values beyond $1.5 \times \text{IQR}$ (interquartile range, or distance between the first and third quartiles).

Figure 16. Expected annual impact of the federal funding of Alternative 2, the hatchery prey increase program (for the current federal funding (Current) and funding that would meet prey increase program goals (Goal) as represented by the expected percent increase of the SRKW prey base (age 3+ Chinook salmon) by spatial region (x-axis) and time step (rows) based on a range of abundances. See Appendix F for further details.

Table 18. Expected annual impact of Alternative 2, the hatchery prey increase program funding under the Current (a) and Goal (b) scenarios as represented by the average expected percent increase of the SRKW prey base (age 3+ Chinook salmon) by spatial region and time step. Table derived from Appendix F, which includes a retrospective analysis of abundances from past years 2009-2018. Asterisks indicate the key times and areas of focus for SRKW.

a)

Alternative 2: Hatchery Prey Program - Current											
Expected prey increase under current (2023) releases											
Year	Oct-Apr			May-Jun			Jul-Sep			*	
	Region	SWWCVI	Salish	NOF	Region	SWWCVI	Salish	NOF	Region		
2009	2.76%	2.39%	1.79%		2.12%	1.92%	0.62%		1.77%	0.48%	1.97%
2010	2.60%	1.86%	2.18%		1.66%	1.44%	0.52%		1.47%	0.46%	1.66%
2011	2.11%	1.86%	1.83%		1.52%	1.45%	0.47%		1.27%	0.07%	1.26%
2012	2.10%	2.74%	1.66%		1.89%	2.27%	0.48%		1.51%	0.77%	0.86%
2013	1.06%	1.65%	1.03%		0.89%	1.36%	0.31%		0.78%	0.34%	0.79%
2014	0.97%	1.11%	0.98%		0.75%	0.89%	0.24%		0.62%	0.21%	0.52%
2015	1.70%	1.97%	1.54%		1.15%	1.56%	0.40%		1.01%	0.43%	1.35%
2016	3.23%	5.21%	2.37%		3.39%	3.98%	0.87%		3.11%	0.97%	1.20%
2017	3.96%	5.28%	3.11%		4.24%	4.17%	1.13%		3.86%	0.77%	1.40%
2018	3.68%	4.51%	2.71%		4.01%	3.52%	1.03%		3.60%	0.66%	1.32%

b)

Alternative 2: Hatchery Prey Program - Goal											
Expected prey increase under target releases											
Year	Oct-Apr			May-Jun			Jul-Sep			*	
	Region	SWWCVI	Salish	NOF	Region	SWWCVI	Salish	NOF	Region		
2009	6.70%	7.29%	3.70%		5.31%	4.61%	1.30%		5.03%	1.03%	4.16%
2010	5.75%	6.25%	3.68%		4.18%	3.67%	1.02%		4.01%	0.96%	3.29%
2011	5.11%	6.11%	3.27%		3.94%	3.72%	0.98%		3.81%	0.50%	2.83%
2012	5.25%	8.21%	3.24%		4.88%	5.54%	1.04%		4.61%	1.50%	1.99%
2013	3.21%	6.23%	2.40%		2.72%	3.80%	0.78%		2.75%	0.93%	2.21%
2014	3.04%	4.86%	2.08%		2.47%	2.78%	0.59%		2.45%	0.82%	1.49%
2015	3.84%	5.82%	2.68%		2.82%	3.77%	0.81%		2.83%	1.24%	2.92%
2016	7.21%	12.42%	4.81%		7.43%	8.26%	1.75%		7.47%	2.68%	2.73%
2017	8.94%	12.34%	6.32%		8.69%	7.72%	2.07%		8.33%	1.83%	3.43%
2018	8.12%	10.30%	5.34%		8.14%	6.56%	1.87%		7.76%	1.72%	3.07%

We note that under these scenarios, not all hatchery production would become prey for SRKW. Our modeling does take into account harvest by other fisheries and natural mortality (see Appendix F for details), and the percent prey increases presented above represent the expected increase in prey abundance after accounting for other sources of mortality. However, there is some uncertainty in how much of this additional prey SRKW would actually consume under each of these scenarios, due to the seasonal migrations in space and time of hatchery salmon, SRKWs, and how many salmon SRKWs actually consume within each season and location.

Alternative 2 provides a meaningful increase in prey availability for SRKWs. Compared to Alternative 1 (No Funding for Prey Increase Program), Alternative 2 provides more prey availability for SRKWs in the times and areas described in Figure 14. The maximum increase in prey availability could be as high as 7.3% for Chinook salmon in the Salish Sea, and 5.4% in the SWWCVI region, in the October through April time period under the “goal” level of funding and production. However, we note that SRKWs would experience the increase in prey availability resulting from production under this alternative 3-5 years following hatchery production funding, according to the time it takes for salmon to age into the preferred prey base for SRKWs (age 3+). In the meantime, fish produced with federal and state funds prior to 2024, as described in the affected environment, would continue to return as adults and contribute to the SRKW prey base.

In total, the percent increases in prey due to Alternative 2 translate to an increase of 40,295 to 91,494 Chinook salmon annually (Table 19). For further description, please see Table 3 in Appendix F.

Table 19. Estimated mean annual nominal increase in returns to the river mouth by FRAM stock resulting from Alternative 2 based on 2023 releases.

FRAM Stock	Mean Nominal Increase		
	Federal	WA State	Total
Nooksack/Samish Fall	0	6,716	6,716
Nooksack Spr Hatchery	0	6,860	6,861
Skagit Spring Year	0	3,786	3,787
Snohomish Fall Fing	0	4,179	4,181
Tulalip Fall Fing	983	0	983
Mid PS Fall Fing	11,769	3,988	15,760
South Puget Sound Fall Fing	0	1,996	2,007
White River Spring Fing	0	1,565	1,566
CR Oregon Hatchery Tule	546	0	548
CR Bonneville Pool Hatchery	0	0	3
Columbia R Upriver Summer	9,066	7,472	16,540
Columbia R Upriver Bright	0	1,567	1,576
Cowlitz River Spring	0	2,849	2,849
Willamette River Spring	17,931	0	17,933
WA North Coast Fall	0	2,896	2,898
Willapa Bay	0	7,283	7,286
TOAL	40,295	51,157	91,494

Given the current status of SRKWs and the PST mitigation goal of providing an increase in prey availability for SRKWs in the range of 4-5% (NMFS 2019), the benefits of the currently funded federal hatchery production under Alternative 2 (current funding scenario) to SRKWs are medium and considered significant, but the benefits of the high end of the range considered under Alternative 2 (prey increase program goal scenario) are high and considered significant.

4.3.3. Alternative 3: Habitat-based Prey Increase Program

Under Alternative 3, federal funding would be directed towards activities to enhance and restore freshwater habitat specifically for Chinook salmon throughout the analysis area. Section 4.2.3 describes the anticipated increases in natural-origin Chinook salmon abundances that are used here to evaluate Alternative 3 on SRKWs in marine waters.

SRKWs are expected to benefit from habitat restoration activities that improve the production of natural Chinook salmon, as any such activities are expected to result in long-term benefits to natural Chinook salmon populations. For example, habitat restoration activities could include improving spawning and rearing areas in freshwater to increase habitat capacity and productivity for Chinook salmon, and thus provide benefits for SRKWs when these fish are in marine areas. Improvements to fish passage for upstream and downstream migrants of salmon can increase the spatial distribution, abundance, and productivity, of natural populations.

Habitat restoration priorities would be focused on Chinook salmon stocks and ESUs that are determined to be most important for SRKW prey (similar to Alternative 2). Benefits to natural production would be over the long-term (> 5 years), and not immediately but accruing over time, as the habitat improvements continue to improve the survival of salmon. There could also be compounding effects of habitat restoration benefits as improvements to habitat complexity continue to improve instream conditions from more large woody debris accumulation, improvement and growth of riparian areas, and improvements to water quality.

Any such benefit to Chinook salmon would be expected to occur no sooner than two to five years following restoration activities, as natural production increases and juvenile salmon emigrate to marine waters, grow into adult salmon, and become available as prey for SRKWs. Chinook salmon would continue to spawn and rear in improved habitat conditions. The benefits would continue to accrue each year afterwards.

The increases in natural Chinook salmon abundance from this alternative are expected to be low because current federal funding to implement habitat restoration projects (average of \$6.2 million annually) is limited and not sufficient to support a meaningful increase in natural production, due to the nature of the action being considered here. Even with the assumption funding is doubled to be equivalent to the funding in Alternative 2 to meet prey increase program goals, the benefits are still expected to be low given the goals for increasing prey availability for SRKWs of 4-5% in marine waters. Funding could be used to support habitat restoration in a single watershed, thus focusing the limited funds to increase more prey in a single area. However, improving natural production of a single stock may have limited utility to SRKWs, who consume many different stocks with varied run timing. Alternatively, the limited funding could be spread across several watersheds, thus supporting natural production of a diverse range of stocks. However, the amount that each individual project could achieve would be low. See Appendix C

for a possible scenario of habitat projects. The amount of funding does not equate to significant additional natural production across the analysis area. Given natural mortality of juvenile salmon in freshwater, which is typically very high, the overall increase in SRKW prey abundance from Alternative 3 in marine waters is expected to be very low.

The quantity of increased abundance of Chinook salmon for SRKWs from this alternative is unknown, but expected to be low (Section 4.2.3). The increases in prey for SRKWs from this alternative is likely an order of magnitude lower than for Alternative 2. Alternative 3 would result in greater benefits to SRKWs compared to Alternative 1 (No Funding for Prey Increase Program) because of habitat restoration actions that increase habitat capacity and productivity for Chinook salmon and their habitats.

4.3.4. Alternative 4: Reduced Fishing to Increase Prey

Under Alternative 4, U.S. Chinook salmon fisheries would be reduced as further described in Section 2.4 to increase prey availability for SRKWs. Two scenarios were modeled for fishery reductions to increase prey availability for SRKWs according to 1) the current federal funding level, and 2) attaining prey program goals. The first scenario used the current average federal funding of \$6.2 million dollars for the prey increase program for fishery harvest reductions. The second scenario reduced fishery harvest needed to approximate the prey increase program goals of 4-5% additional prey availability for SRKWs (funding level minimum of \$25 million; see section 2.4 for further details).

Current Federal Funding

Applying the current federal funding level of \$6.2 million to compensate for reductions in fishery harvest could be used in a variety of seasons and time periods over the course of the fisheries annually. For this alternative, we modeled three hypothetical examples that reduce fishery harvest to an equivalent of \$6.2 million in ex-vessel and community level economic costs (Table 22). The intent in all three examples was to reduce all Chinook salmon fisheries equally to the extent possible. The reduction in fishery harvest under these three examples ranges from 42,000 to 83,000 Chinook salmon. The foregone harvest in SEAK salmon fisheries includes salmon stocks originating in Alaska and British Columbia, which would not be expected to migrate south and become prey for SRKWs. As such, these estimates are considered a maximum estimate, and the benefit to SRKWs is expected to be lower.

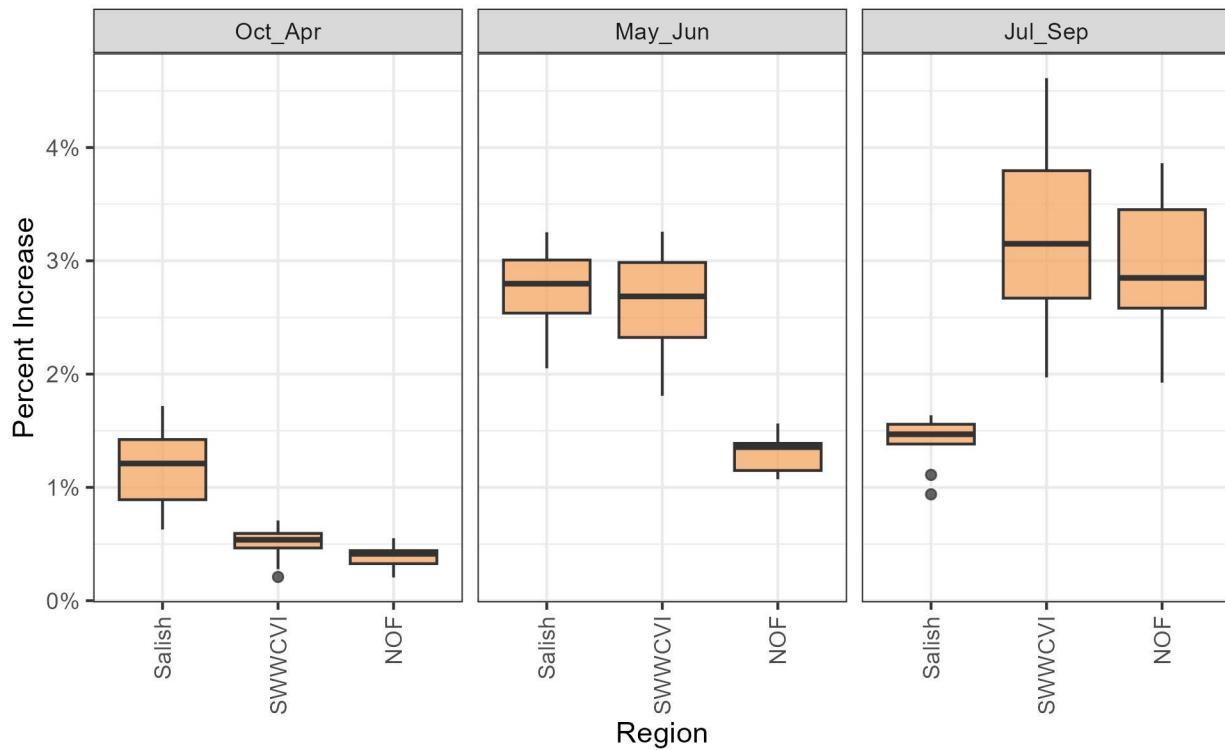
The fishery harvest reductions in Alternative 4 at the current funding level for the summer time period equates to 39% to 86% of the prey increase provided by Alternative 2 (current) in the regions of SWWCVI, Salish, and NOF.

Prey Increase Program Goals

For the second scenario to analyze the possible effects of Alternative 4, we also conducted a modeling exercise to determine what fishery reductions in U.S. fisheries managed under the PST would be needed to approximate the prey increase program goals of 4-5% additional prey availability for SRKWs. This is also a similar level of benefit to SRKWs as in Alternative 2. To make this determination, a stepwise approach was taken to reduce salmon harvest first in the times and areas most beneficial to SRKWs. Additional reductions in fisheries were taken as needed in order to get to the same benefits as in Alternative 2, which is approximately 4-5% depending upon the time and area.

We focused on the same three spatiotemporal strata as Alternative 2 that are known to be important for SRKW and foraging: Salish Sea during the summer/fall, NOF during the winter, and SWWCVI during the spring and summer (Section 3.3). For the specific conditions modeled for this alternative, see Appendix F. As described in Appendix F, the fishery reductions were first closed in the winter/spring periods as this provides the most direct potential benefit to SRKWs during the critical winter/spring periods (Section 3.3). The average expected prey increase in NOF winter abundances from closing all marine U.S. winter and spring Chinook fisheries is 0.39% (Figure 16), as compared to the average expected winter increases in NOF under Alternative 2 (Current Funding) of 1.9% and Alternative 2 (Attain Goals) of 3.6%. The average expected prey increase in SWWCVI spring abundances from closing all marine U.S. winter and spring Chinook fisheries is 2.64% (Figure 16), as compared to the average expected spring increases in SWWCVI under Alternative 2 of 2.1% (Current Funding) or 4.8% (Attain Goals). Therefore, according to these estimates, it is apparent that a complete closure of U.S. winter and spring Chinook salmon fisheries under Alternative 4 would result in less than the prey abundance increases expected under Alternative 2 (Attain Goals), and close to or less than those expected under Alternative 2 (Current Funding), but more than Alternative 1, and more immediate abundance increases as compared to Alternative 3.

There is also a downstream effect from closing marine U.S. winter and spring Chinook salmon fisheries that affect the regional abundances in the summer time period (i.e., fish that would have been caught in a winter or spring fishery would survive and count towards summer abundances). For the Salish Sea region, this results in an average percent increase of approximately 1.4% during Jul-Sep (Figure 16), which is higher than the mean estimated increase of 0.5% under Alternative 2 (Current Funding), and similar to the estimate under Alternative 2 (Attain Goals) of 1.2%. For SWWCVI, this results in an average percent increase of approximately 3.2% during Jul-Sep (Figure 16), as compared to the estimated increase of 1.8% under Alternative 2 (Current Funding) or 4.6% under Alternative 2 (Attain Goals).

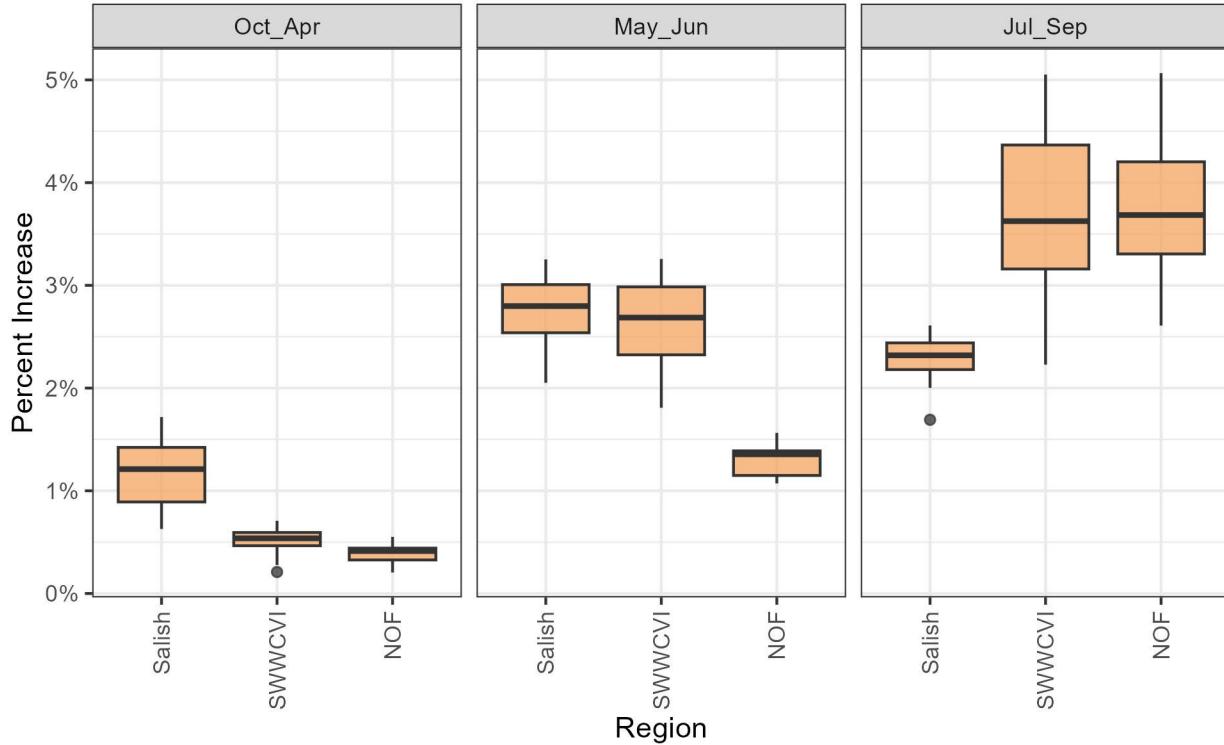


Note: box-and-whisker plots display a box representing the first quartile, median, and third quartile as the lower bound, midline, and upper bound of the box, respectively, the whiskers representing the minimum and maximum values, and the dots representing outliers which are values beyond $1.5 \times \text{IQR}$ (interquartile range, or distance between the first and third quartiles).

Figure 17. Expected annual impact resulting from a full closure of all U.S. Chinook directed fisheries from October through June as represented by the expected percent increase of the SRKW prey base (age 3+ Chinook salmon) by spatial region (x-axis) and time step (columns). Figure taken from Appendix F.

To estimate what level of fishery reductions might approach the level of increased prey availability achievable under Alternative 2, we ran an additional modeling scenario that included the same closure of all marine U.S. winter and spring Chinook salmon fisheries as described in the step above, plus adding a fifteen percent reduction to all marine U.S. Chinook salmon fisheries that occurred during the summer time period that would be expected to affect SRKW prey availability. The results of including this fifteen percent reduction to marine U.S. Chinook fisheries in the summer time period are presented in Figure 17. The average percent increase to the Salish Sea abundance in the summer time period for this scenario is 2.3%, which is higher than the projected average increase of 0.5% under Alternative 2 (Current Funding) and the average of 1.3% under Alternative 2 (Attain Goals). The average percent increase to the SWWCVI abundance in the summer time period under Alternative 4 is 3.7%. Comparatively, the average

percent increase to the SWWCVI abundance in the summer time period due to the hatchery prey increase program is 1.9% under Alternative 2 (Current Funding) or 4.9% under Alternative 2 (Attain Goals).



Note: box-and-whisker plots display a box representing the first quartile, median, and third quartile as the lower bound, midline, and upper bound of the box, respectively, the whiskers representing the minimum and maximum values, and the dots representing outliers which are values beyond 1.5*IQR (interquartile range, or distance between the first and third quartiles).

Figure 18. Expected annual impact resulting from a full closure of all U.S. Chinook directed fisheries from October through June in addition to a fifteen percent reduction to all U.S. Chinook directed fisheries from July to September as represented by the expected percent increase of the SRKW prey base (age 3+ Chinook salmon) by spatial region (x-axis) and time step (columns). Figure taken from Appendix F.

We note that under these scenarios, not all foregone harvest becomes prey for SRKW. Our modeling does take into account harvest by other fisheries and natural mortality (see Appendix F for details), and the percent prey increases presented above represent the expected increase in prey abundance after accounting for other sources of mortality. However, there is some uncertainty in how much additional prey SRKW would consume under each of these scenarios, as explained above.

As compared to Alternative 1 (No Prey Increase Program), Alternative 4 is expected to benefit SRKW by increasing the amount of prey available in their habitat. Alternative 4 is expected to provide more

immediate benefits to SRKW as compared to Alternative 3, which has uncertain and future benefits. One of the modeling scenarios under Alternative 4 (harvest reduction to attain program goals) would (by design) provide an increase in prey availability for SRKWs at a level similar to the higher funding level considered under Alternative 2; however, it is important to keep in mind that this level of harvest reduction requires significantly more federal funding to achieve the desired outcomes than current funding provides or than is required to achieve the program goal under Alternative 2. Additionally, there is uncertainty regarding the amount of funds required to implement Alternative 4 as there is currently no legal mechanism available to use funding to reduce fishing effort and catch for the purpose of increasing prey availability for SRKWs. As compared to Alternative 2, Alternative 4 is expected to provide fewer benefits to SRKW during the winter time period (low, insignificant), as fisheries are already so limited that reducing them further to a complete closure would not result in a prey increase comparable to that seen under Alternative 2. Alternative 4 has the potential for comparable benefits (medium, significant) to Alternative 2 during the spring and summer months. Additionally, Alternative 4 would be expected to reduce some impacts of vessels in Chinook fisheries that overlap in time and space with SRKWs, including physical and noise disturbance, to SRKWs (e.g., fewer vessels fishing, or reduced time spent targeting Chinook salmon). However, Alternative 4 has the potential to increase prey to SRKWs immediately (that fishing season), while Alternative 2 would increase SRKW prey 3-5 years following initial production (see Section 4.3.2).

Table 20. Details of fishery reductions associated with Figure 16. Table derived from Appendix F. Asterisks indicate the key times and areas of focus for SRKW.

Alternative 4: Fisheries Reductions Oct-Jun										
Year	Oct-Apr			May-Jun			Jul-Sep			Expected prey increase under closure of all marine U.S. winter and spring Chinook salmon fisheries
	Region		*	*	*		*	*	*	
	SWWCVI	Salish	NOF	SWWCVI	Salish	NOF	SWWCVI	Salish	NOF	
2009	0.45%	1.43%	0.31%	3.09%	3.14%	1.34%	3.79%	1.52%	2.78%	
2010	0.53%	1.15%	0.43%	2.67%	2.90%	1.26%	2.79%	1.64%	2.53%	
2011	0.57%	1.72%	0.44%	3.07%	3.25%	1.39%	3.80%	1.57%	2.92%	
2012	0.55%	1.41%	0.40%	2.72%	2.89%	1.11%	3.51%	1.39%	2.48%	
2013	0.21%	1.28%	0.20%	1.81%	2.47%	1.10%	1.97%	1.11%	2.73%	
2014	0.60%	1.05%	0.43%	2.58%	2.50%	1.56%	2.72%	1.46%	3.86%	
2015	0.52%	0.65%	0.38%	2.23%	2.71%	1.38%	2.27%	1.58%	3.47%	
2016	0.71%	0.84%	0.52%	2.71%	2.66%	1.37%	3.80%	1.48%	3.70%	
2017	0.67%	1.65%	0.55%	3.26%	3.04%	1.50%	4.61%	1.38%	3.39%	
2018	0.28%	0.63%	0.23%	2.24%	2.05%	1.07%	2.65%	0.94%	1.92%	

Table 21. Details of fishery reductions associated with Figure 17. Table derived from Appendix F.

Alternative 4: Fisheries Reductions Oct-Jun + 15% Summer Closure										
Expected prey increase under closure of all marine U.S. winter and spring Chinook salmon fisheries plus a 15% reduction of summer Chinook salmon fisheries										
Year	Oct-Apr			May-Jun			Jul-Sep			*
	Region		*	*		*	*		*	
	SWWCVI	Salish	NOF	SWWCVI	Salish	NOF	SWWCVI	Salish	NOF	
2009	0.45%	1.43%	0.31%	3.09%	3.14%	1.34%	4.38%	2.42%	3.65%	*
2010	0.53%	1.15%	0.43%	2.67%	2.90%	1.26%	3.20%	2.45%	3.18%	*
2011	0.57%	1.72%	0.44%	3.07%	3.25%	1.39%	4.35%	2.56%	3.72%	*
2012	0.55%	1.41%	0.40%	2.72%	2.89%	1.11%	4.02%	2.61%	3.26%	*
2013	0.21%	1.28%	0.20%	1.81%	2.47%	1.10%	2.23%	2.00%	3.45%	*
2014	0.60%	1.05%	0.43%	2.58%	2.50%	1.56%	3.23%	2.15%	5.07%	*
2015	0.52%	0.65%	0.38%	2.23%	2.71%	1.38%	2.61%	2.27%	4.23%	*
2016	0.71%	0.84%	0.52%	2.71%	2.66%	1.37%	4.37%	2.30%	4.82%	*
2017	0.67%	1.65%	0.55%	3.26%	3.04%	1.50%	5.05%	2.34%	4.12%	*
2018	0.28%	0.63%	0.23%	2.24%	2.05%	1.07%	3.15%	1.69%	2.61%	*

4.4. Effects on Other Fish and Wildlife Species

A complete list of the other fish and wildlife species considered for impacts of the four alternatives are listed in Appendix D. For species not included in this analysis in Section 4.4, we expect there to be no effect of any of the alternatives on the species beyond the current conditions. There would be negligible differences among the alternatives on the effects to these species.

For marine mammals in the analysis area, effects of the alternatives are expected for Steller sea lions, California sea lions, and harbor seals as they regularly feed on salmon in marine and freshwater areas.

For fish in the analysis area, effects of the alternatives are expected for ESA-listed yelloweye rockfish and bocaccio rockfish in Puget Sound/Georgia Basin and the southern DPS of eulachon. The effects of the alternatives on these species are assessed below.

4.4.1. Alternative 1 (No Action): No Funding for Prey Increase Program

Alternative 1 would result in no funds being distributed to increase prey availability for SRKWs. Most of the fish and wildlife species in the affected environment could potentially benefit from Chinook salmon being present as prey during all of their life stages; as these species eat salmon when available, except as described below. This alternative would not increase the abundance of Chinook salmon available to these species at the level described in section 4.2.1. None of the species in this section rely upon salmon to the same degree as SRKWs, and thus effects of this lack of increase in prey availability for Stellar sea lions, California sea lions, and harbor seals, and ESA-listed rockfish in Puget Sound/Georgia Basin and southern DPS eulachon is expected to be low and not considered significant. These species are more opportunistic predators responding to local feeding conditions and availability with salmon representing a minor proportion of their dietary intake.

Under this alternative, potential predation of ESA-listed juvenile rockfish in the Puget Sound/Georgia Basin region and southern DPS of eulachon by juvenile hatchery Chinook salmon during the summer would not increase compared to the affected environment.

4.4.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

Alternative 2 would increase Chinook salmon abundance at the level described in section 4.2.2. The effects of Alternative 2 overall for these species is expected to be low and not considered significant. There may be certain times and areas where Chinook salmon prey is important for these species, because of the opportunity to prey upon salmon, but overall this increase is not significant to their overall dietary intake needs.

For yelloweye and bocaccio rockfish in Puget Sound/Georgia Basin, Alternative 2 will release additional hatchery Chinook salmon that may interact with these species as they enter and live in pelagic habitats of marine areas (NMFS 2020). Hatchery Chinook salmon smolts will enter marine waters during the spring and summer and potentially prey upon young of the year larval rockfish during the period when rockfish are small and co-occurring with juvenile salmon in pelagic waters. The duration of this effect will occur predominately from June through September as larval rockfish are present with hatchery salmon throughout Puget Sound/Salish Sea (Figure 19). After this period, larval rockfish grow larger and migrate to bottom habitats and juvenile salmon migrate to other marine waters, and therefore the interaction between these fish is minimal. NMFS (2020) concluded a small fraction of larval rockfish may be consumed by the total releases of all hatchery salmon and steelhead throughout Puget Sound (as described in the Affected Environment). Alternative 2 may increase this interaction; albeit it will be at a very low level because proposed releases are relatively low in this alternative compared to the regionwide totals of hatchery fish.

As rockfish grow to a larger size, juvenile and sub-adult Chinook salmon may be prey for these rockfish species when available. The benefits of salmon to these rockfish species is estimated to be negligible (NMFS 2020).

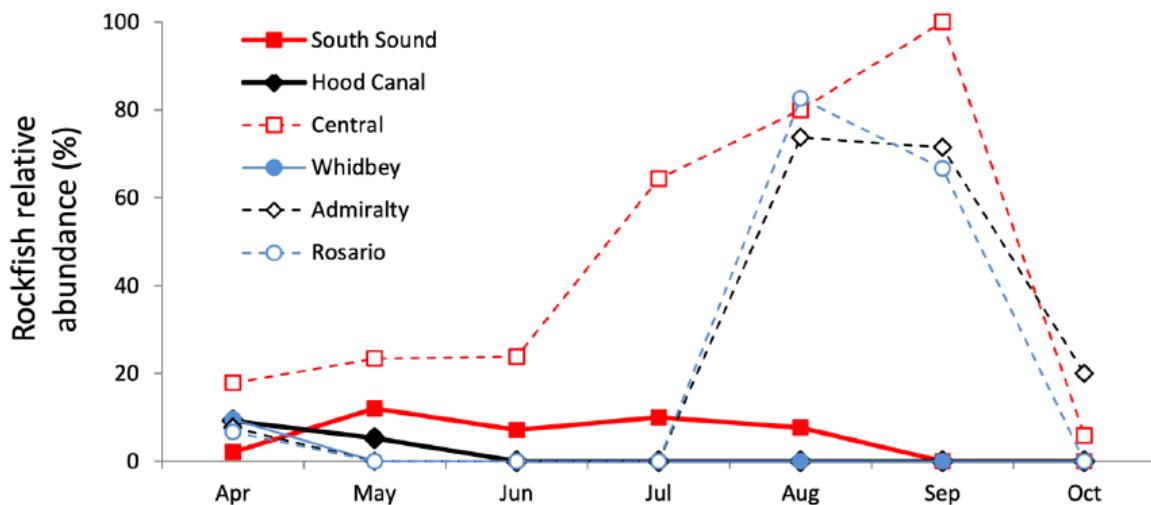


Figure 19. Relative abundance of rockfish at a subset of index sites from April through October. Image from Greene and Godersky (2012).

For the southern DPS of eulachon, there is the possibility of ecological interactions between eulachon and Chinook salmon. Interactions at the juvenile and adult life stages of eulachon is expected to be negligible

with juvenile Chinook salmon. Predation by adult Chinook salmon may occur on all life stages of eulachon due to the size of prey salmon typically feed upon. The highest risk of predation currently known occurs in the Lower Columbia River during the winter period when early returning hatchery spring Chinook salmon (e.g. Willamette stock) are present with returning adult eulachon. The interaction is expected to be low as eulachon enter the tributaries to spawn. The magnitude of effect is negligible given the abundance of eulachon, the relatively low numbers of adult hatchery salmon co-occurring during this time, and the significant predation pressures by marine mammals on both of these fish species during this period (NMFS 2022).

4.4.3. Alternative 3: Habitat-based Prey Increase Program

Alternative 3 would result in an increase in the natural production of Chinook salmon from habitat restoration projects at the level described in section 4.2.3. The increase in Chinook salmon abundance for Alternative 3 is likely to be an order of magnitude lower than for Alternative 2. The overall benefit to these species (sea lions, seals, and rockfish) for this alternative is likely to be negligible and not considered to be significant.

4.4.4. Alternative 4: Reduced Fishing to Increase Prey

Alternative 4 would reduce the harvest of Chinook salmon in marine fisheries during certain times and areas in US waters; providing an increase in Chinook abundance as described in section 4.2.4. The benefits in terms of prey availability for these species is low and not considered to be significant. The adverse effects of additional Chinook salmon predation on other species is considered to be negligible under this alternative due to the relatively small increase in abundance (e.g. 4-5%) compared to the scale of overall predation effects. Alternative 4 is equivalent to the low benefits in Alternative 2, but provides more benefits to these species (sealions, seals, and rockfish) than Alternatives 1 and 3.

4.5. Effects on Socioeconomics

Communities in the analysis area receive substantial income and employment activity from the commercial, tribal, and recreational salmon fisheries, and other economic inputs from federal funding. Many of these communities are located in rural settings where all economic inputs are essential to maintaining the viability of these human environments (Figure 11). Native American tribes throughout the entire analysis area use salmon as an important food for sustenance and commercial purposes, and

salmon are a strong spiritual symbol and central to their traditions and culture. Salmon are also an iconic species of great cultural and ecological importance.

4.5.1. Alternative 1 (No Action): No Funding for Prey Increase Program

Alternative 1 would not provide funding for the prey increase program. Following this cessation in funding, additional Chinook salmon (hatchery- and/or natural-origin) would no longer be produced and/or released. The increase in adult Chinook abundance (resulting from the prey increase program ending in FY 2024 and beyond) would diminish beginning 2026 and thereafter as adult salmon enter possible fisheries in marine and freshwaters after being available to SRKWs. This cessation for funding of hatchery Chinook salmon would affect the socioeconomics throughout the region by not distributing an average of \$6.2 million dollars annually from the federal funding of the prey increase program. In addition, there is a multiplier effect of this funding to affect other local goods and services, and recreational and commercial fisheries in freshwater and marine areas.

Alternative 1 would result in no additional benefits from the prey increase program. The loss of the production of hatchery Chinook salmon, as in the current affected environment, and the benefits these salmon provide to affected communities would no longer occur beginning in 2024 and beyond.

4.5.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

The socioeconomic effects of Alternative 2 would be beneficial from the production of additional hatchery Chinook salmon. The annual funding of the prey increase program distributed to local communities (on average \$6.2 million dollars annually under current funding, and up to \$12 million for prey increase program goals) to produce additional hatchery fish would benefit state and tribal organizations as described in the Chapter 3, Affected Environment. The abundance of Chinook salmon would increase in commercial, tribal, and recreational fisheries throughout the analysis area (Table 18). Therefore, the impacts on socioeconomics under Alternative 2, related to an increase in potential catch in fisheries, especially in freshwater, after being available as prey for SRKWs in marine waters, would be medium beneficial impact and is considered significant. Alternative 2 would provide significantly greater socioeconomic benefits than Alternatives 1, 3, and 4.

4.5.3. Alternative 3: Habitat-based Prey Increase Program

The socioeconomic effects of Alternative 3 would benefit from the annual funding of the habitat restoration program to local communities that spend the money (on average \$6.2 million dollars annually under current funding, and up to the assumed \$12 million for prey increase program goals) to implement habitat restoration activities (and the multiplier effects of this federal funding) and the resultant increased natural production of Chinook salmon throughout the analysis area. Benefits of Alternative 3 would be greater than Alternatives 1 and 4, but much lower than Alternative 2. Therefore, the benefits of Alternative 3 on socioeconomics would be medium, but considered significant for the affected communities. Benefits to these local communities would be primarily over the long-term as habitat restoration and the associated benefits to the local community from watershed habitat improvements and natural salmon production occur.

4.5.4. Alternative 4: Reduced Fishing to Increase Prey

The socioeconomic effects of Alternative 4 are related to Chinook fishery closures and reductions in catch in US waters as described in section 2.4 for this alternative. Two scenarios were modeled for fishery reductions to increase prey availability for SRWKs according to current federal funding level and prey program goals. The first scenario used the current average federal funding of \$6.2 million dollars for the prey increase program for fishery harvest reductions based upon socioeconomic impacts (ex-vessel value for commercial fisheries, and community level value for sport fisheries). The second scenario reduced fishery harvest needed to approximate the prey increase program goals of 4-5% additional prey availability for SRKWs (salmon not harvested), and then calculate the foregone socioeconomic value of those lost fishery harvest opportunities, which is estimated at a minimum of \$25 million annually (see below). For the second scenario, it is important to keep in mind that this level of harvest reduction requires significantly more federal funding to achieve than current federal funding or the amount of federal funding estimated to achieve the program goal under Alternative 2. We also note there is currently no legal mechanism available to use funding to reduce fishing effort and catch for the purpose of increasing prey availability for SRKWs, and this adds uncertainty regarding the cost estimates for this alternative.

Current Federal Funding

The minimum socioeconomic value of foregone harvest of Chinook salmon equating to \$6.2 million in ex-vessel and community level economic impacts (PFMC 2023; NMFS 2024b) is significant and ranges from a total of 42,000 to 83,000 Chinook salmon annually depending upon the assumptions of fishery

season and specific fishery closed. Table 22 provides three examples of fishery closures, with the intent to reduce all fisheries equally to the extent possible, and foregone Chinook salmon harvest and associated socioeconomic impacts up to \$6.2 million. These estimates should be considered minimum loss values because for commercial fisheries only ex-vessel values are used that do not consider other economic benefits throughout the community from fish processing, crew income, support services, and tax revenue. Thus, the amount of funding available would not completely offset the economic losses associated with these fishery reductions.

Table 22. Three hypothetical examples of fishery harvest reductions, each equating to an estimated \$6.2 million in minimum socioeconomic costs. See text for details.

Fishery	Example #1	Oct-April		May-June	
		Catch Reduction by 100%	Minimum Economic Value	NOF Only - 52% Catch Reduction	Minimum Economic Value
SEAK commercial	33,766	\$2,141,237	no change		
SEAK sport	NA	NA	no change		
NOF commercial	NA	NA	21,040	\$1,726,719	
NOF sport	NA	NA	2,220	\$184,922	
SOF commercial	9,398	\$771,284	no change		
SOF sport	7,951	\$662,159	no change		
PS commercial	2,436	\$199,920	no change		
PS sport	6,443	\$536,573	no change		
Total:	59,994	\$4,311,174	23,260	\$1,911,640	
Grand Total (catch, \$):		83,254	\$6,222,814		
Fishery	Example #2	May-June			
		Catch Reduction by 76%	Minimum Economic Value		
SEAK commercial	5,990	5,990	\$379,845		
SEAK sport	6,777	6,777	\$3,415,789		
NOF commercial	10,520	10,520	\$863,359		
NOF sport	1,110	1,110	\$92,461		
SOF commercial	14,305	14,305	\$1,174,033		
SOF sport	2,654	2,654	\$221,038		
PS commercial	261	261	\$21,410		
PS sport	272	272	\$22,645		
Total:	41,890	41,890	\$6,190,582		

Fishery	Example #3 Catch Reduction by 31%	July-Sept	
		Minimum Economic Value	
SEAK commercial	27,833	\$1,765,027	
SEAK sport	3,070	\$1,547,381	
NOF commercial	7,743	\$635,436	
NOF sport	6,390	\$532,184	
SOF commercial	8,698	\$713,853	
SOF sport	5,044	\$420,081	
PS commercial	1,535	\$125,984	
PS sport	5,303	\$441,592	
Total:	65,617	\$6,181,538	

Prey Increase Program Goals

Table 23 provides a summary of the average reduction in catch associated with closing U.S. Chinook salmon fisheries in the winter and spring time periods and reducing U.S. Chinook salmon fisheries in summer by 15%; in order to approximate the prey increase program goals of 4-5% additional prey availability for SRKWs (see section 2.4 for more details). We applied complete closures to the winter and spring time periods to show the maximum possible benefits to increasing prey availability for SRKWs, and the associated socioeconomic effects of doing this are evaluated here. Table 24 provides the same information but is also broken out by gear type to show the specific fishery sectors affected. An important consideration in interpreting these results is that fisheries were closed entirely or reduced equally without consideration for which specific fisheries might provide greater benefit to the abundances in the specific time/area strata being targeted. Again, this was to demonstrate the maximum benefits of fishery harvest reductions to increase prey availability for SRKWs (as described in section 4.3.4). It is likely that there are alternative scenarios that could provide similar benefits to abundances while requiring a smaller overall reduction to catches. However, this would involve more fine tuning and unequal treatment across fisheries, resulting in a disproportionate sharing of the burden across regions (see Appendix F).

Table 23. Reduction in catch by fishery region due to winter and spring closure (Oct-June) and a 15% reduction of summer (July-Sept) U.S. Fisheries. WAC is Washington coast net fishery in state waters (e.g. Willapa, Grays Harbor). Table taken from Appendix F.

FISHERY REGION	CATCH REDUCTION		
	OCT-APR	MAY-JUN	JUL-SEP
SEAK	33,766	53,197	14,717
PFMC_NOF	0	48,459	6,730
PFMC_SOF	17,349	70,665	6,544
WAC	0	0	1,490
PS	8,880	2,220	3,255

Table 24. Reduction in catch by fishery region and gear type due to winter and spring closure (Oct-June) and a 15% reduction of summer (July-Sept) U.S. Fisheries. Table taken from Appendix

FISHERY REGION	GEAR	CATCH REDUCTION		
		OCT-APR	MAY-JUN	JUL-SEP
SEAK	Net	0	4,266	757
SEAK	Sport	0	28,239	1,462
SEAK	Troll	33,766	20,692	12,497
PFMC_NOF	Sport	0	4,626	3,043
PFMC_NOF	Troll	0	43,833	3,687
PFMC_SOF	Sport	7,951	11,059	2,402
PFMC_SOF	Troll	9,398	59,606	4,142
WAC	Net	0	0	1,490
PS	Net	176	0	682
PS	Sport	6,443	1,133	2,525
PS	Troll	2,260	1,087	49

The reductions in catch under Alternative 4 are substantial. In SEAK, the total catch reduction is 101,679 Chinook salmon, which in some years would represent a reduction in at least half of the PST treaty catch limit for Chinook salmon in SEAK. In NOF region, the total catch reduction is 55,189 Chinook salmon.

In the SOF region, the total catch reduction is 94,558 Chinook salmon. In Puget Sound, the catch reduction is 14,355 Chinook salmon. The total Chinook salmon catch reduction under Alternative 4 is 267,271 salmon across all regions and times.

In order to quantify the socioeconomic costs to fishers, the industry, and local communities involved with Chinook salmon fisheries, the value of the foregone catch of Chinook salmon associated with Alternative 4 was estimated using fishery data from 2022 (PFMC 2023) for southern US fisheries and data from Conrad and Thynes (2022) and NMFS (2024b) for SEAK fisheries.

The estimated foregone value of the Chinook salmon harvest associated with Alternative 4 totals \$25.4 million dollars annually. The economic loss estimated for southern US recreational and commercial fisheries is \$13.4 million dollars annually (Table 25). The economic loss estimated for southeast Alaska recreational and commercial fisheries is \$12.0 million dollars annually (Table 26). These estimates should be considered minimum loss values because for commercial fisheries only ex-vessel values are used that do not consider other economic benefits throughout the community from fish processing, crew income, support services, and tax revenue. For the sport fishery in SEAK, the assumption on catch rates was high; and therefore, the catch quota would be reached sooner resulting in minimal economic estimates for that fishery compared to lower catch rates that would equate to more days out on the water and greater economic estimates. In summary, the funds available are insufficient to compensate for these reductions, and as the reductions are based on only ex-vessel values, the funds would not begin to address the broader socioeconomic effects of foregoing fisheries.

Table 25. Annual estimated value of foregone Chinook salmon harvest associated with Alternative 4 for southern US (S.U.S.) commercial and recreational fisheries. See text for details on the values reported in this table.

S.U.S. Commercial Troll Fishery	Chinook Harvest Reduction	Avg Weight per Chinook	Price/Pound	
North of Falcon	47,520	10.7	7.67	
South of Falcon	73,146			
Puget Sound	3,396			
Total Catch Reduction	124,062			
Total Exvessel Value	\$10,181,644			
S.U.S. Recreational Fishery	Chinook Harvest Reduction	Economic Impact per Salmon Harvested	Total Economic Impact	
North of Falcon	7,669	\$83.28	\$3,263,577	
South of Falcon	21,418			
Puget Sound	10,101			
Total Catch Reduction	39,188			

Table 26. Annual estimated value of foregone Chinook salmon harvest associated with Alternative 4 for southeast Alaska (SEAK) commercial and recreational fisheries. See text for details on values reported in this table. These values are estimated to be minimum values because it was assumed two Chinook salmon harvested per day, which has not been allowed under recent regulations (i.e. if only one salmon can be harvested per day, the economic benefit would be substantially greater than presented here). The value for the SEAK commercial fishery are minimum values because they only include ex-vessel value. See NMFS (2024b) for further information on economic values used here.

SEAK Commercial Fishery	Chinook Harvest Reduction	Avg Weight per Chinook	Price/Pound
Troll	66,955	11.7	\$5.42
Net	5,023		
Total Catch Reduction	71,978		
Total Exvessel Value	\$4,564,413		
SEAK Recreational Fishery	Chinook Harvest Reduction	Economic Impact per Day Saltwater Fishing	Total Economic Impact
Sport	29,701	\$504	\$7,484,652
Total Catch Reduction	29,701	Assume 2 Chinook harvested per day	

Alternative 4 would substantially reduce Chinook salmon harvest beyond existing management agreements (e.g. PST) and further reduce fishing opportunities for fishing communities that are already suffering from the long-term decline of Chinook salmon. A foregone harvest of 267,271 Chinook salmon annually in US salmon fisheries would be devastating. The annual funding of \$6.2 million dollars associated with the current federal prey increase program would only equate to 24%, and the “program goal” level of federal funding considered in Alternative 2 would only equate to approximately 50%, of the minimum annual economic losses (\$25.4 million) of Chinook salmon fishery harvest in the affected communities under the scenario of meeting prey increase program goals.

Alternative 4 would have the highest adverse impacts on socioeconomics and is considered to be significant to the affected communities. Alternatives 1,2, and 3 all have significantly lower socioeconomics adverse effects because fishery harvest is not constrained beyond existing regulatory regimes; compared to Alternative 4.

For SEAK in particular, any reductions to SEAK commercial fisheries under Alternative 4 would lead to significant, adverse economic impacts. Rural SEAK communities, including Alaska Native communities and tribal citizens, would experience negative impact from the reduction of the commercial salmon fishery. The Central Council of Tlingit & Haida Indian Tribes of Alaska have reported that the closures or reductions of the summer and winter Chinook salmon troll fishery would have a devastating cultural and economic impact on their tribal citizens and their communities that rely on the commercial salmon fishery for their livelihood and their cultural well-being. Approximately 11 % of the total earnings for SEAK residents comes from the seafood industry and the majority of that comes from salmon fishing.¹¹ Across all seafood sectors, salmon accounted for approximately 60 to 70 % of SEAK's seafood production value. While this analysis presented in this section only includes ex-vessel value for the commercial sector of the SEAK troll and net fisheries, based upon the overall economic output and labor income, we can assume that Alternative 4 would result in substantially greater economic losses to SEAK economy than we provide here. Using data from the most recent comprehensive economic study produced by ASMI in 2020, the SEAK salmon fishery produced \$303 million in output, \$165 million in labor income for SEAK, and 7,910 in jobs for the region. Under Alternative 4, it is assumed that the economic output, labor income, and jobs in the region would be reduced by an unknown but significant amount, with adverse impacts on the rural communities of coastal SEAK.

4.6. Effects on Environmental Justice

As described in Chapter 3, Affected Environment, Native American tribes and other local communities throughout the analysis area may experience disproportionate effects from the alternatives as it relates to environmental justice concerns (Figure 11 and Figure 12). These communities rely upon salmon, SRKWs, and other natural resources for their survival, livelihood, ceremonial and subsistence, nutrition, and fishery harvest activities to support their cultural, spiritual, and in general, their well-being and way of life.

¹¹ <https://www.seconference.org/wp-content/uploads/2023/09/SE-by-the-numbers-2023-Final.pdf>

4.6.1. Alternative 1 (No Action): No Funding for Prey Increase Program

Under Alternative 1, the following ecological, cultural, economic, and social effects on environmental justice communities would be expected in both the short and long term:

- The elimination of funding to increase prey availability for SRKWs is of significant importance and interest to Native American tribes throughout the analysis area who depend upon SRKWs for a variety of reasons.
- No increased abundance of Chinook salmon from the prey increase program (of either natural-origin or hatchery-origin) beginning in 2024 and beyond. This would result in a lower number of salmon which is important to Native American tribes for cultural, ceremonial, and subsistence interests as described in section 4.2.1. These salmon would be available to Native American tribes for potential harvest after being available for SRKWs in marine waters.
- No increased abundance of Chinook salmon from the prey increase program beginning in 2024 and beyond in rural and impoverished local communities throughout the analysis area for important cultural and economic interests. These additional salmon would have been available to affected communities after being available as prey to SRKWs in marine waters.
- A potential impact to environmental justice communities from the employment of full-time and seasonal employees associated with Chinook salmon hatcheries and the funding of the prey increase program salmon.
- No benefit to environmental justice communities from increased fisheries targeting Chinook salmon that increase the local purchase of supplies such as fishing gear, camping equipment, consumables, and fuel at local businesses; these increases would benefit environmental justice communities.
- Alternative 1 would no longer provide additional benefits from the prey increase program on environmental justice to the affected communities beginning in 2024 and thereafter. There would no longer be additional prey provided for SRKWs compared to the current affected environment.

4.6.2. Alternative 2 (Proposed Action/Preferred Alternative): Hatchery Prey Increase Program

Under Alternative 2, the following ecological, cultural, economic, and social effects on environmental justice communities would be expected in both the short and long term:

- An increase in the abundance of hatchery Chinook salmon available for SRKWs, which is of significance to Native American tribes for cultural and spiritual reasons.
- A potential increase in the amount of Chinook salmon potentially available to Native American tribes for cultural, ceremonial, and subsistence interests after the salmon are available as prey to SRKWs in marine waters.
- A potential benefit to the health and status of SRKWs from increased prey availability, which is important to Native American tribes for spiritual, ecological, and other reasons.
- A potential increase in beneficial impact to environmental justice communities from the purchase of goods and services to support Chinook salmon fisheries.
- A positive impact to environmental justice communities from the employment of full-time and seasonal employees associated with Chinook salmon fisheries.
- A potential increase in impact to environmental justice communities from fisheries targeting hatchery salmon that increase the local purchase of supplies such as fishing gear, camping equipment, consumables, and fuel at local businesses; these increases would benefit environmental justice communities from increased salmon abundance after being available as prey for SRKWs in marine waters.

Therefore, Alternative 2 would have medium positive impacts on environmental justice. Given the tribal and other community demographic parameters of concern for environmental justice, this would likely be a significant benefit (NWIFC 2023). Alternative 2 would provide substantially more benefits, with least amount of harm compared to alternatives 1, 3, and 4.

4.6.3. Alternative 3: Habitat-based Prey Increase Program

Under Alternative 3, the following ecological, cultural, economic, and social effects on environmental justice communities would be expected in both the short and long term:

- A potential increase in the amount of Chinook salmon potentially available to Native American tribes; albeit likely to be low over the short term compared to Alternative 2,

with longer term benefits from restoration work, habitat improvement, and increased natural production of salmon.

- A potential increase in beneficial impact to other local communities over the longer term from the purchase of goods and services to support Chinook salmon fisheries, after the salmon are available as prey for SRKWs in marine waters.
- Some increase in impact to environmental justice communities from the employment of full-time and seasonal employees associated with Chinook salmon fisheries over the long term.
- A potential increase in impact to environmental justice communities from fisheries targeting natural salmon that increase the local purchase of supplies such as fishing gear, camping equipment, consumables, and fuel at local businesses; these increases would benefit environmental justice communities.

Therefore, Alternative 3 would have low potential benefits to environmental justice. Given the tribal and other community demographic parameters of concern for environmental justice, this would likely be a low but significant impact (NWIFC 2023).

4.6.4. Alternative 4: Reduced Fishing to Increase Prey

Under Alternative 4, two scenarios were modeled for fishery reductions to increase prey availability for SRKWs according to current federal funding level and prey program goals and have significantly different effects on environmental justice. The first scenario used the current average federal funding of \$6.2 million dollars allocated for the prey increase program to help compensate for fishery harvest reductions. In our analysis, these reductions in fishery harvest ranged 42,000 to 83,000 Chinook salmon annually in commercial, tribal, and sport fisheries across the Pacific Northwest and SEAK (Table 22). This would equate to a significant impact to tribal and rural communities dependent upon salmon fisheries (NWIFC 2023).

The second scenario reduced fishery harvest needed to approximate the prey increase program goals of 4-5% additional prey availability for SRKWs (salmon not harvested). These reductions averaged 267,271 salmon annually from commercial, tribal, and recreational fisheries in the Pacific Northwest and SEAK. The minimum economic loss of this scenario is at least \$25 million annually (section 4.5.4). This scenario would result in significant impacts to all affected tribal and rural communities throughout the analysis area.

Both of these scenarios represent significant impacts to Native American tribes in the SEAK and Pacific Northwest regions, who are already severely impacted from declines in regional Chinook salmon abundance and reduced fishing opportunities for ceremonial, subsistence, cultural, and commercial interests. In addition, the local communities throughout the analysis area rely upon Chinook salmon and the fisheries to the same extent. These environmental justice communities would be significantly impacted both of these fishery reduction scenarios.

Under Alternative 4, the following ecological, cultural, economic, and social effects on environmental justice communities would be expected in both the short and long term:

- An increase in the abundance of adult Chinook salmon available for SRKWs which is of importance to Native American tribes for cultural and spiritual reasons.
- A substantial decrease in the amount of Chinook salmon potentially available to Native American tribes for cultural, ceremonial, and subsistence fisheries interests from the fishery reductions in SEAK, NOF, WAC, and PS Chinook salmon fisheries (Table 22; Table 24.). In addition to a substantial decrease in access to salmon for subsistence and food security, cultural resiliency, traditional ways of life, and intergenerational and cultural connections, a substantial economic impact on Alaska Native participation in commercial fisheries in SEAK and the stability of communities across SEAK since a number of the Southeast communities reliant on salmon fisheries in Southeast Alaska are Alaska Native communities and Alaska Native citizens hold a number of net and troll permits.
- A substantial decrease in beneficial impact to other local communities from the purchase of goods and services to support Chinook salmon fisheries.
- A substantial decrease in impact to environmental justice communities from the employment of full-time and seasonal employees associated with Chinook salmon fisheries.
- A substantial decrease in impact to environmental justice communities from fisheries targeting hatchery salmon that increase the local purchase of supplies such as fishing gear, camping equipment, consumables, and fuel at local businesses; these increases would benefit environmental justice communities.

Therefore, Alternative 4 would have high adverse impacts on environmental justice tribal and non-tribal communities throughout the analysis area. Given the demographic parameters of concern for environmental justice, this would likely be a significant impact.

5. CUMULATIVE IMPACTS

5.1. Introduction

As described in Chapter 3, Affected Environment, and Chapter 4, Environmental Consequences, ascertaining the effects of a prey increase program for SRKWs, whether via hatchery (Alternative 2) or natural (Alternative 3) is extremely complicated due to the life cycle of salmon in the wild, in a variety of habitats (freshwater and ocean), interacting with a host of aquatic and terrestrial species, under highly variable environmental conditions that can affect the salmon's survival by orders of magnitude at every life stage. The environments of a salmon are not static in space and time, and fluctuate greatly, making the effects of the actions also variable in space and time. All of these factors must be taken into account when describing the cumulative effects of the preferred alternative.

The central issue being analyzed in this PEIS is the insufficient amount of salmon prey currently available for endangered SRKWs and to mitigate for the effects of the PST fisheries in light of the long-term decline of Chinook salmon abundances over the last several decades. Prey availability for SRKWs is still a key limiting factor/threat impeding the recovery of this species. The insufficient production of salmon available in marine areas for SRKWs is the symptom of other problems currently affecting the production of salmon throughout all of their life stages. Salmon runs throughout the project area have declined significantly over the last 30 years in particular due to a whole host of factors (NWIFC 2023). The health of SRKWs is tied to the health of salmon runs. The health of salmon runs is tied to the health of their freshwater and marine habitats in which they need to survive and reproduce. The cumulative effects analysis describes this complicated situation from this perspective.

5.2. Past, Present, and Reasonably Foreseeable Future Actions

By definition, cumulative impacts analyses for NEPA documents must include a consideration of the reasonably foreseeable future activities, in addition to the impacts from NMFS' proposed action (Chapter 4) and all other actions taken within the affected environment (Chapter 3). The proposed action for hatchery production, as described above, is only a low proportion of the total hatchery fish releases funded through other sources that will occur into the foreseeable future. Other actions affecting SRKW and salmon survival and productivity will also occur across the region into the foreseeable future. The expected effects of human activities on the natural environment, which in turn affects SRKWs and salmon, is not likely to decrease into the foreseeable future throughout the region as a whole, as human

population growth continues to increase, and the corresponding development and impacts on the natural environment continue to increase. Below is a list of reasonably foreseeable future actions that may contribute negatively or positively to a cumulative effect to the natural or human environment across the region:

- The analysis area has experienced unprecedented effects from climate change to the physical and biological processes over the last decade which in return affects salmon, SRKWs, and the ecosystems upon which they depend (Crozier et al. 2021). At a large, ecosystem scale, warming temperatures, lower precipitation, lower streamflows, and drought conditions have severely impacted terrestrial and aquatic environments. The abundance and productivity of salmon across the landscape has and will continue to be severely impacted by climate change into the foreseeable future. The marine environment will continue to be severely affected as well which has much bearing on salmon survival and SRKWs.
- Coastal development in the United States West Coast (Washington, Oregon, California) has increased steadily since the 1960s. There are only 254 counties (out of 3,142 total nationwide) situated on the coast, yet these counties contain almost a third of the U.S. population, and are home to intense concentrations of economic and social activity. Degradation or development of existing natural areas, or disruption of natural processes through increased human activity, all have the potential to impact the affected area and specifically project sites and resources during implementation of the preferred alternative or after restoration has been completed.
- Natural disasters and climate-related impacts could cause major devastation to coastal communities and natural resources. Wildfires throughout the region are widespread and impact the condition of freshwater habitats for salmon. A shift in priorities, as well as the physical degradation or damage to natural resources, could have a meaningful impact on how the preferred alternative is implemented. Similarly, changes in weather patterns or other meteorological shifts may impact salmon survival and ultimately change where and when an alternative is implemented. For example, extended drought may nullify the efforts of watershed revegetation and in-stream habitat construction projects, and changes in ocean conditions may modify migratory fish behavior. Production of hatchery fish may have to be modified based upon water quality concerns at existing hatchery facilities that are not as favorable to fish survival as previously.
- Natural resource management regimes may shift to include greater or fewer species being proposed or listed under the Endangered Species Act (and subsequently their critical habitat

designations) or within fishery management plans (and subsequently their essential fish habitat designations). The amount of salmon restoration funds for habitat projects may decrease in the future as budget and funding changes.

- Public and private funding availability that is normally used to implement restoration may expand or contract. Depending on how such changes come to pass could impact the hatchery facilities in which the preferred alternative is implemented.
- State environmental conservation programs that regularly conduct on-the-ground projects within the affected environments of the proposed action could contribute to a cumulative effect. Fish stocking, invasive species removal, land acquisition, and stormwater management actions performed by state programs may enhance the benefits of the restoration of salmon habitats.
- Ocean and freshwater tribal, commercial, and recreational fisheries will likely continue to be implemented according to applicable fishery management plans approved under the MSA or other authorities. The PST prescribes the allowable exploitation rates on various Chinook salmon stocks throughout the analysis area depending upon annual abundance estimates for the particular fishery, and each party of the PST must implement the fisheries management framework domestically, through the MSA or other authorities. These fisheries will continue into the future.

5.3. Climate Change

Climate change is exerting substantial and interconnected effects on salmon, SRKWs, and the ecosystems upon which they depend. The rise in global temperatures has led to warmer ocean waters, impacting the physiology, migration patterns, and reproduction of most salmon stocks and consequently SRKWs. Additionally, the absorption of excess carbon dioxide has caused ocean acidification, affecting the development of salmon, particularly during their early life stages, and influencing the availability of prey species. Disruptions in ocean currents due to climate change can alter the distribution of nutrients and prey crucial for salmon, while rising sea levels are transforming coastal habitats vital for salmon spawning and rearing. Changes in food availability, influenced by climate-induced shifts, further affect the survival and growth of salmon populations. Extreme weather events, such as storms and floods, are becoming more frequent and intense, posing direct and indirect threats to salmon habitats and migration routes. The melting of glaciers, a consequence of climate change, is impacting the cold, nutrient-rich environments that support salmon habitats. Additionally, habitat loss, driven by climate change, affects critical areas like wetlands and estuaries, limiting the available spaces for salmon to spawn and rear. Warmer waters also facilitate the

spread of diseases and parasites, posing additional challenges to salmon populations. In essence, climate change is presenting a complex set of challenges that collectively jeopardize the life cycle, distribution, and overall abundance and productivity of salmon, and the availability of salmon as prey for SRKWs.

5.4. Cumulative Effects by Resource

5.4.1. Chinook Salmon and Their Habitats

Chapter 3, Section 3.2, Affected Environment, describes the baseline conditions for Chinook salmon. This includes the biological status of Chinook salmon and their habitats and current hatchery and harvest effects in the present baseline. These conditions are the result of many years of habitat loss and degradation, development, land management, fishery harvest, and hatcheries (Lackey et al. 2006). The expected direct and indirect effects of the alternatives on Chinook salmon are described in Chapter 4, Section 4.3, Effects on Chinook Salmon and Their Habitat. The expected future actions are described in Section 5.2 above. This section describes the cumulative effects of the proposed action on Chinook salmon and their habitats as it relates to the key aspect of increasing the prey availability for SRKWs.

Chinook salmon will continue to face significant challenges throughout the analysis area related to conservation and recovery of natural populations and their habitats. Continued habitat loss and degradation is likely to continue into the foreseeable future. Recovery actions aimed at mitigating and even slowing these declines will also occur into the future. Climate change impacts on summer stream temperatures, lower streamflow during critical life stages in freshwater, and warmer temperatures even through the winter will all impact Chinook salmon growth and survival while in freshwater. Hatchery salmon will even experience these conditions as hatchery facilities raise the salmon from natural water supplies from adjacent rivers and streams. Hatchery fish will also experience altered stream conditions after the fish are released from the hatcheries and emigrate through freshwater habitats to the ocean. Fishery harvest in marine and freshwater areas will continue to affect Chinook salmon with varying cumulative exploitation rates depending upon the stock. There will be continued pressures on both natural- and hatchery-origin Chinook salmon into the future throughout the analysis area.

Alternative 2, the hatchery prey increase program, is the preferred alternative in this EIS. The effects of this additional hatchery production is relatively minor, within the larger context of existing hatchery production for Chinook salmon throughout the analysis area. Chinook salmon natural populations and their habitats will continue to face challenges from a range of effects of pHOS and habitat degradation

even in the absence of the hatchery prey increase program. Washington state also has produced hatchery Chinook salmon to increase Chinook prey availability for SRKW as described in Chapter 3, Affected Environment. The combined effects of both federal and state funding for hatchery production to increase prey for SRKWs is currently approaching the original goals established to increase prey for SRKW by Dygert et al (2018); a meaningful increase in prey availability of 4-5% and the thought at that time was that this could be attained by additional 20 million hatchery smolts released. In recent years, 2022 and 2023, the combined effects of the federal and state funding for prey production is approaching this goal with releases at approximately 20 million in 2023 (Table 7; Figure 9). Alternative 2 considers a range of federal funding for production (from current funding to program goals), that would result in production of up to 20 million hatchery smolts at the high end of the range. We assume that the high end of the Alternative 2 range for federal funding would only occur if state funding were eliminated, thus a higher federal funding level would not increase hatchery production beyond 20 million smolts annually, but would make up for any reduction in state funding.

Hatchery effects on Chinook salmon will continue, regardless of the proposed action/preferred alternative/status quo. The additional hatchery production resulting from combined state and federal funding represents a maximum of 14% of the total regional releases of juvenile hatchery Chinook salmon (Figure 6; Figure 7; Figure 9). Depending upon the baseline conditions of pHOS in the natural population before the prey increase program was initiated, the percent increase in pHOS attributable to the cumulative prey increase funding (federal and state) is likely less than 14% for affected natural populations at the maximum prey increase program level. The greatest percent increases in pHOS from Alternative 2 is expected in populations with the lowest pHOS (Figure 14).

Our analysis discloses the effects of these releases at a programmatic level, and the overall effects on Chinook salmon and their habitats. The effects of the hatchery releases are additive to the existing baseline conditions of which hatchery effects are a part. Most of the natural populations throughout the analysis area have pHOS levels that are not affected by the hatchery prey increase program (federal and state) because these hatchery fish are not released in these areas (Table 17). Figure 4 and Figure 5 show the limited number of prey increase program hatchery facilities within the larger context of hatcheries throughout the region. The cumulative effects of the prey increase program (federal and state) on Chinook salmon and their habitats, within the larger existing context of hatcheries, is not significant. Current challenges with Chinook salmon recovery will continue even without the hatchery prey increase program.

Alternatives 1, 3, and 4 do not rely upon hatchery production to the same degree as Alternative 2. Alternative 1 would not continue federal funding for the purpose of increasing prey for SRKW; but state funding through the Washington legislature could continue at their discretion. The other alternatives provide funding for natural recovery and fishery reduction. The cumulative effects of these potential actions could provide some help to Chinook salmon over the short- and long-terms, but it is not likely to be significant due to the scope of the limited funding over the larger landscape of Chinook salmon recovery throughout Washington, Idaho, and Oregon.

5.4.2. Southern Resident Killer Whales

This section describes the cumulative effects to SRKWs of other actions taken in the affected environment as they relate to all threats to SRKWs, including those that impact prey availability in marine and estuarine waters.

NMFS, in coordination with its multiple partners, has implemented targeted management actions identified in the SRKW recovery plan (NMFS 2008a) and informed by research. Transboundary efforts between the U.S. and Canada have occurred to address all the threats identified in the recovery plan. Since 2019, Canada has implemented annual conservation actions geared towards SRKWs including area-based fishery closures, interim sanctuary zones, and both voluntary initiatives and mandatory vessel regulations as part of interim orders to protect the whales. Interim measures have been released for 2023,¹² and are designed to reduce vessel- and prey-related threats for SRKWs when in the Salish Sea.

Harvest

Chinook salmon are the primary prey of SRKW throughout their geographic range, which includes the analysis area. The abundance, productivity, spatial structure, and diversity of Chinook salmon are affected by a number of natural and human actions, and these actions also affect prey availability for SRKWs. As discussed in Section 3.3, the abundance of Chinook salmon now is significantly less than historic abundance due to a number of human activities. The most notable human activities that cause adverse effects on ESA-listed and non ESA-listed salmon include land use activities that result in habitat loss and

¹² <https://www.pac.dfo-mpo.gc.ca/fm-gp/mammals-mammifères/whales-baleines/srkw-measures-mesures-ers-eng.html>

degradation, hatchery practices, harvest, and hydropower systems. Details regarding current conditions of ESA-listed Chinook salmon in the analysis area are described above in Section 3.2.

Salmon fisheries that intercept fish that would otherwise pass through the analysis area and become available prey for SRKWs occur all along the Pacific Coast, from Alaska to California. Past, current, and future harvest actions, including Puget Sound salmon fisheries (NMFS 2019), PFMC-area salmon fisheries (PFMC 2023), the Pacific Salmon Treaty 2009 Agreement (NMFS 2008h), the southeast Alaska salmon fisheries (NMFS 2019), and the U.S. v. Oregon Management Agreements, have short-term and long-term effects on SRKWs via prey reduction from fishery operations. In conducting ESA Section 7 consultations on these actions, we considered the short-term direct effects to whales resulting from reductions in Chinook salmon abundance that occur during a specified year, and the long-term indirect effects to whales that could result if harvest affected viability of the salmon stock over time by decreasing the number of fish that escape to spawn. Additionally, the PFMC groundfish fisheries catch Chinook salmon as bycatch, and the most recent Biological Opinion found the PFMC groundfish fishery is likely to adversely affect, but not jeopardize, ESA-listed Chinook salmon (NMFS 2017).

In 2021, the PFMC adopted Amendment 21 to address effects of PFMC-area ocean salmon fisheries on the Chinook salmon prey base of SRKWs. The Amendment established a threshold representing a low pre-fishing Chinook salmon abundance in the NOF area (including the EEZ and state ocean waters), below which the PFMC and States will implement specific management measures (NMFS 2023).

Hatcheries

Hatchery production of salmonids has occurred for over a hundred years. There are over 300 hatchery programs in Washington, Oregon, California, and Idaho that produce and release juvenile salmon that migrate through coastal and inland waters of the analysis area. Many of these fish contribute to both fisheries and the SRKW prey base in coastal and inland waters of the analysis area.

NMFS has completed Section 7(a)(2) consultations on more than two hundred hatchery programs (Doremus and Friedman 2021); refer to Appendix C, Table C.1). A detailed description of the effects of these hatchery programs can be found in the site-specific Biological Opinions referenced in Appendix C, Table C.1). Additionally, a description of the effects of hatchery production receiving federal funds to increase SRKW prey is included in site specific ESA and NEPA documents for the funded programs (NMFS 2020, 2021, 2022). These effects are further described in Appendix C of NMFS (2018c), which is

incorporated here by reference. Currently, hatchery production is a significant component of the salmon prey base within the range of SRKWs (Barnett-Johnson et al. 2007); NMFS 2019). As described in Section 3.3, the Washington State Legislature has provided approximately \$13 million annually since 2019 for SRKW prey hatchery production, and has committed to continue until at least 2025.

Habitat

Habitat-altering activities such as agriculture, forestry, marine construction, levy maintenance, shoreline armoring, dredging, hydropower operations, and new development continue to limit the ability of the habitat to produce and support salmon, and thus limit prey available to SRKWs in the analysis area. Many of these activities have a federal nexus and have undergone Section 7(a)(2) consultation. Those actions have nearly all met the standard of not jeopardizing the continued existence of the listed salmonids or adversely modifying their critical habitat, and when they did not meet that standard, NMFS identified RPAs.

Activities that NMFS has consulted on that affect salmon habitat, and therefore also likely limit prey available to SRKWs, include hydropower projects (Mud Mountain Dam (NMFS 2014b), Howard Hanson Dam, Operation, and Maintenance (NMFS 2019c)), Klamath Project Operations (NMFS 2019) and decommissioning (NMFS 2021), the National Flood Insurance program (NMFS 2008b), marine construction (NMFS 2020a; 2021l; 2022c), and the Salish Sea Nearshore Programmatic (NMFS 2022i).

In 2020, 2021, and 2022, NMFS issued Opinions for 39 (NMFS 2020a), 11 (NMFS 2021l), and 15 (NMFS 2022c) habitat-modifying projects in the nearshore marine areas of Puget Sound. The Opinions concluded that the proposed action would jeopardize the continued existence of, and adversely modify critical habitat for, Puget Sound Chinook salmon and SRKWs. The expected improvements to Chinook salmon abundance resulting from implementation of the RPAs and conservation offsets as implemented under the Salish Sea Nearshore Programmatic Opinion (NMFS 2022i) for pending projects are expected to improve the amount of prey available for SRKWs and avoid jeopardy and adverse modification for SRKWs and their critical habitat.

In 2021, NMFS consulted on the removal of four dams on the mainstem Klamath and associated activities such as infrastructure modifications, removal, and reservoir drawdown, that impact Chinook salmon habitat (NMFS 2021). While temporary impacts to Chinook salmon are expected due to hatchery phase-

out and short-term habitat degradation, long-term benefits to the SRKW prey base are expected due to increased natural-origin Chinook salmon production and survival.

The funding initiative for U.S. domestic actions associated with the 2019-2028 PST Agreement (Pacific Salmon Commission 2022) included funding for habitat restoration projects to improve habitat conditions for specified populations of Puget Sound Chinook salmon (\$31.2 million over 3 years; FY 2020-2022). In FY20, FY21, and FY22, \$8.9 million, \$8.8 million, and \$8.8 million, respectively, was directed at habitat restoration projects within the northern boundary watersheds of Nooksack, Skagit, Stillaguamish, Snohomish, Dungeness, and Mid-Hood Canal. Projects were selected according to a list of preferred criteria, one of which included projects that supported high priority Chinook salmon populations for SRKW. As a result of improving habitat conditions for these populations, we anticipate Puget Sound Chinook salmon abundance would increase and thereby benefit SRKWs in the long term.

Vessels

Commercial shipping, cruise ships, and military, recreational, and fishing vessels occur in the inland and coastal range of SRKWs. Additional whale watching, ferry operations, and recreational and fishing vessel traffic occur in their inland range. The overall density of traffic is lower in coastal waters compared to inland waters of the Salish Sea. Several studies in inland waters of Washington State and British Columbia have linked vessel interactions with short-term behavioral changes in NRKW and SRKW (see review in Ferrara et al. (2017)), whereas there have been no studies that have examined interactions of vessels and SRKWs with behavioral changes in coastal waters. These studies that occurred in inland waters concluded that vessel traffic may affect foraging efficiency, communication, and/or energy expenditure through the physical presence of the vessels, underwater sound created by the vessels, or both. Collisions of killer whales with vessels are rare, but remain a potential source of serious injury and mortality, although the true effect of vessel collisions on mortality is unknown.

The physical and noise disturbance due to vessels may interfere with the ability of SRKW to detect, locate, and capture prey in their environment, and as such have an effect on prey availability as experienced by the whales. This effect may be amplified when prey abundance is low, preventing SRKW from accessing the little prey that is available. There are currently federal and state regulations in place in Washington State waters of the Salish Sea. A Washington state law was signed in 2019 increasing vessel viewing distances from 200 to 300 yards to the side of the whales and limiting vessel speed within $\frac{1}{2}$ nautical mile of the whales to seven knots over ground. This state law (Senate Bill 5577) also established

a commercial whale watching license program and charged WDFW with administering the licensing program and developing rules for commercial whale watching by January 2021 for inland Washington waters (see RCW 77.65.615 and RCW 77.65.620). On December 18th, 2020, new commercial whale watching rules were adopted that took effect in 2021. These rules specify that commercial whale watching occur at distances of <0.5 nautical mile from July-September during two 2-hr time periods in the day for no greater than three vessels at once, make the no-go zone on the west side of San Juan island mandatory for commercial whale watching, and establish training, reporting, monitoring, and license procedures.¹³ There is also an exclusion from approaching a group with a calf under one year old or an otherwise vulnerable, e.g., pregnant or malnourished, individual. Senate Bill 5918 amends RCW 79A.60.630 to require the state's boating safety education program to include information about the Be Whale Wise guidelines, as well as all regulatory measures related to whale watching, which is expected to decrease the effects of vessel activities to whales in state waters. WDFW submitted a report to the State Legislature in November 2022 about the effectiveness of state regulations for SRKW, including general vessel regulations and those associated with the commercial whale watching license program. That report summarized relevant information and results from public survey and focus group engagement. The analysis of all input resulted in WDFW recommending an expansion of the buffer distance for all vessels to 1000 yards from SRKWs. That recommendation became Senate Bill 5371, and was signed by Governor Jay Inslee in May 2023, to go into effect in 2025.

Contaminants and Oil Spills

Contaminants enter marine waters and sediments from numerous sources, but are typically concentrated near populated areas of high human activity and industrialization. Freshwater contamination is also a concern because it may contaminate salmon that are later consumed by the whales in marine habitats. Chinook salmon contain higher levels of some contaminants than other salmon species, however levels can vary considerably among populations. Mongillo et al. (2016) reported data for salmon populations along the west coast of North America, from Alaska to California, and found marine distribution was a large factor affecting persistent pollutant accumulation. They found higher concentrations of persistent pollutants in Chinook salmon populations that feed in close proximity to land-based sources of contaminants. There is some information available for contaminant levels of Chinook salmon in inland waters (i.e., Krahn et al. 2007; O'Neill and West 2009; Veldhoen et al. 2010; Mongillo et al. 2016). Some of the highest levels of certain pollutants were observed in Chinook salmon from Puget Sound and the

¹³ <https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/orca/rule-making>

Harrison River (a tributary to the Fraser River in British Columbia, Canada) (Mongillo et al. 2016). These populations are primarily distributed within the urbanized waters of the Salish Sea and along the west coast of Vancouver Island (DFO Canada 1999; Weitkamp 2010). Nutritional stress, potentially due to periods of low prey availability or in combination with other factors, could cause SRKW to metabolize blubber, which can redistribute pollutants to other tissues and may cause toxicity. Pollutants are also released during gestation and lactation which can impact calves (Noren et al. 2023).

SRKWs are vulnerable to the risks imposed by an oil spill. There is some level of risk from serious spills in the analysis area because of the heavy volume of shipping traffic and proximity to petroleum refining centers. The total volume of oil spills in inland waters of Washington has increased since 2013 and inspections of high-risk vessels have declined since 2009 (WDOE 2017). The total volume of oil spills was less in 2017-2019 than in 2015-2017 but still higher than previous years (WDOE 2019).

In 2021, NMFS consulted on the reauthorization of the North Wing pier at the British Petroleum (BP) Cherry Point refinery (NMFS 2021a). This Opinion concluded that the action was likely to adversely affect but not likely to jeopardize the survival and recovery of SRKW or adversely modify their critical habitat. The action does result in an incremental increase in risk of large oil spills. However, the oil spills most likely to occur would be substantially smaller in magnitude than the size likely to be catastrophic to SRKW according to Lacy et al. (2017). Ongoing smaller spills are likely to continue but these are not expected to occur at a frequency or magnitude that would indirectly or directly expose SRKW to acute toxicity or significantly affect toxin accumulation through prey.

5.4.3. Other Fish and Wildlife Species

The primary fish and wildlife species of concern are Steller sea lion, California sea lion, harbor seal, and Puget Sound/Georgia Basin yelloweye and bocaccio rockfish. With the exception of ESA-listed rockfish and western DPS Steller sea lion, the other species are near carrying capacity and considered healthy. All of the alternatives will have minimal effects on these species because Chinook salmon (hatchery or natural) are not the prey these marine mammals depend upon throughout their lives, and the larger environmental effects controlling marine productivity and predator-prey dynamics will be the key drivers for these species in the future. Given the opportunistic behavior of these marine mammals to take advantage of prey throughout their entire life, none of the alternatives are expected to drastically change the future outlook for these species. Climate change, and the effects on ocean productivity off the west coast of the U.S., will continue to be the key determinant for the health of these species.

For ESA-listed rockfish in Puget Sound/Georgia Basin, none of the alternatives will result in a significant impact to these species because the expected impacts are short-lived and of low intensity. The larger environmental effects and key limiting factors/threats will continue into the foreseeable future for these species in the absence of the prey increase program.

5.4.4. Socioeconomics

The effects of the alternatives on socioeconomic are significantly different. Alternative 4 impacts affected communities significantly from the reduction of Chinook salmon harvest. The amount of fishery harvest reduction to reach a similar benefit as the hatchery prey increase program was substantial. Entire fishery seasons had to be closed, with an additional 15% reduction in all Chinook fisheries in the summer period. The affected communities in SEAK and off the coasts of Washington and Oregon have suffered from the decline in Chinook salmon abundances, and subsequent reductions in fisheries, for more than three decades. The PST agreement in 2019 further reduced these fisheries with additional socioeconomic impacts. Alternative 4 applies additional socioeconomic impacts to an already depressed fishery situation across the entire analysis area. The intent of the prey increase program was to mitigate for these fishery losses on affected communities and Alternative 2 provides substantial fishery mitigation while meeting the needs of SRKWs. Going into the foreseeable future, Chinook salmon will continue to face significant pressures, and the fisheries will have to be adjusted according to their abundances, which could mean that additional reductions will have even greater socioeconomic effects.

The socioeconomic impacts vary among the alternatives. Alternative 2 provides for attaining the biological goals of the prey increase program for SRKWs, while minimizing concurrent impacts to affected communities. Alternative 4 reduces fishery harvest in already impoverished and affected communities from declines in Chinook salmon and would result in significant cumulative effects from decades of declining salmon runs, reduced commercial, tribal and recreational fisheries, and adding additional fishery harvest burdens into the future.

5.4.5. Environmental Justice

The effects of the alternatives on environmental justice are significantly different. Alternative 4 impacts affected communities significantly from the reduction of Chinook salmon harvest. Alternative 2 provides funding for tribal hatcheries through a portion of the analysis area and, helps maintain important ceremonial, subsistence, and other uses for the tribes and other rural communities. Alternative 3 has these

effects as well, but to a lesser extent. Chinook salmon, and the fisheries supported by these runs, have declined significantly over the last three decades in particular. Tribal fisheries are guaranteed by federal treaties with tribes and are a necessity of life both spiritually and physically. Without improvements to habitat, these concerns will continue into the foreseeable future as Chinook salmon runs continue to be in trouble. Long-term support for habitat improvements necessary to facilitate Chinook salmon recovery is still the most important aspect to guarantee tribal treaty rights and access to fishing for subsistence, commercial, cultural, recreational, traditional, and other significant aspects for tribal citizens and tribal communities, and helps support other rural communities that depend upon natural resources for their way of life, health, and prosperity.

The environmental justice impacts vary among the alternatives. Alternative 2 provides for attaining the biological goals of the prey increase program for SRKWs, while minimizing concurrent impacts to environmental justice communities, consistent with the intent of the prey increase program to mitigate for fishery losses on affected communities including environmental justice communities. Under Alternative 4, rural West Coast and SEAK fishing communities, including Native American and Alaska Native communities and tribal citizens, would experience negative impact from the reduction of the salmon fisheries. Many West Coast and SEAK coastal communities do not have the alternative employment opportunities that major population centers have. The Central Council of Tlingit & Haida Indian Tribes of Alaska have reported that the closures or reductions of the Chinook salmon troll fishery would have a devastating cultural and economic impact on their tribal citizens and their communities that rely on the commercial salmon fishery for their livelihood and their cultural well-being. Under Alternative 4, it is assumed that the economic output, labor income, and jobs in these fishery-dependent communities would be reduced by an unknown but significant amount, with adverse impacts on these small rural communities. Aside from economic impacts, cultural and health well-being would decrease and access to a critical protein source—salmon—would be undermined, which could exacerbate food insecurity across rural and remote areas. This could, in turn, fray the cultural, health, well-being, and connectedness of Native American and Alaska Native peoples who have been stewards of their homelands for at least 10,000 years.

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