UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Effects of the Pacific Coast Salmon Fishery Management Plan on the California Coastal Chinook Salmon Evolutionarily Significant Unit Listed Under the Endangered Species Act.

NMFS Consultation Number: *WCRO-2023-00367*

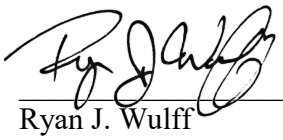
Action Agency: National Marine Fisheries Service (NMFS)

Affected Species and NMFS Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
California Coastal Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	No	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon Fishery Management Plan	No	No
Pacific Coast Groundfish Fishery Management Plan	No	No
Coastal Pelagic Species Fishery Management Plan	No	No
Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species	No	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: 

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Date: February 29, 2024

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Acronyms and Abbreviations

BO Biological Opinion
CC California Coastal
CDFW California Department of Fish and Wildlife
CFR Code of Federal Regulations
CPS Coastal Pelagic Species
DPS Distinct Population Segment
DQA Data Quality Act
EEZ Exclusive Economic Zone
EFH Essential Fish Habitat
ESA Endangered Species Act
ESU Evolutionarily Significant Unit
FMP Fishery Management Plan
FR Federal Register
HMS Highly Migratory Species
HR Harvest Rate
IP Intrinsic Potential
ITS Incidental Take Statement
KMZ Klamath Management Zone
KOHM Klamath Ocean Harvest Model
KRFC Klamath River Fall Chinook Salmon
MSA Magnuson-Stevens Fishery Conservation and Management Act
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
PBF Physical or Biological Features
PCE Primary Constituent Element
PFMC Pacific Fishery Management Council
PST Pacific Salmon Treaty
RPA Reasonable and Prudent Alternative
RPM Reasonable and Prudent Measure
SWFSC Southwest Fisheries Science Center
USFWS U.S. Fish and Wildlife Service
VSP Viable Salmonid Population

1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document and is incorporated by reference into sections 2 and 3, below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with Section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with Section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the National Oceanic and Atmospheric Administration (NOAA) Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Sustainable Fisheries Division Portland, OR office.

1.2 Consultation History

Since 1977, salmon fisheries in the U.S. Exclusive Economic Zone (EEZ) (3 to 200 nautical miles offshore) off Washington, Oregon, and California have been managed by NMFS and the Pacific Fishery Management Council (PFMC) under the Pacific Coast Salmon Fishery Management Plan (salmon FMP) (PFMC 2022c). The salmon FMP governs the PFMC's development of annual ocean fishing regulations to manage salmon fishing within the EEZ. The annual regulations must be consistent with the guidance and requirements of the FMP, applicable regulations for the fishery, and other applicable requirements as defined under the Magnuson-Stevens Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.). If NMFS determines the annual regulations meet these requirements, it implements them.

Salmon species listed under the Endangered Species Act (ESA) that are affected by the ocean salmon fisheries are included as stocks in the salmon FMP. As required under the ESA, NMFS consults on the effects of these fisheries on ESA-listed salmon species. NMFS has completed consultations analyzing the effects of the fisheries on all the ESA-listed salmon affected by the fisheries, and where appropriate, measures needed to avoid jeopardy to ESA-listed species have been incorporated into the management framework for the fishery. The FMP and its implementing regulations incorporate those measures and the take limits from the consultations as conservation objectives or control rules for each species. This section describes the consultation history of the fisheries managed under the salmon FMP and provides details specific to previous consultations on the California Coastal (CC) Chinook Salmon Evolutionarily Significant Unit (ESU).

Since 1991, 28 salmon ESUs and steelhead Distinct Population Segments (DPSs) on the West Coast of the U.S. have been listed under the ESA (Table 1) as well as several non-salmonid species. The incidental take of these species associated with the proposed action is addressed in existing opinions (Table 2).

Table 1. Status, critical habitat designations, and Federal Register (FR) notices for species listed under the Endangered Species Act (Listing status: 'T' means listed as threatened; 'E' means listed as endangered).

Species	Listing Status: FR Notice		Critical Habitat Designated	
Chinook Salmon (*Oncorhynchus tshawytscha*)				
Sacramento River Winter-run	E: 70 FR 37160	06/28/05	58 FR 33212	06/16/93
Snake River Fall-run	T: 70 FR 37160	06/28/05	58 FR 68543	12/28/93
Snake River Spring/summer-run	T: 70 FR 37160	06/28/05	64 FR 57399	10/25/99
Puget Sound	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Lower Columbia River	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Upper Willamette River	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Upper Columbia River Spring-run	E: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Central Valley Spring-run	T: 70 FR 37160	06/28/05	70 FR 52488	09/02/05
California Coastal	T: 70 FR 37160	06/28/05	70 FR 52488	09/02/05
Chum salmon (*O. keta*)				
Hood Canal Summer-run	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Columbia River	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Coho Salmon (*O. kisutch*)				
Central California Coast	E: 70 FR 37160	06/28/05	64 FR 24049	05/05/99
Southern Oregon/Northern California Coast	T: 70 FR 37160	06/28/05	64 FR 24049	05/05/99
Lower Columbia River	T: 70 FR 37160	06/28/05	81 FR 9251	02/24/16
Oregon Coast	T: 76 FR 35755	06/20/11	73 FR 7816	02/11/08
Sockeye Salmon (*O. nerka*)				
Snake River	E: 70 FR 37160	06/28/05	58 FR 68543	12/28/93
Ozette Lake	T: 70 FR 37160	06/28/05	70 FR 52630	09/02/05
Steelhead (*O. mykiss*)				
Southern California	E: 71 FR 834	01/05/06	70 FR 52488	09/02/05
South-Central California Coast	T: 71 FR 834	01/05/06	70 FR 52488	09/02/05
Central California Coast	T: 71 FR 834	01/05/06	70 FR 52488	09/02/05
Northern California	T: 71 FR 834	01/05/06	70 FR 52488	09/02/05
California Central Valley	T: 71 FR 834	01/05/06	70 FR 52488	09/02/05
Upper Columbia River	T: 71 FR 834	01/05/06	70 FR 52630	09/02/05
Snake River Basin	T: 71 FR 834	01/05/06	70 FR 52630	09/02/05
Lower Columbia River	T: 71 FR 834	01/05/06	70 FR 52630	09/02/05
Upper Willamette River	T: 71 FR 834	01/05/06	70 FR 52630	09/02/05
Middle Columbia River	T: 71 FR 834	01/05/06	70 FR 52630	09/02/05
Puget Sound Steelhead	T: 72 FR 26722	05/11/07	81 FR 9251	02/24/16
Green Sturgeon (*Acipenser medirostris*)				
Southern DPS	T: 71 FR 17757	04/07/06	74 FR 52300	10/09/09
Killer Whales (*Orcinus orca*)				
Southern Resident DPS	E: 70 FR 69903	11/18/05	71 FR 69054	11/29/06
Eulachon (*Thaleichthys pacificus*)				
Southern DPS	T: 75 FR 13012	03/18/10	76 FR 65324	10/20/11
Puget Sound/Georgia Basin Rockfish (*Sebastes*)				
Bocaccio	E: 75 FR 22276	04/28/10	80 FR 7977	2/13/15
Yelloweye	T: 75 FR 22276	04/28/10	80 FR 7977	2/13/15

Table 2. Endangered Species Act determinations regarding Evolutionary Significant Units and Distinct Population Segments (DPSs) affected by ocean salmon fisheries and the date of the 4(d) Limit determination or biological opinion (BO). Only decisions currently in effect are included.

Date (Decision type)	Citation	Species Considered
Salmonid Species		
March 8, 1996 (BO)	(NMFS 1996)	Snake River Spring/summer Chinook Salmon Snake River Fall-run Chinook Salmon Snake River Sockeye Salmon
April 28, 1999 (BO)	(NMFS 1999)	Central California Coast Coho Salmon Oregon Coast Coho Salmon Southern Oregon/Northern California Coast Coho Salmon
April 28, 2000 (BO)	(NMFS 2000)	Central Valley Spring-run Chinook Salmon
February 28, 2023 (BO)	(NMFS 2023a)	California Coastal Chinook Salmon
April 30, 2001 (BO)	(NMFS 2001a)	Upper Willamette River Chinook Salmon Columbia River Chum Salmon Ozette Lake Sockeye Salmon Upper Columbia River Spring-run Chinook Salmon 10 DPSs of Steelhead
September 14, 2001 (BO, 4(d) Limit)	(NMFS 2001b)	Hood Canal Summer-run Chum Salmon
April 26, 2012 (BO)	(NMFS 2012)	Lower Columbia River Chinook Salmon
April 9, 2015 (BO)	(NMFS 2015)	Lower Columbia River Coho Salmon
March 30, 2018 (BO)	(NMFS 2018)	Sacramento River Winter-run Chinook Salmon
April 28, 2022 (BO)	(NMFS 2022a)	Southern Oregon/Northern California Coast Coho Salmon
May 12, 2023 (BO)	(NMFS 2023b)	Puget Sound Chinook Salmon Puget Sound Steelhead
Non-Salmonid Species		
April 30, 2007 (BO)	(NMFS 2007)	Southern DPS Green Sturgeon
April 30, 2010 (BO)	(NMFS 2010a)	Puget Sound/Georgia Basin DPS of Canary Rockfish, Yelloweye Rockfish, and Bocaccio
April 30, 2011 (BO)	(NMFS 2011)	Southern DPS Eulachon
April 21, 2021 (BO)	(NMFS 2021)	Southern Resident DPS Killer Whale

NMFS has issued new biological opinions as new species were listed, or reinitiated consultation on existing listed species when appropriate. In most consultations, NMFS determined that the fisheries would have no effect, were not likely to adversely effect, or were not likely to jeopardize the continued existence of the species, and determined that the fisheries would not destroy or adversely modify designated critical habitat. In cases where NMFS determined that fisheries were likely to jeopardize the continued existence of the species, NMFS developed a Reasonable and Prudent Alternative (RPA) that would avoid jeopardizing the continued existence of the species.

1.2.1 2000 Biological Opinion

In 2000, NMFS consulted on the effects on CC Chinook salmon from fisheries managed under the salmon FMP and issued a biological opinion (NMFS 2000). Data were insufficient at that time to directly evaluate the fisheries' impact on the CC Chinook Salmon ESU, so NMFS used age-4 Klamath River Fall Chinook salmon (KRFC) as a surrogate for the CC Chinook Salmon ESU. The 2000 opinion concluded that harvest on KRFC allowed under the salmon FMP (at the time) could increase fishing mortality on CC Chinook salmon and appreciably reduce the likelihood of the survival and recovery of the ESU. As a result, NMFS issued an RPA (described below) that would not jeopardize the species. The RPA placed a limit on the projected harvest rate (HR) for age-4 KRFC in the ocean salmon fisheries authorized by NMFS under the salmon FMP. NMFS (2000) used the term "projected harvest rate" to refer to the HR predicted to occur under a set of management measures proposed during the pre-season planning process. After the fishing season is completed, harvest and escapement data are analyzed and the HR is estimated post-season.

The RPA consisted of four parts, which required:

1. Regulations implemented under the salmon FMP must achieve a projected age-4 ocean HR[1] of KRFC of 0.16[2] or less,
2. NMFS must continue to evaluate the use of the KRFC age-4[3] ocean HR as an appropriate indicator of the level of incidental take of CC Chinook salmon,
3. NMFS, in cooperation with the State of California and the U.S. Fish and Wildlife Service (USFWS), must, within 2 years of the issuance of the 2000 opinion, identify monitoring and evaluation programs to estimate post-season HRs on one or more appropriate Central Valley Chinook salmon stocks, and
4. NMFS shall cooperate with the affected states and the PFMC to ensure that ocean salmon fisheries are monitored and sampled for stock composition, including the collection of coded wire tags in all fisheries and other biological information to allow for a post-season analysis of fishery impacts on listed species.

The PFMC incorporated the limit for age-4 ocean HR of KRFC of 0.16 into the salmon FMP as a conservation objective for CC Chinook salmon. Reductions in ocean salmon fisheries occurred prior to the development of the conservation objective for CC Chinook salmon. Beginning in 1991, harvest allocation and salmon FMP management objectives required substantially lower ocean harvest of KRFC. From 1991 to 1999, ocean HRs (post-season estimates) on age-4 KRFC declined by 75 percent when compared to the previous 10 years (NMFS 2000; PFMC 2022c). In 1993, allocation objectives established equal sharing of harvest between tribal and non-tribal fisheries, which served to further constrain the ocean harvest of KRFC. In 1996, constraints on ocean fisheries were introduced to protect Sacramento River winter-run Chinook salmon. The

[1] HR is the estimated amount of harvest in a single year divided by the estimated abundance in that same year.
[2] The 2000 opinion specified a projected (modeled pre-season) limit of 0.17, which was the maximum post-season rate estimated over a four-year (1996 – 1999) period during which the spawning escapement suggested abundance of CC Chinook salmon. In 2002, the PFMC adopted new procedures for calculating the age-4 HR on KRFC which reduced the maximum estimated HR to 0.16 during 1996-1999 (McInnis 2005).
[3] Age-4 KRFC are considered fully recruited to the fishery (Prager and Mohr 2001).

reductions in ocean salmon fisheries in the 1990s reduced harvest impacts on Chinook salmon stocks originating from California. During this same period, the abundance of CC Chinook salmon appeared to increase. This suggested that constraints to ocean fisheries were sufficient to allow for persistence of CC Chinook salmon (NMFS 2000; McInnis 2005). NMFS (2000) used the post-season HR estimate for the period from 1996 to 1999 to establish a baseline (see footnote 2) because this represented a time period when ocean salmon fisheries had been constrained and abundance of some populations of CC Chinook salmon appeared to increase. NMFS (2000) concluded that harvest of CC Chinook salmon under management measures during 1996 – 1999, designed to achieve reduced harvest of KRFC and Sacramento River winter-run Chinook salmon, were sufficiently low to allow persistence of CC Chinook salmon populations at low abundance levels.

1.2.2 2005 Reinitiation

In 2003 and 2004, the HR estimated post-season for KRFC significantly exceeded the projected (pre-season) HR (Table 3, Figure 1, and Figure 2) (McInnis 2005). NMFS reviewed the Klamath Ocean Harvest Model[4] (KOHM) in 2004 but did not identify any errors or biases in the design, implementation, or execution of the KOHM that would result in an underprediction of the ocean HR (McInnis 2005). A subsequent PFMC analysis determined that the poor performance in projecting the age-4 ocean HR for KRFC in 2004 was due largely to underpredicted contact-rate-per-unit-effort of KRFC in various fisheries along the Pacific coast (PFMC 2005).

The high post-season HRs observed in 2004 indicated that the fishery had exceeded the amount of incidental take specified in the 2000 opinion, which required reinitiation of consultation (50 CFR 402.16(a)). In 2005, NMFS reinitiated consultation on the effects of the salmon FMP on the CC Chinook Salmon ESU (McInnis 2005). In this consultation, NMFS reviewed the 2000 opinion and RPA, recent performance of the KOHM, and the status of the CC Chinook Salmon ESU. NMFS determined that the RPA was still necessary and the limit on the projected age-4 ocean HR on KRFC as a surrogate for impacts on CC Chinook salmon remained valid, pending an assessment of the accuracy of the KOHM (McInnis 2005). NMFS reiterated that the pre-season, projected HR is intended to be an unbiased estimate of the HR calculated post-season; that is, post-season HRs are expected to deviate (both positively and negatively) from projected HRs in a reasonable range (McInnis 2005). The consultation committed NMFS to act with respect to parts 1 and 2 of the RPA of the opinion (see section 1.2.1) such that NMFS and the PFMC continue the analysis of pre- and post-season HRs and, in particular, determine the probability that the post-season age-4 HR is expected to exceed the take limit given a pre-season HR target. Depending on the outcome of that analysis, the consultation specified that NMFS may specify either pre- or post-season limits on the age-4 HR to better protect CC Chinook salmon in the future. The incidental take statement remained unchanged from the 2000 opinion pending results of the analysis, which might provide the basis for revising the take limit in the future.

[4] Klamath Ocean Harvest Model (KOHM): Model used to predict the age-specific HRs on KRFC resulting from proposed management measures. The KOHM uses observed annual estimates of effort, associated contact rates, and associated season length in the recreational and commercial salmon fisheries to predict fishing effort as a function of fishing opportunity (effort/day open), and contact rates as a function of fishing effort (Prager and Mohr 2001).

Table 3. Pre-season and post-season estimated harvest rates for Age-4 Klamath River fall Chinook salmon from 1986 to 2022 (PFMC 2023d).

Year	KRFC Age-4 Harvest Rate		
	Pre-season	Post-season	Residual
1986-90	0.30	0.44	0.14
1991-95	0.09	0.13	0.04
1996-00	0.11	0.10	-0.01
2001	0.14	0.09	-0.05
2002	0.13	0.15	0.02
2003	0.16	0.21	0.05
2004	0.15	0.35	0.20
2005	0.08	0.20	0.12
2006	0.11	0.10	-0.01
2007	0.16	0.21	0.05
2008	0.02	0.10	0.08
2009	0.00	0.00	0.00
2010	0.12	0.04	-0.08
2011	0.16	0.08	-0.08
2012	0.16	0.08	-0.08
2013	0.16	0.20	0.04
2014	0.16	0.17	0.01
2015	0.16	0.22	0.06
2016	0.08	0.09	0.01
2017	0.03	0.04	0.01
2018	0.12	0.24	0.12
2019	0.16	0.36	0.20
2020	0.09	0.23	0.14
2021	0.11	0.27	0.16
2022	0.10	0.38	0.28

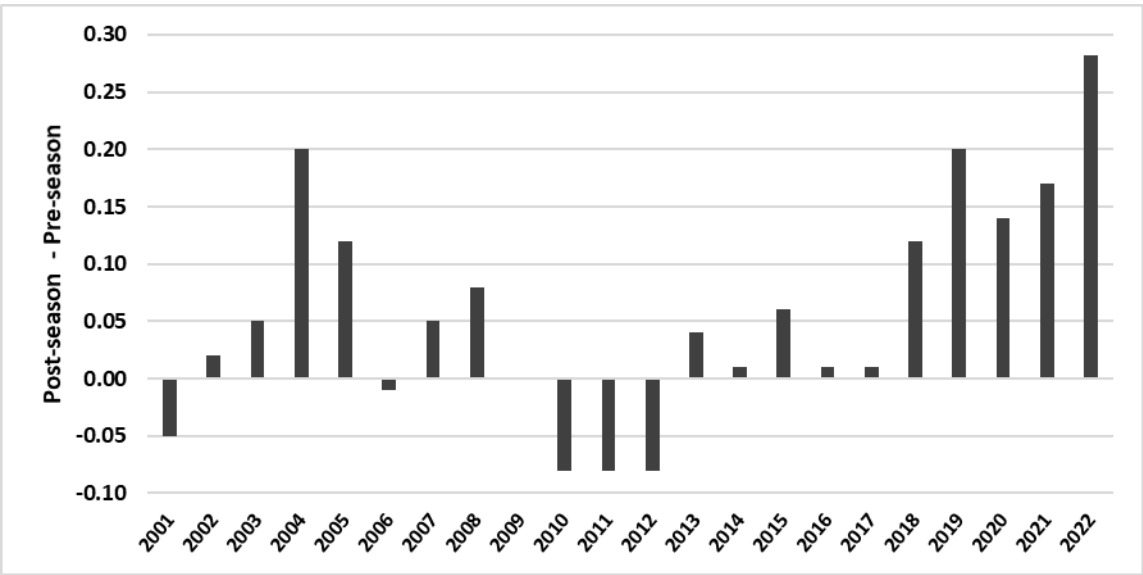

Figure 1. Difference between pre-season projections and post-season estimates of harvest rates of age-4 Klamath River fall Chinook salmon in ocean fisheries from 2001 to 2022 (PFMC 2023d).

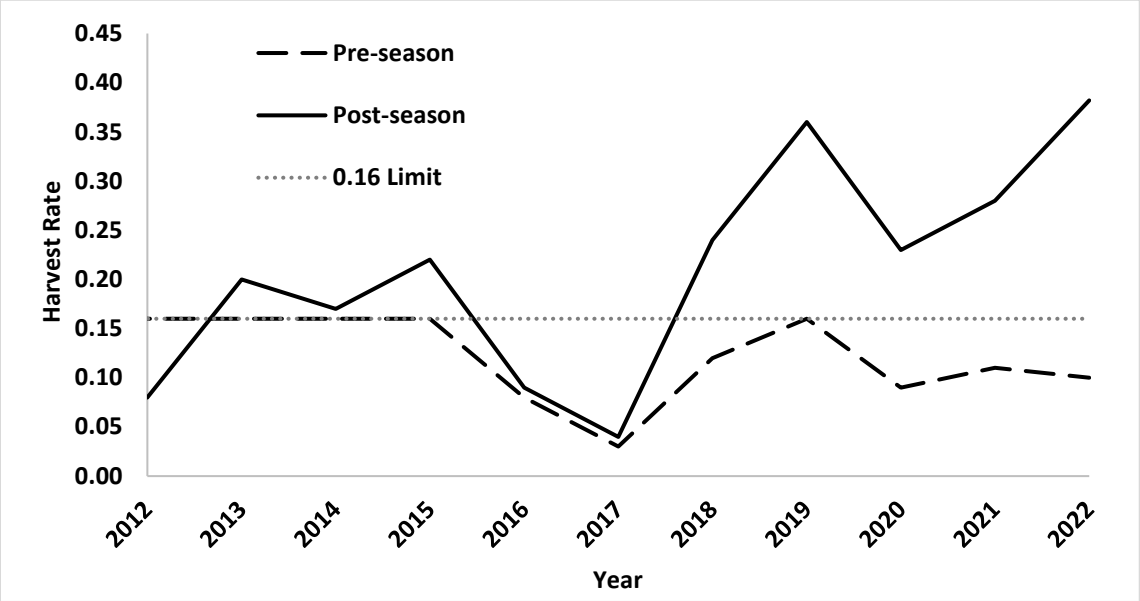

Figure 2. Pre-season and post-season estimated harvest rates of age-4 Klamath River fall Chinook salmon in ocean fisheries from 2012 to 2022 (PFMC 2023d).

1.2.3 2022 Reinitiation

In 2006, the PFMC adjusted the KOHM to use contact-rate-per-unit-effort from 2003 forward (PFMC 2006; O'Farrell, Satterthwaite and Spence 2012). From 2006 to 2017, the pre-season HRs appeared to be an unbiased predictor (i.e., average projected rates equal to average post-season estimates) of the post-season HRs (Table 3 and Figure 1). However, post-season estimates were consistently underpredicted during 2013 to 2020 and substantially so during 2018 to 2020 (Table 3, Figure 1 , and Figure 2). The PFMC updated the KOHM in 2021 to use contact-rate-per-unit-effort from 2013 forward (PFMC 2021b). Based on the success of the adjustment made in 2005, NMFS expected that these adjustments to the KOHM would bring estimates of pre- and post-season HRs into realignment. However, despite the adjustments, the 2021 pre-season estimate under-predicted the post-season estimate of the KRFC age-4 ocean HR by a substantial margin (i.e. 0.27 post-season compared to 0.11 pre-season) and exceeded the projected 0.16 threshold (PFMC 2022e). On March 29, 2022, NMFS reinitiated the consultation on the effects of the fisheries managed under the salmon FMP on the CC Chinook Salmon ESU (Bishop 2022). NMFS completed an opinion on February 28, 2023 and determined that ocean salmon fishery managed consistent with the conservation objective and implemented as a post-season limit of 0.16 on the ocean HR for age-4 KRFC, was not likely to jeopardize the continued existence of CC Chinook salmon (NMFS 2023a).

1.2.4 2023 Reinitiation

For planning ocean salmon fisheries in 2022, NMFS recommended the PFMC manage 2022 ocean salmon fisheries conservatively (i.e., a buffer of 40 percent on projected age-4 KRFC ocean HR) so as not to exceed the conservation objective for CC Chinook salmon (NMFS 2022c; Thom 2022). The PFMC adopted management measures for 2022 ocean salmon fisheries

modeled to result in a KRFC age-4 ocean HR of 0.10 (PFMC 2022f). Additionally, the PFMC updated the KOHM again to use contact-rate-per-unit-effort from 2015 forward (PFMC 2022e). Despite the concerted effort to apply a buffer and update the pre-season model , the 2022 ocean fisheries attained an HR for age-4 KRFC of 0.38 (estimated post-season) (PFMC 2023d). This exceeded the limit of 0.16 by a significant amount and exceeded the extent of take considered by NMFS (2023a). As a result, on March 20, 2023, NMFS requested reinitiation of consultation on the effects on the CC Chinook Salmon ESU of the authorization of the ocean salmon fishery in the EEZ through promulgation of regulations implementing the salmon FMP, including approval and implementation of the conservation objective for CC Chinook salmon (Bishop 2023). NMFS reinitiated the ESA Section 7(a)(2) consultation on March 21, 2023.

For planning ocean salmon fisheries in 2023, NMFS again recommended that the PFMC manage using a conservative approach so as not to exceed the conservation objective for CC Chinook salmon (Rumsey 2023). The NMFS recommendations included a buffered pre-season age-4 KRFC HR of 0.10 and in-season management measures to ensure impacts remain within pre-season projections. NMFS recommended the PFMC take both actions to ensure the fisheries would not exceed the conservation objective. In response to record low forecasts for KRFC and Sacramento River Fall Chinook (SRFC), the PFMC recommended the closure of commercial and recreational salmon fisheries off the coast of California for 2023 (PFMC 2023e). NMFS approved the management measures recommended by the PFMC for ocean salmon fisheries including the closure of salmon fisheries of the coast of California. The projected KRFC age-4 ocean HR for the adopted management measures was 0.003 (PFMC 2023e).[5]

Leading up to the 2023 season, the California Department of Fish and Wildlife (CDFW) had expressed concern over the recent trends in escapement and harvest of California stocks of Chinook salmon and suggested novel management measures for the ocean salmon fisheries off the coast of California to ensure that the fisheries remained within pre-season projections. In November 2022, CDFW requested that the PFMC recommend direct measures to curtail the commercial fishery in 2023 and beyond, to ensure that catch of Chinook salmon off California does not continue to substantially exceed projections (CDFW 2022). During the PFMC meeting in March 2023, CDFW recommended that the 2023 range of alternatives developed for analysis include in-season management of California ocean fisheries, consistent with the salmon FMP, in order to keep catch within pre-season projections and not exceed the conservation objective. In April of 2023, CDFW recommended additional management measures (e.g., trip and landing limits) for achieving conservation objectives for California stocks of Chinook salmon (CDFW 2023). Because fisheries were closed off the coast of California, the measures that had been recommended by CDFW were not adopted for 2023 fisheries. However, consideration of landing limits for California commercial troll fisheries was included in the regulations for fisheries planned for April and May, 2024. From April to November 2023, NMFS and CDFW developed a set of measures ("the framework") intended to achieve conservation objectives for California stocks of Chinook salmon. In November 2023, the PFMC adopted the framework (described in Section 1.3) and recommended it to NMFS for implementation in regulation. The framework is part of the proposed action considered in this opinion.

[5] Although ocean salmon fisheries were closed off the California coast, encounters of low numbers of KRFC were anticipated in fisheries off of Oregon and Washington.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976; August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later, on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in this opinion and ITS would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3 Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).

NMFS has dual responsibilities as both the action agency that authorizes ocean fisheries under the MSA and as the consulting agency under the authority of the ESA. The proposed action is the authorization of the ocean salmon fishery in the EEZ through approval of the salmon FMP and promulgation of regulations implementing the salmon FMP, which includes the conservation objective for CC Chinook salmon (Table 3-1 in the salmon FMP). The proposed action includes regulations implementing the management framework adopted by the PFMC and described in detail below, to ensure fisheries do not continue to exceed the conservation objective.

As of 2023, the best available data remain insufficient to develop an ESU-specific conservation objective for CC Chinook salmon (O'Farrell et al. 2022). Consequently, KRFC remains the best available surrogate for CC Chinook salmon (PFMC 2022c). Under the proposed action, the ocean salmon fisheries will (1) continue to be managed so that the post-season ocean HR for age-4 KRFC does not exceed 0.16 and (2) be managed under the framework (see below) recommended by the PFMC to NMFS to ensure that ocean salmon fisheries do not exceed the 0.16 limit. All other provisions required by the salmon FMP and existing consultations (Table 2) would continue.

The ocean salmon fisheries in the EEZ consist of recreational and commercial troll fisheries that use hook-and-line gear to catch salmon. Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and pink salmon (*O. gorbuscha*) are the main species caught in these fisheries, and the salmon FMP designates fishery management objectives for these species. Salmon caught in the EEZ are managed under the salmon FMP and the provisions of the Pacific Salmon Treaty (PST) between the U.S. and Canada. An exception to this is sockeye salmon (*O. nerka*) and pink salmon fisheries in the area between 49°N latitude and 48°N latitude. The Fraser River Panel of the Pacific Salmon Commission manages these fisheries. Catch of sockeye salmon, chum salmon (*O. keta*) and steelhead (*O. mykiss*) in PFMC-managed ocean fisheries is inconsequential (low hundreds of fish or less each year) to very rare (PFMC 2021b). The

fisheries are mixed-stock fisheries, where fish encountered typically represent more than one stock or ESU of Chinook or coho salmon.

The salmon FMP and codified regulations govern the development of annual management measures for the ocean salmon fisheries. The management measures apply to the period from May 16 of the current year through May 15 of the following year. Under the salmon FMP, each salmon stock (or stock complex [6]) is managed subject to a conservation objective. Some stocks are managed using harvest control rules which specify the allowable harvest of stocks based on their abundance. Other stocks are managed under the PST and have objectives defined in the PST. The impacts of the fisheries on ESA-listed species are managed consistent with conservation objectives that have been analyzed in, or identified as RPAs or take limits in ESA-consultations[7]. The conservation objective for an ESA-listed species equates to levels of incidental take that NMFS has determined (through ESA Section 7 consultation) are not likely to jeopardize the continued existence of the species. In some cases, the limit on incidental take is combined with additional management measures (e.g. Sacramento winter-run Chinook salmon) to ensure that the conservation objective is achieved. The amount of fishing opportunity and the catch allowed in the fisheries managed under the salmon FMP varies from year to year depending on stock-specific run sizes, fishing-related mortality anticipated in other fisheries, and fishery allocation decisions, but the fisheries are managed such that their impacts are consistent with all of the conservation objectives in the salmon FMP (PFMC 2022c).

Upon completion of the pre-season planning process in April of each year, the PFMC transmits recommendations for annual management measures to the Secretary of Commerce. If the measures are consistent with the MSA and other applicable law (e.g., ESA and obligations under the PST), NMFS promulgates the measures in a final rule (see 88 FR 30235; May 11, 2023) under the authority of the MSA. NMFS may take in-season action to modify fishery management measures such as retention regulations, fishing dates, gear restrictions and bag limits after consultation with state fishery managers and the PFMC chair (50 CFR 660.409(b)). In-season actions must be consistent with the salmon FMP's conservation objectives, treaty Indian fishing rights, and other applicable laws and salmon FMP provisions.

Successful management of the PFMC salmon fisheries requires monitoring to collect information on the fish stocks, the amount of effort for each fishery, the harvest that occurs in each fishery, the location and timing of harvest, and other biological and fishery metrics. In general, the information can be divided into that needed for in-season management and that needed for annual and long-term management. The data needs and reporting requirements for the fishery are described in the salmon FMP (PFMC 2022c). Catch, effort, escapement, and compliance with conservation objectives are reported annually in the PFMC report: Review of Ocean Salmon Fisheries (PFMC 2023f).

[6] The MSA National Standards provide a structure for classifying stocks in and around the fishery, and organizing stock complexes (50 CFR 600.310). Individual stocks can also be formed into stock complexes for management and assessment purposes. Stock complexes are groups of stocks that are sufficiently similar in geographic distribution, life history, and vulnerabilities to the fishery such that the impacts of management actions on the stocks are similar (PFMC 2022c). Stock complexes may be formed to facilitate management requirements. Each stock complex has one or more indicator stocks to establish annual harvest constraints based on status of those indicator stocks.

[7] Conservation objective and consultation standard are often used interchangeably for ESA-listed salmon.

Framework to Achieve Conservation Objectives for California Stocks of Chinook Salmon

Under the proposed action, ocean salmon fisheries will be managed using the following framework of management measures designed to ensure that the ocean salmon fisheries between the Oregon/California border and Pigeon Point) do not exceed the CC Chinook salmon conservation objective (i.e., age-4 ocean HR for KRFC of 0.16 or less).

The framework is focused on the ocean salmon fisheries off the coast of California (i.e., California Klamath Management Zone (KMZ), Fort Bragg, San Francisco, and Monterey management areas) for the following reasons:

1. The majority of the KRFC harvest (and assumed impacts on CC Chinook salmon) in the ocean occurs in this area (PFMC 2023d).
2. The age-4 ocean HR for KRFC in this area has consistently exceeded pre-season projections in recent years (PFMC 2023d).
3. Contact-rate-per-unit-effort in this area have exceeded projections in recent years (Appendix B in PFMC (2021b) and Appendix D in PFMC (2022e)).
4. The fisheries in this area have been managed primarily through season controls such as time and area restrictions (as opposed to use of landing limits and quota management) (PFMC 2022d).
5. Time and area restrictions in this area have not been effective in controlling harvest of KRFC (and assumed impacts on CC Chinook salmon) in recent years (PFMC 2023d).
6. Ocean fisheries in other areas routinely implement the same or similar management measures as those described in the framework.

Under the proposed action, the following framework would apply to the development of annual management measures for the California KMZ, Fort Bragg, San Francisco, and Monterey management areas for ocean salmon fisheries beginning in 2024 as described below:

1) Management measures will be designed to ensure that fisheries do not exceed the CC Chinook salmon conservation objective (i.e., KRFC age-4 ocean HR of 0.16 or less).

2) The management measures will include an allowable harvest level[8] expressed in numbers of Chinook salmon that is computed, using the KOHM and Sacramento Harvest Model, to ensure fisheries do not exceed the conservation objective. The allowable harvest level will be used to develop landing and possession limits.

3) In calculating the allowable harvest level, NMFS and the PFMC may use a HR that is lower than the conservation objective (i.e., a buffered HR) in order to address the potential for exceeding the objective in a particular year.

[8] The term allowable harvest level represents a limit on the total allowable harvest of Chinook salmon. We use the term allowable harvest level to be consistent with the terminology used in the implementing regulations but the term all stock harvest may be used to represent the same thing in other context referring to the implementation of this framework.

a) The buffered HR will be determined in two steps. First, NMFS and the PFMC will calculate the average percent error (i.e., projected HR as compared to the post-season HR) for the previous five years, and apply the average percent error to the conservation objective. Only positive percent error will be applied because the intent is to keep the post-season HR below 0.16.

b) In the second step, other relevant factors affecting the pre-season assessment of the age-4 KRFC HR will be considered. These other factors include revisions to fishery management models used to estimate the pre-season HR, environmental indicators relevant to the status of KRFC and CC Chinook salmon, and other constraints on fisheries in the areas and months with greatest impacts on KRFC Chinook salmon.

4) The management measures will include the following to ensure fisheries affecting CC Chinook salmon do not exceed the allowable harvest level for the year:
   a) Landing and possession limits for the commercial troll fisheries will be developed based on the allowable harvest level and the projected effort.
   b) Landing and possession limits will be set for periods not to exceed one week (e.g., Thursday through Wednesday) and will be determined (pre-season) for each month the fishery is open.
      i) A shorter period may be used (e.g., Thursday through Monday (five days) to compress the landings into a shorter timeframe to allow for reporting and accounting of catch.
      ii) Landing and possession limits may vary from one calendar month to the next but will be the same for periods within the same calendar month.
   c) Management measures will include provisions for quick reporting/notification (within 24 hours) of electronic fish tickets to CDFW.
   d) Catch triggers (e.g., 50 percent of the allowable harvest level) will be established to identify when in-season action would be considered to ensure that the harvest limit is not exceeded.
   e) In season actions will be used to ensure that harvest does not exceed the allowable harvest level. In-season actions may be utilized to reduce landing and possession limits, areas, and/or fishing periods and will close areas and seasons upon reaching the allowable harvest limit.

5) For the first two years in which salmon fisheries occur off the California coast, in-season actions will only be used to further restrict harvest (i.e., reduce landing limits, reduce time/area, and close the fishery when the allowable harvest level is projected to have been met).

In March of each year, the PFMC develops and considers alternatives consistent with the salmon FMP and implementing regulations. Our understanding is that CDFW plans to provide analysis

and information to the PFMC advisory bodies (to assist in their development of management alternatives at the March PFMC meeting that are consistent with the management framework.

The measures described above would be included in the alternatives. Following public review and comment on the alternatives, the PFMC will adopt a preferred alternative and recommend that to NMFS for implementation in regulation.

We considered, under the ESA, whether or not the proposed action would cause any other activities. While the salmon FMP and implementing regulations apply only in the EEZ, the states of Washington, Oregon, and California generally manage salmon fisheries in state ocean waters (i.e., 1 to 3 nautical miles off the coast) consistent with the Federal regulations. In short, management of salmon fisheries in state ocean waters is closely coordinated with and largely mirrors Federal management. This has the effect of managing ocean salmon fisheries in Federal and state waters collectively for the conservation objectives for each of the salmon stocks in the salmon FMP. For this reason, we consider salmon fishery management in state waters to be a consequence of implementing the proposed action in federal waters for purposes of this opinion.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by Section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and Section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, Section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

NMFS determined the proposed action is not likely to adversely affect critical habitat for the CC Chinook salmon ESU. Our concurrence is documented in Section 2.12.

2.1 Analytical Approach

This opinion includes a jeopardy analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion, we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species:

- Evaluate the rangewide status of the species expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species.
- Evaluate the effects of the proposed action on species using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects on the environmental baseline, and, in light of the status of the species, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species
- If necessary, suggest an RPA to the proposed action.

2.2 Rangewide Status of the California Coastal Chinook Salmon ESU

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis.

The CC Chinook Salmon ESU was listed as threatened under the ESA on September 16, 1999 (64 FR 50394). Protective regulations were issued in 2002 and 2005 (67 FR 1116; January 9, 2002 and 70 FR 37160; June 28,2005). Critical habitat for the ESU was designated in 2000 (65 FR 7764; March17, 2000) and reaffirmed in 2005 (70 FR 52488; September 2, 2005) The ESA listing status was reaffirmed in 2014 (79 FR 20802; April 14, 2014).

NMFS reviewed the status of the species in 2005, 2011, and 2016 (Good, Waples and Adams 2005; Williams et al. 2011; NMFS 2016a). Additionally viability assessments for the ESU were completed in 2005, 2008, and 2016 (Bjorkstedt et al. 2005; Spence et al. 2008; Williams et al. 2016). A recovery plan was finalized in 2016 (NMFS 2016b). In the most recent status review, NMFS (2016a) concluded that no change in the status of the species was warranted. The ESU remains listed as threatened at the time of this opinion. A five-year status review is currently underway but was not finalized before this opinion was completed. However, information from a recent viability assessment (SWFSC 2022) and a technical memorandum (O'Farrell et al. 2023) are incorporated into this opinion.

The CC Chinook Salmon ESU includes naturally spawned Chinook salmon originating from rivers and streams south of the Klamath River to (and including) the Russian River in California (Figure 3) (70 FR 37160; June 28, 2005). The ESU historically comprised 38 populations including 32 fall-run populations and 6 spring-run populations (Spence et al. 2008). All six of the spring-run populations are considered extinct (Williams et al. 2011). For recovery planning, the

ESU is divided into four diversity strata (North Coastal, North Mountain-Interior, North-Central Coastal, and Central Coastal) comprising 17 populations (Figure 4 and Table 4) (NMFS 2016b). Several hatchery programs were included as part of the ESU when the listing was affirmed in 2005 (70 FR 37160; June 28, 2005) but those programs are no longer active.

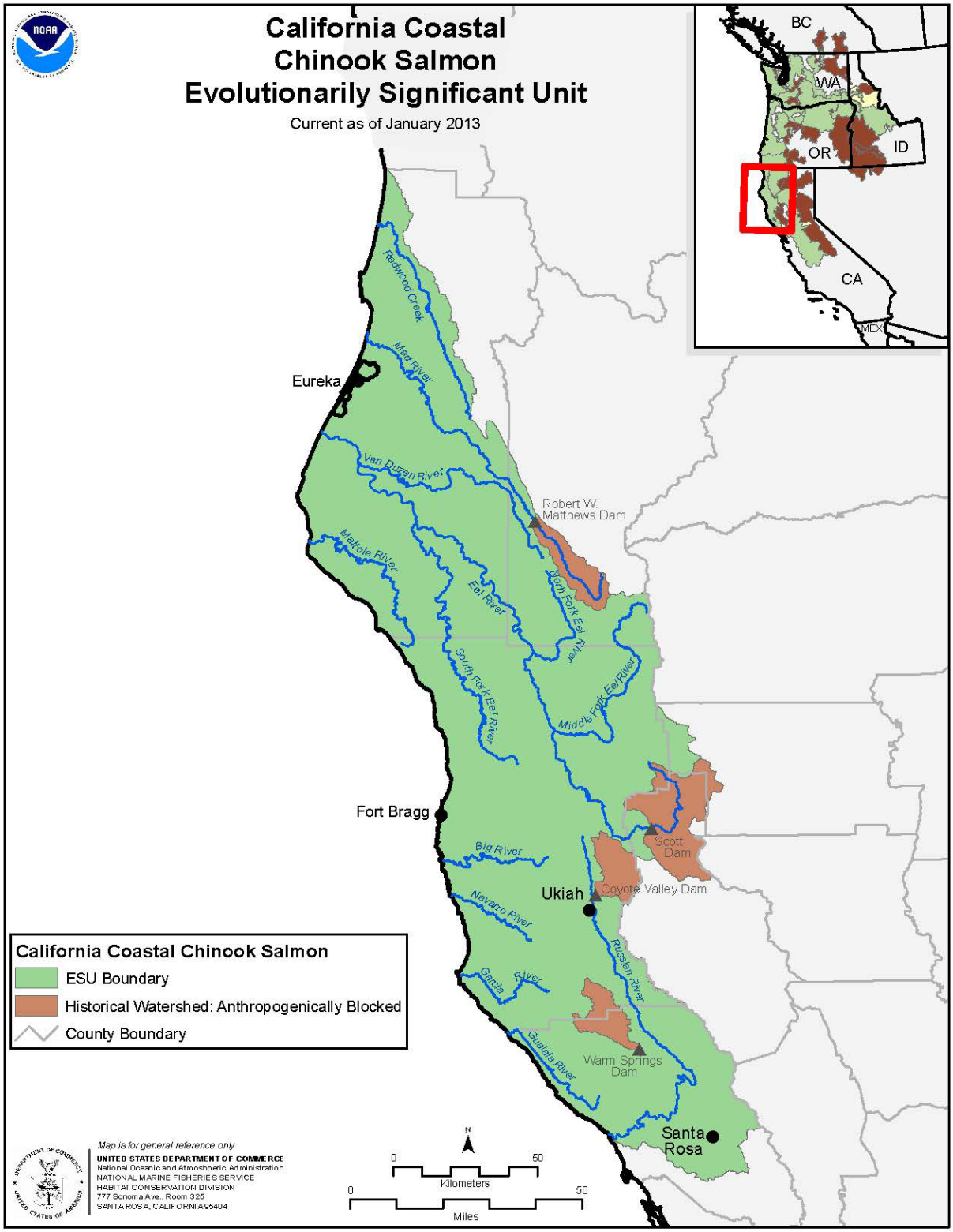

Figure 3. Map of the California Coastal Chinook Salmon Evolutionary Significant Unit.

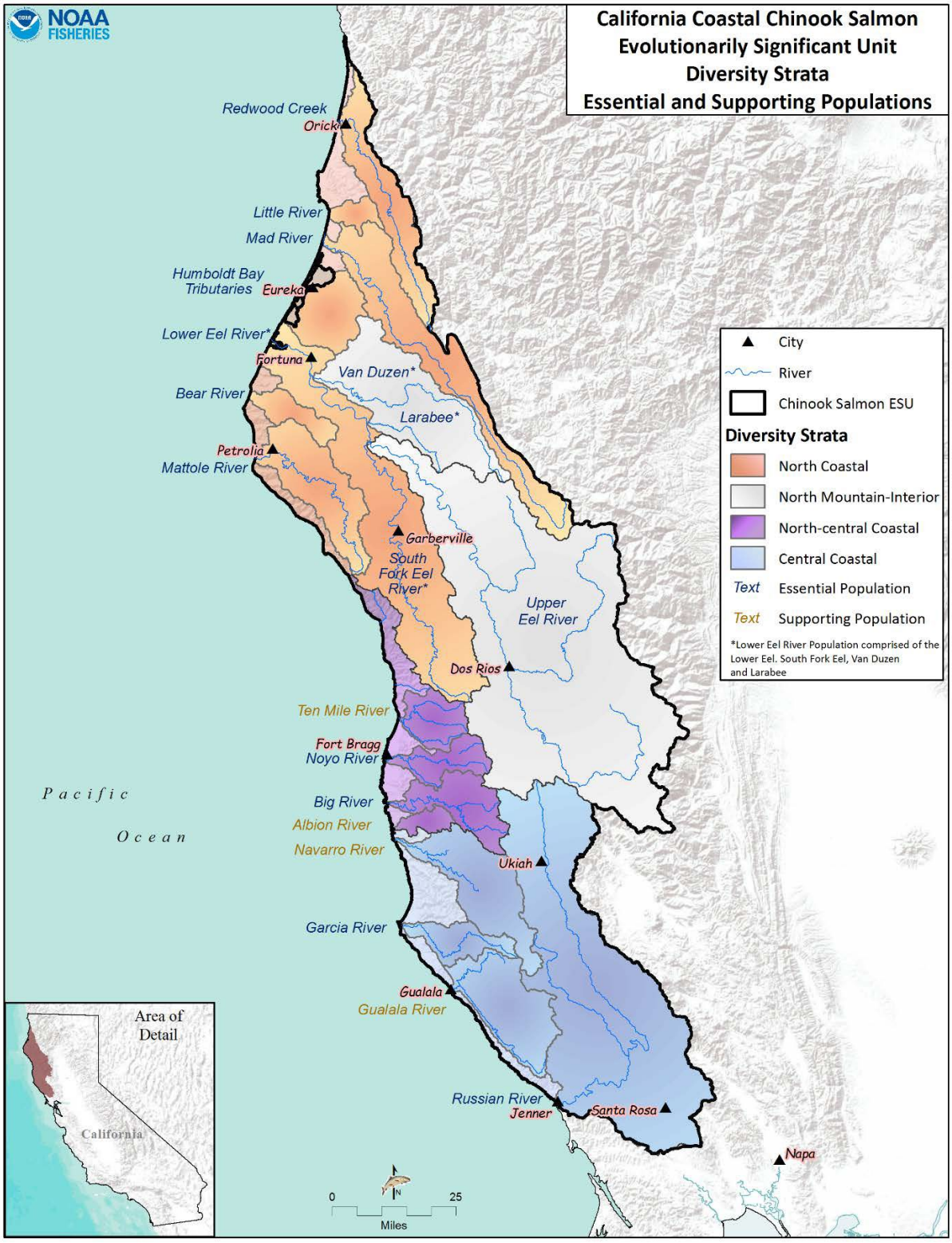

Figure 4. Map of the diversity strata and populations of the California Coastal Chinook Salmon Evolutionarily Significant Unit (NMFS 2016b).

Table 4. Diversity strata, populations, historical status, population's role in recovery, current Intrinsic Potential (IP), recovery criteria, and current extinction risk for California Coastal Chinook salmon (Spence et al. 2008; NMFS 2016b; SWFSC 2022). Recovery target corresponds to the spawner density target multiplied by the IP. Depensation threshold corresponds to 1 spawner per IP-km.

Diversity Strata	Population	Historical Status	Role in Recovery	Intrinsic Potential (IP-km)	Spawner Density Target	Recovery (Low-Risk) Target	Depensation (High-Risk) Threshold	Extinction Risk
North Coastal	Redwood Creek	Independent	Essential	116.1	29.3	3,400	116	Data Deficient
	Little River	Independent	Essential	17.4	40.0	700	17	Data Deficient
	Mad River	Independent	Essential	94.4	31.7	3,000	94	Data Deficient
	Humboldt Bay Tributaries	Independent	Essential	76.6	33.7	2,600	77	Data Deficient
	Lower Eel and South Fork Eel*	Independent	Essential	368.4	20.0	7,400	368	Data Deficient
	Bear River	Independent	Essential	39.4	37.8	1,500	39	Data Deficient
	Mattole River	Independent	Essential	177.5	22.5	4,000	178	Moderate/High
North Mountain-Interior	Van Duzen River and Larabee Creek*	Independent	Essential	144.0	20.0	2,900	144	Data Deficient
	Upper Eel River	Independent	Essential	528.5	20.0	10,600	529	Data Deficient
North-Central Coastal	Ten Mile River	Independent	Supporting	67.2	6-12	401-804	67	High
	Noyo River	Independent	Essential	62.2	35.3	2,200	62	High
	Big River	Independent	Essential	104.3	30.6	3,200	104	High
	Albion River	Dependent	Supporting	17.6	6-12	104-209	18	N / A
Central Coastal	Navarro River	Independent	Supporting	131.5	6-12	787-1,576	132	High
	Garcia River	Independent	Essential	56.2	36.0	2,000	56	High
	Gualala River	Independent	Supporting	175.6	6-12	1,052-2,105	176	High
	Russian River	Independent	Essential	465.2	20.0	9,300	465	Low

* The Lower Eel River population is divided between the North Coastal Strata (Lower Eel River mainstem and South Fork Eel River) and the North-Mountain Interior Strata (Van Duzen River and Larabee Creek).

2.2.1 Viability

Viability is the likelihood that a population will sustain itself over a 100-year time frame (McElhany et al. 2000). We assess the status of the CC Chinook Salmon ESU using criteria based on the Viable Salmonid Population (VSP) concept developed by McElhany et al. (2000). The VSP concept uses parameters of abundance, productivity, spatial structure, and diversity to assess species viability, evaluate extinction risks, and develop delisting criteria. VSP criteria for CC Chinook salmon are described in NMFS viability assessments, 5-Year Status Reviews, and the Recovery Plan for CC Chinook Salmon (Good, Waples and Adams 2005; Spence et al. 2008; Williams et al. 2011; NMFS 2016a; 2016b; Williams et al. 2016; SWFSC 2022). While the VSP criteria were designed to address all of the VSP parameters (abundance, productivity, spatial structure, and diversity), the available metrics for CC Chinook salmon are primarily based on abundance because of the paucity of information (SWFSC 2022).

Populations of CC Chinook salmon are categorized as “essential” and “supporting” depending on their role in rebuilding the ESU to recovery (NMFS 2016b). Essential populations must attain low risk of extinction to achieve ESU recovery. Supporting independent populations must attain

moderate extinction risk to achieve ESU recovery. Supporting dependent populations will contribute to redundancy and occupancy.

Myers et al. (1998) and Good, Waples and Adams (2005) concluded that CC Chinook salmon were likely to become endangered in the foreseeable future. Good, Waples and Adams (2005) cited continued evidence of low population sizes relative to historical abundance, mixed trends in the few available time series of abundance indexes available, low abundance and extirpation of populations in the southern part of the ESU, and the apparent loss of the spring-run life-history type throughout the entire ESU as significant concerns. Williams et al. (2011) concluded that there was no evidence to indicate a substantial change in conditions since the previous review of Good, Waples and Adams (2005), but noted that the lack of population-level estimates of adults continued to hinder assessments of status. They further noted that although independent populations persisted in the North Coastal and North Mountain Interior diversity strata, there was high uncertainty about the current abundance of these populations. They also cited the apparent extirpation of populations in the North-Central Coastal Stratum and the loss of all but one population (Russian River) in the Central Coastal Stratum as significant concerns because this gap reduced connectivity among strata across the ESU (Williams et al. 2011). The 2016 viability assessment (Williams et al. 2016) concluded there was a lack of compelling evidence to suggest that the viability of these populations has improved or deteriorated since the previous assessment. The assessment reiterated concerns about the high uncertainty in northern populations such as the Eel and Mad rivers, but noted that improved monitoring indicated that low numbers of Chinook salmon were returning to watersheds (North-Central Coastal and Central Coastal strata) where they were previously believed to be extirpated (SWFSC 2022).

Prior status reviews and viability assessments for CC Chinook salmon have noted the paucity of long-term population-level estimates of abundance for CC Chinook salmon populations anywhere in the ESU (Myers et al. 1998; Good, Waples and Adams 2005; Williams et al. 2011). Additionally, there are challenges with the reliability of some data sets throughout all four strata. However, data availability and reliability has improved somewhat since previous status reviews (NMFS 2016a; SWFSC 2022). Adult Chinook salmon abundance estimates include (1) sonar-based estimates on Redwood Creek and the Mad and Eel rivers, (2) weir counts at Freshwater Creek (one tributary of the Humboldt Bay population), (3) trap counts at the Van Arsdale Fish Station[9] (representing a small portion of the upper Eel River population), (4) adult abundance estimates based on spawner surveys for six populations on the Mendocino Coast, and (5) video counts of adult Chinook salmon at Mirabel Dam on the Russian River. A summary of available data from SWFSC (2022) are presented for each diversity stratum in the following subsections. The abundance estimates are for natural-origin fish as hatchery programs within the ESU were discontinued by the early 2000s.

North Coastal Stratum

The North Coastal Stratum includes coastal Chinook salmon populations from Redwood Creek to the Mattole River (Table 4 and Figure 4) except for the interior portions of the Eel River basin. All seven populations are independent and are considered essential to recovery. Estimates of population-level abundance are currently available for three populations (Redwood Creek,

[9] The Van Arsdale Fish Station is located at the terminus of anadromous access on the mainstem Eel River.

Mad River, and Mattole River) of Chinook salmon in the North Coastal Stratum and shown in Table 5. Estimates of Chinook salmon in Redwood Creek are available beginning in spawning year[10] 2010. Population estimates have averaged 2,896 (range 1,455–4,541) showing a slightly positive, but not significant trend (p = 0.31) (Table 5, Figure 5, and Figure 6). The population mean represents 85 percent of the recovery target of 3,400 spawners. Estimates of Chinook salmon abundance are available for the Mad River since 2014. Estimates have averaged 7,059 fish (range 2,169–12,667) and, though the time series is too short for formal trend analysis, numbers have increased during this brief period (Table 5, Figure 5, and Figure 6). The mean estimated abundance exceeds the recovery target of 3,000 for this population. Spawner surveys have been conducted in the Mattole River since 2013, with results reported as total redd estimates. Redd estimates have averaged 862 (range 331–2,202) with a slightly positive trend (Table 5, Figure 5, and Figure 6).

In addition to the population-level estimates, longer time series of partial abundance estimates are available for two populations. Weir counts have been conducted in Freshwater Creek (part of the Humboldt Bay population) since 2001. Counts have averaged 29 fish (range 0–154) over the period of record, and there has been a negative and significant downward trend (p = 0.0001) (Figure 7 and Figure 8). This trend was driven by high numbers of returns in the early part of the time series, which likely reflects the legacy of a small hatchery program that was discontinued in the early 2000s. Counts have been very low but relatively stable since the late 2000s. Estimates of Chinook salmon redds are available for the South Fork Eel River (part of the Lower Eel River population) since 2011. The average estimate has been 768 (range 68–1829) during this period and trends appear to be increasing, however the trend is not statistically significant (p = 0.709) (Figure 7 and Figure 8).

Table 5. Average abundance, population trend, and spawner density for independent populations of California Coastal Chinook salmon (SWFSC 2022).

Strata	Population	Number of Years	Average Abundance	Population Trend	Spawner Density
North Coastal	Redwood Creek	8	2,896	0.049	24.9
	Mad River	5	7,059	NA	74.8
	Mattole River	7	862	0.121	4.9
North-Central Coastal	Ten Mile River	11	92	0.351	NA
	Noyo River	11	19	-0.161	0.3
	Big River	10	16	-0.249	0.2
Central Coastal	Navarro River	10	2	-0.174	NA
	Garcia River	10	34	**0.442**	0.6
	Russian River	18	2,947	NA	6.8

NA = Not available or not applicable
Population trends shown only for populations where time series is ≥ 6 years
Bold number indicates significant population trend.

[10] The spawning year (as defined in SWFSC (2022)) is the calendar year at the end of the spawning season (e.g., spawning year 2010 refers to the 2009–2010 spawning season).

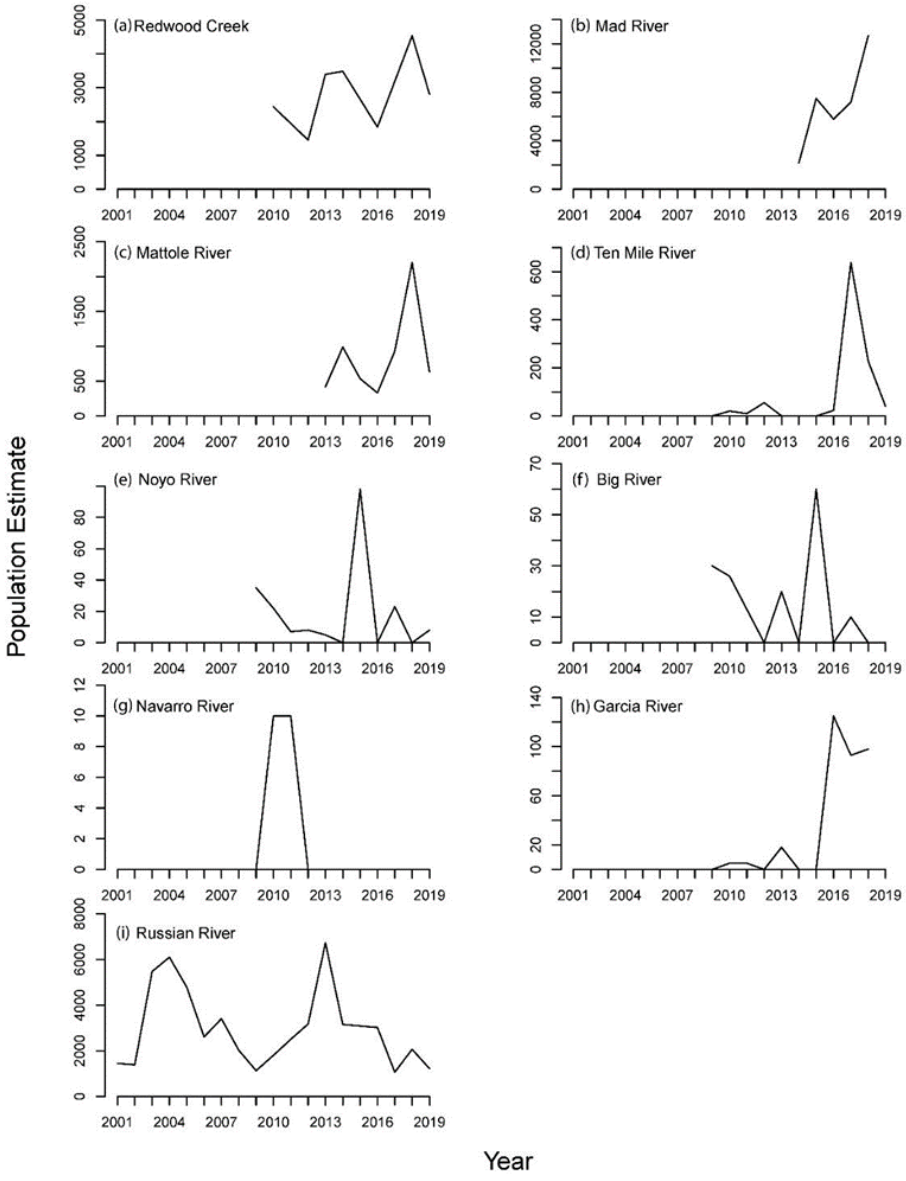

Figure 5. Time series of abundance estimates for independent populations of California Coastal Chinook salmon. (SWFSC 2022).

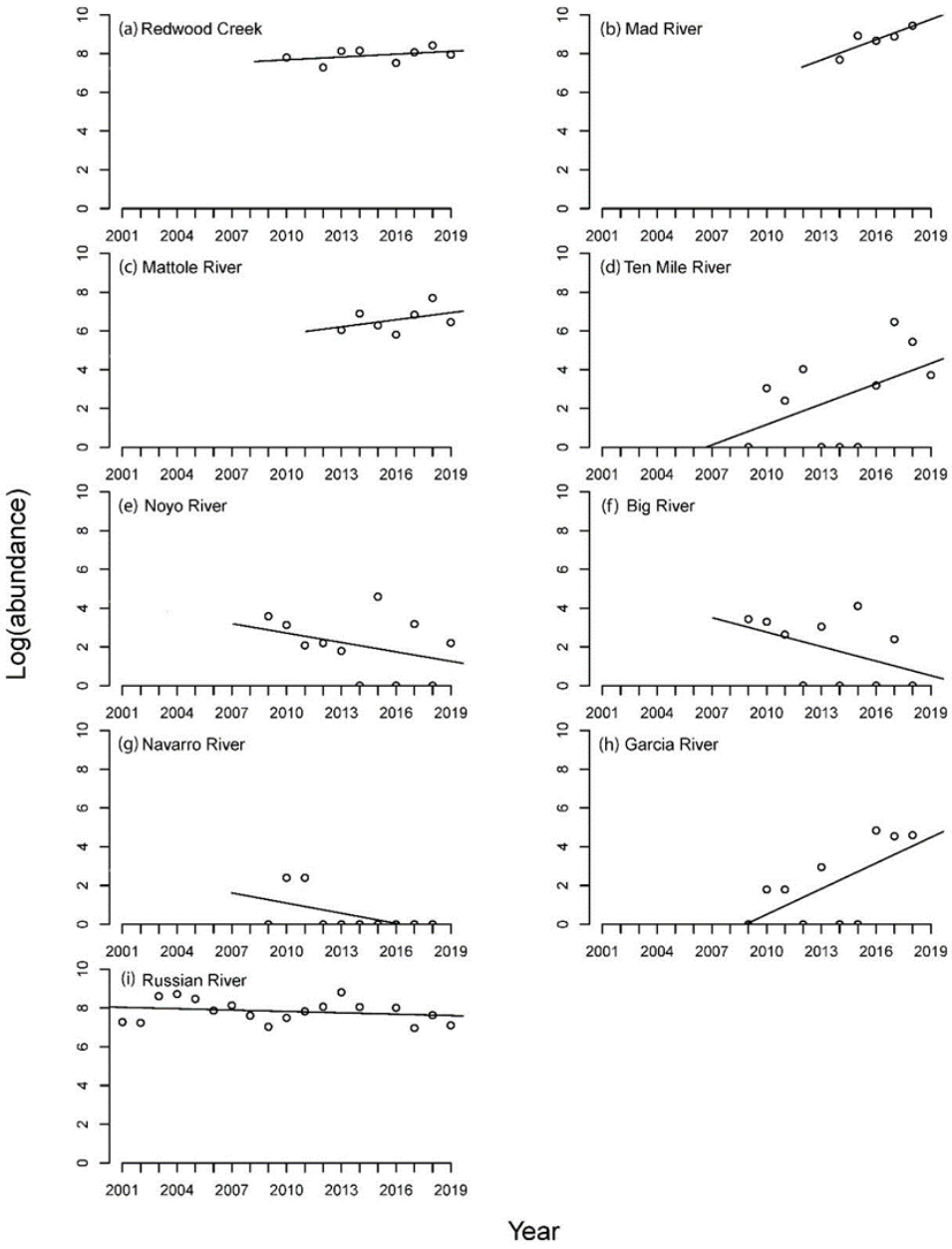

Figure 6. Population trends (log abundance) for independent populations of California Coastal Chinook salmon (SWFSC 2022).

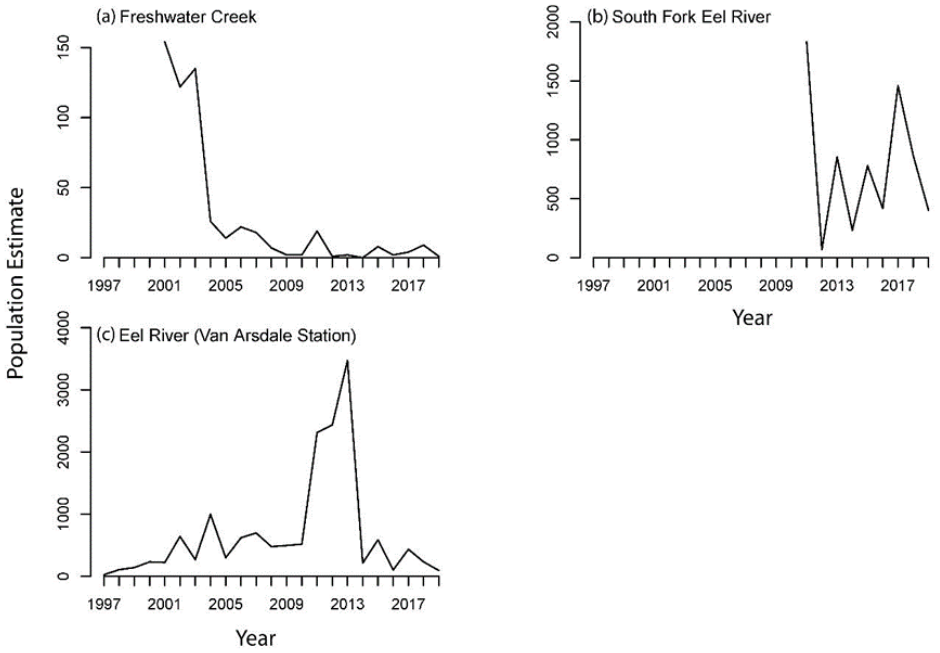

Figure 7. Time series of partial abundance estimates for independent populations of California Coastal Chinook salmon (SWFSC 2022).

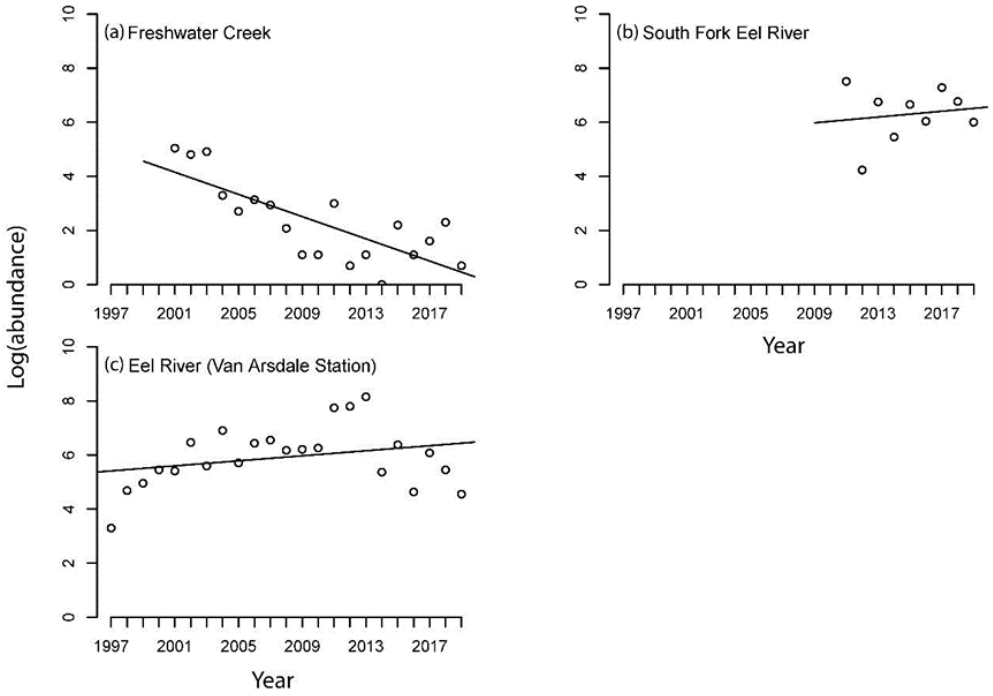

Figure 8. Population trends (log abundance) for partial abundance estimates of independent populations of California Coastal Chinook salmon (SWFSC 2022).

North Mountain Interior Stratum

The North Mountain Interior Stratum includes Chinook salmon populations in the upper Eel River and in two tributaries to the lower Eel River, Van Duzen River, and Larabee Creek (Table

4 and Figure 4). Both populations in this stratum are independent and considered essential to recovery. A long-running time series (since 1947) of adult counts is available from the Van Arsdale Fish Station giving a partial abundance estimate for the Upper Eel River population. An average of 680 Chinook salmon (range 26–3,471) have been counted annually (Figure 7). The trend in abundance appears to be increasing but is not significant ($p = 0.709$) (Figure 8). A new program for estimating abundance of the Upper Eel River Chinook salmon population was initiated in 2019 and produced an estimate of 3,844 fish (36 percent of the recovery target). This same year, only 94 fish were counted at the Van Arsdale Fish Station. These new data highlight the fact that the Van Arsdale Fish Station count represents only a small (and potentially variable) fraction of the total Upper Eel River population.

North-Central Coastal Stratum

The North-Central Coastal Stratum includes Chinook salmon populations in Ten Mile River, Noyo River, Big River, and Albion River (Table 4 and Figure 4). The Ten Mile River population is independent and considered supporting to recovery rather than essential. Adult estimates have averaged 92 fish (range 0–638) over the years of record with no significant trend ($p > 0.10$) (Table 5, Figure 5, and Figure 6). The mean represents 11–22 percent of the recovery target for the Ten Mile River population. The Noyo River and Big River are independent populations and considered essential to recovery. The Noyo River estimate has averaged 19 (range 0–98) and Big River has averaged 16 (range 0–60) (Table 5, Figure 5, and Figure 6) and trends appear to be declining. These mean values are less than 1 percent of proposed recovery targets and fall below the depensation thresholds for high risk. Likewise, the generational averages fall below the high-risk threshold for effective population size.

Central Coastal Stratum

The Central Coastal Stratum includes Chinook salmon populations from the Navarro River, Garcia River, Gualala River, and the Russian River in the south (Table 4 and Figure 4). All 4 populations are independent, and the Garcia River and Russian River populations are considered essential to recovery. The Gualala and Navarro populations are considered supporting to recovery. Population monitoring has continued for three populations of Chinook salmon in the Central Coastal Stratum. Monitoring of the Navarro and Garcia river populations was initiated in spawn year 2009. In the Navarro River, small numbers ($n = 10$) of Chinook salmon were reported in 2010 and 2011, but they have not been observed since (Table 5, Figure 5, and Figure 6). In the Garcia River, estimates have averaged 34 (range 0–125) with a significant positive trend ($p = 0.04$) (Table 5, Figure 5, and Figure 6). However, the population mean is currently less than 2 percent of the recovery target. Both the Navarro and Garcia river populations are categorized as high risk based on depensation and effective population size criteria (Table 4).

Monitoring of adult Chinook salmon on the Russian River has been conducted since 2001. An average of 2,947 (range 1,062–6,730) Chinook salmon have been counted annually over the 18-year period of record (Table 5 and Figure 5). However, counts for 2015, 2016, and 2017 were derived using alternative methods due to issues with video cameras. Consequently, the statistical significance of this trend cannot be evaluated. However, the trend appears relatively stable over the period of record (Figure 6). The average count represents about 32 percent of the recovery target for the Russian River and the population is considered low risk based on the effective population size criterion.

Summary

In the North Coastal Stratum, improved monitoring programs indicate that some populations are doing better than believed in prior assessments and trends appear to be increasing where population-level estimates are available. All North Coastal populations are considered essential to recovery. The Redwood Creek population is approaching the recovery target in some years with average abundance at 85 percent of the recovery target. The Mad River population is exceeding the recovery target. The Mattole River population appears to be increasing based on positive trends in redd estimates. Partial abundance estimates exist for Freshwater Creek and the South Fork Eel populations, which are part of the Humboldt Bay and Lower Eel populations, respectively. In Freshwater Creek, long term trends in abundance have declined, but this is heavily influenced by hatchery releases during the early part of the time series. In the South Fork Eel River, estimates of redds have shown an increasing trend.

In the North Mountain Interior Stratum, data are extremely limited, and long-term trends only exist for a portion of the Upper Eel River population (essential to recovery). The partial abundance estimates from data collected at the Van Arsdale Fish Station have shown an increasing trend despite high variability and low reliability. A new program has been implemented to estimate population-level abundance for the Upper Eel River, and early results indicate significantly higher abundance than the partial abundance estimate.

In the North-Central Coastal Stratum, trends are mixed. Trends in abundance for the Noyo River have been relatively stable while the trends for the Big River have declined. Both the Noyo River and Big River populations are essential to recovery and are at high risk of extinction due to depensation. The North Central-Coastal populations are all at low abundance. However, previous viability assessments and status reviews indicated the apparent extirpation of populations in this stratum, so presence even at low levels appears to be an improvement.

In the Central Coastal Stratum, overall trends appear to be improving. The Garcia River population is essential to recovery and has shown a significant positive trend despite being at high risk due to depensation. The Russian River population is essential to recovery, is at low risk of extinction, and its trends in abundance appear relatively stable. This population has consistently numbered in the low thousands of fish in most years, making it the largest population south of the Eel River. Similar to the North-Central Coastal Stratum, populations in the Central Coastal Stratum (except for the Russian River) were thought to be extirpated in previous viability assessment and status reviews.

Abundance trends across the CC Chinook Salmon ESU have been mixed but several populations appear to be stable or increasing. Overall extinction risk for the ESU is moderate and has not changed appreciably since the previous viability assessment (SWFSC 2022).

2.2.2 Threats

The 2016 recovery plan (NMFS 2016b) determined that the threats of greatest concern to the ESU are channel modification, roads and railroads, logging and wood harvesting, water diversion and impoundments, and severe weather patterns (Table 6). Threat from hatcheries and aquaculture are not applicable within the ESU given the termination of hatchery programs for CC Chinook salmon. Fishing was identified as a medium threat for most of the populations of

CC Chinook salmon because of freshwater fishing. While retention of Chinook salmon is prohibited in the freshwater areas of the ESU, poaching and encounters during steelhead fisheries (especially during low flow conditions) remain a concern (NMFS 2016b). To address this, CDFW has implemented low flow fishing closures, including additional closures in 2022, to reduce the impact on Chinook salmon across the ESU. The specific threats to the CC Chinook Salmon ESU are discussed in detail in the recovery plan (NMFS 2016b) and status reviews (Good, Waples and Adams 2005; Williams et al. 2011; NMFS 2016a; SWFSC 2022). Threats for each stratum are summarized in the following subsections.

Table 6. Threats to essential populations of California Coastal Chinook salmon. Cells with [-] were not rated or not applicable. Letters correspond to the level of threat identified: Low (L), Medium (M), High (H), and Very High (H) (NMFS 2016b).

Threat	**Diversity Strata / Population**													
	North Coastal							North Mountain Interior			North-Central Coastal		Central Coastal	
	Redwood Creek	Little River	Mad River	Humboldt Bay	Lower Eel / South Fork Eel	Bear River	Mattole River	Van Duzen River	Larabee Creek	Upper Eel River	Noyo River	Big River	Garcia River	Russian River
Agriculture	M	M	M	M	M	M	L	M	M	L	L	-	M	M
Channel Modification	VH	H	H	H	H	M	M	H	M	L	L	L	M	H
Disease, Predation and Competition	H	M	M	M	M	M	M	H	H	M	-	-	M	M
Fire, Fuel Management and Fire Suppression	M	M	M	L	M	M	M	M	M	M	L	L	L	L
Fishing and Collecting	M	M	M	M	M	M	M	M	M	H	M	M	H	M
Hatcheries and Aquaculture	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Livestock Farming and Ranching	M	M	M	M	M	H	M	M	M	L	-	-	M	L
Logging and Wood Harvesting	H	H	M	H	M	H	M	M	M	M	M	M	H	L
Mining	H	-	H	L	M	M	M	M	M	L	-	-	L	M
Recreational Areas and Activities	M	M	M	L	M	M	M	M	M	L	L	L	L	L
Residential and Commercial Development	M	M	M	M	M	M	M	M	M	L	L	L	M	H
Roads and Railroads	H	H	H	M	H	H	M	M	M	H	M	M	H	H
Severe Weather Patterns	H	M	M	H	H	M	H	M	M	M	M	M	M	M
Water Diversion and Impoundments	M	M	M	M	H	M	H	H	M	L	L	L	M	H

North Coastal Stratum

Threats of greatest concern for the North Coastal Diversity Stratum were channel modification, logging and wood harvesting, roads and railroads, and severe weather patterns (Table 6). Threats of minimal concern included fishing and collecting, recreational areas and activities, and residential and commercial development.

North Mountain Interior Stratum

Despite poor viability ratings throughout the stratum, most threat ratings were low or medium (Table 6). Disease, predation, and competition were the most significant threats followed by roads and railroads, water diversions and impoundments, and channel modification. Fishing and collecting was identified as a threat for the Upper Eel River because of a lack of low flow fishing closures in September (NMFS 2016b). However, CDFW implemented new regulations in 2022 extending the low flow fishing closure to September 1 for the Eel River and most of the rivers in the ESU (CDFW 2021).

North-Central Coastal Stratum

The North-Central Coastal Stratum was the only stratum without threats identified as high or very high. Many threats were deemed not applicable for the stratum. Roads, severe weather, logging, and fishing were identified as medium threats (Table 6). To address the concern related to freshwater fishing, CDFW implemented new regulations in 2022 extending the low flow fishing closure to September 1 for Mendocino County (CDFW 2021).

Central Coastal Stratum

The most significant threat identified for the Central Coastal Diversity Stratum was roads and railroads (Table 6). Channel modification, logging and wood harvesting, residential and commercial development, and water diversions and impoundments were identified as concerns for one population. Fishing and collecting were identified as a high threat for the Garcia River because of poaching. However, new CDFW regulations for a low flow fishing closure starting in September 2022 may help address this threat (CDFW 2021). Fire, fuel management, fire suppression, and recreational areas and activities were considered low threats for both populations in the stratum.

2.2.3 Recovery Goals

Recovery goals objectives and criteria for CC Chinook salmon are outlined in the 2016 Recovery Plan (NMFS 2016b).

Recovery plan objectives are to:

1. Reduce the present or threatened destruction, modification, or curtailment of habitat or range;
2. Ameliorate utilization for commercial, recreational, scientific, or educational purposes;
3. Abate disease and predation;
4. Establish the adequacy of existing regulatory mechanisms for protecting CC Chinook salmon now and into the future (i.e., post-delisting);

5. Address other natural or manmade factors affecting the continued existence of CC Chinook salmon; and
6. Ensure the status of CC Chinook salmon is at a low risk of extinction based on abundance, growth rate, spatial structure, and diversity.

2.2.4 Climate Change and Other Ecosystem Factors

Climate plays an important role in salmon habitat at every stage of their lifecycle. Predictable seasonal climate variations interact with the physiography of salmon watersheds to provide predictable seasonally-varying water temperature and streamflow for supporting diverse life-history pathways for salmon populations (SWFSC 2022). Irregular climate and weather variations like persistent drought, episodic floods, or persistent marine heatwaves, can affect salmon populations by altering their aquatic habitats and food-webs, thus altering individual salmon growth and survival rates in ways that can impact salmon populations at local to regional scales (SWFSC 2022). Climate variations impacting large areas can therefore impact ESU/DPS viability through impacts on abundance, productivity, spatial diversity, and distribution.

At various times from 1999–2012, relatively favorable regional climate conditions supported relatively high freshwater and marine survival rates and high adult returns for many salmon populations throughout the Pacific Northwest (SWFSC 2022). In contrast, 2013–2021 has been exceptional for West Coast in the frequency and magnitude of drought and terrestrial heat, widespread and severe wildfire, and record-setting marine heatwaves in the California Current Large Marine Ecosystem and broader northeast Pacific Ocean (SWFSC 2022). A strong and persistent warming trend and large year-to-year variations in precipitation are among the most notable features of western U.S. climate in recent decades (SWFSC 2022). For the north coast area of California, air temperature has increased and precipitation has decreased over the last 20 years (Figure 9 and Figure 10). The combination of high temperatures and low precipitation has come with a preponderance of widespread drought conditions, meaning low snowpack and low streamflow years for California's salmon and steelhead watersheds (SWFSC 2022). Climate extremes from 2013–2021 have contributed to extreme bottlenecks in survival rates for many West Coast salmon populations resulting in declines in abundance for many DPSs and ESUs (SWFSC 2022). Climate change may have long-term effects on salmon including: depletion of important cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species (ISAB 2007).

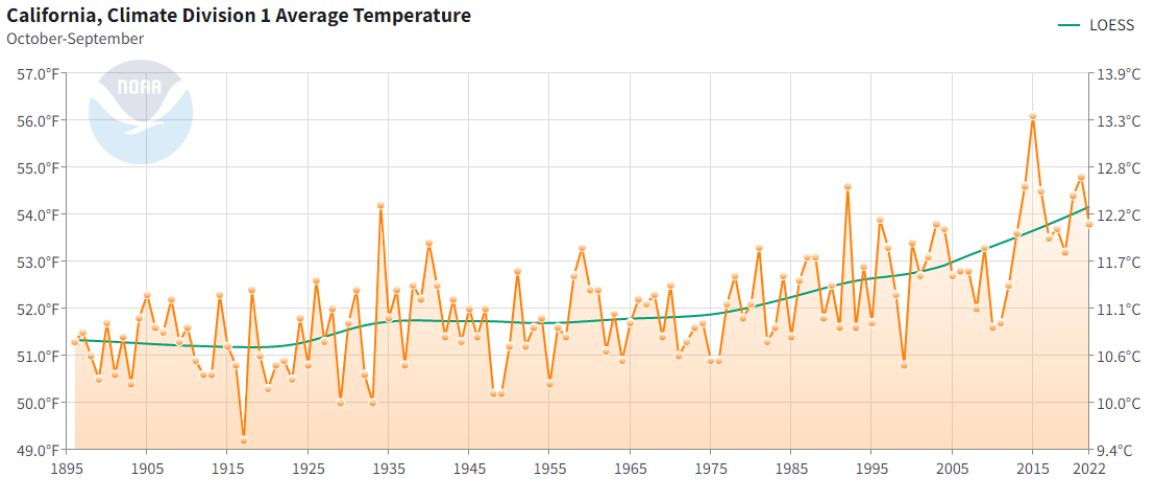

Figure 9. Average of annual surface air temperature for the north coast region of California. Smoothed trend line is shown in green. Source: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series/0401/tavg/

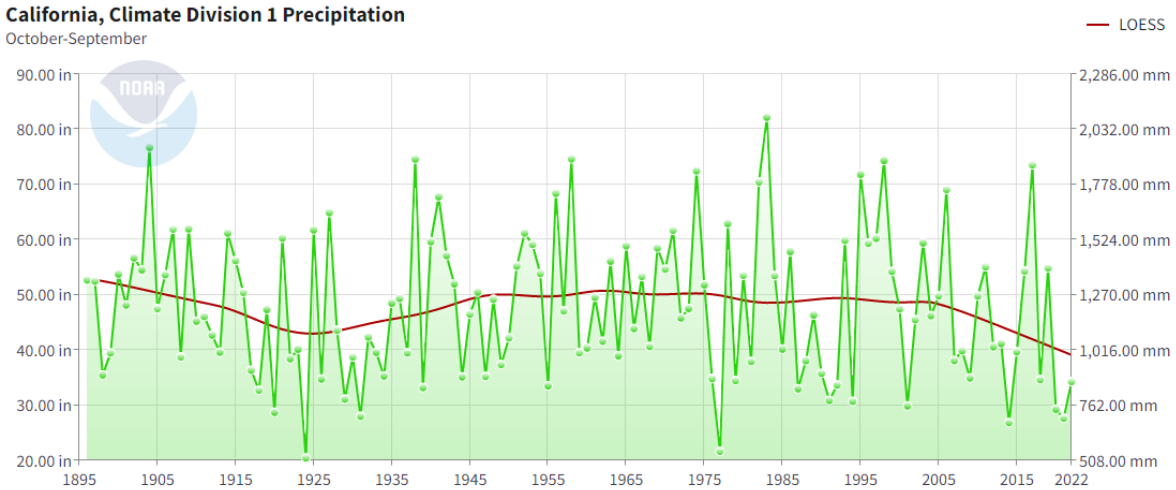

Figure 10. Annual water year (October-September) precipitation the north coast region of California. Smoothed trend line is shown in red. Source: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series/0401

In coastal and estuarine ecosystems, climate change is likely to result in sea level rise, loss of coastal wetlands, and changes in sea surface temperatures and precipitation patterns. Rising sea level will alter the habitat in estuaries and will either provide increased opportunity for feeding and growth or, in some cases, will lead to the loss of estuarine habitat and a decreased potential for estuarine rearing. Marine ecosystems face a unique set of stressors related to global climate change, all of which may have deleterious impacts on growth and survival of salmon. Simulations have predicted changes in California coastal upwelling transitions due to climate change, which may change distribution and availability of salmon prey in the California region (Brady et al. 2017). In the northeast Pacific Ocean, sea surface temperatures from 2013-2020 were exceptionally high and coincided with widespread declines and low abundances for many

west coast salmon and steelhead populations (SWFSC 2022). In general, the effects of changing climate on marine ecosystems are not well understood given the high degree of complexity and the overlapping climatic shifts that are already in place (e.g., El Niño-Southern Oscillation and Pacific Decadal Oscillation). Overall, climate change is believed to represent a growing threat, and will challenge the resilience of salmonids in Northern California including the CC Chinook Salmon ESU.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action. Consequences of the action may occur later in time and may occur outside the immediate area involved in the action. To determine the action area, we considered the immediate area involved in the action, the location where listed species and critical habitat will be affected, and the location in which consequences to listed species and critical habitat may occur.

Effects of the proposed action on CC Chinook salmon will occur in the EEZ and the marine coastal waters of Washington, Oregon, and California, where the ocean salmon fisheries will occur. The EEZ and marine coastal waters off Washington, Oregon and California are outside of the area designated as critical habitat for CC Chinook salmon. Chinook salmon may also experience mortality or reduced fitness later in time and outside of the area in which the fisheries occur because of fisheries interactions (non-retention mortality). Our analysis accounts for non-retention mortality, and we expect based on our assessment using KRFC as a surrogate that this mortality will be low. While it is possible that some fish will perish or be less fit in freshwater areas as a result of non-retention mortality, we have no information with which to quantify that effect or to identify in which rivers or streams it might occur, thus it is essentially immeasurable, and any assumptions we might make about it would be speculative. For that reason, we are not including freshwater areas in the action area. The action area for this consultation includes the EEZ and coastal waters, where the fisheries may interact with CC Chinook salmon.

Given these considerations, the action area for this opinion is the waters of the EEZ (i.e., 3-200 nautical miles off the states of California, Oregon, and Washington) and the marine coastal waters (0 to 3 nautical miles off the coast) of Washington, Oregon, and California (Figure 11). This is the geographic area where the activities associated with the proposed action will occur and is the area where the proposed action will affect CC Chinook salmon.

Figure 11. Map of Pacific Coast showing major salmon fishing ports, ocean salmon management areas, and the Exclusive Economic Zone.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1 Ocean Salmon Fisheries

Commercial and recreational salmon fisheries, occurring in the EEZ off the coasts of Washington, Oregon, and California, are managed by NMFS and the PFMC under the salmon FMP (see section 1.3). While the salmon FMP and implementing regulations apply only in the EEZ, the states of Washington, Oregon, and California generally manage salmon fisheries in state ocean waters consistent with the Federal regulations. This has the effect of managing ocean salmon fisheries in Federal and state waters collectively for the conservation objectives for each of the salmon stocks in the salmon FMP. Collectively, these ocean fisheries target healthy or abundant stocks of Chinook and coho salmon, but may incidentally encounter CC Chinook salmon off northern California and southern Oregon (PFMC 2022c). Harvest control rules and management measures are used to limit incidental take of ESA-listed species. To limit the effects on CC Chinook salmon, ocean salmon fisheries are constrained by the CC Chinook salmon conservation objective. This conservation objective restricts the ocean fisheries to an HR of 0.16 or less of the estimated abundance of age-4 KRFC (PFMC 2022c). Additionally, conservation objectives for other salmon stocks (e.g., Sacramento River fall Chinook salmon) may further constrain salmon fisheries in some years and further reduce impacts on CC Chinook salmon.

Since 2001, the ocean HR of age-4 KRFC has averaged 0.17 and has exceeded the CC Chinook salmon conservation objective in 12 out of 22 years (Table 3 and Figure 12). Since 2013, the HR has averaged 0.22 and exceeded the conservation objective in 8 out of 10 years. From 2018 through 2022, the HR averaged 0.30 and significantly exceeded the conservation objective in each year. The high ocean HRs of age-4 KRFC that occurred during 2018 to 2022 suggest that the level of impacts on CC Chinook salmon have likely increased. In 2023, ocean salmon fisheries were closed off the coast of California in response to record low forecasts for KRFC and SRFC (PFMC 2023e).

The PFMC uses a model, the KOHM, to predict the age-specific harvest of KRFC resulting from proposed fisheries. The KOHM was updated in 2006, 2021, and 2022 to address the underprediction of the post-season estimates of the ocean HR of age-4 KRFC (PFMC 2006; 2021b; 2022e). Based on the success of the adjustment made in 2006, NMFS expected the 2021 and 2022 updates to better align pre- and post-season estimates of HR. However, the post-season estimate in 2021 was 0.27 compared to a projection of 0.11 pre-season (PFMC 2022e). In 2022, the KOHM again underpredicted the harvest of age-4 KRFC with a projected pre-season HR of 0.10 compared to a post-season estimate of 0.38 (PFMC 2023d).

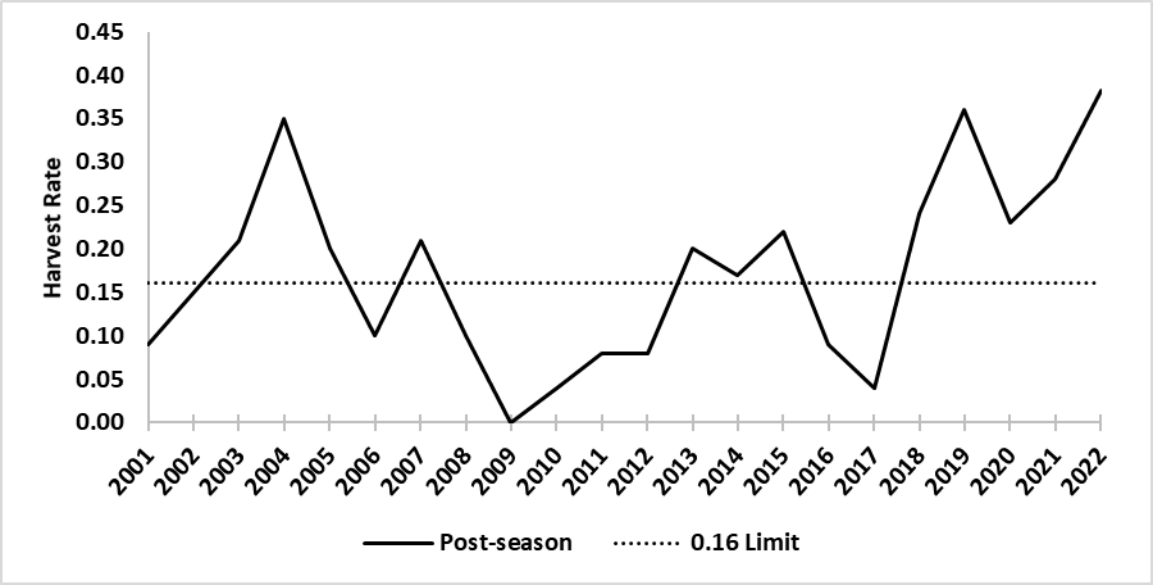

Figure 12. Post-season ocean harvest rates of age-4 Klamath River Fall Chinook salmon compared to the conservation objective of 0.16 (dotted line) for years 2001 – 2022 (PFMC 2023d).

2.4.2 Groundfish Fisheries

The PFMC manages groundfish fisheries in Federal waters off the West Coast under the Pacific Coast Groundfish FMP (Groundfish FMP) (PFMC 2023c). The Groundfish FMP includes 82 species, nearly all of which live on or near the ocean floor. Major types of fishes included in this group include rockfish, flatfish, roundfish, sharks, and skates (PFMC 2023c). Most groundfish are harvested using trawls, pots, and hook-and-line gear. Chinook salmon are caught in the bottom trawl and whiting components of the groundfish fishery off the coasts of Washington, Oregon, and California. In a 2017 opinion on the Groundfish FMP, NMFS determined that the incidental take of salmon in the groundfish fisheries would not likely jeopardize the continued existence of ESA-listed salmon (NMFS 2017). Impacts on CC Chinook salmon from the fisheries managed under the Groundfish FMP are estimated at less than two percent of the ESU's estimated abundance (NMFS 2017).

2.4.3 Other Fisheries

The PFMC manages fisheries for Coastal Pelagic Species (CPS) under the CPS FMP (PFMC 2023a). CPS fisheries target sardines, mackerels, herrings, anchovies, squid, and krill. Chinook salmon are incidentally captured in fisheries targeting CPS but at relatively low levels. NMFS evaluated the CPS FMP in 2010 and determined fishery activities and implementing regulations were not likely to jeopardize any endangered or threatened species under their jurisdiction (NMFS 2010b). In its analysis, NMFS determined that Chinook salmon bycatch in the CPS fishery off the California coast is extremely rare and discountable (NMFS 2010b).

The PFMC manages fisheries for Highly Migratory Species (HMS) under the HMS FMP (PFMC 2023b). The HMS fishery targets various species of tunas, sharks, billfishes, and mahi-mahi.

Although CC Chinook salmon may be present in the area where HMS fishing occurs, there are no records of take of listed salmonids in any HMS fisheries (NMFS 2016b).

NMFS consulted on the West Coast Pacific Halibut fishery in 2023 and determined that CC Chinook salmon are not likely to be adversely affected by the fisheries (NMFS 2023c).

2.4.4 Scientific Research

CC Chinook salmon are the subject of scientific research and monitoring activities. Most opinions issued by NMFS have conditions requiring specific monitoring, evaluation, and research projects to gather information to aid the preservation and recovery of listed species. Additionally, there are stand-alone research and monitoring activities. The impacts of these research activities pose both benefits and risks. In the short term, CC Chinook salmon may be affected during scientific research through removal, contact with gear or handling during conducting the research. However, these activities have a great potential to benefit ESA-listed species in the long-term.

NMFS has issued several Section 10(a)(1)(A) scientific research permits allowing lethal and non-lethal take of ESA-listed salmonids, including CC Chinook salmon (NMFS 2022b). In a separate process, NMFS also completed a review of state and tribal scientific salmon and research programs under ESA Section 4(d) Limit 7. The expected encounters and mortalities of CC Chinook salmon during the ongoing research authorized under ESA Sections 4(d) and 10(a)(1)(A) are shown in Table 7, below.

Table 7. Total expected handle and mortality of California Coastal Chinook salmon for scientific research and monitoring approved for 2022 (NMFS 2022b).

Life Stage	Origin	Encounters	Mortalities	Percent of Species Encountered	Percent of Species Killed
Adult	Natural	388	21	2.95	0.16
Juvenile	Natural	68,867	1,424	2.88	0.06

Actual levels of encounters and mortality associated with research activities are likely to be substantially lower than the permitted levels. Most researchers do not handle the full number of individual fish allowed and estimates of mortality for each proposed study are purposefully inflated to account for accidental deaths (NMFS 2022b).

2.5 Effects of the Action on CC Chinook Salmon

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

As described in the proposed action, we expect that the states of Washington, Oregon, and California will continue to manage salmon fisheries in state ocean waters (i.e., 1 to 3 nautical miles off the coast) consistent with the Federal regulations. – Therefore, we expect that that measures described in the proposed action will be implemented in both Federal and applicable state (California) marine waters.

The proposed action (described in detail in section 1.3) would (1) limit the post-season ocean HR for age-4 KRFC to 0.16 as the conservation objective for CC Chinook salmon; and (2) implement the framework (described in detail in section 1.3) to constrain the fisheries (as necessary) so that they do not exceed the conservation objective. In this section, we: 1) describe the rationale for continuing to rely on KRFC as a surrogate for evaluating impacts on CC Chinook salmon, 2) describe the implementation of the proposed CC Chinook salmon conservation objective including the framework, and 3) analyze the effects of the proposed action on CC Chinook salmon.

KRFC as a surrogate for CC Chinook Salmon

For CC Chinook salmon, sufficient monitoring data do not exist to estimate ESU-level escapement and incidental take in ocean fisheries (Williams et al. 2011; O'Farrell, Satterthwaite and Spence 2012; Satterthwaite et al. 2014; O'Farrell et al. 2015; O'Farrell et al. 2023) (see also description of limited escapement data in section 2.2.1). In mixed stock fisheries, information on harvest effects specific to each salmon population or stock caught in those fisheries may be unavailable because of data limitations. In these cases, fisheries managers can use information derived from stocks with similar distribution, migration timing, and life-history traits as a surrogate for management.

In the ocean, the geographic distribution of CC Chinook salmon is between that of KRFC and Central Valley fall Chinook salmon. Due to this intermediate distribution, we infer that ocean fishery constraints on KRFC and Central Valley Chinook salmon will effectively constrain impacts on CC Chinook salmon (NMFS 2000; McInnis 2005; O'Farrell, Satterthwaite and Spence 2012; Satterthwaite et al. 2014; O'Farrell et al. 2023). To investigate this, Satterthwaite et al. (2014) and Jensen et al. (2022) analyzed genetic information to compare distribution and fishery vulnerability of CC Chinook salmon and KRFC in recreational and commercial ocean fisheries. Results from these studies suggest similar patterns of encounters for the two stocks in ocean salmon fisheries. Satterthwaite et al. (2014) suggested that distribution of the two stocks may diverge in late summer and early fall, which may indicate that impacts of fisheries on the two stocks may diverge later in the season depending on the spatial distribution of fishing seasons. However, establishment of KRFC as a surrogate for CC Chinook salmon does not assume that HRs of the two stocks are perfectly correlated (NMFS 2000; O'Farrell, Satterthwaite and Spence 2012). Instead, we assume that a limit on ocean harvest of KRFC effectively constrains impacts on CC Chinook salmon. KRFC are a well-studied stock with detailed harvest management models that are used to inform fisheries management and they overlap with CC Chinook salmon during most of the ocean fishing season (Satterthwaite et al. 2014). We consider KRFC to be an appropriate surrogate to represent the relative impacts on CC Chinook salmon in ocean salmon fisheries for these reasons. Therefore, restrictions on KRFC HRs will effectively constrain impacts on CC Chinook salmon, and the KRFC HR can be monitored and assessed

(NMFS 2000; McInnis 2005; O'Farrell, Satterthwaite and Spence 2012; Satterthwaite et al. 2014; O'Farrell et al. 2023).

The conservation objective for CC Chinook salmon is specific to age-4 KRFC harvested in ocean fisheries. While significant harvest of KRFC occurs in freshwater fisheries, retention of Chinook salmon is prohibited in freshwater areas throughout the range of the CC Chinook Salmon ESU (CDFW 2021). Because of this, freshwater fishery impacts on KRFC are not representative of impacts on CC Chinook salmon. Therefore, the ocean HR on KRFC provides a better surrogate for the impacts on CC Chinook salmon than total (i.e., ocean and freshwater) HR. We use the age-4 component of KRFC because the harvest of age-4 KRFC is highly correlated and proportional to overall harvest of adult KRFC (NMFS 2000; Satterthwaite et al. 2014).

Implementation of the CC Chinook Salmon Conservation Objective and the Management Framework

The proposed action is the authorization of the ocean salmon fishery in the EEZ through approval of the salmon FMP and promulgation of regulations implementing the salmon FMP, which includes the conservation objective for CC Chinook salmon (Table 3-1 in the salmon FMP). The proposed action includes regulations implementing the management framework adopted by the PFMC (described in Section 1.3) to ensure fisheries do not continue to exceed the conservation objective.

To ensure fisheries do not exceed the limit of 0.16 on the ocean HR for age-4 KRFC, as assessed post-season, fisheries will be designed pre-season and managed in-season to stay within the objective. Prior to the start of pre-season planning, NMFS will review the percent error of the pre-season projected HR (as compared to the post-season HR) occurring over the most recent five years. Based on this review and other factors, the PFMC and NMFS may use a HR that is lower than the conservation objective (i.e., apply a "buffer"). The buffer would to account for management error and reduce the potential for exceeding the conservation objective. Fishery managers will compute the allowable harvest level of Chinook salmon consistent with the conservation objective (including a buffer, if applicable). Using the allowable harvest level and projected effort, managers will determine landing and possession limits pre-season to ensure that the fishery does not exceed the allowable harvest level. The fishery will be monitored in-season and actions (as described in the framework) will be taken as needed to prevent the fisheries from exceeding the allowable harvest level. We expect that this multilayered conservative approach (i.e., a buffer, fishery output control, and in-season actions) will ensure that the fisheries remain within the pre-season projection and adhere to the CC Chinook salmon conservation objective.

We anticipate that the fishery may occasionally exceed the conservation objective due to management error, however, with the proposed approach we expect that any such exceedances would be infrequent (not in consecutive years) and would be relatively small, such that fishery impacts on average would not exceed the conservation objective.

Previously, the commercial troll fisheries off the coast of California were managed primarily through time and area restrictions (as opposed to using landing limits and quota management) (PFMC 2022d). The fisheries were designed by setting fishing periods based on the pre-season projected HR, contact-rate-per-unit-effort, and anticipated effort. The fishing seasons were

implemented without limits on the number of Chinook salmon that could be retained. In recent years, the contact-rate-per-unit-effort for the commercial troll fishery has been much higher than anticipated pre-season resulting in much higher catches and age-4 KRFC HR than projected pre-season (Appendix B in PFMC (2021b) and Appendix D in PFMC (2022e)). Under the proposed framework, there will be controls on the number of Chinook salmon that can be retained by each vessel per landing week, the harvest of Chinook salmon will be monitored in-season, and modifications to the landing and possession limits will be modified in-season so that so that the allowable harvest level is not exceeded. For the first two years in which salmon fisheries occur off the California coast, in-season actions will only be used to further restrict harvest (i.e., reduce landing limits, reduce time/area) or close the fishery upon reaching the allowable harvest level.

Effects on CC Chinook Salmon

The proposed action is likely to affect individual CC Chinook salmon when they are encountered in ocean salmon fisheries. The effects on CC Chinook salmon are incidental to the ocean salmon fisheries, which are directed at healthy or abundant stocks of Chinook salmon and coho salmon. Mortality of individual CC Chinook salmon will occur when they are caught in the fishery and retained. In addition, fish that are encountered but not retained (e.g., caught and released or encountered but not landed) may be stressed, injured, or killed because of the encounter. Stress and injury may lead to death at a later time.

As described above, KRFC are used as a surrogate to limit the effects of ocean salmon fisheries on CC Chinook salmon. Under the proposed action, ocean salmon fisheries would be managed under the CC Chinook salmon conservation objective so that the post-season estimated HR for age-4 KRFC does not exceed 0.16. In addition, the framework to achieve conservation objectives for California stocks of Chinook salmon will be implemented to ensure that the conservation objective is not exceeded.

In the 2000 RPA, NMFS (2000) concluded that harvest of CC Chinook salmon under management measures during 1996 – 1999, designed to achieve reduced ocean harvest of KRFC and Sacramento River winter-run Chinook salmon, were sufficiently low to allow persistence of CC Chinook salmon populations. This was based on indications that abundance of CC Chinook salmon appeared to increase during the same period that ocean salmon fisheries resulted in KRFC age-4 ocean HRs of 0.16 [11] or less (NMFS 2000; McInnis 2005). As discussed in the subsequent sections, we believe that the findings of NMFS (2000) remain valid, and that restricting the post-season HR to 0.16 will allow for persistence of CC Chinook salmon. Lower impacts on CC Chinook salmon than those observed in recent years may allow for increases in abundance.

To assess the effects of the proposed action on CC Chinook salmon, we consider the effects on the status of the populations, strata, and ESU. We do not have any information indicating that the proposed action is likely to differentially affect the individual populations of CC Chinook salmon, and we do not expect that the proposed action will affect the distribution or genetic and

[11] The 2000 opinion analyzed a projected (modeled pre-season) limit of 0.17, which was the maximum post-season rate estimated over a four-year (1996 – 1999) period. In 2002, the PFMC adopted new procedures for calculating the age-4 HR on KRFC which reduced the maximum estimated HR to 0.16 during 1996-1999 (McInnis 2005).

behavioral traits of CC Chinook salmon at the population level. Therefore, we do not expect any measurable effects on spatial structure or diversity due to the proposed action across the populations in the ESU. Productivity may be affected by the proposed action, but those effects would be the result of, and are discussed under, the effects on abundance. The proposed action will affect the abundance of CC Chinook salmon.

Section 2.2 provides a detailed assessment of the status of the CC Chinook salmon populations and strata. Here we provide an overview of each strata in context with the proposed action.

In the North Coastal Stratum, all the populations are considered essential to recovery. Where population-level information is available, trends appear to indicate an increase in abundance. One population is approaching its ESA recovery target, and another is exceeding the recovery target. Trends in partial abundance (i.e., the data do not represent the entire population) of one population have decreased over the long term, however this population was previously bolstered by hatchery supplementation. Over the available timeseries, Chinook salmon in the North Coastal Stratum have persisted and overall abundance has improved despite several years when the conservation objective for CC Chinook salmon has been exceeded. Therefore, under the proposed action, we expect populations in the North Coastal Stratum to persist at current levels with a potential for increases in abundance.

In the North Mountain Interior Stratum, data are extremely limited for the two populations in the stratum. Both populations are considered essential to recovery. Long-term trends only exist for a portion of one population, but the trend appears to be increasing. Early results from a new monitoring program indicate significantly higher abundance than what had been estimated previously from partial abundance estimates of the population. Over the available timeseries, Chinook salmon in the North Mountain Interior Stratum have persisted and abundance has increased in at least a portion of the stratum despite several years where the conservation objective for CC Chinook salmon has been exceeded. Under the proposed action, we expect CC Chinook salmon in the North Mountain Interior Stratum to persist with potential for increased abundance.

In the North-Central Coastal Stratum, two of the four populations are considered essential to recovery. Trends in abundance are mixed and all populations are at low abundance and at high risk of extinction. However, these populations were previously considered extirpated so presence even at low levels appears to be an improvement for the status of this stratum. Over the available timeseries, Chinook salmon in the North-Central Coastal Stratum have persisted despite several years where the conservation objective for CC Chinook salmon has been exceeded. Under the proposed action, we expect Chinook salmon in the North-Central Coastal to persist at low levels of abundance.

In the Central Coastal Stratum, two of the four populations are considered essential to recovery. Overall trends appear to indicate improvement. One essential population has shown a significant positive trend in abundance despite being at high risk due to depensation. The other essential population is at low risk of extinction and trends in abundance appear stable. Most of the populations in the Central Coastal Stratum were previously considered extinct. Over the available timeseries, Chinook salmon in the Central Coastal Stratum have persisted and abundance has remained stable or increased despite several years where the conservation

objective for CC Chinook salmon has been exceeded. Under the proposed action, we expect Chinook salmon in the Central Coastal Stratum to persist with potential for increased abundance.

Since 2000, the post-season ocean HR of age-4 KRFC has averaged 0.17 and frequently (greater than 50 percent of the time) exceeded 0.16. Over this same period, CC Chinook salmon have persisted in all the strata and abundance has remained stable or improved for most of the populations. From 2018 to 2022, the post-season HR consistently and significantly (range 0.23 to 0.38) exceeded 0.16. Abundance data for CC Chinook salmon is only available through 2019 and it is not possible to fully observe the potential impact on abundance of the high harvest experienced in the ocean salmon fisheries from 2018 through 2022. Managing fisheries under the proposed action should decrease impacts on the CC Chinook salmon ESU such that those impacts are within the limits of the CC Chinook salmon conservation objective going forward. The management framework will increase the certainty of this occurring.

Under the management framework the PFMC and NMFS will implement harvest management controls and in-season actions in ocean fisheries across the entire California coast that will directly control contact-rate-per-unit-effort (the primary contributor to exceeding the ESA take limit in recent years) (Appendix B in PFMC (2021b) and Appendix D in PFMC (2022e)). Previously, harvest controls and landing and possession limits were only used in a limited capacity in the California KMZ. Implementation of this framework is intended keep harvest levels consistent with pre-season projections and will ensure that the post-season ocean HR of age-4 KRFC does not exceed 0.16. By achieving this conservation objective, the proposed action would result in reduced ocean harvest of KRFC of at least 46 percent when compared to the recent 5-year year average HR of 0.30. Since KRFC are used as a surrogate for CC Chinook salmon, a reduction in the ocean harvest of KRFC would also result in reduced impacts on CC Chinook salmon in ocean salmon fisheries. We anticipate this would result in increased escapement for populations within the ESU but lack data that would allow assessment of the magnitude and for which populations. From this, we infer that management measures effective in limiting the post-season ocean HR for KRFC to 0.16 or less will result in reduced impacts on CC Chinook salmon, as compared to recent years.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult, if not impossible, to distinguish between the action area's future environmental conditions caused by global climate change (that are part of the environmental baseline) versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of the status of the species (section 2.2).

Activities in the action area are primarily those conducted under state, tribal or Federal government management. Future tribal, state, and local government actions will likely be in the

form of legislation, administrative rules, or ocean policy initiatives; shoreline growth management; designation of marine protected areas; and resource permitting, including fishing. Private activities include continued resource extraction, vessel traffic, development, and other activities that contribute to non-point source pollution. Any of these actions could affect the listed species. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area, which encompasses several government entities exercising various authorities, and the changing economies of the region, make any analysis of cumulative effects difficult and speculative. Although state, tribal, and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects. Based on the best available information, we assume that effects of future tribal, state, or private activities in the action area will have a neutral or positive effect for the duration of this opinion.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species. In this section, we add the effects of the action (section 2.5) on the environmental baseline (section 2.4) and the cumulative effects (section 2.6), taking into account the status of the species (section 2.2), to formulate the agency's opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution.

Rangewide Status of the Species

- The status of the CC Chinook Salmon ESU is described in section 2.2. A recovery plan was finalized in 2014 and status of the ESU was evaluated in 2016. Best available information indicates that the ESU remains threatened. A new 5-year status review is currently underway and a new viability assessment was recently completed. Overall extinction risk is moderate for the ESU and has not changed since the previous viability assessment. Data availability has improved somewhat since previous status reviews.
- The CC Chinook Salmon ESU includes four diversity strata comprising 17 populations (Table 4). Long-term trends of abundance are not available for most of the populations and there are data reliability issues with some data sets throughout all four strata. Extinction risk for most populations is not assessed due to data limitations. All the identified populations in the ESU are independent except for one, Albion River. Nearly all the independent populations are identified as essential to the recovery of the ESU.
- In the North Coastal Stratum, population-level assessments are available for three of the populations and the abundance trends appear to be positive with one population above its recovery target and another population approaching the recovery target.
- There are no population-level assessments available for the North Mountain Interior Stratum. However, the trend in partial abundance of one population appears to indicate an increase. Additionally, a new program has been implemented to estimate population-level abundance, and early results indicate significantly higher abundance than what has been estimated using the partial abundance estimate.
- In the North-Central Coastal Stratum, population-level assessments are available for 3 of the 4 populations. Small numbers of fish are present in most years, trends are mixed and all populations are at high risk of extinction.

- In the Central Coastal Stratum, population-level assessments are available for 3 of the 4 populations. One population is at low risk with a stable trend in abundance and the other populations are at high risk. However, abundance has increased significantly in one population.
- Across all the diversity strata, trends are mixed but overall abundance appears to be stable or increasing (Table 5 and Figure 6). In the two southern strata, Chinook salmon are present in areas where they were previously considered extirpated.
- Threats of greatest concern for the ESU are channel modification, logging and wood harvesting, roads and railroads, water diversions and impoundments, and severe weather patterns. Fishing was identified as a medium threat for the ESU due to incidental harvest in freshwater areas during low flow conditions. However, CDFW recently introduced low-flow restrictions for rivers and streams across the ESU to address that threat. Threats from hatcheries and aquaculture are not applicable for CC Chinook salmon given the termination of hatchery programs within the range of the ESU.
- Threats for individual populations are shown in Table 6. In the North Coastal Diversity Stratum, threats of greatest concern are channel modification, logging and wood harvesting, roads and railroads, and severe weather patterns. In the North Mountain Interior Stratum, disease, predation, and competition are the most significant threats. In the North-Central Coastal Stratum, Roads, severe weather, logging, and freshwater fishing were the highest threats identified, however the level of threat is medium. In the Central Coastal Diversity Stratum, roads and railroads are the most significant threats.
- Climate change has negatively affected the habitat of the CC Chinook Salmon ESU and is a growing threat that will challenge the resilience of all salmonids in California. For the north coast area of California, air temperature has increased and precipitation has decreased over the last 20 years resulting in widespread drought, low snowpack, and low streamflow.

Environmental baseline

- CC Chinook salmon are encountered incidentally in ocean fisheries off the coasts of Washington, Oregon, and California. State and Federal ocean salmon fisheries are managed collectively consistent with the salmon FMP and target healthy or abundant stocks of Chinook and coho salmon. Since 2000, the CC Chinook salmon conservation objective has been a limit on the ocean HR for age-4 KRFC to 0.16 or less. The KRFC age-4 ocean HR (post-season) averaged 0.44 during 1986–1990 and fell to an average of 0.12 for years 1991-2000. Since 2001, the post-season ocean HR of age-4 KRFC has averaged 0.17 but has exceeded 0.16 in 12 out of 22 years (Table 3 and Figure 12). From 2018 through 2022 the post-season HR significantly exceeded 0.16 with an average of 0.30. The recent increases in the post-season KRFC age-4 ocean HR suggests that the level of impacts on CC Chinook salmon has likely increased in recent years.
- Impacts on CC Chinook salmon in other fisheries managed by the PFMC have been evaluated by NMFS. Impacts in the groundfish fishery are estimated at less than two percent. Encounters of CC Chinook salmon in the CPS and HMS fisheries are extremely rare. Any effects to CC Chinook salmon from the halibut fishery are insignificant. NMFS evaluated impacts on CC Chinook salmon from scientific research and the expected mortality is less than 0.2 percent.

Effects of the action

- The proposed action is the implementation of the ocean fisheries under the salmon FMP including the CC Chinook salmon conservation objective and the management framework to achieve conservation objectives for California stocks of Chinook salmon (See section 1.3). The ocean salmon fisheries will be designed pre-season and managed in-season to stay within a post-season limit of 0.16 on the ocean HR for age-4 KRFC.
- The proposed action will affect CC Chinook salmon incidentally. It is not possible to estimate the number of CC Chinook salmon that will be affected by the proposed action because of extremely limited data specific to the impacts of ocean fisheries on CC Chinook salmon. Instead, for the reasons described previously in this opinion, KRFC serve as a surrogate to limit impacts on CC Chinook salmon.
- We consider KRFC to be an appropriate surrogate to represent the impacts on CC Chinook salmon, because KRFC and CC Chinook salmon have similar ocean distributions. Therefore, restrictions on KRFC will effectively constrain impacts on CC Chinook salmon, and the KRFC HR can be monitored and assessed.
- Ocean salmon fisheries will be designed each year to adhere to the conservation objective. The annual management measures will include an allowable harvest level. Fishery managers will project an allowable harvest level of Chinook salmon based on an HR that is equal to the conservation objective or lower than the conservation objective (i.e., buffered) if deemed necessary given information available that year. Using the allowable harvest level and projected effort, managers will develop landing and possession limits to ensure that the HR does not exceed pre-season projections. The fishery will be managed using the landing and possession limits and monitored in-season. In-season actions will be taken to prevent the fisheries from exceeding the allowable harvest level.
- The PFMC has updated the KOHM several times in response to underprediction of the post-season HR. We expect that the PFMC will continue to monitor the pre-season predictor, and update the KOHM as necessary.
- Under the proposed action, we expect the ocean salmon fisheries to be managed under the CC Chinook salmon conservation objective and to be implemented so that the post-season estimated HR for age-4 KRFC does not exceed 0.16. Implementation of the management framework will ensure that pre-season projections of Chinook catch in California ocean salmon fisheries are not exceeded, thereby maximizing the likelihood that fisheries will not exceed the age-4 KRFC HR objective.
- To assess the effects of the proposed action on CC Chinook salmon, we considered the effects of the proposed action on the status of the populations, strata, and ESU. The proposed action will affect the abundance of CC Chinook salmon. We do not expect any measurable effects on spatial structure or diversity. Productivity may be affected but those effects would be the result of changes in abundance and are accounted for in the effects analysis.
- Since 2000, PFMC fisheries have been managed under the CC Chinook salmon conservation objective. Abundance in each diversity strata of CC Chinook salmon has remained stable or shown improvement despite several years where the HR has exceeded 0.16. Under the proposed action, we expect the post-season HR to stay within the 0.16 HR limit, thus based on past performance we would expect Chinook salmon in each of the CC Chinook salmon diversity strata to continue to persist with potential for increased

abundance in some of the strata. Therefore, we expect the ESU to persist with potential for increased abundance with the proposed action.

- Our analysis indicates the proposed action should be effective in constraining age-4 KRFC HRs below 0.16, which would result in reduced ocean harvest of KRFC as compared to recent years and the long-term average. Because we use KRFC as a surrogate to limit the impacts of ocean fisheries on CC Chinook salmon, a reduction in the ocean HR would also result in reduced impacts on CC Chinook salmon. From this, we infer that management measures designed to limit the ocean harvest of KRFC to 0.16 or less, as estimated post-season, would reduce impacts on CC Chinook salmon compared to recent years.

Cumulative effects

- Activities in the action area are primarily those conducted under state, tribal or Federal government management. Future tribal, state, and local government actions will likely be in the form of legislation, administrative rules, or ocean policy initiatives; shoreline growth management and development; designation of marine protected areas; and resource permitting, including fishing. Private activities include continued resource extraction, vessel traffic, development, and other activities that contribute to non-point source pollution. We assume that effects of future tribal, state, or private activities in the action area will have a neutral or positive effect for the duration of this opinion.

In summary, we have considered the effects of the proposed action together with the status of the species, the conditions in the environmental baseline, and cumulative effects. Extinction risk for the ESU is moderate and has remained unchanged since the previous viability assessment. Available data on long-term trends in abundance are severely limited across the CC Chinook salmon ESU, however, there have been improvements in data availability in recent years. Abundance appears to be stable or increasing for many populations across the strata and ESU but some populations have decreased in abundance. We reviewed the effects of the proposed action and determined that impacts on CC Chinook salmon from the proposed action will allow for persistence of CC Chinook salmon with the potential for increased abundance and is not likely to impede recovery of the CC Chinook salmon ESU. Climate change will continue to adversely affect the CC Chinook Salmon ESU and there is uncertainty in the level of effects. We do not believe the effect of climate change alters our analysis of the effects of the proposed action, the environmental baseline, and cumulative effects. However, the risk posed by climate change, coupled with low abundance and declining abundance of some CC Chinook salmon populations, necessitates careful management of the PFMC fisheries so that they do not exceed the CC Chinook salmon conservation objective. With the adoption of the framework to achieve conservation objectives for California stocks of Chinook salmon, we expect that this multilayered conservative approach (i.e., a buffer, fishery output control, and in-season actions) will ensure that the fisheries remain within the pre-season projections and will not exceed the CC Chinook salmon conservation objective.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' opinion

that the proposed action is not likely to jeopardize the continued existence of the CC Chinook Salmon ESU.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In this opinion, NMFS determined that incidental take is reasonably certain to occur from the proposed action of authorizing ocean salmon fisheries pursuant to the salmon FMP and promulgation of regulations implementing the salmon FMP.

NMFS anticipates incidental take of ESA-listed CC Chinook salmon to occur each year in PFMC salmon fisheries. Because it is not possible to estimate the annual abundance or harvest of CC Chinook salmon directly, we cannot quantify the expected incidental take in numbers of CC Chinook salmon. We have identified KRFC as an appropriate surrogate to limit the incidental take of CC Chinook salmon. In this opinion, we conclude that restrictions on KRFC HRs, as estimated post-season, together with implementation of the framework (see section 1.3), will effectively constrain impacts on CC Chinook salmon. Under the proposed action, PFMC salmon fisheries will be managed to not exceed the conservation objective of an ocean HR of age-4 KRFC of 0.16 as a surrogate for the CC Chinook Salmon ESU, as assessed post-season.

During the pre-season planning process, the PFMC will develop the annual management measures for the ocean salmon fisheries consistent with the CC Chinook salmon conservation objective and the framework. The HR for age-4 KRFC will be projected by the PFMC during the pre-season planning process and then estimated post-season. We expect the pre-season prediction to be an unbiased estimator of the post-season HR. Therefore, consistent with these expectations and the effects considered in this opinion, fisheries should be planned and managed so that the post-season ocean HR of age-4 KRFC does not exceed 0.16. However, we anticipate some level of management error may occur and considered that in our analysis. As a result, even with the implementation of the framework, the post-season HR could exceed 0.16 in some years. We do not expect this to happen in consecutive years, frequently, or that any exceedance would be substantial. Thus, the extent of take will be exceeded if the conservation objective is exceeded in successive years, frequently, or by substantial amount. As such we define two triggers for

exceeding the extent of take. The extent of take will be exceeded if either: 1) the post-season HR exceeds 0.16 more than once in any three-year period; or 2) the four-year rolling arithmetic mean of the post-season HR exceeds 0.16. The first trigger considers the frequency and recurrence of exceeding the conservation objective (e.g., two times in succession without interruption would exceed the trigger). The second trigger considers the magnitude of exceedance in relation to the previous three years.

The proposed action includes a new management framework intended to keep harvest impacts within the CC Chinook conservation objective. Therefore, the triggers for the extent of take above will begin with post-season HR for 2024. That is, the first year of implementation will only consider the HR achieved in 2024, the second year will consider the HR achieved in 2024 and 2025, and so on.

2.9.2 Effect of the Take

In this opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

NMFS concludes that the following RPMs are necessary and appropriate to minimize the impacts on listed species from fisheries considered in this opinion. In doing so NMFS, in cooperation with the PFMC, shall ensure that management measures and in-season actions are developed based on the best available information and are consistent with the conservation objective for CC Chinook salmon, the management framework described in the proposed action, the implementing regulations, and applicable provisions of the salmon FMP:

1. NMFS, in coordination with the PFMC, shall annually assess the effectiveness of the measures designed to keep the HR for KRFC, as assessed post-season, within the conservation objective and report that information to the PFMC.
2. NMFS, in cooperation with the PFMC, shall ensure harvest impacts on KRFC are monitored using the best available measures such that harvest estimates are available for in-season management and post-season assessment.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. NMFS, or any applicant, has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse. Although NMFS is the Federal agency responsible for ensuring that this reasonable and prudent measure is carried out, it is the states, tribes, PFMC, and U.S. Fish and Wildlife

Service (USFWS) that conduct monitoring and reporting of catch and other data necessary to complete the analyses of impacts.

1. The following terms and conditions implement RPM 1:
   a) NMFS, in cooperation with the affected states and the PFMC, must ensure that the pre-season projected and post-season HRs for age-4 KRFC and the average percent error for the previous five years are estimated and reported each year.
   b) NMFS, in cooperation with the affected states and the PFMC, must ensure that the effectiveness of in-season management to keep harvest within pre-season projections is assessed and reported each year.
2) The following terms and conditions implement RPM 2:
   a) NMFS, in cooperation with the affected states and the PFMC, must ensure that harvest impacts in ocean salmon fisheries are monitored on an annual basis using the best available measures. Catch monitoring must be stratified by gear, time, and management area.
   b) NMFS, in cooperation with the affected states and the PFMC, must ensure that fisheries are sampled for stock composition, including the collection of coded wire tags and other biological information, to allow for a thorough, representative, and robust post-season analysis of fishery impacts on age-4 KRFC.
   c) NMFS, in cooperation with the affected states, tribes, the PFMC, and USFWS, must ensure that data on spawning populations of KRFC and CC Chinook salmon are collected. Surveys of spawning populations must be conducted at a level sufficient to provide reliable estimates of abundance. Where possible, surveys of spawning populations of CC Chinook salmon should be increased to address data gaps discussed in this opinion.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. NMFS, in collaboration with the PFMC and the state of California, should continue to increase the amount and quality of information collected on escapement of CC Chinook salmon.
2. NMFS, in collaboration with the PFMC and the state of California, should continue to develop tools that can be used in-season to monitor and manage harvest, contact-rate-per-unit-effort, and other effects of ocean fisheries in order to reduce the potential for exceeding the CC Chinook salmon conservation objective.
3. NMFS, in collaboration with the PFMC and the state of California, should continue to develop indicators to identify conditions contributing to high contact-rate-per-unit-effort or changes in Chinook salmon distribution and evaluate how that information could be used in management of ocean salmon fisheries.

4. NMFS, in collaboration with the affected states and the PFMC, should investigate ways to collect information to estimate the harvest impacts of ocean fisheries on CC Chinook salmon.
5. NMFS, in collaboration with the affected states and the PFMC, should work to increase the amount of information gathered on marine survival and migration patterns of CC Chinook salmon.

2.11 Reinitiation of Consultation

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in the opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

2.12 "Not Likely to Adversely Affect" Determinations

CC Chinook Salmon ESU Critical habitat

Critical habitat for CC Chinook salmon was designated in 2000 (65 FR 7764; March 17, 2000). In 2005, the designation was reaffirmed, and minor updates were made (70 FR 52488; September 2, 2005). Critical habitat for CC Chinook salmon includes watersheds from Redwood Creek (Humboldt County, California) in the north to the Russian River (Sonoma County, California) in the south.

The following physical or biological features (PBFs) were designated as essential for conservation of the CC Chinook Salmon ESU:

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.
- Freshwater rearing sites with:
    - water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    - water quality and forage supporting juvenile development; and
    - natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
- Estuarine areas free of obstruction and excessive predation with:

- Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
- Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
- Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Designated critical habitat for the CC Chinook Salmon ESU does not include the EEZ and marine coastal waters off Washington, Oregon, and California, where the proposed action would occur. A consequence of the proposed action is that some salmon may die and will not return to freshwater areas within designated critical habitat as they would have if not for the proposed action. We considered the consequence of an unknown number of CC Chinook salmon not returning to freshwater areas and how this would affect PBFs of critical habitat. We determined that it is not possible to meaningfully measure, detect, or evaluate any potential changes in the value of PBFs. Additionally, the location of any impacts would be unknown and speculative given the number of populations in the ESU and the low level of expected mortality based on use of the KRFC surrogate. Therefore, any impacts would be so broad and diffuse that they would not meaningfully relate to the species under consultation. Consequently, we conclude that effects on critical habitat for the CC Chinook salmon ESU would be insignificant, discountable, and not likely to adversely affect critical habitat.

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

The analysis is based, in part, on the EFH assessment provided by NMFS and descriptions of EFH for Pacific coast groundfish (PFMC 2022b), CPS (PFMC 2021a), Pacific coast salmon (PFMC 2022c), and HMS (PFMC 2022a) contained in the FMPs developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

For this EFH consultation, the proposed action and action area are described in detail above in sections 1.3 and 2.3, respectively. The action area is the EEZ and the marine waters of the states of Washington, Oregon, and California (Figure 11). The estuarine and offshore marine waters are designated EFH for various life stages of Pacific Coast salmon, Pacific Coast groundfish, CPS, and HMS managed by the PFMC.

Pursuant to the MSA, the PFMC has designated EFH for six CPS (PFMC 2021a), over 90 species of groundfish (PFMC 2022b), 11 HMS (PFMC 2022a), and three species of Pacific salmon (Chinook salmon, coho salmon, and pink salmon) (PFMC 2022c). The PFMC does not manage the fisheries for chum salmon or steelhead. Therefore, EFH has not been designated for these species.

EFH for CPS includes all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10° C to 26° C (PFMC 2023a). The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10°C isotherm, which varies seasonally and annually. The EFH designation for all species of krill extends the length of the West Coast from the shoreline to the 1,000-fathom isobath and to a depth of 400 meters. A more detailed description and identification of EFH for CPS is found in the most recent CPS FMP (PFMC 2023a).

EFH for groundfish includes all waters, substrates and associated biological communities from the mean higher high-water line, or the upriver extent of saltwater intrusion in river mouths, seaward to the 3,500-meter depth contour plus specified areas of interest such as seamounts (in depths greater than 3,500 meters) (PFMC 2023c). Additionally, EFH for groundfish includes any areas designated as Habitat Areas of Particular Concern not already identified by the previous criteria. A more detailed description and identification of EFH for groundfish is found in the most recent Pacific Coast Groundfish FMP(PFMC 2023c).

EFH for HMS ranges from vertical habitat within the upper ocean water column, from the surface to depths generally not exceeding 200 meters, to vertical habitat within the mid-depth ocean water column (from depths between 200 and 1,000 meters). These range from coastal waters as shallow as 11 meters) to the open sea, beyond continental and insular shelves. For a more detailed description of EFH for each highly migratory species, see the most recent FMP for U.S. West Coast Fisheries for HMS(PFMC 2023b).

Marine EFH for Chinook, coho, and pink salmon in Washington, Oregon, and California includes all estuarine, nearshore, and marine waters north of Point Conception within of the EEZ, 200 nautical miles offshore. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers, and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 18 to the Pacific Coast Salmon Plan (PFMC

2014). Assessment of potential adverse effects on these species' EFH from the proposed action is based, in part, on this information.

The harvest-related activity of the proposed action considered in this consultation involves boats using hook-and-line gear. The use of hook-and-line gear affects the water column rather than estuarine and near shore substrate or deeper water, offshore habitats.

3.2 Adverse Effects on Essential Fish Habitat

The PFMC assessed the effects of fishing on salmon EFH, mostly in freshwater, and provided recommended conservation measures in Appendix A to Amendment 18 of the Pacific Coast Salmon Plan (PFMC 2014). The PFMC identified five types of impacts on EFH: 1) gear effects; 2) harvest of prey species by commercial fisheries; 3) removal of salmon carcasses; 4) redd or juvenile fish disturbance; and 5) fishing vessel operation on habitat.

Salmon fishing activities have decreased over the last three decades. Therefore, any gear related effects have also been reduced over this period. Derelict gear effects occur in fishing activities managed by the PFMC and in fishing activities not managed by the PFMC. However, the action considered in this opinion does not include commercial trawl nets, gillnets, long lines, purse seines, crab and lobster pots or recreational pots. These types of gear losses are those most commonly associated with effects on EFH. Hook-and-line gear is not placed into this category, and so long as the action continues to authorize fisheries using hook-and-line regulations, gear effects on EFH will not occur.

Prey species can be considered a component of EFH (NMFS 2010c). However, the action considered in this opinion is promulgation of fisheries targeting adult salmon, which are not considered prey for any of the remaining species managed under the other three Pacific coast FMPs. Furthermore, the salmon fisheries considered in this opinion have not documented interception of prey species for the adult species managed under the other three FMPs either.

The PFMC addresses the third type of possible EFH impact, the removal of salmon carcasses, by continuing to manage for maximum sustainable spawner escapement (to the extent information is available) and implementation of management measures to prevent overfishing. The use of proper spawner escapement levels and harvest constraints ensures PFMC salmon fisheries are returning a consistent level of marine-derived nutrients back to freshwater areas.

Fishing vessel operation will occur in the EEZ as a result of the action. Vessels can adversely affect EFH by affecting physical or chemical mechanisms. Derelict, sunk, or abandoned vessels can cause physical damage to any bottom habitat the vessel comes into contact with. Vessels operate in the EEZ during fisheries governed by any of the four FMPs, and for other non-fishing related activities. All these operations provide potential for physical damage to any bottom habitat.

As discussed above, the use of hook-and-line gear in the fisheries promulgated through the action (see section 1.3) considered in this opinion does not contribute to a decline in the values of estuarine and near shore substrate or deeper water, offshore habitats through gear effects. As adult salmon are not known prey species for the other species in the remaining three FMPs, prey removal is also not considered to have a discernable impact on EFH. Additionally, the fishery

does not occur within freshwater EFH, therefore redd or juvenile fish disturbance will not result from the action in this opinion. Fishing vessel operation resulting from the action has the potential for physical damage to marine EFH. Generally, fishing effort has fluctuated in recent years, but has remained much lower than the 1979-1990 average (PFMC 2022g). The fishing effort solely attributable to the action considered in this opinion is unknown. However, based on the gear type used and the total fishing effort, the effect on essential habitat features of the affected species from the action discussed in this opinion will be minimal, certainly not enough to contribute to a decline in the values of the habitat.

It is NMFS' opinion that no discernible adverse effects on EFH for species managed under the FMPs for CPS (PFMC 2023a), Pacific Coast Groundfish(PFMC 2023c), HMS (PFMC 2023b), and Pacific Coast Salmon (PFMC 2022c) will result from the proposed action considered in this opinion.

3.3 Essential Fish Habitat Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. However, NMFS concludes that sufficient measures addressing possible EFH impacts have been adopted for the PFMC fisheries and the proposed fisheries will not adversely affect EFH. Therefore, no additional conservation recommendations beyond those identified and already adopted are needed.

3.4 Statutory Response Requirement

Because there are no conservation recommendations, there are no statutory response requirements.

3.5 Supplemental Consultation

The NMFS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The DQA specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are NOAA's NMFS, the PFMC, and its associated participating entities. Individual copies of this opinion were provided to the PFMC via electronic mail. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data, and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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