UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

January 14, 2022 **Refer to NMFS No:** WCRO-2021-02179

Amy Dutschke
Regional Director
Bureau of Indian Affairs
Pacific Regional Office
2800 Cottage Way, Room W-2820
Sacramento, California 95825

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Hatchery and Genetics Management Plan (HGMP) for Hoopa Valley Tribal Hatchery Coho Salmon

Dear Ms. Dutschke:

Thank you for your letter of August 25, 2021, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Hoopa Valley Tribe's Hatchery and Genetics Management Plan (HGMP) for coho salmon.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)], and concluded that the action would adversely affect the EFH of Pacific coast salmon. Therefore, we have included the results of that review in Section 3 of this document.

Based on the best scientific and commercial information available, NMFS concluded in the biological opinion that the proposed action is not likely to jeopardize the continued existence of the Southern Oregon/Northern California Coast (SONCC) coho salmon evolutionarily significant unit. Our biological opinion does not include an analysis of the effects to SONCC coho salmon critical habitat, as none has been designated in the action area.

Thank you for the time your staff has invested in working with the Hoopa Valley Tribal staff in developing the HGMP for their coho salmon production. NMFS looks forward to continuing to work with you on the implementation of this HGMP and on-going recovery efforts in the Trinity River. Please contact Seth Naman at seth.naman@noaa.gov or 707-825-5180 if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

ec: Jay Hinshaw, BIA, jay.hinshaw@bia.gov
Mike Orcutt, HVT, director@hoopa-nsn.gov
ARN 151422WCR2021AR00172

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Hatchery and Genetics Management Plan (HGMP) for the
Hoopa Valley Tribal Hatchery Coho Salmon

NMFS Consultation Number: WCRO-2021-02179
Action Agency: Bureau of Indian Affairs

Table 1. Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?
Southern Oregon Northern California Coast coho salmon ESU	Threatened May 6, 1997 (62 FR 24588)	Yes	No

Table 2. Essential Fish Habitat and NMFS' Determinations:

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	Yes	Yes

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: January 14, 2022

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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

NOAA's 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 two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at California Coastal NMFS office.

1.2. Consultation History

On September 25, 2020, NMFS approved the Trinity River coho salmon Hatchery and Genetics Management Plan (HGMP) under Limit 5 of the ESA 4(d) Rule for salmon and steelhead, 50 CFR 223.203 (July 10, 2000; 65 FR 42422, amended June 28, 2012, 70 FR 37160), provided that the hatchery operations are implemented in accordance with the implementation and reporting requirements.

The 4d approval includes the distribution of all eggs, fry, juvenile, or adult coho salmon in excess of those needed to produce coho salmon yearlings released at Trinity River Hatchery (TRH) to an entity with a supplementation plan approved by NMFS, for supplementation of tributaries (in any of the three Trinity River coho salmon population units) for conservation of the populations. The Hoopa Valley Tribe (HVT) requested the use of excess coho salmon from the Trinity River Hatchery for their tributary supplementation.

On June 24, 2021, NMFS virtually met with the Bureau of Indian Affairs (BIA) and HVT to discuss the proposed HVT coho salmon hatchery. Since that meeting and through August 2021, NMFS provided technical assistance to the HVT on the drafting of the HGMP for coho salmon supplementation. On August 25, 2021, the BIA requested formal consultation with NMFS on the HVT's coho salmon supplementation plan (HVT 2021).

On December 13, 2021, representatives from the BIA, HVT, and NMFS virtually met to discuss the HVT's short and long term hatchery operations, and agreed that 12 years would be the appropriate length for this section 7 consultation. During the next few years, NMFS and the HVT will coordinate on a revised HGMP to incorporate local broodstock management into the hatchery operations for an eventual tribal 4d process.

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). The BIA proposes to fund the HVT to operate the HVT’s hatchery (HVTH) for coho salmon, pursuant to Section 7 of the ESA.

The Hoopa Valley Tribe Fisheries Department (HVTFD) proposes to begin rearing coho salmon eyed eggs at the HVTH in the winter of 2021. Beginning in the spring and summer of 2022, the HVT will release coho salmon at the parr life stage into tributaries of the lower Trinity River on the Hoopa Valley Reservation (HVR). Releases are planned initially for 50,000 coho salmon parr, up to 100,000 parr the second year, and up to 200,000 parr in subsequent years. The purpose of the HVTH is to encourage reseeding of HVT tributaries with coho salmon and to provide a harvest benefit while minimizing ecological and genetic impacts to ESA-listed coho salmon. Details regarding adult spawning and broodstock management for this hatchery are not contained in this document, but rather incorporated by reference in the Bureau of Reclamation (Reclamation) and the California Department of Fish and Wildlife (CDFW) (2017).

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. We considered whether or not the proposed action would cause any other activities that would have consequences on SONCC coho salmon or its critical habitat and determined that it would contribute to a prolonged tribal fisheries in the lower Klamath and Trinity rivers.

1.3.1. Program Performance Standards

The following are the performance standards and their definitions for the HVTH (Table 3):

1) Promote genetic and life history diversity in locally adapted Lower Trinity River coho salmon populations produced by HVTH through the initial seeding of HVR tributaries with TRH derived stock;
2) Augment, restore and create viable naturally spawning populations using conservation and reintroduction strategies;
3) Provide fish for harvest in a manner which minimizes the risk of adverse effects on listed wild populations.

Table 3. Performance standard definitions for the HVTH. Adapted from Reclamation and CDFW (2017).

Performance Standard	Definition
Achieve Hatchery Best Management Practices	Culture practices are intended to increase life-stage specific survival rates, protect the genetic resources of cultured population, produce a high-quality rearing environment
Produce High Quality Pre-smolts	High quality pre-smolt has similar genetic, physical, behavioral traits and survival rates to naturally produced fish.
Achieve Production Targets	Culture and release the number of juveniles necessary to achieve annual production targets.
Achieve Conservation Objective(s)	The conservation objective of this program is to be consistent with the protection of genetic resources of Trinity River coho salmon.

1.3.2. Performance Indicators

The HVTH intends only to obtain eggs and/or fry produced at TRH. Accordingly, performance indicators associated with genetic risks particularly as they relate to broodstock selection and hatchery origin recruit (HOR) straying will be consistent with the TRH Hatchery and Genetic Management Plan (HGMP). Otherwise, specific performance indicators for the HVT HGMP largely address juvenile life stages and expected returns of adult HORs to the target areas for seeding (Table 4).

Table 4. Hatchery performance indicators, metrics used to assess or actions taken to ensure performance, and the benefits of high performance, risks of low performance, and how indicators will be monitored and evaluated.

Indicator	Metric/Action	Benefits and Risks and Monitoring and Evaluation
High fry to parr survival rate	Initial anticipated Survival Rate(s): >80% Egg-to- Fry >80% Fry-to- Parr	Benefit: Hatchery culture practices that maximize life-stage survival make the most efficient use of the resource and reduce the need to include additional NOR adults for use as broodstock. Risk: Low egg-to-fry, fry-to-parr survival rates would indicate poor hatchery culture practices or physical and environmental constraints.
Number and Severity of Disease Outbreaks is Low	Follow Best Culture Practices	Benefit: Having fewer and less severe disease outbreaks reduces the disease risks that hatchery populations and operations pose to natural populations. This results in better natural population productivity, diversity and spatial structure as natural populations located close to the hatchery may be more impacted than those farther away. Minimizing disease losses also allows accurate evaluation of the number of contributing parents and family size variation, which are important components of effective population size estimates. Risk: Frequent and severe disease outbreaks reduce population productivity and require higher numbers of natural and hatchery origin broodstock to produce a similar number of fish. The use of more natural origin fish in the hatchery reduces natural spawning escapement, which may reduce population productivity, spatial structure, and diversity.

Indicator	Metric/Action	Benefits and Risks and Monitoring and Evaluation
Release Timing, Fish Health, Size and Condition of Released Fish Produce High Survival	Fish Size at Release (70 - 100 fish per pound [fpp]) Release Window (June 1 and July 15) and Health Certification	Benefit: Releasing healthy fish at target size and time increases overall survival and reduces the release numbers needed to achieve conservation and harvest objectives. Risk: Releasing fish that are too large may result in increased predation on natural fish. A mismatch between release timing and environmental conditions required for good survival may reduce overall hatchery performance. This could also result in precociousness, i.e., fish that never go to the ocean, but become sexually mature.
High Parr-to-Adult Return Rate (PAR)	Average PAR >0.53 percent	Benefit: High PAR is an indicator that the hatchery is producing a high quality parr that can survive in the natural environment from point of release to return as an adult. The higher the survival rates the fewer hatchery fish that need to be produced to achieve conservation and harvest objectives. Decreased hatchery production reduces interaction with the natural population, which may result in increased natural fish abundance. coho salmon PAR in the northwestern contiguous United States has been demonstrated to vary between 0.19 - 0.87% (Lauren and Allen 1958 & Wunderlich 1993). Risk: Low survival rates may indicate that rearing practices are producing a fish of lesser quality. Hatchery production levels required to achieve conservation and harvest objectives may be higher than optimal and represent a risk to natural populations.
Adult Run-timing (HOR and NOR)	Support Similar Adult Run-timing by obtaining egg/fry from TRH which are representative of entire run of HOR/NOR coho salmon	Benefit: For integrated programs, the run-timing of hatchery and natural runs should match, as this is an indicator that the two populations are expressing similar life- histories, and that both are being exposed and adapting to the full range of environmental conditions present in the basin. Risk: A mismatch in run-timing between the two populations (HOR and NOR) indicates that hatchery practices are selecting for life histories dissimilar from those being expressed by the natural population. The two populations may become more divergent over time resulting in greater genetic impacts to natural populations from hatchery fish spawning in the natural environment. This could include a loss in productivity, diversity, and spatial structure.
High HOR Straying	While proportion of hatchery origin spawners (pHOS) <0.05 in Lower Trinity coho salmon Population in areas above HVR pHOS >0.05 in the HVR portion of the Lower Trinity Population	Benefit: Good homing fidelity of HOR fish to the acclimation tributaries is important for encouraging natural reproduction in under seeded habitats. Risk: High HOR straying rates may result in the population becoming more and more adapted to the hatchery rather than the natural environment. This makes the population less resistant or adaptable to environmental change, reduces population diversity, and increases the need for using NORs from these populations as hatchery broodstock (i.e., increases proportion of natural origin broodstock (pNOB)).
Provide harvest opportunities for HVT while minimizing	Production of HOR at HVTH is balanced to provide for meaningful fishery and sufficient HOR seeding in HVR	Benefit: HVT access to surplus HOR's to complement harvest while pHOS is reduced. Risk: HVT Fishery removes too many HVTH HORs impacting sufficient HOR seeding of available habitat in HVR tributaries.

Indicator	Metric/Action	Benefits and Risks and Monitoring and Evaluation
impacts on natural origin coho salmon	portion of Lower Trinity Population	

1.3.3. Type of program

No broodstock will be collected and no spawning of adults will occur as part of the proposed action. The TRH coho salmon program, where eggs and fry would be obtained, is operated as an integrated program as defined by the California Hatchery Scientific Review Group (CA HSRG 2012) and the Pacific Northwest Hatchery Scientific Review Group (HSRG 2004). The geographic extent of integration for the Upper Trinity River Population Unit from TRH is from the Junction City, CA weir, to TRH. Eggs and fry from the upper Trinity River Population Unit will be transported for release into the lower Trinity River Population Unit, which is deemed to be a segregated population from TRH.

1.3.4. Broodstock collection, origin, and mating

No broodstock will be collected, nor will any mating occur as a result of the Proposed Action. Broodstock collection and mating practices are detailed in Reclamation and CDFW (2017). Adult coho salmon collected as a result of TRH operations will be taken from the upper Trinity River population of coho salmon. Surplus eggs and fry will then be transferred to HVTH for incubation and rearing.

1.3.5. Expected size of program

The HVT proposes to release up to 200,000 hatchery-raised coho salmon parr into acclimation ponds on the lower reaches of restored tributary streams, as well as upper reaches of selected tributary streams with good coho salmon rearing habitat to encourage subsequent natural coho salmon seeding of the treated streams (Table 5). The program will release 50,000 coho salmon parr in 2022, 100,000 coho salmon parr in 2023, and 200,000 coho salmon parr in 2024.

Table 5. Production goals for the HVTH.

Release Years	Life Stage	Number of Releases
2022	parr 70-100fpp	50,000
2023	parr 70-100fpp	100,000
2024+	parr 70-100fpp	200,000

1.3.6. Egg take and incubation

Eggs will be taken at TRH and survival rates to eyed-up and/or ponding are outlined in Reclamation and CDFW (2017). The level of necessary eggs shall be roughly equivalent to 40% more than the intended stocking numbers in the particular production year. Presently, an additional 40% in excess of stocking numbers is targeted to account for up to 20% mortality in the egg to fry and fry to parr life stages respectively. This compensation for mortality may be adjusted depending on actual losses observed in the first two years of operation. As this program is dependent upon obtaining genetic material from TRH that would be surplus to TRH needs, the maximum number of fertilized eggs may be restricted by availability in any given year.

After the first year of operation, the anticipated life-stage survival rates will be reevaluated, and egg take will be adjusted accordingly for subsequent years of operation. Under this scenario, the HVTH doesn't anticipate the need to dispose of surplus eggs if the release goal is expected to be exceeded by 10%; surplus fry may be culled, or release level may be adjusted in consultation with NOAA.

Eggs average 112 to the ounce. In each Heath incubator tray, flows are between 3-10 gallons per minute (gpm) with an average flow rate of 5 gpm (Leitritz and Lewis 1980). Approximately 50-160 ounces of eggs will be placed in each vertical incubator tray (Leitritz and Lewis 1980); actual loading densities will be adjusted as needed to achieve target survival rate. Daily water temperature and dissolved oxygen monitoring will occur. Water temperature for incubation will be kept between 46 and 54°F depending on season. Dissolved oxygen level for incubation will be kept fully saturated. Water quality is generally expected to be excellent.

1.3.7. Incubation Facilities and Rearing Facilities

The hatchery building consists of 104 Heath stack trays used as vertical flow incubators and four 450-gallon round tanks used for rearing. At full 200,000 parr production, the HVT will use all the stack trays during the spawning season from October through December. The HVT plans to add an additional four 650 gallon and four 2,500-gallon tanks (see below for tank dimensions). Each tank is operated as a one-pass system with an inflow of up to 0.01 cubic feet per second (cfs). If all tanks are in use, the instantaneous water demand is expected to total 0.14 cfs.

Heath stack trays with vertical flow incubators will be used with 16 trays arrayed per stack and a total of 104 trays. Water flow is adjustable and will be set to achieve 5 gpm. Rearing facilities for fry and parr for the HVTH include the following:

- Four 450-gallon circular tanks: 190.5 cm x 66 cm,
- Four 650-gallon circular tanks: 216 cm x 76 cm,
- Four 2,500-gallon circular tanks: 305 cm x 122 cm.

1.3.8. Rearing

1.3.8.1 Density

Density and loading criteria monitoring will consist of weekly standard weight counts (defined by fish per pound) as well as fork length measurements to determine growth rate, condition factors and prevent overcrowding. The hatchery tracks average weight, in conjunction with mortality counts for each rearing unit. Fish are dispersed into more units as necessary to prevent exceeding the stocking density limits and to meet release standards. HVTH sets maximum rearing densities at 0.25 lbs/ft^3 or less in all the hatchery rearing units.

1.3.8.2 Feed

A dry formula crumble or pellet manufactured by Skretting, Inc. will be fed to juveniles. Fish will be fed 4 - 12 times daily depending on their size. Feeding rate range is 5 percent body weight (BW) for swim-ups to 0.8 percent body weight for parr.

1.3.8.3 Water Quality

Temperature and dissolved oxygen (DO) will be monitored daily. HVTH water temperature ranges between 45 and 54°F, depending on the season. DO level is kept minimally at 4.2 mg/L, with an acceptable average between 6.0-8.0 mg/L. Turbidity, pH, ammonia, and alkalinity parameters are monitored weekly or as needed.

1.3.8.4 Marking

All fish will be marked with an adipose fin clip and a coded wire tag (CWT) will be inserted in 100% of hatchery coho salmon parr prior to release from HVTH. CWT codes will be assigned by Pacific States Marine Fisheries Commission and final release data, including numbers released and effectively tagged and/or marked will be recorded with this agency upon release as well.

1.3.9. Acclimation, ponding and release

Two winter rearing ponds located on Mill Creek, HVR, that are each approximately 6 m x 6 m x 2 m (72 m^3) will be used for rearing, in addition to direct planting into HVR tributaries. Flow rate into ponds is from 0.67 to 2+ cfs depending on the season. Temperature of ponds ranges from 40-65°F. Conservatively, the ponds (combined) can accommodate 82,000 parr with an average size of 85 fpp during low flow and 245,000 parr at high flow. For purposes of this document, we will use the low threshold of 82,000 parr. This translates to 569 parr/m^3.

All coho salmon will be ponded at swim-up stage at a size of approximately 1,200 fish to the pound and 34 mm in length. Fish ponding is not volitional. Coho salmon ponding is expected to occur in approximately the first week of February through March 30th in a typical year. When pond capacity is reached, the remaining fish will be distributed among the headwater reaches of selected reservation tributaries with suitable coho salmon habitat. Suitable coho salmon habitat will be derived from (NMFS 2014). Temperature of rearing tanks will be matched to ponds and/or tributaries two weeks prior to release. Two weeks prior to release, HVTH staff will record temperature readings twice daily (AM and PM) at selected tributary sites (e.g., creek headwater or ponds). These temperature readings will be matched by water temperatures of hatchery rearing units prior to release. Temperature within these units will be monitored and adjusted daily to ensure fish are thermally acclimated to the current water temperature of tributary release points. Average water temperatures in HVR tributaries during the spring release period closely resemble the average 50°F temperature of HVTH well water.

HVTH reared coho salmon will be released as parr one year in advance of ocean migration. A portion of the fish will be placed in winter rearing ponds, though the majority will be released in headwater regions of Trinity and Klamath River tributaries on the HVR. Parr that are released into the winter rearing ponds on Mill Creek will be allowed to exit the ponds volitionally and enter tributaries. Parr that are released into selected tributaries will be allowed to exit the tributaries volitionally.

1.3.10. Fish transportation

In preparation of fish transportation to release, coho salmon parr will be stocked to the maximum capacity or the desired number of fish for a specific tributary or pond if under the maximum carrying capacity. There are two transportation trucks available for this task. One truck carries a 400-gallon transport tank that will be able to accommodate 710 pounds (approximately 60,000 parr) of fish with average fish length of 82 mm (length based on Condition Factor conversion). The other truck hauls a 250-gallon transport tank with the capacity to stock up to 445 pounds (approximately 38,000 parr). Transportation water temperature will be maintained at 50°F, maximum fish load will be decreased by 5.6% for each 1°F increase in water temperature (Piper 1982).

The transport tanks are equipped with oxygen aerators that will be monitored continuously (every 30 minutes) for DO. Level of DO saturation will be adjusted as necessary. A list of other water quality parameters and fish health assessment, including water temperature, initial water quality, fish health, ammonia, pH, trip duration, fish waste, and fish stress will also be documented. No temperature control measures will be undertaken given the short duration of the trip as well as the thick wall construction of the transport tank to insulate cold well water. The transport will not exceed two hours though the trip duration on average is expected to be an hour or less due to the close proximity of HVR tributaries to the HVTH.

For egg and fry transport to HVTH from TRH, eggs will be kept moist in trays, and fry will be transported in low density in closed oxygenated tanks. Water temperatures will be regulated in transport for both eggs and fry. For parr outplanting, a flatbed and/or pickup truck will be used with either 250 or 400-gallon mobile transport tanks. The tanks are constructed of 4-inch-thick fiberglass walls with a stainless-steel hull. Electrical and aeration hook-ups are built into the tanks for oxygen and air pump hookup. The tanks are equipped with eight-inch and six-inch cams, respectively, with quick-connect eight-foot hoses for fish release. If more than an eight-foot hose is required to span the distance from tank to release site, any additional distance will be accomplished with a fitted 6-8 inch PVC pipe span of necessary length.

1.3.11. Release locations

Several release locations in as many as seven streams may be utilized for release locations for coho salmon parr.

Table 6. Coho salmon release streams and gps coordinates of release locations.

Release site	GPS coordinates
Mill Creek	41.088757, -123.696447 41.180027, -123.564536 41.159131, -123.503151
Supply Creek	40.967952, -123.745403 41.035805, -123.709266
Pine Creek	41.002899, -123.768002 41.073469, -123.773244
Tish Tang Creek	41.098629, -123.496010 41.095467, -123.479510
Campbell Creek	40.971545, -123.699185
Soctish Creek	41.107089, -123.747559
Hostler Creek	41.069031, -123.586819

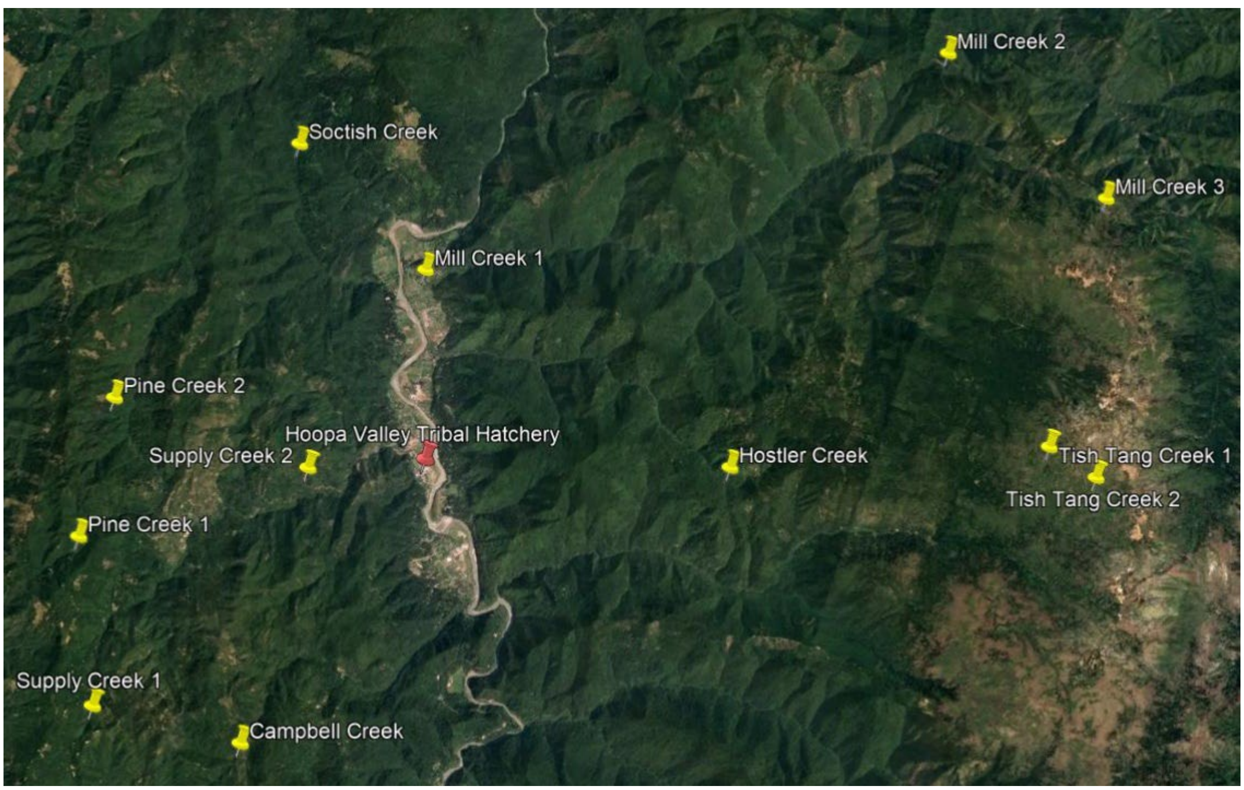

Figure 1. Map of coho salmon release locations.

1.3.12. Expected duration of program

As the purpose of the HVTH program is to restore naturally reproducing populations of coho salmon to the tributaries of the Lower Trinity River within the HVR, the program will continue for up to twelve years (four coho salmon generations). The program will be re-evaluated every two successive generations of coho salmon (6 years) and would include an examination of the proportion of NORs utilizing newly colonized reaches of seeded tributaries and the proportion on NOR/HOR juveniles as indicated with outmigrant trapping. As NOR/HOR proportion approaches 0.5, adult seeding with HOR in anadromous reaches of respective tributaries will be decreased and emphasis will be placed on stocking above anadromous reaches to reduce NOR-HOR interactions. As the viability of naturally reproducing populations increase, program practices will be re-evaluated and potentially augmented in order to further promote local adaptation to seeded tributaries.

1.3.13. Release dates

HVTH coho salmon parr will be released between June 1 and July 15 in HVR tributaries annually.

1.3.14. Water source

Water for the HVTH is derived from a sixty-five-foot subterranean well that taps into the bedrock aquifer of the Trinity River. Well water source supplies incubation trays, troughs, and circular tanks, limited by the capacity of the well pump at 75 gallons/minute (0.167 cfs). The 65 foot well taps into a true aquifer of the Lower Trinity River. After flowing through the HVTH and subsequent leach field, the water returns to the Lower Trinity River aquifer. Therefore, the water is naturally filtered upon entering and exiting the HVTH system and little water is wasted in this process.

1.3.15. Fish health monitoring

Routine fish health monitoring and sanitation procedures will be incorporated into standard hatchery operation protocols. Overall fish health maintenance and sanitation procedures include weekly rearing unit cleaning to remove accumulated solids and fish wastes to maintain a healthy rearing environment. Hatchery staff will assess health conditions daily based on general behaviors, external appearance, and appetite. Weight counts and fork length sampling will also be conducted weekly to examine growth, condition factors and overall fish health.

If a severe disease outbreak occurs, USFWS CA/NV Fish Health Center or/and CAHFS in San Bernardino is readily available to conduct pathogen identification, determine the likely cause of the outbreak, and apply necessary and appropriate treatments. Any pathologist-recommended treatments are implemented by HVTH personnel. Chemical treatments for external parasites are limited to those approved by the pathologist. Additional treatment for bacterial pathogens may be accomplished using Terramycin/Florfenicol medicated feed. Carcasses from juvenile fish mortalities are expected to be minimal and will be frozen for disposal at the local landfill. Pathologists from USFWS CA/NV Fish Health Center or CAHFS in San Bernardino will conduct pre-release fish health analyses. Fish will not be released until certified healthy by one of these laboratories.

1.3.16. Emergency procedures

HVTH will be staffed full-time and equipped with an automatic backup propane generator with activation alarm to help prevent catastrophic fish loss resulting from water system failure. A backup well pump and 1-2 days water storage (36,000 gallons) are on site. City water with installed dechlorinators is on site in case of backup systems failure.

A backup automatic-starting propane generator (25kw Cummins) is installed in event of power outage. This generator is dedicated exclusively for HVTH use. In the event the primary well pump fails, there is a backup well pump on site that will require one day of plumbing work (through a contractor with Whitson Plumbing and Electric, Willow Creek, CA) to switch out the malfunctioned pump. In the meantime, HVTH has water reserves in storage tanks that are sufficient to operate for 1 to 2 days without a functioning well pump. A water tanker will be contracted to fill three 12,000 water storage tanks daily in the event of complete power failure.

If, based on an assessment of the best available data, the facility manager determines that the facility is in imminent danger of flooding or water system failure, fish will be loaded and transported immediately from the hatchery to the selected tributaries on HVR for emergency release.

1.3.17. Monitoring and Evaluation of Performance Indicators

A number of measures within the hatchery program will be in place to minimize and avoid risks to ESA-listed species and other anadromous fish species. Most of the monitoring and evaluation activities of the Hoopa Valley Tribal Hatchery coho salmon program will be incorporated into, or facilitated by, routine operations within the hatchery.

The HVTFD will collect and record data of important aspects of the fish propagation program. This will include water quality, hatchery parr-adult-return rates, life stage survival rates, release timing, size, and condition, stray rates, and impacts on NOR coho salmon. These efforts will be emphasized under this HGMP. A summary of the in-hatchery monitoring and evaluation (M&E) activities is included in Table 7. After 2024, HVTFD will review program performance, attainment of performance criteria, and status of natural coho salmon production to determine if fish release numbers and/or release location should be altered.

Table 7. HVTH performance indicators, metrics and M&E methods.

Performance Indicator	Performance Metric	Monitoring and Evaluation Method
Eyed Egg-to-Fry Survival Rate	> 80%	HVTH staff will enumerate the number of eyed eggs prior to stocking of incubation trays at HVTH and the number of button-up fry prior to stocking of circular rearing units. These data will be documented.
Fry-to-Parr Survival Rate	> 80%	HVTH staff will enumerate the number of button-up fry prior to stocking of circular rearing units and the number of parr during the loading of fish to transport tanks prior to release. These data will be documented.
Release Timing	Between June 1 and July 15	The course of fish release including loading, transportation, and fish planting will take place and complete annually between June 1 and July 15. The exact release dates will be documented.
Release Size	70-100 fpp	Size at release information will be collected throughout the rearing period to ensure that growth profiles are appropriate to meet the fish size at release target within the identified range for each program. Length frequency data will also be collected bi-weekly from a sample of fish from each rearing unit.
Fish Health and Condition at Release	Issuance of health certification by pathology contractor prior to release	Pathologists from USFW CA/NV Fish Center or/and California Animal Heath and Food Safety (CAHFS) laboratory in San Bernardino will conduct health inspections of cultured fish one month prior to release which warrants a fish health certification ensuring the condition of parr at release.
Average Parr-to-Adult Return Rate (PAR).	0.53%	PAR will be calculated annually based on numbers of coho salmon parr released and numbers of HVTH HORs contributing to fisheries and escapement. All parr coho salmon released will be marked with an AD/CWT to facilitate run reconstruction.
Disease Control and Prevention: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.	Necropsies of fish to assess health, nutritional status, and culture conditions. Performance indicators will be based on test performed. Biosecure culture techniques.	Pathology contractors will conduct health inspections of cultured fish during any disease or parasite outbreak. Pathologists will instruct HVTH staff to implement corrective actions as needed. Pathology monitoring, disease/parasite outbreaks and issues, and corrective actions will be documented. A biosecurity plan will be established and adhered to by HVTH staff.
Adult Run-timing (HOR)	Adult run timing is representative of that seen at TRH	Ensure that eggs obtained from TRH are representative of run timing at that facility.
HOR Straying	pHOS <0.05 in Lower Trinity coho salmon Population above HVR. High pHOS initially (>0.05). Once natural origin returns increase, strive to achieve <0.05 pHOS	Monitor HOR coho salmon within tributaries of the HVR portion of the Lower Trinity River population. Information on both HOR adult returns and marked juvenile out migrants within HVR tributaries will be used to determine future supplementation strategy.

Performance Indicator	Performance Metric	Monitoring and Evaluation Method
Provide harvest opportunities for HVT while minimizing impacts on NOR coho salmon	Selective harvest of TRH HOR coho salmon	Monitor harvest in the ITMF and at the Hoopa Selective Harvest weir for the contribution of HVTH HORs. Contributions to other fisheries shall also be evaluated through CWT (e.g., Lower Klamath YT fishery).

1.3.18. Juvenile Monitoring Snorkeling Surveys

Snorkeling surveys will be conducted during late spring and summer following protocols based on O'Neal (2007) and Garwood and Ricker (2014). Surveyors enter each habitat unit wearing a dry or wet suit, mask, and snorkel, and count the number of juvenile coho salmon, steelhead, and Chinook salmon present, typically working in a downstream to upstream direction. On the first day of the survey, typically half (but up to 100%) of the pools and flat waters are snorkeled. On the second day, a fraction (~20%) of the habitat units snorkeled on the first day is resampled to estimate sampling error. This effort gives an approximation of juvenile coho salmon abundance prior to outmigration.

1.3.19. Adult Contributions to Fisheries

Determining adult returns to Trinity River of outplanted HVTH coho salmon will require recovery of fishery and escapement monitoring information. Presently, coho salmon are not legally retained in the recreational fishery within Klamath Basin, but are encountered and occasionally retained by un-knowledgeable anglers. Sampling of recreational fisheries is limited, but has occurred in the vicinity of Klamath River mouth by State of California samplers over recent decades. Additionally, the HVT has conducted creel sampling in the Lower Trinity River for three decades. The future of these efforts is not assured. However, in the event sampling does occur, every effort shall be made to recover the incidence of any illegally retained coho salmon in the recreational fishery.

Tribal fisheries by both the Hoopa Valley and Yurok Tribes encounter coho salmon on an annual basis. Total effort, catch, and biological sampling typically involves the examination of from 20% to 60% of the estimated total harvest. Biological sampling of these examined specimens provides recovery of coded wire tags (CWTs), which will be collated by HVTFD personnel on an annual basis to estimate total HVTH coho salmon contributions.

There are occasional mark selective fisheries in the southern Oregon marine recreational fisheries that are sampled by the State of Oregon. Recovered CWTs are generally appended to recovery records in the Pacific States Marine Fisheries Commission online database, which will be inspected annually to further determine contributions of HVTH to fisheries and then documented in HVTH annual reports.

1.3.20. Adult Contributions to Spawner Escapement

Beginning in fall after fish are observed moving up the mainstem Trinity River, surveys are conducted approximately every 4-7 days until mid-December. Mainstem surveys are generally conducted from drift boats while tributary surveys on HVR tributaries are conducted on foot by two-person crews walking upstream. Surveyors document the number of live coho salmon spawners, carcasses, and redds. Crews assign unique numbers to and flag all newly encountered redds. Records of live fish observations and location are recorded. Carcasses are scanned for presence of a CWT, adipose clip, and other marks or tags. If a carcass is still in good condition, scales will be collected. If the carcass has a CWT in the snout, the head is removed and frozen for subsequent CWT extraction. If redds are complete and no fish are present, redd measurements are taken without disturbing the redd. CWT recoveries from any sampled coho salmon shall add to harvest estimates for reconstructing adult returns to the river by HVTH produced coho salmon salmon. Length frequency analyses of fork lengths obtained from fish examined in redd/carcass and harvest monitoring surveys shall be used to determine the proportion of adults (age-3) relative to precocious returns (age-2).

1.3.21. CWT Retrieval

HVTFD will process all HVTH CWTs retrieved through various aforementioned surveys and/or agency efforts. These data will be included in the annual HVTH report. This effort will inform parr to adult returns (PAR), HOR, pHOS and fidelity of HVTH origin coho salmon.

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.

2.1. Analytical Approach

This biological opinion includes a jeopardy analysis. The proposed action area lies entirely within the bounds of the HVR, or within the bounds of the Yurok Tribal Reservation as it lies downstream of the HVR where coho salmon migrate. An adverse modification analysis is not included in this biological opinion because critical habitat has not been designated in the proposed action area. The decision to not list the Hoopa and Yurok Tribes' reservation lands as critical habitat for the SONCC coho salmon ESU included consideration of the unique government-to government relationship of the United States with Indian tribes and the need to respect the exercise of tribal sovereignty over the management of Indian lands and tribal trust resources as well as ESA section 7 consultations through BIA and other Federal agencies, in combination with the continued development and implementation of tribal resource management programs that support coho salmon conservation (64 FR 24049; May 5, 1999).

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, 44977; 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 to 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 a reasonable and prudent alternative to the proposed action.

A Proposed Action is analyzed for effects, positive and negative, on the attributes that define population viability (viable salmonid population, or VSP), including abundance, productivity, spatial structure, and diversity. The effects of a hatchery program on the status of an ESU or steelhead DPS "will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery fish within the ESU affect each of the attributes" (NMFS 2005). The presence of hatchery fish within the ESU can positively affect the overall status of the ESU by increasing the number of natural spawners, by serving as a source population for repopulating unoccupied habitat and increasing spatial distribution, and by conserving genetic resources. "Conversely, a hatchery program managed without adequate consideration can affect a listing determination by reducing adaptive genetic diversity of the ESU, and by reducing the reproductive fitness and productivity of the ESU" (NMFS 2005). NMFS also analyzes and takes into account the effects of hatchery facilities, for example, weirs and water diversions, on each VSP attribute.

The effects, positive and negative, for the two categories of hatchery programs are summarized in Table 8. Generally speaking, effects range from positive to negative for programs that use local fish for hatchery broodstock and from negligible to negative when a program does not use local fish for broodstock. Hatchery programs can benefit population viability but only if they use genetic resources that represent the ecological and genetic diversity of the target or affected natural population(s).

For a properly integrated hatchery program, the proportion of natural origin (NOR) coho salmon incorporated into the hatchery broodstock (pNOB) must exceed the proportion of the natural spawning population composed of hatchery fish (pHOS). Maintaining this ratio above 0.5 results in the natural environment having a greater influence on the adaptation of the composite NOR and HOR population than the hatchery environment (CA HSRG 2012). Referred to as the proportionate natural influence (PNI), this parameter is calculated as follows:

$$PNI = pNOB/(pNOB + pHOS).$$

High PNI values are expected to result in increased fitness, reproductive success, life history diversity and productivity of the population over time (Figure 2). Increasing the fitness of natural populations also increases the benefits that current and future habitat improvements produce with respect to fish production (HSRG 2014). These results show that many generations are required to increase fitness in a hatchery dominated stock, and higher PNI levels result in greater population abundance and fitness. Mixed hatchery and natural populations of salmon with a low PNI are known to suffer from poor reproductive success, and fail to meet NMFS criteria for maintaining productivity and diversity. Populations with a high proportion HOR spawners in the wild and low proportion of natural origin broodstock have fitness values that are lower than those of properly integrated populations (Figure 2), making them dependent on human supplementation and more at risk from catastrophic population declines from environmental stochasticity.

The term “local fish” is defined to mean fish with a level of genetic divergence relative to the local natural population(s) that is no more than what occurs within the ESU or steelhead DPS (70 FR 37215, June 28, 2005). Exceptions include restoring extirpated populations and gene banks.

Analysis of an HGMP or Proposed Action for its effects on ESA-listed species depends on seven factors. These factors are:

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

Table 8. An overview of the range of effects on natural population viability parameters from the two categories of hatchery programs.

Natural population viability parameter	Hatchery broodstock originate from the local population and are included in the ESU or DPS	Hatchery broodstock originate from a non-local population or from fish that are not included in the same ESU or DPS
Productivity	Positive to negative effect Hatcheries are unlikely to benefit productivity except in cases where the natural population's small size is, in itself, a predominant factor limiting population growth (i.e., productivity) (NMFS 2004b).	Negligible to negative effect This is dependent on differences between hatchery fish and the local natural population (i.e., the more distant the origin of the hatchery fish the greater the threat), the duration and strength of selection in the hatchery, and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).
Diversity	Positive to negative effect Hatcheries can temporarily support natural populations that might otherwise be extirpated or suffer severe bottlenecks and have the potential to increase the effective size of small natural populations. Broodstock collection that homogenizes population structure is a threat to population diversity.	Negligible to negative effect This is dependent on the differences between hatchery fish and the local natural population (i.e., the more distant the origin of the hatchery fish the greater the threat) and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).
Abundance	Positive to negative effect Hatchery-origin fish can positively affect the status of an ESU by contributing to the abundance and productivity of the natural populations in the ESU (70 FR 37204, June 28, 2005, at 37215).	Negligible to negative effect This is dependent on the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible effect), handling, maintenance, evaluation, and research and facility operation, maintenance and construction effects
Spatial Structure	Positive to negative effect Hatcheries can accelerate recolonization and increase population spatial structure, but only in conjunction with remediation of the factor(s) that limited spatial structure in the first place. "Any benefits to spatial structure over the long term depend on the degree to which the hatchery stock(s) add to (rather than replace) natural populations" (70 FR 37204, June 28, 2005 at 37213).	Negligible to negative effect This is dependent on facility operation, maintenance, and construction effects and the level of isolation achieved by the hatchery program (i.e., the greater the isolation the closer to a negligible affect).

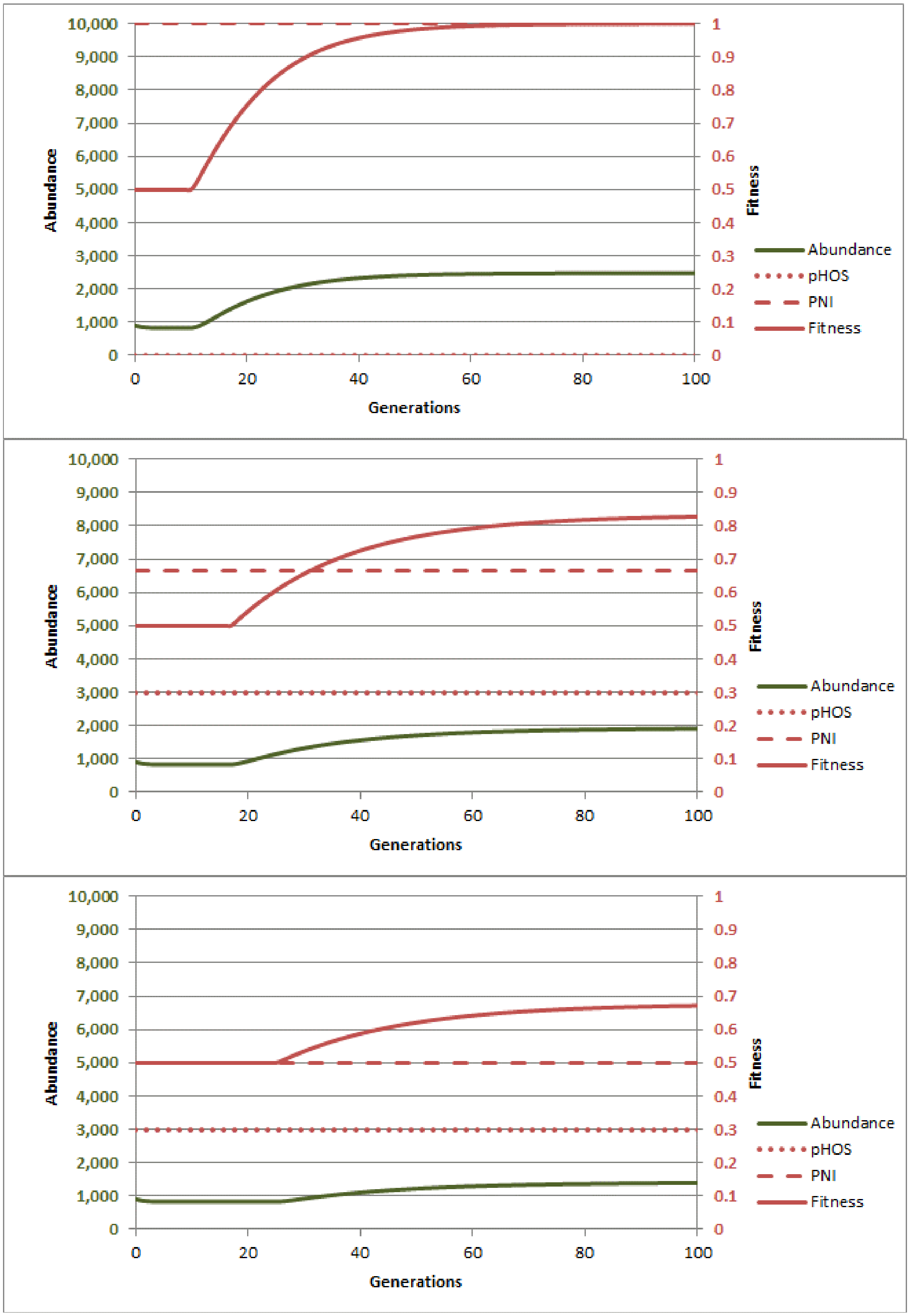

Figure 2. Estimated increase in adult abundance (green line) and fitness (red line) over 100 generations for a hatchery program operated to attain a PNI of 1.0 (Top), 0.67 (Middle) and 0.5 (Bottom). The analysis assumes that the initial hatchery program has a fitness value of 0.5.

The analysis assigns an effect for each factor from the following categories. The categories are:

(1) positive or beneficial effect on population viability,
(2) negligible effect on population viability, and
(3) negative effect on population viability.

"The effects of hatchery fish on the status of an ESU will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery within the ESU affect each of the attributes" (NMFS 2005). The category of affect assigned is based on an analysis of each factor weighed against the affected population(s) current risk level for abundance, productivity, spatial structure and diversity, the role or importance of the affected natural population(s) in ESU or steelhead DPS recovery, the target viability for the affected natural population(s), and the Environmental Baseline including the factors currently limiting population viability.

2.1.1. Factor 1

This factor considers the risk to a natural population from the removal of natural-origin fish for hatchery broodstock. The level of effect for this factor ranges from neutral or negligible to negative. A primary consideration in analyzing and assigning effects for broodstock collection is the origin and number of fish collected. The analysis considers whether broodstock are of local origin and the biological pros and cons of using ESA-listed fish (natural or hatchery-origin) for hatchery broodstock. It considers the maximum number of fish proposed for collection and the proportion of the donor population tapped to provide hatchery broodstock. "Mining" a natural population to supply hatchery broodstock can reduce population abundance and spatial structure. Also considered here is whether the program "backfills" with fish from outside the local or immediate area. The physical process of collecting hatchery broodstock and the effect of the process on ESA-listed species is considered under Factor 2.

2.1.2. Factor 2

NMFS also analyzes the effects of hatchery fish and the progeny of naturally spawning hatchery fish on the spawning grounds. The level of effect for this factor ranges from positive to negative. There are two aspects to this part of the analysis: genetic effects and ecological effects. NMFS generally views genetic effects as detrimental because, at this time, based on the weight of available scientific information, we believe that artificial breeding and rearing is likely to result in some degree of genetic change and fitness reduction in hatchery fish and in the progeny of naturally spawning hatchery fish relative to desired levels of diversity and productivity for natural populations. There is considerable debate regarding genetic risk. The extent and duration of genetic change and fitness loss and the short and long-term implications and consequences for different species, for species with multiple life-history types, and for species subjected to different hatchery practices and protocols remains unclear and should be the subject of further scientific investigation. Although there is biological interdependence between them, NMFS considers three major areas of genetic effects of hatchery programs: within-population diversity, outbreeding effects, and hatchery-influenced selection.

However, NMFS recognizes that there are benefits as well, and that the risks just mentioned may be outweighed under circumstances where demographic or short-term extinction risk to the population is greater than risks to population diversity and productivity. Conservation hatchery programs may accelerate recovery of a target population by increasing abundance faster than may occur naturally (Waples 1999). Hatchery programs can also be used to create genetic reserves for a population to prevent the loss of its unique traits due to catastrophes (Ford et al. 2011). Furthermore, As a result, NMFS believes that hatchery intervention is a legitimate and useful tool to alleviate short-term extinction risk, but otherwise managers should seek to limit interactions between hatchery and natural-origin fish and implement hatchery practices that harmonize conservation with applicable laws and policies (NMFS 2011). As we have stated above, in most cases, the effects are viewed as risks, but in small populations these effects can sometimes be beneficial, reducing extinction risk when there are few to noe naturally spawning coho salmon in natural areas.

2.1.3. Factor 3

NMFS also analyzes the potential for competition, predation, and premature emigration when the progeny of naturally spawning hatchery fish and hatchery releases share juvenile rearing areas. The level of effect for this factor ranges from neutral or negligible to negative. Several factors influence the risk of competition posed by hatchery releases: whether competition is intra- or interspecific; the duration of freshwater co-occurrence of hatchery and natural-origin fish; relative body sizes of the two groups; prior residence of shared habitat; environmentally induced developmental differences; and, density in shared habitat (Tatara and Berejikian 2012). En masse hatchery salmon smolt releases may cause displacement of rearing naturally produced juvenile salmonids from occupied stream areas, leading to abandonment of advantageous feeding stations, or premature out-migration (Pearsons et al. 1994). Pearsons et al. (1994) reported small-scale displacement of juvenile natural-origin rainbow trout from stream sections by hatchery steelhead.

Another potential ecological effect of hatchery releases is predation. Salmon and steelhead are piscivorous and can prey on other salmon and steelhead (Hawkins and Tipping 1999; Naman and Sharpe 2012). Predation, either direct (direct consumption) or indirect (increases in predation by other predator species due to enhanced attraction), can result from hatchery fish released into the wild. Considered here is predation by hatchery-origin fish and by the progeny of naturally spawning hatchery fish and by avian and other predators attracted to the area by an abundance of hatchery fish. However, substantial difference in body size between hatchery fish predators and wild fish prey is necessary for the predation risk to be high enough to warrant concern (Naman and Sharpe 2012). Without a large difference (greater than 50%) in body size between predator and prey, predation risk is expected to remain low (Naman and Sharpe 2012).

2.1.4. Factor 4

Based on a review of the scientific literature, NMFS' conclusion is that the influence of density dependent interactions on the growth and survival of salmon and steelhead is likely small compared with the effects of large-scale and regional environmental conditions and, while there is evidence that large-scale hatchery production can affect salmon survival at sea, the degree of effect or level of influence is not yet well understood or predictable. The same thing is true for mainstem rivers and estuaries. NMFS will monitor emerging science and information on the frequency, the intensity, and the effect of density-dependent interactions between hatchery and natural-origin fish. NMFS will consider re-initiation of section 7 consultation when new information reveals effects of the action that may affect listed species in a manner or to an extent not considered in this consultation (50 CFR 402.16).

2.1.5. Factor 5

NMFS also analyzes proposed M&E for its effects on listed species. The level of effect for this factor ranges from positive to negative. Generally, negative effects on the fish from M&E are weighed against the value or benefit of new information, particularly information that tests key assumptions and that reduces critical uncertainties. M&E actions including but not limited to collection and handling (purposeful or inadvertent), holding the fish in captivity, sampling (e.g., the removal of scales and tissues), tagging and fin-clipping, and observation (in-water or from the bank) can cause harmful changes in behavior and reduced survival. These effects should not be confused with handling effects analyzed under broodstock collection. In addition, NMFS also considers the overall effectiveness of the M&E program. There are five factors that NMFS takes into account when it assesses the beneficial and negative effects of hatchery M&E: (1) the status of the affected species and effects of the proposed M&E on the species, (2) critical uncertainties over effects of the Proposed Action on the species, (3) performance monitoring and determining the effectiveness of the hatchery program at achieving its goals and objectives, (4) identifying and quantifying collateral effects, and (5) tracking compliance of the hatchery program with the terms and conditions for implementing the program. After assessing the proposed hatchery M&E and before it makes any recommendations to the action agencies, NMFS considers the benefit or usefulness of new or additional information, whether the desired information is available from another source, the effects on ESA-listed species, and cost.

Hatchery actions also must be assessed for masking effects. For these purposes, masking is when hatchery fish included in the Proposed Action mix with and are not identifiable from other fish. The effect of masking is that it undermines and confuses M&E and status and trends monitoring. Both adult and juvenile hatchery fish can have masking effects. When presented with a proposed hatchery action, NMFS analyzes the nature and level of uncertainties caused by masking and whether and to what extent listed salmon and steelhead are at increased risk. The analysis also takes into account the role of the affected salmon and steelhead population(s) in recovery and whether unidentifiable hatchery fish compromise important M&E.

2.1.6. Factor 6

The construction/installation, operation, and maintenance of hatchery facilities can alter fish behavior and can injure or kill eggs, juveniles and adults. It can also degrade habitat function and reduce or block access to spawning and rearing habitats altogether. Here, NMFS analyzes changes to riparian habitat, channel morphology and habitat complexity, in-stream substrates, and water quantity and water quality attributable to operation, maintenance, and construction activities and confirms whether water diversions and fish passage facilities are constructed and operated consistent with NMFS criteria. The level of effect for this factor ranges from neutral or negligible to negative.

2.1.7. Factor 7

There are two aspects of fisheries that are potentially relevant to NMFS' analysis of HGMP effects in a Section 7 consultation. One is where there are fisheries that exist because of the HGMP (i.e., the fishery is an interrelated and interdependent action) and listed species are inadvertently and incidentally taken in those fisheries. The other is when fisheries are used as a tool to prevent the hatchery fish associated with the HGMP, including hatchery fish included in an ESA-listed ESU from spawning naturally. The level of effect for this factor ranges from neutral or negligible to negative. "Many hatchery programs are capable of producing more fish than are immediately useful in the conservation and recovery of an ESU and can play an important role in fulfilling trust and treaty obligations with regard to harvest of some Pacific salmon and steelhead populations. For ESUs listed as threatened, NMFS will, where appropriate, exercise its authority under Section 4(d) of the ESA to allow the harvest of listed hatchery fish that are surplus to the conservation and recovery needs of the ESU, in accordance with approved harvest plans" (NMFS 2005). In any event, fisheries must be strictly regulated based on the take, including catch and release effects, of ESA-listed species.

2.2. Rangewide Status of the Species

This opinion examines the status of SONCC coho salmon that would be adversely affected by the proposed action. Their status is determined by the level of extinction risk that the listed species faces, 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 current "reproduction, numbers, or distribution" of the species as described in 50 CFR 402.02.

In this Opinion, NMFS assesses four population viability parameters to help us understand the status of the SONCC coho salmon ESU and its ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity (McElhaney et al. 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Recovery Plan for SONCC coho salmon (NMFS 2014) to determine the general condition of each population and factors responsible for the current status of the ESU. We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20).

2.2.1. Status of SONCC coho salmon

The SONCC coho salmon ESU was listed as threatened on May 6, 1997 (62 FR 24588). The listing was most recently reaffirmed on June 28, 2005 (70 FR 37160). In 2005, the Final 4(d) protective regulations were published (70 FR 37160, June 28, 2005). Three hatchery stocks, Trinity River Hatchery, Iron Gate Hatchery, and Cole Rivers Hatchery on the Rogue River are included in the ESU. There are seven diversity strata in the SONCC coho salmon ESU, including the interior-Trinity Diversity Stratum (Table 9; Figure 3). Although long-term data on coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the last status review for populations in this ESU (Williams et al. 2016). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.

Table 9. Diversity strata of the SONCC coho salmon ESU, including the number of population types (F: functionally independent, P: potentially independent, D: dependent, and E: ephemeral) (Williams et al. 2008).

	Population types (*n*)			
Diversity Strata	F	P	D	E
Northern Coastal Basins	2	2	3	2
Central Coastal Basins	4	2	5	0
Southern Coastal Basins	3	1	2	0
Interior-Rogue River	3	0	0	0
Interior-Klamath	3	2	0	0
Interior-Trinity	2	1	0	0
Interior-Eel	2	4	0	0

The distribution of SONCC coho salmon within the ESU's range is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which SONCC coho salmon are now absent (Williams et al. 2011, Williams et al. 2016). Extant populations can still be found in all major river basins within the range of the ESU (70 FR 37160). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the range of the ESU indicate that the SONCC coho salmon spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution. A viable ESU contains populations that exist as a metapopulation that as an entity is naturally self-sustaining into the foreseeable future, no longer needs the protection of the Endangered Species Act, and therefore can be "delisted" – taken off the list of threatened and endangered species.

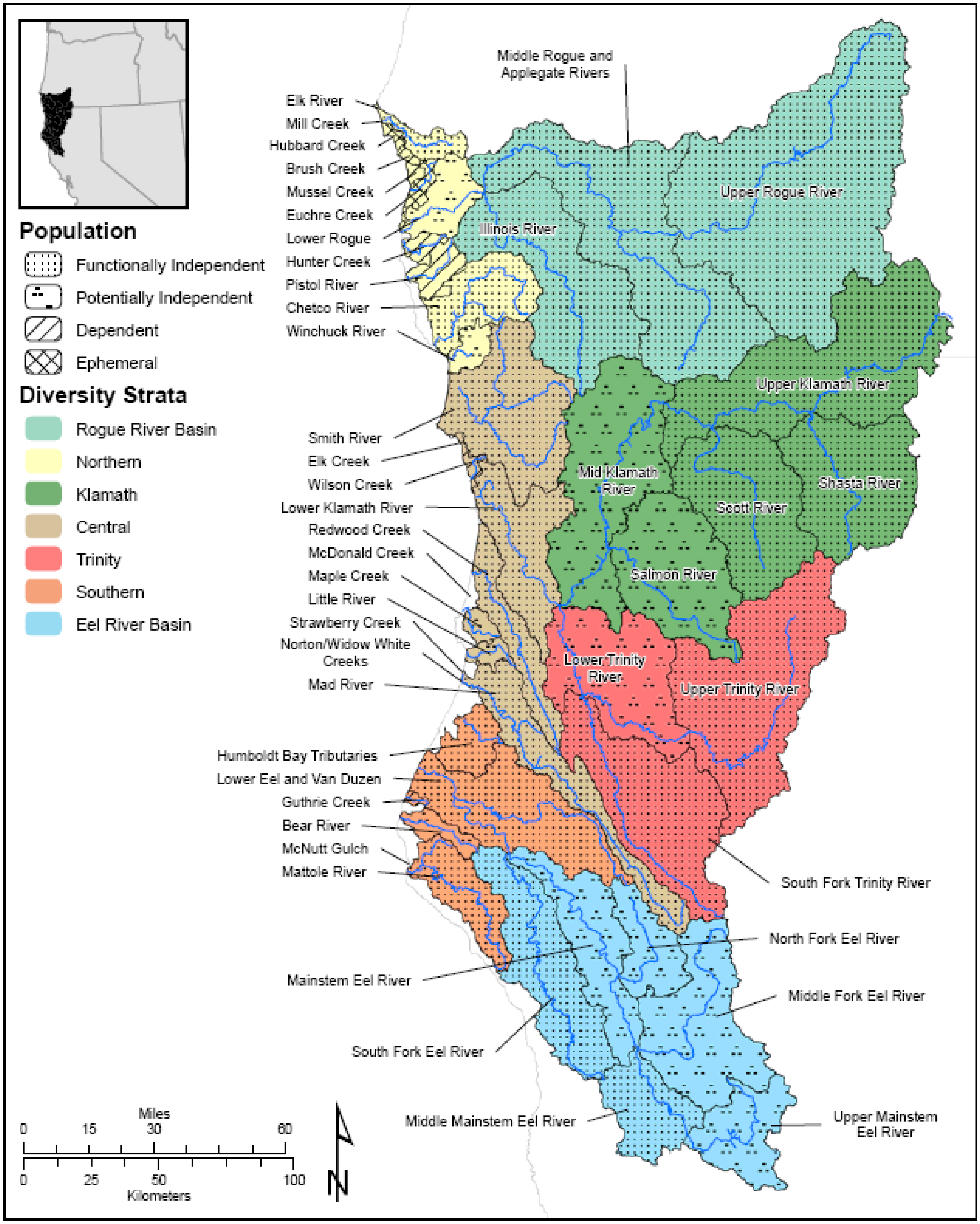

Figure 3. Diversity strata for populations of coho salmon in the SONCC ESU. From Williams et al. (2008).

2.2.2. Factors Responsible for the Decline of Species

The factors that caused declines include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good et al. 2005, Williams et al. 2016). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance of SONCC coho salmon (Good et al. 2005). From 2014 through 2016, the drought in California reduced stream flows and increased temperatures, further exacerbating stress, disease, and decreasing the quantity and quality of spawning and rearing habitat available to SONCC coho salmon. Ocean conditions have been unfavorable in recent years (2014 to present) due to El Niño conditions and the warm water "Blob" which impacted the U.S. west coast, and reduced ocean productivity and forage for SONCC coho salmon.

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). For this proposed action, the action area includes the Trinity River and associated tributaries within and downstream of the HVR, and the Klamath River from its confluence with the Trinity to its mouth in the Pacific Ocean (Figure 3). The action area also includes the nearshore portions of Pacific Ocean at the mouth of the Klamath River. The action area lies entirely within the bounds of the HVR and the Yurok Tribal Reservation, which do not have any designated critical habitat.

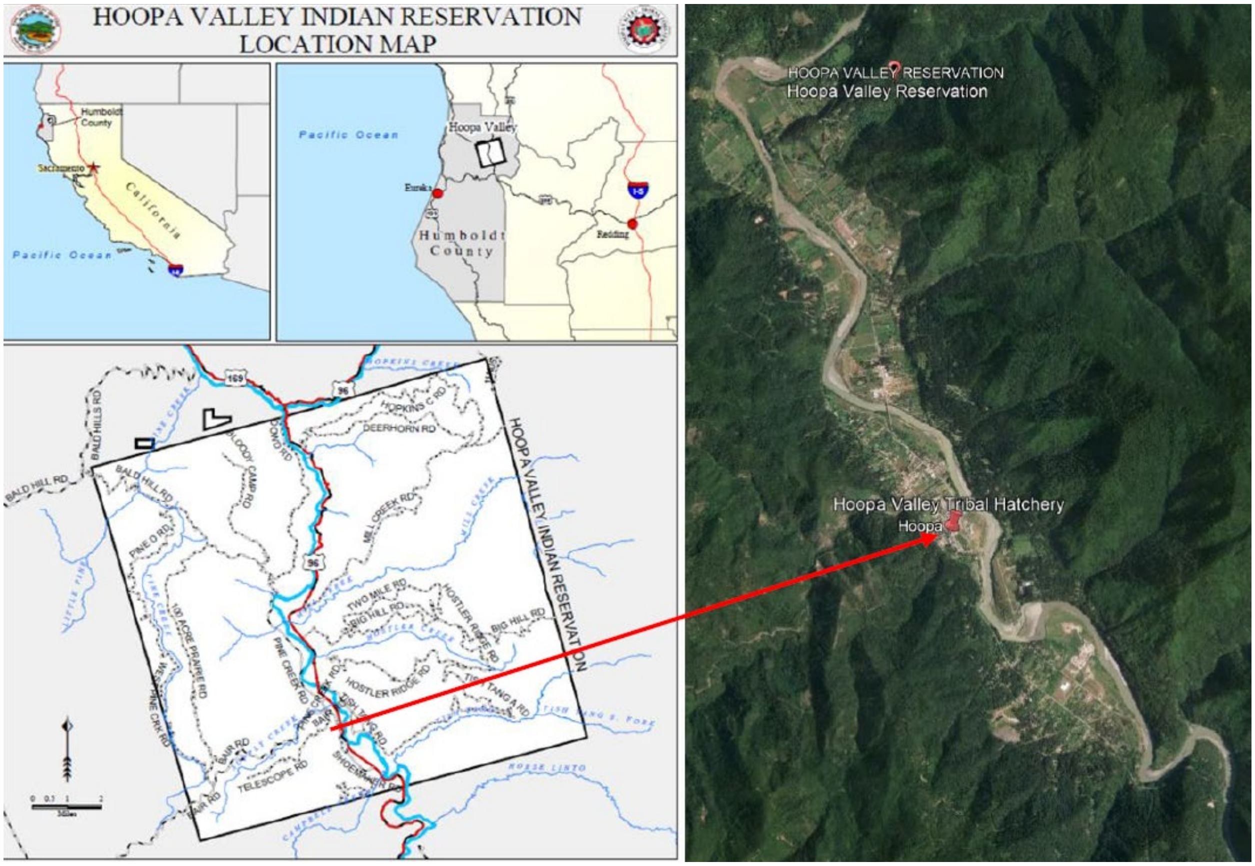

Figure 4. Action area for the Proposed Action.

The HVTH is located in Hoopa, California, in the Trinity River watershed near the confluence of Supply Creek, on the Hoopa Valley Indian Reservation (Figure 4). The affected geographic boundaries of this HGMP include tributaries to the lower Trinity River, California where it flows through the Hoopa Valley Indian Reservation boundaries (Trinity River mile 12 to river mile 0.5). The Trinity River is the largest tributary to the Klamath River and joins the Klamath River at river mile 44. The tributaries are Tish-Tang, Mill, Supply, Soctish, Hostler, Campbell, and Pine Creek, tributary to the Klamath River. The HVTH's location is described further as: USGS Watershed code 18010211; Hydrologic Unit 106.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species in the action area, without the consequences to the listed species 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 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. SONCC Coho Salmon Populations in the Action Area

The Lower Trinity River and the Lower Klamath River population units are in the action area (Table 10). Although they migrate through the lower Klamath River portion of the action area, the population units of the Interior-Klamath Stratum will have little exposure to the proposed action.

Table 10. Population unit boundaries for SONCC coho salmon populations in the action area (Williams et al. 2008).

Population Unit	Boundaries	Adult population needed for recovery
Lower Trinity River	Confluence of Klamath River upstream to confluence with North Fork Trinity River (non-inclusive).	3,600
Lower Klamath River	Mouth of Klamath River upstream to confluence with Trinity River.	5,900

The Lower Trinity River and Lower Klamath River Population Units are "core" population units, and need to achieve a robust level of adult spawners for recovery of the ESU (Table 10; NMFS 2014). Therefore, the Action Area is very important to the survival and recovery of the ESU because the ESU cannot recover without these population units in the Action Area being recovered.

Population units in the Trinity River have a high conservation value. As mentioned above, at least two of them must be viable for the diversity stratum to be viable and for the ESU to be viable. The discharge of the Lower Trinity River is dominated by rain while discharge of other population units in the stratum are more of a rain-snowmelt mix. These population units have developed different life history strategies to take advantage of this difference. The Lower Klamath River Population unit is important in order for populations in the Central Coastal Basins Diversity Stratum to maintain connectivity with other populations to the north and south along the California and Oregon coasts. This population unit has access to a wide range of diverse off channel pond and slough habitat types, which aids in a diversity of life history strategies, which protects it and the ESU against environmental change, catastrophes, and natural disasters.

2.4.2. Status of SONCC Coho Salmon Populations in the Action Area

Limited information about the population size of individual SONCC coho salmon population units within the action area is available. No systematic surveys that monitor population sizes in any of the populations are performed. CDFW monitors coho salmon run size at a weir near Willow Creek, California on the lower Trinity River. Because adult coho salmon from all three population units of the Interior-Trinity Diversity Stratum pass through the weir site due to its location, it is not known which population of coho salmon is captured at the weir. As such, the weir estimates provide an aggregate population estimate for all unmarked coho salmon upstream of the weir. All coho salmon marked by maxillary bone removal captured at the weir are known to be of TRH origin. Hatchery origin adults often make up 80% or greater of the overall run. The California drought from 2013 to 2017, combined with poor ocean conditions during the same period pushed adult coho salmon returns to some of their lowest levels in recent decades (Figure 5). The reduced production at TRH also changed the number of returning TRH origin coho salmon in recent years (Figure 5).

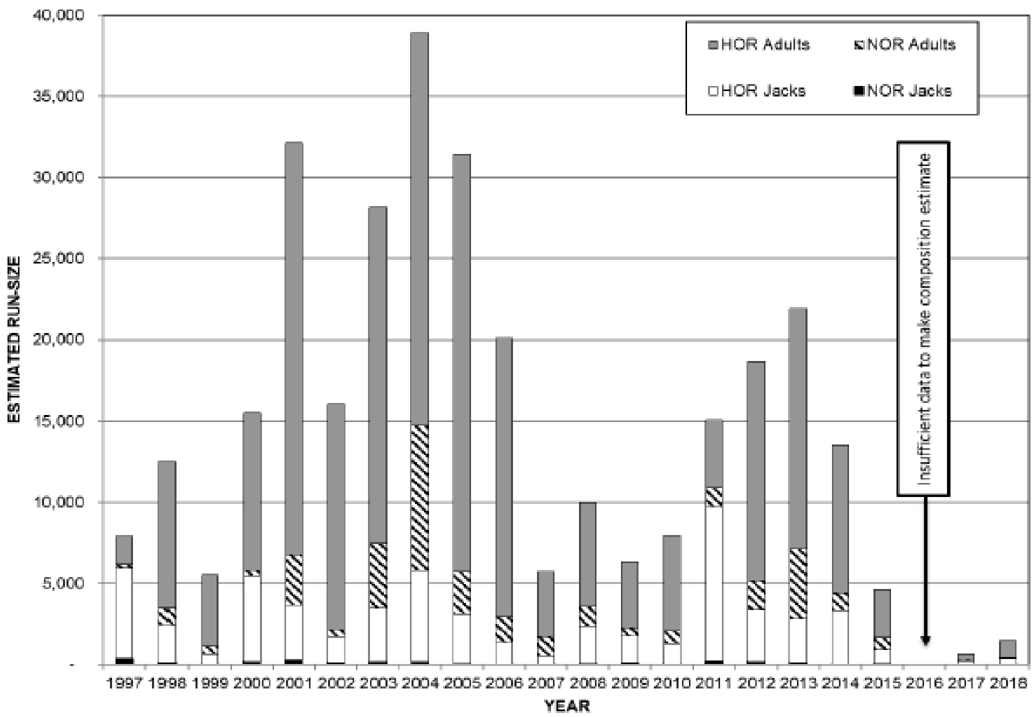

Figure 5. Coho salmon run size estimates for the Trinity River upstream of the Willow Creek Weir 1997 to 2018 (Kier et al. 2019).

2.4.2.1 Lower Trinity River Population Unit

Limited data exists for this population as few surveys have been completed. The limited data available from the U.S. Forest Service and the Hoopa Valley Tribe for the Lower Trinity River population suggests that much of the habitat in the Lower Trinity River is currently unoccupied or only sporadically occupied. Brood year coho salmon may be missing and the adult coho salmon population is likely less than the depensation threshold of 112 adults. The population growth rate in Lower Trinity River sub-basin has not been quantified. Many streams in the lower Trinity River population unit appear to be unoccupied and coho abundance has declined substantially since the early 2000s (Figure 6; Figure 7). In the last decade, streams in the HVR appear to rarely have spawning adult coho salmon. The Lower Trinity population is at high risk of extinction as described in the SONCC coho salmon salmon recovery plan (NMFS 2014). This population needs to have adult returns of 3,600 for the SONCC coho salmon ESU to be viable as described in the SONCC coho salmon salmon recovery plan (NMFS 2014), but numbers of returning adults are likely in the low hundreds, or less.

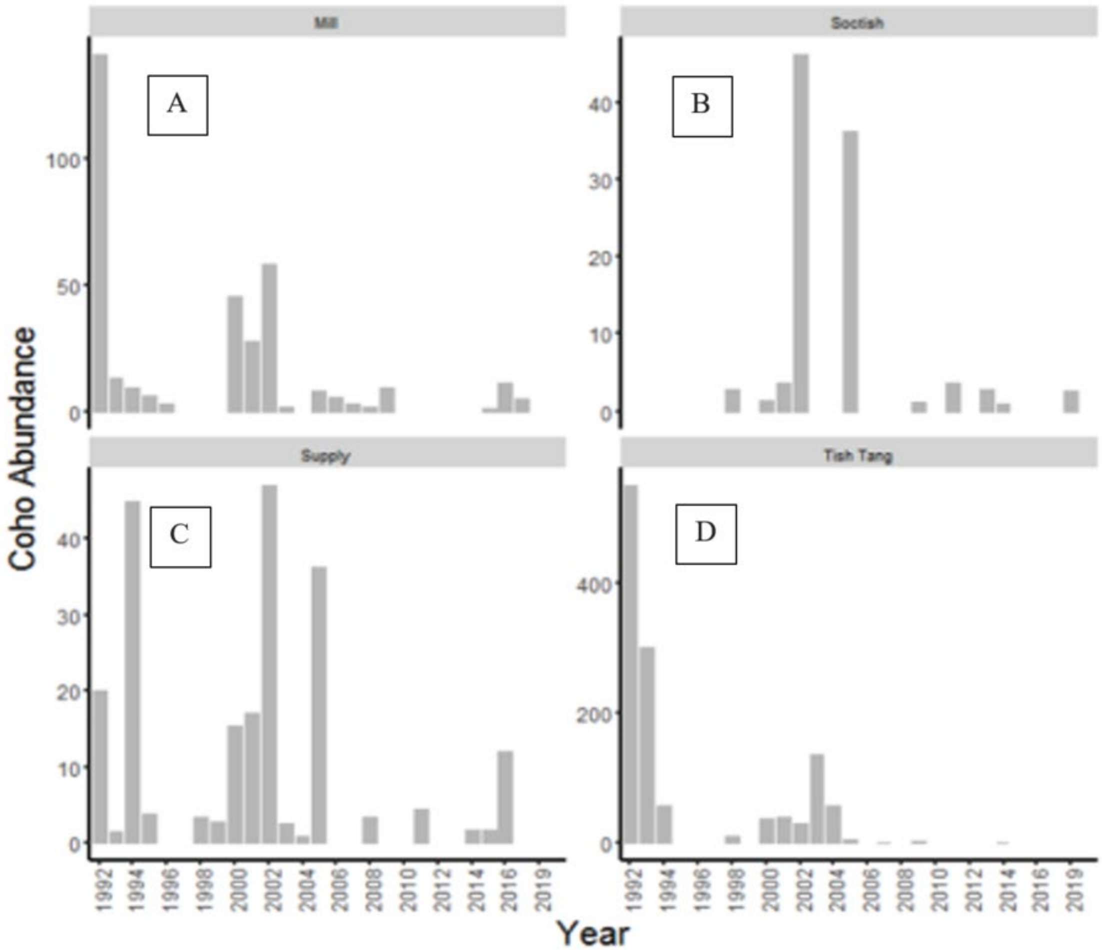

Figure 6. Expanded annual catch of Coho Salmon standardized for creeks fished from 1992 to 2019 (A-Mill, B-Soctish, C-Supply, and D-Tish Tang creeks) from outmigrant trapping on the Hoopa Valley Indian Reservation in northern California (Alvarez 2020).

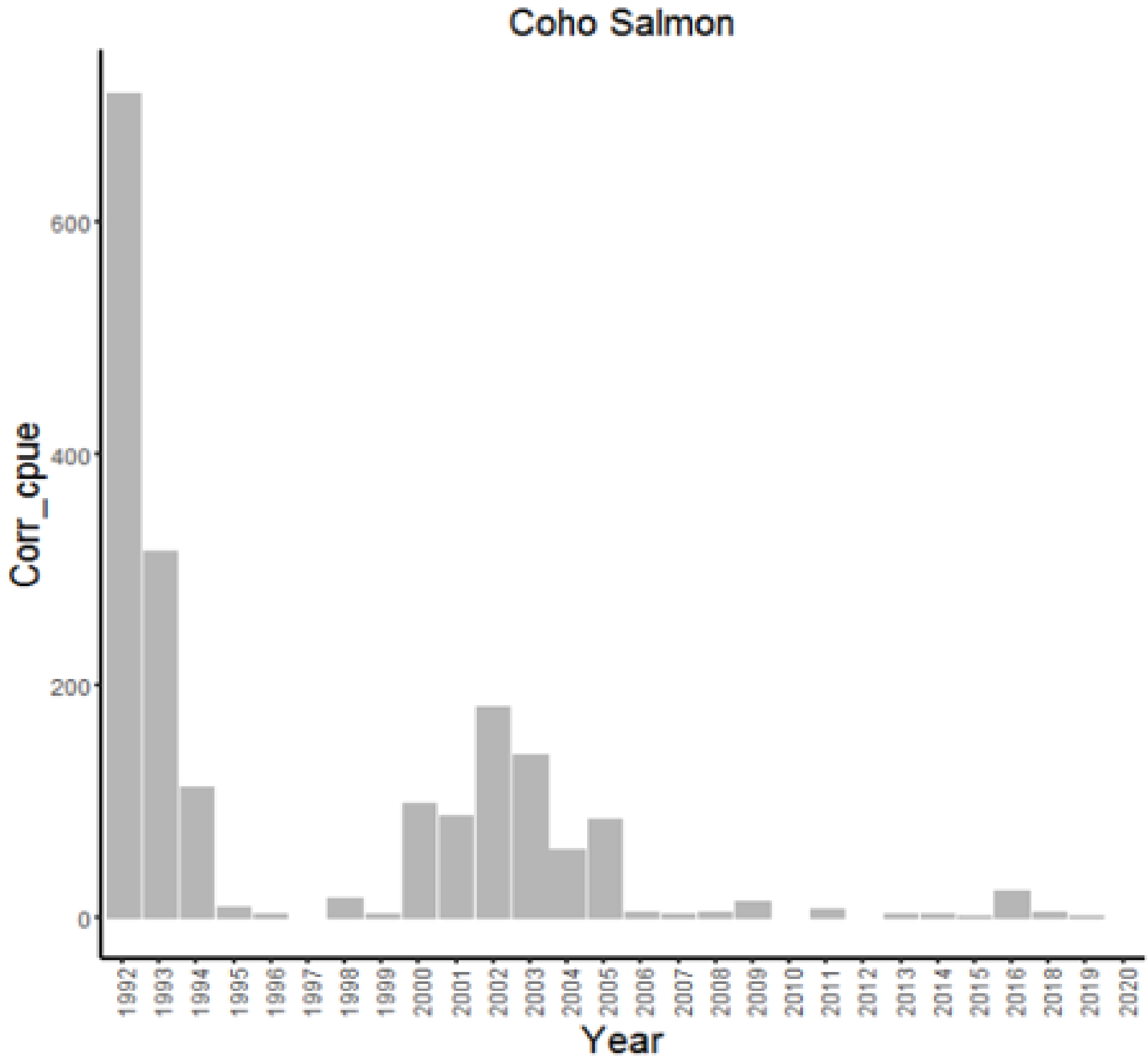

Figure 7. Standardized annual catch of Coho Salmon during annual outmigrant trapping from 1992 to 2020 on the Hoopa Valley Indian Reservation in northern California (Martel 2020).

2.4.2.2 Lower Klamath River Population Unit

NMFS (2014) determined that based on criteria established by Williams et al. (2008), the Lower Klamath River population is at high risk of extinction because the spawner abundance has likely been below the depensation threshold of 205 adult coho salmon. The productivity of the population, based on the limited information available, appears to be declining (NMFS 2014). This population needs to have adult returns of 5,900 for the SONCC coho salmon ESU to be viable as described in the SONCC coho salmon salmon recovery plan (NMFS 2014).

2.4.3. Factors Affecting SONCC Coho Salmon Populations in the Action Area.

There are a variety of factors affecting SONCC coho salmon in the action area, most of which have a negative effect on SONCC coho salmon (Table 15). The California drought, combined with the warm water "Blob" in the northeast Pacific Ocean had a toll on SONCC coho salmon in the action area, contributing to low returns of adult coho salmon. Limited and poor quality freshwater habitat, disease, and lack of forage in the ocean environment for multiple years in a row appears to have pushed adult returns to their lowest levels throughout the region. Restoration activities in the Trinity River basin and the lower Klamath River will likely benefit coho salmon populations by reducing several stressors in the action area like sedimentation or loss of large woody debris (LWD).

Table 11. Factors affecting coho salmon in the action area.

Factors affecting coho salmon in the Action Area	Effects	Stressors
Forestry Activities	Negative	Sedimentation of spawning gravels, increased water temp, loss of LWD, poor water quality, reduced pool frequency and depth
Roads	Negative	Sedimentation, habitat blockage, reduced pool frequency and depth
Hatchery Activities	Negative and positive	Negative: Genetic and ecological interactions. Positive: Demographic support at low run sizes, marine derived nutrients.
Climate Change	Negative	Warming water temperatures, reductions in summer and fall streamflow
Agriculture	Negative	Sedimentation, decrease in water quality, decrease in summer base flows, riparian habitat loss
Urban, residential, and industrial development	Negative	Urban non-point pollution runoff, increased water utilization, channelization, riparian habitat loss
Water Diversions	Negative	Loss or reduction of summer baseflow (tributaries other than mainstem Trinity River), habitat reduction, increase in water temperatures, hydrologic alteration, habitat reductions.
Restoration	Positive	Addition of LWD, increase in habitat quantity and quality
Fisheries	Negative	Mortality of returning adults and jacks

Effects from timber harvest including sedimentation, riparian habitat loss, reduced LWD recruitment, and water temperature impacts, are expected to continue through the action period. Impacts from roads are expected to remain similar or slightly decrease throughout the Proposed Action as more roads are decommissioned. Road decommissioning and culvert replacement will help to reduce sedimentation in the future. Residential growth in the Trinity basin and Lower Klamath River is expected to continue at a moderate pace, and its effects are negative due to increasing runoff and water use. Mortality of marked and unmarked Trinity River coho salmon averaged 6.2% (range 3.0% to 12.1%) in ocean fisheries and 3.8% (range 0.9% to 10.2%) in tribal fisheries in the lower Klamath and Trinity rivers.

2.4.4. Iron Gate and Trinity River Hatchery Chinook Salmon and Steelhead Production

While Iron Gate Hatchery (IGH) is not in the action area, the hatchery produces Chinook salmon and coho salmon that migrate and rear in the lower Klamath River. Trinity River Hatchery also produces Chinook salmon and steelhead that are released at the hatchery and migrate and rear from the hatchery to the Pacific Ocean. Reclamation (2018) determined that the release of Chinook salmon and steelhead from TRH would result in the loss of 4.4% of fry and 5.1% of juvenile coho salmon. IGH Chinook salmon and coho salmon are expected to adversely affect coho salmon in the action area through competition in the lower Klamath River.

Table 12. Iron Gate and Trinity River hatcheries Production Goals.

<table>
<tr><th>Hatchery</th><th>Species</th><th>Number released</th><th>Released</th><th>Adult Run timing</th></tr>
<tr><td rowspan="3">IGH</td><td rowspan="2">Chinook Salmon</td><td>5,100,000 smolts</td><td>May-June</td><td rowspan="2">Mid-September to early November</td></tr>
<tr><td>900,000 smolts</td><td>November</td></tr>
<tr><td>Coho Salmon</td><td>75,000 smolts</td><td>March-May</td><td>October to January</td></tr>
<tr><td rowspan="4">TRH</td><td rowspan="2">Chinook Salmon</td><td>3,000,000 smolts</td><td>May-June</td><td rowspan="2">Mid-September to early November</td></tr>
<tr><td>1,300,000 smolts</td><td>November</td></tr>
<tr><td>Steelhead</td><td>448,000 smolts</td><td>April</td><td>November to March</td></tr>
<tr><td>Coho Salmon</td><td>300,000 smolts</td><td>March</td><td>October to January</td></tr>
</table>

When released into the freshwater, HOR fish compete with NOR fish for food and habitat, and can predate on smaller NOR salmonids already in the system (Fleming et al. 2000, Kostow et al. 2003, Kostow and Zhou 2006). Chinook Salmon are released from IGH and TRH in May and June and the release overlaps with the coho salmon smolt peak emigration period in the Klamath River Basin (near the middle of May), which is also the same period that the river flows are in sharp decline. Accordingly, HOR Chinook salmon from the hatcheries that remain in the river system for weeks at a time compete for food and habitat with NOR coho salmon, though there are some interspecifc differences in habitat selection. As the hydrograph declines and suitable rearing habitat diminishes in quantity and quality, ecological interactions between HOR Chinook salmon and HOR steelhead, and juvenile NOR coho salmon increase. Suitable summer rearing habitat likely becomes limited as juvenile salmonids are forced to rear into increasingly small thermal refugia areas with high salmonid density and limited feeding opportunities. These interactions likely have an adverse effect on juvenile NOR coho salmon if they are displaced from suitable rearing areas or outcompeted for prey resources.

NMFS (2018) required that Reclamation ensure that at least 95% of adipose clipped TRH Chinook salmon fingerling emigration will occur prior to July 31, as measured near the North Fork Trinity River. Similarly, Reclamation must ensure at least 75% of adipose clipped Chinook salmon yearling emigration past the North Fork Trinity River will occur prior to October 20. The volitional release approach for HOR Chinook salmon from TRH and IGH likely reduces the severity of ecological interactions, although to what level is still unknown.

The exact extent of effects of the release of HOR Chinook Salmon from IGH and TRH and salmon and steelhead from TRH are unknown. However, NOR coho salmon are exposed to increased competition with HOR Chinook salmon and steelhead. These ecological interactions likely have an adverse effect on NOR coho salmon.

2.4.5. Climate Change in the Action Area

Figure 8 shows downscaled projections for representative climate pathway 4.5 (RCP 4.5) developed by the International Panel on Climate Change for 32 climate models for the region near Hoopa, California, the location of HVTH (cal-adapt.org 2021). The RCP 4.5 projections for air temperatures are expected to be lower than the more recent RCP 8.5 projections. The modeled annual mean air temperature are expected to increase approximately 4°F under the RCP 4.5 scenario to 8°F under the RCP 8.5 scenario from the present to 2100 (Figure 8). For precipitation, the projections for RCP 4.5 and RCP 8.5 are expected to be similar, and not expected to change significantly from the present to 2100 (Figure 8). There has already been a significant loss of snowpack in northern California, particularly at low elevations (Mote et al. 2018), and warming caused by climate change will continue to exacerbate future snowpack loss, regardless of any potential increases in precipitation (Zhu et al. 2005, Vicuna et al. 2007). A transition to a warmer climate state and sea surface warming may be accompanied by reductions in ocean productivity which affect fisheries (Ware and Thomson 2005; Behrenfeld et al. 2006). Due to the corresponding increase in water temperatures, decrease in summer and fall stream flows and potential declines in ocean productivity, the amount of habitat available to all life stages of SONCC coho salmon in the action area is expected to shrink and/or become less suitable. This is expected to reduce the number of successful offspring produced per adult spawner, and challenge the resiliency of SONCC coho salmon in the action area.

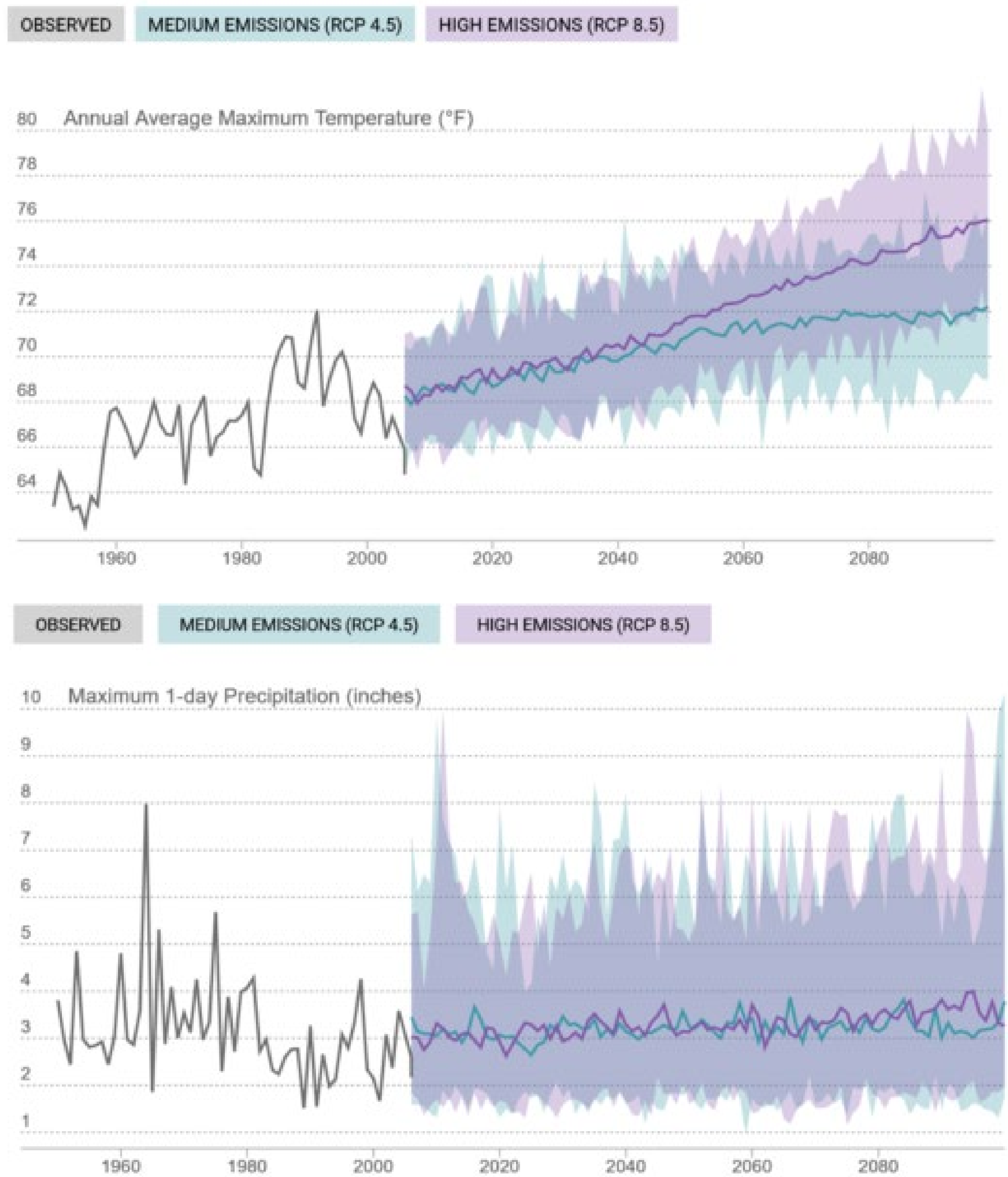

Figure 8. Panel figure showing predicted top) average annual air temperatures, and bottom) precipitation through 2100 for the region near Hoopa, California. Data are from cal-adapt.org (2021).

2.5. Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species 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).

Analysis of an HGMP or Proposed Action for its effects on ESA-listed species depends on seven factors. These factors are:

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

The analysis assigns an effect for each factor from the following categories. The categories are:

(1) positive or beneficial effect on population viability,
(2) negligible effect on population viability, and
(3) negative effect on population viability.

In the action area, coho salmon are likely to be negatively affected as a result of two of the seven factors described above. They are: hatchery fish and the progeny of naturally spawning hatchery fish on spawning grounds and encounters with natural-origin and hatchery fish at adult collection facilities and hatchery fish and progeny of naturally spawning hatchery fish in juvenile rearing areas (i.e., competition). At low NOR abundance, HOS can be beneficial by providing demographic support. An overview of the analysis is described below.

2.5.1. Factor 1

Negligible demographic effect: This hatchery program will not remove any natural coho salmon from the Trinity River. The HVTH will use surplus coho salmon eggs and/or fry from the TRH. The effects of removal of natural coho salmon from the upper Trinity River population of coho salmon for use at TRH are described in NMFS (2020), who found it to be a negative demographic effect. The effects of removal of natural coho salmon from the upper Trinity River population is expected to occur with or without the proposed action.

2.5.2. Factor 2

Negative genetic effect: Genetic effects on populations in the Trinity River are likely to occur from interactions on the spawning grounds between hatchery fish or progeny of naturally spawning hatchery fish and natural-origin coho salmon when adult hatchery coho salmon return to spawn in tributaries on the HVR. At the highest expected parr-to-adult survival rates, combined with the highest fry release levels in the proposed action, the maximum expected adult return is 1,740 coho salmon. This adult return level is approximately half of the low risk spawner threshold of 3,600 returning adult coho salmon for the lower Trinity River population. Though less than half of the IP habitat of the lower Trinity River population unit is on the HVR, the relatively modest expected adult return levels in Table 13 are not a cause of concern for NMFS in terms of potential hatchery overproduction.

Table 13. Parr to adult survival and return estimates.

Fry Released	Parr to Adult Return (%)	Adult Return
50,000	0.19[1]	95
100,000		190
200,000		380
50,000	0.87[2]	435
100,000		870
200,000		1740

[1]Estimated minimum survival rates for coho salmon based on Lauren and Allen 1958
[2]Estimated maximum survival rates for coho salmon based on Wunderlich 1993

Coho salmon population levels in tributaries of the HVR are at very low levels, with the number of juveniles trapped at zero in some recent years (Figure 6; Figure 7). Coho salmon population estimates provided by CDFW (Figure 5) similarly indicate very low levels of abundance in recent years, with so few returns in 2016 that a population estimate could not be made. Given this information, it is unlikely that the number of adult coho salmon returning to the lower Trinity River exceeds the high risk depensation threshold of 112 adults (see above).

Small population dynamics are extremely important to consider for recovery of listed species because the time-to-extinction for a species decreases as the population size decreases (Caughley 1994; Fagan and Holmes 2006). This long standing theoretical prediction and empirically observed phenomenon of small populations (Fagan and Holmes 2006) highlights the importance of keeping currently healthy salmonid populations from reaching low abundance levels. Small populations are often defined as those having approximately 100 individuals (Treuren et al 1991; Thomas 1990). For anadromous salmonids, small populations are defined as those that fall near or below the depensation (high risk) threshold.

This low population level is of great concern to NMFS, as small populations are subject to both environmental and demographic stochasticity that threatens their existence. Environmental stochasticity occurs because fluctuations in external environmental factors (e.g. ocean conditions and precipitation) drive population level fluctuations in birth and death rates (May 1973; Melbourne and Hastings 2008). Inbreeding, loss of genetic variation, and failure to find mates are all forms of depensatory mechanisms that cause depensation (Liermann and Hilborn 2001). The fact that small populations can be affected by multiple forms of stochasticity results in extinction probabilities substantially greater than the extinction probabilities that would occur from of a single form of stochasticity (Melbourne and Hastings 2008).

For the above reasons, NMFS believes that the potential demographic boost (Janowitz-Koch et al. 2018) that is expected in the short-term from the HVTH coho salmon supplementation program outweighs the potential risks of outbreeding depression from hatchery coho salmon supplementation, as well as the genetic consequences of movement of eggs and fry from adults in the upper Trinity River population unit to the lower Trinity River population unit. At the very least, there currently appears to be so few returning adult spawners to tributaries on the HVR, that the risks of outbreeding depression from hatchery supplementation appear low. Moreover, TRH hatchery coho salmon strays have been known to spawn in tributaries in the lower Trinity River population unit for decades, considering coho salmon have been reared at TRH since the 1960s.

Overall, the proposed action should result in a demographic boost to coho salmon in the lower Trinity River in the short term (one generation). Janowitz-Koch et al. (2018) found that a supplementation program was successful at increasing the number of Chinook salmon adult offspring. However, HOR spawners had a lower reproductive success than NOR spawners, and the demographic boost that occurred in the first year of the study was short lived for HOR x HOR pairings as their relative reproductive success was low compared to HOR x NOR or NOR x NOR pairings. Importantly, the broodstock used in the Janowitz-Koch et al. (2018) study was 100% natural origin. Therefore, for the findings of Janowitz-Koch et al (2018) to be applicable to the HVTH, the broodstock at TRH would need to be 100% NOR. Currently that is not the case, and there are concerns with negative fitness effects on the lower Trinity River population given the low proportion of NOR in the broodstock at TRH.

While NMFS expects a short term demographic boost to coho salmon populations in tributaries of the HVR from supplementation resulting from the proposed action, the reproductive success of returning HOR coho salmon adults is expected to be significantly less than naturally produced coho salmon due to the heavy reliance on HOR broodstock at TRH, and because the proposed action provides no means by which to control HOR and NOR pairings in the wild (no controls on PNI).

The proposed action includes a theorized maximum parr-to-adult return rate of 0.87% (Table 13), resulting in a maximum of 1,740 adults returning as a result of the proposed action at the 200,000 parr release level. Given the lower Trinity River population unit low risk spawner threshold of 3,600 adults, the maximum number of adults that would return resulting from the proposed action would be less than half of the low risk spawner threshold for this population. At lower parr-to-adult return rates, and lower release levels, the number of returning adults to this population would be a small fraction of the low risk spawner threshold for this population (Table 13). Therefore, NMFS does not expect that the numbers of returning adults will be so many that offspring (second generation) from first generation hatchery fish will be unsuccessful at finding habitat and resources to grow as juveniles or spawning habitat when returning as adults. At a return of 1,740 adults, NMFS does not expect that genetic interactions between HOR adults and natural produced coho salmon would reduce the potential for the lower Trinity River population to achieve recovery. Because there are currently few, if any natural coho salmon returning to the tributaries of the HVR, NMFS believes the proposed action will be beneficial to these streams by helping to jumpstart coho salmon production.

As noted by Janowitz-Koch et al (2018), the demographic boost measured in their study only continued for successive years if the offspring were from parents of HOR x NOR crosses or NOR x NOR crosses. Without these two metrics being met in the future under the proposed action (controls on parental spawning and 100% HOR broodstock), NMFS does not expect long-term gains in natural production and assumes natural coho salmon will require annual supplementation to maintain any measurable level of production.

The phenomena of natural population of coho salmon having low reproductive success and being dependent on annual supplementation and breeding of HOR fish in the upper Trinity River was hypothesized by Naman and Perkins (2016) and NMFS (2020). This appears to have played out when simultaneous unprecedented drought and poor ocean conditions (Pacific Ocean Blob; 2013-2016) reduced the smolt-to-adult survival rate for TRH coho salmon to the lowest levels ever recorded (i.e., less than 1%). Coincident with these unprecedented environmental conditions was an approximately 40% reduction in TRH coho salmon production in 2013, thereby reducing adult TRH coho salmon returns to the Trinity River to some of the lowest levels ever recorded (Figure 5). And coming on the wake of those very low returns of TRH coho salmon to the Trinity River was a nearly complete collapse of the naturally spawning coho salmon population in the upper Trinity River, in accordance with the hypothesis that natural coho salmon production in the upper Trinity River is dependent on continual spawning input from TRH coho salmon (NMFS 2014; Naman and Perkins 2016; NMFS 2020).

Coho salmon in the Trinity River have been under long standing (>50 years) intensive production, which cumulatively contributes to lack of reproductive success in the wild (Araki et al. 2007; Araki et al. 2008; Christie et al 2014). Unless the HVTH coho salmon program takes clear steps to ameliorate the issue of low reproductive success of naturally spawning adult hatchery coho salmon, NMFS expects that coho salmon in tributaries of the HVR will be dependent on continual annual hatchery supplementation to maintain limited natural coho salmon production. These genetic effects will likely limit the long term diversity and productivity of the lower Trinity River population unit, while providing increases in abundance and spatial structure. Over the duration of the proposed action (12 years), NMFS believes the benefits from demographic support to population abundance and spatial structure of having HOR spawners in the wild and their offspring outweighs the cost to population productivity and diversity of having hatchery dominated coho salmon stocks in the HVR tributaries.

2.5.3. Factor 3

Negative ecological effect in rearing areas: The HVTH is expected to increase the numbers of parr and smolts in juvenile rearing areas in tributaries on the HVR and in the lower Trinity River. Because TRH will likely not have a significant number of surplus eggs or fry available annually, the number of coho salmon released from HVTH is expected to be less than 200,000 in most years. The analysis completed by Reclamation and CDFW (2017) indicated that the total loss of NOR coho salmon fry in the upper Trinity River population from a release of 300,000 TRH hatchery yearlings would be 0.4 percent of coho salmon natural production potential. For NOR yearlings, the average loss would be 1.6 percent. Reclamation and CDFW (2017) found that the release of 300,000 TRH yearlings had the potential to reduce potential NOR production by as much as 2.0% total.

The proposed action would release parr instead of yearlings, which will increase the duration that the hatchery fish are in the river as they will rear for one year prior to outmigration. This would presumably increase the effects of ecological interactions on natural coho salmon populations relative to that of an action that would release yearlings ready to go to sea; however, the low survival rate of HVTH coho salmon parr planted into streams (Table 13) is expected to limit the effects of competition for food and habitat with natural coho salmon. Additionally the proposed action will release a maximum of 200,000 parr, substantially less than the 300,000 TRH hatchery smolts. These ecological effects will result in some negative impacts to the abundance and productivity of population units in the action area. For the above reasons, NMFS believes the proposed action's effects to natural coho salmon populations will be substantially less than the maximum 2.0% mortality of natural coho salmon yearlings and fry estimated for the TRH coho salmon operations.

If a severe disease outbreak occurs, US Fish and Wildlife Service CA/NV Fish Health Center lab or California Animal and Food Safety laboratory will be employed to conduct pathogen identification, determine the likely cause of the outbreak, and apply necessary and appropriate treatments. One or more pathologists from these labs will conduct pre-release fish health analyses. Fish will not be released until certified healthy by one of these laboratories. For the above reasons, NMFS considers the risk of negative effects from disease transmission to be low.

There will be some benefit to rearing juvenile coho salmon in the action area from the minor increase in marine derived nutrients that will result from an increase in hatchery origin adult coho salmon carcasses as a result of the proposed action.

2.5.4. Factor 4

Negligible ecological effect in migration corridors, estuary, and ocean: The HVTH is expected to increase the numbers of parr and smolts entering the lower Trinity River, the Klamath River and estuary, as well as the nearshore ocean environment. Some authors have found that competition for food and resources in the ocean affects populations of wild salmonids (e.g., Ruggergone and Connors 2015). Reclamation and CDFW (2017) found that the modeled reduction in potential NOR coho salmon production from releasing 300,000 yearlings to the upper Trinity River from TRH was 2.0%. Given that the proposed action would result in the release of parr instead of smolts, which is expected to have a much lower survival rate, and have a lower release number (a maximum of 200,000 versus 300,000), NMFS believes that the reduction in NOR coho salmon production from the proposed action would be less than 2.0%. Additionally there are currently very few naturally produced coho salmon in the action area (Figure 5). Little if any predation effect in the migration corridor is expected because fry are not concentrated in the migration area, and because the parr planted from the proposed action are not large enough to prey on natural coho salmon fry (Naman and Sharpe 2012). By the time parr planted from the proposed action grow to yearling size and become large enough to prey on natural coho salmon fry, their numbers are expected to be low due to the low survival rate of hatchery parr in the wild (Table 13), resulting in an overall low predation rate on natural coho salmon fry. Based on the above factors, NMFS believes hatchery coho salmon and the progeny of naturally spawning hatchery fish in the migration corridor, estuary, and ocean will have a negligible effect on coho salmon individuals.

2.5.5. Factor 5

Negligible effect from M&E: The Proposed Action includes M&E activities that will continue to monitor the performance indicators identified in Table 7, and other actions above, and inform future decisions regarding how the hatchery program can be adjusted to meet their goals while further reducing effects on SONCC coho salmon.

Spawning ground surveys that will occur may disturb adult coho salmon; however, no injuries or mortalities or other adverse effects are expected. Furthermore these surveys are expected to occur with or without the proposed action. Snorkel surveys will be conducted in tributaries where supplementation occurs as part of the proposed action. NMFS expects that some juvenile coho salmon may be disturbed by divers swimming in the water. Some HVTH coho salmon juveniles are expected to die as a result of marking (adipose fin clip) and tagging (CWT) in the proposed action. Generally, these mortalities are minimal and tagging survival is expected to be high. Monitoring of tribal fisheries and determining adult contributions to spawner escapement is expected to continue with or without the proposed action. Retrieval of CWTs of marked hatchery fish captured in fisheries is not expected to have effects on unmarked coho salmon, and adult collection in HVT fisheries is expected to occur with or without the proposed action.

2.5.6. Factor 6

Negligible effect from HVTH infrastructure: The Proposed Action does not include any new construction of facilities or other building or demolition that could affect coho salmon. Because water for the HVTH is derived from a sixty-five-foot subterranean well that taps into the bedrock aquifer of the Trinity River, effects from reduced stream flow or water diversion for hatchery use are not expected. After flowing through the HVTH and subsequent leach field, the water returns to the Lower Trinity River aquifer. Therefore, negligible effects resulting from water use of the hatchery are expected.

Discharge of hatchery wastewater will be into a private septic leach field that cleans effluent before rejoining the aquifer (Section 1.3) in accordance with the regulations set forth in the Hoopa Valley Tribal Environmental Protection Agency's (HVTEPA) Water Quality Control Plan, the Hoopa Valley Tribal Forest Management Plan's Riparian Protection Guidelines, and the Hoopa Valley Tribe's Pollutant Discharge Prohibition Ordinance (HVTEPA 2020). As hatchery effluent, fish waste, and chemicals are not expected to directly reach the Trinity River or surrounding tributaries, negligible effects resulting from effluent discharge are expected.

2.5.7. Factor 7

Negligible demographic effect from fisheries: Coho salmon fisheries conducted by the Yurok Tribe and Hoopa Valley Tribe are not considered dependent on the proposed action. NMFS (2020) found that coho salmon fisheries conducted by the Yurok Tribe and Hoopa Valley Tribe are dependent on TRH coho salmon production. NMFS expects these coho salmon fisheries would continue with or without the proposed action because TRH coho salmon production would continue at the levels analyzed by NMFS (2020).

From the period 1997 to 2016, estimated harvest of NOR coho salmon in the Yurok Tribe fishery ranged from 2 to 168. For HOR coho salmon, harvest in the Yurok Tribe fishery ranged from 6 to 1,214 adult coho salmon. In the Hoopa Valley Tribal fishery, 3 to 134 NOR coho salmon and 20 to 505 HOR coho salmon were harvested from 1997 to 2016. Approximately 2.1% to 11.1% of NOR coho salmon were harvested in these two fisheries combined. Over this same time period, modeled incidental mortality in commercial fisheries in the ocean ranged from 1.6% to 12.1%. NMFS expects these fisheries to continue to operate with or without the proposed action.

In 1993, the retention of coho salmon in ocean commercial fisheries was prohibited from Cape Falcon, Oregon south to the U.S./Mexico border. The following year, coho salmon retention was prohibited in ocean recreational fisheries from Cape Falcon, Oregon to Horse Mountain, California, and expanded to include all California waters in 1995. These regulations have continued to prohibit direct sport and commercial harvest of coho salmon off the California and Southern Oregon coast, the lone exceptions being a mark-selective recreational coho salmon fishery that took place between 1998 and 2002 and again in 2009 in Oregon waters. To reduce bycatch impacts in the ocean, the Pacific Fishery Management Council (PFMC) has set the bycatch limit at 13 percent consistent with the 1999 biological opinion for SONCC coho salmon (NMFS 1999). The fisheries described above that impact the Trinity River SONCC coho salmon populations, would likely operate with or without the proposed action.

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 properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4).

2.6.1. Control of wildland fires on non-federal lands

Control of wildland fires may include the removal or modification of vegetation due to the construction of firebreaks or setting of backfires to control the spread of fire. This removal of vegetation can trigger post-fire landslides as well as create chronic sediment erosion that can negatively affect coho salmon habitat. Also, the use of fire retardants may adversely affect salmonid habitat if used in a manner that does not sufficiently protect streams, causing the potential for coho salmon to be exposed to lethal amounts of the retardant. This exposure is most likely to affect summer rearing juvenile coho salmon. As wildfires are stochastic events, NMFS cannot determine the extent to which suitable coho salmon habitat may be removed or modified by these activities.

2.6.2. Residential development and existing residential infrastructure

Human population growth in the action area is expected to remain relatively stable over the next ten years as there are no known plans for increasing the rate of development on the HVR. The population of people living on the HVR is not expected to increase markedly over the next ten years. Minimal impacts from water use on the HVR are expected to continue to occur throughout the duration of the proposed action. The presence of structures and/or roads near waters has lead to channelization and simplification of stream channels.

2.6.3. Recreation

Construction of summer dams to create swimming holes causes turbidity, destroys and degrades habitat, and blocks migration of juveniles between summer habitats. Impacts to salmonid habitat are expected to be localized, mild to moderate, and temporary. Fishing within the action area, typically for steelhead or Chinook salmon, is expected to continue subject to CDFW and Tribal regulations. Fishing for coho salmon directly is prohibited in the Klamath River, except for Tribal fisheries with an approved Tribal 4d determination. The level of impact to coho salmon within the action area from angling is unknown, but is expected to remain at current levels because there is no information suggesting that angling will increase or decrease.

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 properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.7. Integration and Synthesis

2.7.1. Introduction

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) to 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 biological 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.

The status of SONCC coho salmon population units in the action area mirrors that of the ESU overall, with declining abundance apparent in the Willow Creek Weir counts and seemingly throughout all of the populations (Section 2.4.2). The unprecedented drought (2013-2016), combined with poor ocean conditions over the same time period, reduced stream flows, reduced ocean forage, and increased ocean and stream temperatures, further exacerbating stress, disease, and decreasing the quantity and quality of spawning and rearing habitat available to population units in the action area. While some improvements in factors affecting population units in the action area have improved habitat in some areas (e.g., Trinity River restoration, improvements in hatchery practices), populations in the action area overall have not trended toward recovery.

Cannabis cultivation is expected to continue to negatively impact coho salmon throughout the ESU. Climate change will continue to shrink the amount of habitat available to coho salmon in the action area and throughout the ESU. This will likely reduce the number of successful offspring produced per adult spawner, and challenge the resiliency of SONCC coho salmon in the action area and throughout the ESU. In the event of complete loss of snowpack in the Trinity Alps resulting from climate change, Trinity Reservoir may provide a buffer to mainstem Trinity River water temperatures because water can be drawn from the cold bottom layer of the reservoir.

The SONCC coho salmon ESU is currently considered likely to become endangered within the foreseeable future in all or a significant portion of its range (Williams et al. 2016). Williams et al. (2016) in their review found that there has been no trend toward recovery of SONCC coho salmon since their listing in 1997. The lack of increasing abundance trends across the ESU for the populations with adequate data are of concern (e.g., Shasta River). Moreover, the loss of population spatial scale estimates from coastal Oregon populations is of great concern. The new information since Williams et al. (2011) while cause for concern, did not appear to suggest a change in extinction risk at this time (Williams et al. 2016).

2.7.2. Proposed Action

The proposed action is expected to increase the abundance and spatial structure of coho salmon in the action area, particularly tributaries of the HVR. Through supplementation of juvenile coho salmon parr into tributaries of the HVR, the proposed action is expected to help jumpstart natural production in these tributaries. This will also help seed tributaries where coho salmon can take advantage of the large-scale restoration projects that have improved habitat conditions for coho salmon in Mill and Supply creeks. These habitat restoration projects increased the amount of off-channel and slow water rearing habitat that coho salmon prefer, which was a key recovery action identified by (NMFS 2014). Currently, very few adult coho salmon are returning to the lower Trinity River population unit as described above. The increases in abundance and spatial structure resulting from the proposed action are expected to reduce the probability of extinction of the SONCC coho salmon ESU, particularly in the short term (four coho salmon generations), as the tributaries of the HVR appear largely unoccupied. Therefore, there will likely be a beneficial effect in regard to abundance and spatial structure on the interior-Trinity River diversity stratum or SONCC coho salmon ESU in the short term.

With natural adult returns so low, few options remain to bolster population levels in these important tributaries. There are some expected negative effects from the proposed action, particularly over the long term and a high proportion of broodstock continues to be HOR x HOR crosses from TRH. This would keep the PNI of the supplemented populations low, and result in dependence on continual supplementation to maintain population productivity. There would be a negative effect in regard to diversity and productivity in the long term (greater than four generations) on the interior-Trinity River diversity stratum or SONCC coho salmon ESU if the fry released from the HVTH are the progeny of HOR x HOR crosses. An increase in the numbers of returning adults resulting from the proposed action to the lower Trinity River population (Table 13) is expected to benefit this population as there are currently very few returning spawners (Figure 6; Figure 7). The proposed action would result in a maximum of less than half of the low-risk spawner threshold for the lower Trinity River population, such that second generation hatchery fish and their progeny would still be able to find habitat and resources for rearing and spawning. Furthermore, so few naturally produced coho salmon are present in the action area, NMFS believes the expected increases in abundance and spatial structure outweigh the genetic effects in the short term (four coho salmon generations) to population productivity and diversity).

Other negative effects from the proposed action include competition for food and space between fry released as a result of the proposed action and naturally produced coho salmon juveniles. However there are so few naturally produced coho salmon juveniles in the action area, that the effects from competition are expected to be minimal. Effects from monitoring and evaluation, as well as the effects associated with the operation of the HVTH are expected to be minimal

2.7.3. Summary

With so few naturally spawning coho salmon returning to the lower Trinity River, the proposed action is expected to be beneficial to the interior-Trinity River diversity stratum and the SONCC coho salmon ESU in the short-term by increasing abundance and spatial structure. Productivity and diversity are expected to increase in the short-term, as there are currently so few naturally returning adult coho salmon to the action area. The long-term outlook for the effects of the proposed action on the productivity and diversity of the interior Trinity River diversity stratum and the SONCC coho salmon ESU will depend upon the availability and use of naturally produced coho salmon for broodstock.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the SONCC coho 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 the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Increased mortality of coho salmon eggs and fry resulting directly from HVTH coho salmon adults spawning in tributaries (genetic interactions on the spawning grounds). In addition, up to 2% of the natural-origin coho salmon juveniles in the Lower Trinity River tributaries may be killed annually from increased competition and predation with the released HVTH coho salmon parr.

Take resulting from genetic interactions on the spawning grounds is not possible to quantify because locating small, dead eggs and fry are practically impossible due to decomposition, poor water visibility, and their hidden location within gravel crevices. While take from competition is estimated, monitoring of this take will be difficult because locating dead or ingested coho salmon juveniles will be impossible for similar reasons above. Therefore, NMFS will rely on the maximum estimated parr-to-adult return rate in (i.e., 0.87% in Table 13) as a surrogate for the genetic interactions (i.e., the higher the parr-to-adult return, the higher the number of hatchery coho salmon adults spawning in the tributaries and therefore the higher the genetic interactions on the spawning grounds), and on the annual number of HVTH coho salmon parr released into HVR tributaries as a surrogate for take of natural origin coho salmon juveniles resulting from competition (Table 14).

Table 14. Annual expected take of coho salmon resulting from the proposed action.

Factor	Take	Life stage	Stressor	Amount or Extent of take
2	Genetic interactions on spawning grounds	Egg and fry	Reduction in adult productivity, domestication selection (poor survival of progeny)	Surrogate: Maximum parr-to-adult return rate of 0.87% with up to 200,000 parr released.
3	Competition in HVR tributaries and downstream of HVR.	Juvenile	Death/Reduced growth	Up to 2.0% annual mortality of NOR juveniles in the HVTR tributaries, using the proposed parr release quantities as a surrogate (up to 50k in 2022, up to 100k in 2023, and up to 200k in 2024 to 2033)

2.9.2. Effect of the Take

In the biological 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.

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 reasonable and prudent measures are necessary and appropriate to minimize take of the SONCC coho salmon ESU:

1. HVT must ensure that genetic interactions on the spawning grounds between natural-origin fish and hatchery-origin fish are monitored.
2. HVT must ensure that all monitoring and research activities required to assess hatchery operations objectives outlined in the proposed action (HVT 2021) are funded and implemented.
3. HVT must provide a report to NMFS annually for all funded hatchery operations, and for all M&E activities associated with the Proposed Action.

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. The BIA 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.

1. The following terms and conditions implement reasonable and prudent measure 1:

    a. The HVT must annually monitor the abundance, timing, distribution, and origin of Trinity River coho salmon adults escaping to the HVR tributaries using methods sufficient to provide estimates of the status of the natural- and hatchery-origin components in the supplemented tributaries. The HVT shall develop a monitoring plan detailing how it will implement this term and condition, and provide it to NMFS by December 31, 2022.

    b. The HVT must collect all information sufficient to annually calculate parr-to-adult return rate of HVTH coho salmon.

2. The following terms and conditions implement reasonable and prudent measure 2:

    a. The HVT shall conduct data collection necessary to document all aspects of the HGMP including, but not limited to numbers, pounds, lengths, weights, dates, tag/mark information of fish, results of monitoring and evaluation activities that occur within and outside the hatchery environment, and adult return numbers by fish origin to naturally spawning areas on the HVR.

3. The following terms and conditions implement reasonable and prudent measure 3:

   a. The HVT shall notify NMFS, as soon as possible, but no later than four days, after any incidental take is exceeded or if such an event is likely. This includes the take of any ESA-listed species not otherwise included in this incidental take statement. The HVT shall submit a written report detailing why the authorized take level was exceed or is likely to be exceeded.

   b. The HVT must provide annual reports to NMFS that summarize numbers, pounds, lengths, weights, dates, tag/mark information, carcasses supplemented, excess eggs or fry provided for supplementation, estimated number of HVTH coho salmon parr released, the estimated parr-to-adult return rate for HVTH coho salmon, results of monitoring and evaluation activities that occur within the hatchery environment, and adult return numbers by fish origin to naturally spawning areas. Reports shall also include any analyses of scientific research data; any problems that may have arisen during conduct of the authorized activities; a statement as to whether or not the activities had any unforeseen effects; and steps that have been and that will be taken to coordinate the research or monitoring with that of other researchers. The reports shall be submitted to NMFS annually by September 30. All reports, as well as all other notifications, be submitted to NMFS at:

      NMFS – California Coastal Office
      Attn: North Coast Branch Supervisor
      1655 Heindon Road
      Arcata, California 95521
      Phone: (707) 822-7201

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 recommends that the BIA or the HVT fund a parentage analysis of broodstock used for the HVTH, if data are provided to HVTFD from TRH for the eggs transferred to HVTH, so that fishery managers can have a more complete understanding of the effectiveness of the HVTH coho salmon program. A parentage analysis would allow for a more complete understanding of the potential demographic effects of the hatchery as well as the reproductive success of HVTH coho salmon that spawn in the wild.
2. NMFS recommends that HVT supplement streams on the HVR using salmon or steelhead carcasses or carcass analogs from TRH or other sources to bolster the marine derived nutrient levels and increase the amount of invertebrate prey for coho salmon to consume

while rearing in freshwater. This is expected to help alleviate concerns of high fish density when HVTH coho salmon are planted into streams. Pending approval by a fish pathologist, carcasses from TRH could be utilized for this purpose.

3. If the HVT desires to continue operating the HVTH long term (e.g., beyond 12 years), NMFS recommends that the HVT begin planning with NMFS for a more comprehensive hatchery operation using natural-origin coho salmon adults from the HVT Reservation for broodstock, and work with NMFS on obtaining a Tribal 4d limit. Using 100% natural origin coho salmon broodstock will minimize the amount of domestic selection that occurs and associated genetic effects of supplementation.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Hoopa Valley Tribal Hatchery and Genetics Management Plan (HGMP) for coho salmon.

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 to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

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)].

This analysis is based, in part, on the EFH assessment provided by the BIA and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The Proposed Action would adversely affect EFH for Pacific Coast salmon (PFMC 2014) for Chinook salmon and coho salmon in the Trinity River.

3.2. Adverse Effects on Essential Fish Habitat

The adverse effects to EFH for Pacific Coast salmon are similar to that of coho salmon described in section 2.6.3. The adverse effects to EFH include:

- Temporary reduction in the quality of feeding and rearing areas needed for growth (reduction in abundance of prey species) to rearing Chinook salmon and coho salmon when HVTH coho salmon densities are highest in March and April.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

- NMFS recommends that the BIA work with the HVT to supplement streams on the HVR using salmon or steelhead carcasses or carcass analogs to bolster the marine derived nutrient levels and increase the amount of invertebrate prey for Chinook salmon and coho salmon to consume while rearing in freshwater. This is expected to help alleviate concerns of high fish density when HVTH coho salmon are planted into streams. Pending approval by a fish pathologist, carcasses from TRH could be utilized for this purpose.

Fully implementing this EFH conservation recommendation would protect, by avoiding or minimizing the adverse effects described in section 3.2, for Pacific Coast salmon.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the BIA must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)].

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. Supplemental Consultation

The BIA 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 Data Quality Act (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 the Bureau of Indian Affairs. Other interested users could include the Hoopa Valley Tribe, Yurok Tribe, the Bureau of Reclamation, California Department of Fish and Wildlife, and Trinity River stakesholders. Individual copies of this opinion were provided to the Bureau of Indian Affairs. The document will be available within two 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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