Science, Service, Stewardship

2016 5-Year Review: Summary & Evaluation of California Coastal Chinook Salmon and Northern California Steelhead

National Marine Fisheries Service
West Coast Region

April 2016

5-YEAR REVIEW: CALIFORNIA COASTAL CHINOOK SALMON AND NORTHERN CALIFORNIA STEELHEAD

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
Chinook salmon (*Oncorhynchus tshawytscha*)	California Coastal (CC) Chinook salmon
steelhead (*Oncorhynchus mykiss*)	Northern California (NC) steelhead

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1.0 GENERAL INFORMATION

1.1 INTRODUCTION

Many West Coast salmon and steelhead (*Oncorhynchus sp*.) stocks have declined substantially from their historic numbers and now are at a fraction of their historical abundance. There are several factors that contribute to these declines, including: overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices. These factors, among others, led to the National Marine Fisheries Service's (NMFS) listing of 28 salmon and steelhead stocks in California, Idaho, Oregon, and Washington under the Federal Endangered Species Act (ESA).

The ESA, under section 4(c)(2), directs the Secretary of Commerce to review the listing classification of threatened and endangered species at least once every five years. After completing this review, the Secretary must determine if any species should be: (1) removed from the list; (2) have its status changed from threatened to endangered; or (3) have its status changed from endangered to threatened. NMFS completed a 5-year status review in 2011 and concluded the status for threatened California Coastal (CC) Chinook salmon and Northern California (NC) steelhead should remain as threatened (NMFS 2011a, NMFS 2011b). This document summarizes NMFS's current 5-year review for the threatened CC Chinook salmon and NC steelhead.

1.1.1 BACKGROUND ON SALMONID LISTING DETERMINATIONS

The ESA defines species to include subspecies and distinct population segments (DPS) of vertebrate species. A species may be listed as threatened or endangered. To identify distinct population segments of salmon species we apply the Policy on Applying the Definition of Species under the ESA to Pacific Salmon (56 FR 58612). Under this policy we identify population groups that are evolutionarily significant units (ESU) within their species. We consider a group of populations to be an ESU if it is substantially reproductively isolated from other populations and represents an important component in the evolutionary legacy of the biological species. We consider an ESU as constituting a DPS and therefore a species under the ESA.

In 2006, NMFS applied the joint U.S. Fish and Wildlife Service-National Marine Fisheries Service distinct population segment (DPS) policy (61 FR 4722) rather than the agency's ESU policy for the delineation of West Coast steelhead (O. mykiss) DPSs under the ESA. Under this policy, a DPS of steelhead must be discrete from other con-specific populations, and it must be significant to its taxon. A group of organisms is discrete if it is ''markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, and behavioral factors"

(61 FR 4722). According to the DPS policy, if a population group is determined to be discrete, NMFS must then consider whether it is significant to the taxon to which it belongs. Considerations in evaluating the significance of a discrete population segment include: (1) persistence of the discrete population segment in an unusual or unique ecological setting for the taxon; (2) evidence that the loss of the discrete population segment would cause a significant gap in the taxon's range; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere outside its historical geographic range; or (4) evidence that the discrete population segment has marked genetic differences from other population segments of the species.

Artificial propagation programs (hatcheries) are common throughout the range of ESA-listed West Coast salmon and steelhead. Prior to 2005, our policy was to include in the listed ESU or DPS only those hatchery fish deemed essential for conservation of a species. We revised that approach in response to a court decision and on June 28, 2005, announced a final policy addressing the role of artificially propagated Pacific salmon and steelhead in listing determinations under the ESA (70 FR 37204) (hatchery listing policy). This policy establishes criteria for including hatchery stocks in ESUs and DPSs. In addition, it: (1) provides direction for considering hatchery fish in extinction risk assessments of ESUs and DPSs; (2) requires that hatchery fish determined to be part of an ESU or DPS be included in any listing of the ESU or DPS; (3) affirms our commitment to conserving natural salmon and steelhead populations and the ecosystems upon which they depend; and (4) affirms our commitment to fulfilling trust and treaty obligations with regard to the harvest of some Pacific salmon and steelhead populations, consistent with the conservation and recovery of listed salmon ESUs and steelhead DPSs.

To determine whether a hatchery program is part of an ESU or DPS and therefore must be included in the listing, we consider the origins of the hatchery stock, where the hatchery fish are released, and the extent to which the hatchery stock has diverged genetically from the donor stock. We include within the ESU or DPS (and therefore within the listing) hatchery fish that are derived from the population in the area where they are released and that are no more than moderately diverged from the local population.

Because the new hatchery listing policy changed the way we considered hatchery fish in ESA listing determinations, we completed new status reviews and ESA-listing determinations for West Coast salmon ESUs and steelhead DPSs in 2005 and 2006. On August 15, 2011 we noticed the availability of the 5-year reviews and listing recommendations for 11 ESUs of Pacific salmon and 6 DPSs of steelhead (76 FR 50447).

1.2 METHODOLOGY USED TO COMPLETE THE REVIEW

On February 6, 2015, we announced the initiation of five year reviews for 17 ESUs of salmon and 11 DPSs of steelhead in Oregon, California, Idaho, and Washington (80 FR 6695). We requested that the public submit new information on these species that has become available since our last status review in 2011. In response to our request, we received only one comment during the public comment period. Green Diamond Timber Company submitted comments regarding their Aquatic Habitat Conservation Plan (AHCP) and recommended that NMFS utilize the information provided in the AHCP Biennial Reports when conducting the 5-year reviews for Southern Oregon Northern California Coast (SONCC) coho salmon, CC Chinook salmon, and the NC steelhead. Green Diamond Resource Company also requested the 5-year reviews recognize the contributions of the AHCP to the conservation and recovery of these listed species and their habitats.

To complete the reviews, we first asked scientists from our Southwest Fisheries Science Center (SWFSC) to collect and analyze new information about ESU and DPS viability. To evaluate viability, NMFS scientists used the Viable Salmonid Population (VSP) concept developed by McElhany *et al*. (2000). The VSP concept evaluates four criteria – abundance, productivity, spatial structure, and diversity – to assess species viability. Through the application of this concept, the SWFSC considered new information on salmon and steelhead population viability criteria. They also considered new information on ESU and DPS boundaries. At the end of this process, the science teams prepared reports detailing the results of their analyses. These reports were compiled in a viability assessment report (viability assessment) (Williams *et al*. 2016) and used to inform the review of current status.

To further inform the reviews, we consulted salmon management biologists from the West Coast Region who are familiar with hatchery programs, habitat conditions, dam operations, and harvest management. Salmon biologists met with the SWFSC scientists to review available information on fish distribution and trends; changes to status of listing factors (*i.e*., habitat destruction, overutilization for commercial purposes, disease and predation pressures, inadequacy of existing regulations, other natural or man-made factors); and protective measures implemented since the last status review.

In preparing this report, we considered all relevant information, including the work of the SWFSC (Williams *et al*. 2016); the draft recovery plan for the species in question; technical reports prepared in support of the draft recovery plans for the species in question; the listing record (including designation of critical habitat and adoption of protective regulations); recent biological opinions issued for NC steelhead and CC Chinook salmon; and the information and professional

judgment provided by salmon management biologists. The present report describes the agency's findings based on all of the information considered.

1.3 BACKGROUND – SUMMARY OF PREVIOUS REVIEWS, STATUTORY AND REGULATORY ACTIONS, AND RECOVERY PLANNING

1.3.1 FEDERAL REGISTER NOTICE ANNOUNCING INITIATION OF THIS REVIEW

80 FR 6695; February 6, 2015

1.3.2 LISTING HISTORY

The CC Chinook salmon ESU was originally listed as a threatened species in 1999 (64 FR 50394). In 2005 following a reassessment of its status and after applying NMFS hatchery listing policy, we reaffirmed that the ESU continued to be threatened and also listed several small hatchery stocks that are associated with the ESU (70 FR 37160). See Table 1 for details.

Several west coast steelhead were originally defined as an ESU and listed as a threatened species in 1997 (62 FR 43937) (Table 1). Only anadromous (steelhead) were considered a part of the ESU, non-anadromous (resident rainbow trout) form of the species were not considered part of the ESU that was listed (62 FR 43937). A court ruling in 2001 (Alsea Valley Alliance v. Evans, 161 F. Supp. 2d 1154 (D. Or. 2001)) determined that listing only a subset of a species or ESU/DPS, such as the anadromous portion of the steelhead ESU, was not allowed under the ESA. Because of this court ruling, NMFS conducted updated status reviews for all west coast steelhead ESUs that took into account those non-anadromous populations below dams and other major migration barriers that were considered to be part of the steelhead ESUs (Good *et al.*, 2005). Subsequently, NMFS decided to use the joint FWS-NMFS DPS policy to delineate steelhead-only DPSs rather than ESUs that included both steelhead and the related non-anadromous forms. Using this DPS policy, NMFS redefined the steelhead ESU as steelhead-only DPS and reaffirmed that the NC steelhead only DPS was a threatened species under the ESA (71 FR 834, January 5, 2006).

Table 1: Summary of the listing history under the Endangered Species Act for CC Chinook salmon and NC steelhead.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
Chinook salmon *(O. tshawytscha)*	**California Coastal Chinook salmon**	**FR notice:** 64 FR 50394 **Date:** 9/16/1999 **Classification**: Threatened	**FR notice:** 70 FR 37160 **Date:** 6/28/2005 **Classification**: Threatened including hatchery stocks
steelhead *(O. mykiss)*	**Northern California steelhead**	**FR notice:** 65 FR 36074 **Date:** 6/7/2000 **Classification:** Threatened	**FR notice:** 71 FR 834 **Date:** 1/5/ 2006 **Re-classification:** Reaffirmed threatened

1.3.3 ASSOCIATED RULEMAKING

The ESA requires NMFS to designate critical habitat, to the maximum extent prudent and determinable, for species it lists under the ESA. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features essential to the conservation of the species, and those features which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time of listing if the agency determines that the area itself is essential for conservation of the species. We originally designated critical habitat for CC Chinook salmon when the ESU was promulgated in 2000. We subsequently withdrew our designation for CC Chinook salmon in 2002 and later issued a new designation in 2005 (70 FR 52488) (Table 2). NMFS designated NC steelhead DPS critical habitat in 2005 (Table 2).

Section 9 of the ESA prohibits the take of species listed as endangered. The ESA defines take to mean harass, harm, pursue, hunt, shoot, wound, trap, capture, or collect, or attempt to engage in any such conduct. For threatened species, the ESA does not automatically prohibit take, but instead authorizes the agency to adopt regulations it deems necessary and advisable for species conservation including regulations that prohibit take (ESA section 4(d)). In 2002, NMFS promulgated 4(d) protective regulations for CC Chinook salmon ESU (67 FR 1116). In 2005, the 4(d) rule for CC Chinook salmon ESU was revised. NMFS originally promulgated 4(d) protective regulations for NC steelhead in 2002, respectively, and then subsequently modified those regulations in 2005 (Table 2).

Table 2: Summary of rulemaking for 4(d) protective regulations and critical habitat for CC Chinook salmon and NC steelhead.

Salmonid Species	ESU/DPS Name	4(d) Protective Regulations	Critical Habitat Designations
Chinook salmon *(O. tshawytscha)*	**California Coast Chinook Salmon**	**FR notice:** 67 FR 1116 **Date:** 1/9/2002; **Revised**: 6/28/2005 (70 FR 37160)	**FR notice:** 70 FR 52488 **Date:** 9/2/2005
steelhead *(O. mykiss)*	**Northern California steelhead**	**FR notice:** 65 FR 42422 **Date:** 7/10/2000 **Revised**: 6/28/2005 (70 FR 37160)	**FR notice:** 70 FR 52488 **Date:** 9/2/2005

1.3.4 REVIEW HISTORY

Table 3 lists the numerous scientific assessments of the status of the CC Chinook salmon ESU and NC steelhead DPS. These assessments include status reviews conducted by our Northwest Fisheries Science Center and SWFSC and technical reports prepared in support of recovery planning for these species.

Table 3: Summary of previous scientific assessment for CC Chinook salmon and NC steelhead

Salmonid Species	ESU/DPS Name	Document Citation
Chinook salmon *(O. tshawytscha)*	**California Coast Chinook Salmon**	Myers *et al.* 1998 Busby *et al.* 1996 Good *et al.* 2005 Bjorkstedt *et al.* 2005 Spence *et al.* 2008 Williams *et al.* 2011 Williams *et al.* 2016
steelhead *(O. mykiss)*	**Northern California steelhead**	Busby *et al.* 1996 Adams 2000 Good *et al.* 2005 Bjorkstedt *et al.* 2005 Spence *et al.* 2008 Spence *et al.* 2012 Williams *et al.* 2011 Williams *et al.* 2016

1.3.5 SPECIES' RECOVERY PRIORITY NUMBER AT START OF 5-YEAR REVIEW PROCESS

On June 15, 1990, NMFS issued guidelines (55 FR 24296) for assigning listing and recovery priorities. We assess three criteria to determine a species' priority for recovery plan development, implementation, and resource allocation: (1) magnitude of threat; (2) recovery potential; and (3) existing conflict with activities such as construction and development.

Table 4 lists the recovery priority number for CC Chinook Salmon and NC steelhead, as reported in the most recent report to Congress (Species in the Spotlight: Survive to Thrive, Recovering Threatened and Endangered Species, FY 2013-2014 Report to Congress; available at: http://www.nmfs.noaa.gov/pr/laws/esa/final_biennial_report_2012-2014.pdf, NMFS 2015a).

1.3.6 RECOVERY PLAN OR OUTLINE

NMFS issued a public draft of the Coastal Multispecies Recovery Plan in October 2015, which includes CC Chinook salmon and NC steelhead and anticipates releasing a final plan in late 2016 (NMFS 2015b).

Table 4: Recovery Priority Number and Endangered Species Act Recovery Plan for CC Chinook salmon and NC steelhead.

Salmonid Species	ESU/DPS Name	Recovery Priority Number	Recovery Plan
Chinook salmon *(O. tshawytscha)*	**California Coast Chinook Salmon**	5	Public Draft of the Coastal Multispecies Recovery Plan is available at: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/index.html
steelhead *(O. mykiss)*	**Northern California steelhead**	5	Public Draft of the Coastal Multispecies Recovery Plan is available at: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/index.html

2.0 REVIEW ANALYSIS

In this section we review new information to determine whether CC Chinook salmon and NC steelhead species' delineations remain appropriate.

2.1 DELINEATION OF SPECIES UNDER THE ENDANGERED SPECIES ACT

Is the species under review a vertebrate?

ESU/DPS Name	YES	NO
California Coastal Chinook salmon	X	
Northern California steelhead	X	

Is the species under review listed as an ESU/DPS?

ESU/DPS Name	YES	NO
California Coastal Chinook salmon	X	
Northern California steelhead	X	

Was the ESU/DPS listed prior to 1996?

ESU/DPS Name	YES	NO	Date Listed if Prior to 1996
California Coastal Chinook salmon		X	n/a
Northern California steelhead		X	n/a

Prior to this 5-year review, was the ESU/DPS classification reviewed to ensure it meets the 1996 ESU/DPS policy standards?

Not Applicable

2.1.1 SUMMARY OF RELEVANT NEW INFORMATION REGARDING THE DELINEATION OF THE CC CHINOOK SALMON ESU AND THE NC STEELHEAD DPS

ESU/DPS Boundaries

As part of this five year review process, the SWFSC compiled and evaluated new information relevant to the geographic boundaries of all listed ESUs and DPSs in California to determine if potential boundary changes were warranted (Williams *et al*. 2016).

CC Chinook Salmon

The initial status review for Chinook salmon (Myers *et al*. 1998) proposed a single ESU for Chinook salmon populations inhabiting coastal watersheds from Cape Blanco, Oregon, south to but not including San Francisco Bay, and including tributaries of the Klamath River downstream of its confluence with the Trinity River. Subsequent review led to division of the originally proposed ESU into the SONCC ESU, and the CC ESU, the latter including populations spawning in coastal rivers from Redwood Creek (Humboldt County) south to the Russian River, inclusive (NMFS 1999a).

NMFS' previous status review (Williams *et al*. 2011) discussed the fact that populations that lie between the lower boundary of the Central Valley Fall Chinook salmon ESU (Carquinez Straits) and the southern boundary of CC Chinook salmon ESU (Russian River) were not included in either ESU, despite the fact that Chinook salmon had been reported in several basins. Available genetic evidence indicated fish from the Guadalupe and Napa rivers in San Francisco and San Pablo Bays had close affinity with Central Valley Fall Chinook salmon (Garza *et al*., unpublished data B; Garza and Pearse 2008a), and it was recommended that fish from these two watersheds be included in the Central Valley Fall Chinook ESU. Evidence for fish in Lagunitas Creek was equivocal, with 17 samples assigned almost equally between CC Chinook salmon and Central Valley Fall Chinook salmon. The biological review team in 2011 from SWFSC tentatively concluded that Lagunitas Creek Chinook salmon should be considered part of the CC Chinook salmon ESU pending additional data (Williams *et al*. 2011). NMFS subsequently indicated that a boundary change was under consideration (76 FR 50447); however, no action has been taken to date. Currently there is no new genetic information that helps resolve this issue (Spence 2016).

Northern California Steelhead

In the previous viability assessment (Williams et al. 2011) it was determined that new genetic population structure data not available at the time of the original DPS delineation suggest several potential boundary changes may be warranted for coastal California DPSs. Based on these new data and information, it was recommended that a Biological Review Team (BRT) be convened to compile, review, and evaluate the best available scientific and commercial information on

steelhead genetics, life history and biology, and the ecological/habitat requirements of steelhead that are relevant to evaluation current boundaries and potential DPS boundary changes. The BRT review has yet to be conducted, and therefore there has been no change to the existing boundary delineations of NC steelhead DPS (Spence 2016).

Membership of Hatchery Programs

There are no current hatcheries within the CC Chinook salmon ESU. The Mad River NC steelhead hatchery continues to be operational, but was not included in the DPS listings in 2006 (71 FR 834), and at this time NMFS does not recommend the addition of Mad River hatchery steelhead to the DPS. Reneski (2010) found divergence between hatchery and natural steelhead in the Mad River. A final Hatchery and Genetic Management Plan (HGMP) should be completed by the next 5-Year Status Review and the genetic similarities between hatchery and natural steelhead will be re-evaluated as part of the HGMP process.

2.2 RECOVERY CRITERIA

The ESA requires that NMFS develop recovery plans for each listed species. Recovery plans must contain, to the maximum extent practicable, objective measureable criteria for delisting the species, site-specific management actions necessary to recover the species, and time and cost estimates for implementing the recovery plan.

2.2.1 DO THE SPECIES HAVE FINAL, APPROVED RECOVERY PLANS CONTAINING OBJECTIVE, MEASURABLE CRITERIA?

ESU/DPS Name	YES	NO
California Coastal Chinook salmon		X
Northern California steelhead		X

A multispecies recovery plan is in public draft for CC Chinook salmon ESU, Central California Coast steelhead DPS, and NC steelhead DPS. This multispecies proposed plan includes recovery criteria that are objective and measurable, and utilizes the best available and most up-to-date information on the biology of the species and their habitat. Once the recovery plan is final the recovery criteria can be evaluated in the 5-Year Status Reviews. Since the recovery criteria specified in the public draft plan are subject to change, the SWFSC used the TRTs viability criteria as the basis for evaluating biological viability status in this review.

2.2.2 ADEQUACY OF RECOVERY CRITERIA

Based on new information considered during this review, are the recovery criteria still appropriate?

ESU/DPS Name	YES	NO
Calfornia Coastal Chinook salmon	N/A	
Northern California steelhead	N/A	

Are all of the listing factors that are relevant to the species addressed in the recovery criteria?

ESU/DPS Name	YES	NO
Calfornia Coastal Chinook salmon	N/A	
Northern California steelhead	N/A	

2.2.3 LIST THE RECOVERY CRITERIA AS THEY APPEAR IN THE RECOVERY PLAN

Final recovery plans have not been issued for CC Chinook salmon and NC steelhead, and recovery criteria have not been finalized.

2.3 UPDATED INFORMATION AND CURRENT SPECIES' STATUS

2.3.1 ANALYSIS OF VIABLE SALMONID POPULATION (VSP) CRITERIA

The following ESU summary is taken from the SWFSC's biological viability report. Please see Williams *et al.* 2016, for a more detailed discussion of each species VSP status.

ESU/DPS Summary

California Coastal Chinook Salmon

The lack of long-term population-level estimates of abundance for Chinook salmon populations continues to hinder assessment of status, though the situation has improved with implementation of the Coastal Monitoring Plan (CMP) in the Mendocino Coast Region and portions of Humboldt County. The available data, a mixture of short-term (6-year or less) population estimates or expanded redd estimates and longer-term partial population estimates and spawner/redd indexes, provide no indication that any of the independent populations (likely to persist in isolation) are approaching viability targets. In addition, there remains high uncertainty regarding key populations, including the Upper and Lower Eel River populations and the Mad River population, due to incomplete monitoring across the spawning habitat of Chinook salmon in

these basins (O'Farrell *et al*. 2012). Because of the short duration of most time series for independent populations, little can be concluded from trend information. The longest time series, video counts in the Russian River, indicates the population has remained fairly steady during the 14-year period of record. The longer time series associated with index reaches or partial populations suggest mixed patterns, with some showing significant negative trends (Prairie Creek, Freshwater Creek, Tomki Creek), one showing a significant positive trend (Van Arsdale Station), and the remainder no significant trends. Overall, there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review (Williams *et al*. 2011).

At the ESU level, the loss of the spring-run life history type represents a significant loss of diversity within the ESU, as has been noted in previous status reviews (Good *et al*. 2005; Williams *et al*. 2011). Concern remains about the extremely low numbers of Chinook salmon in most populations of the North-Central Coast and Central Coast strata, which diminishes connectivity across the ESU (Figure 1). However, the fact that Chinook salmon have regularly been reported in the Ten Mile, Noyo, Big, Navarro, and Garcia rivers represents a significant improvement in our understanding of the status of these populations in watersheds where they were thought to have been extirpated. These observations suggest that spatial gaps between extant populations are not as extensive as previously believed. In summary, the new information available since the last status review (Williams *et al*. 2011) does not appear to suggest there has been a change in extinction risk for this ESU.

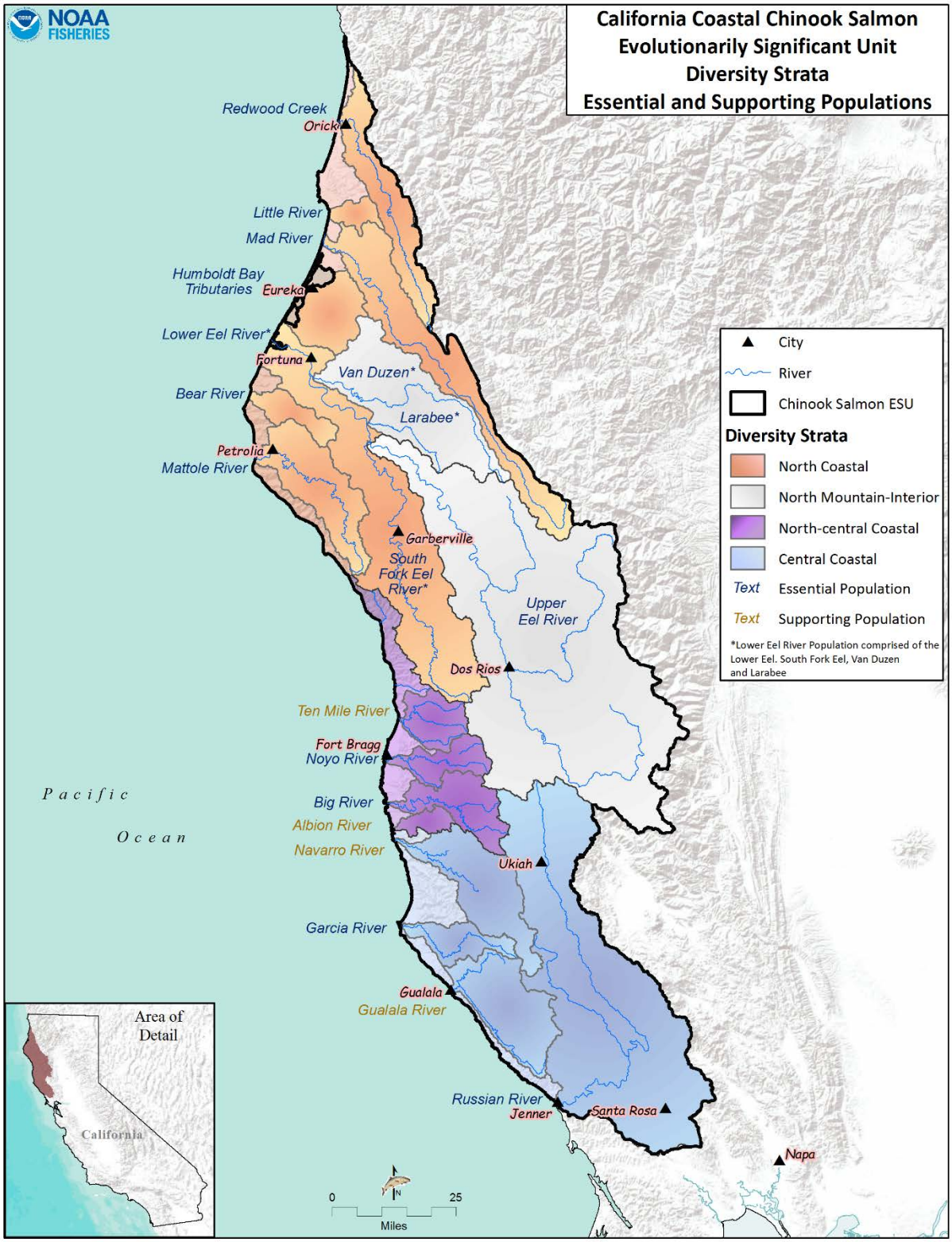

Figure 1: Map of California Coastal Chinook salmon ESU with diversity strata boundaries.

Northern California Steelhead

The availability of information on steelhead populations in the NC steelhead DPS has improved considerably in the past 5 years, due to implementation of the CMP across a significant portion of the DPS. Nevertheless, significant gaps in information still remain, particularly in the Lower Interior and North Mountain Interior diversity strata, where there is very little information from which to assess status (Figure 2). Overall, the available data for winter-run populations— predominately in the North Coastal, North-Central Coastal, and Central Coastal strata— indicate that all populations are well below viability targets, most being between 5% and 13% of these goals (Figure 2). For the two Mendocino Coast populations with the longest time series, Pudding Creek and Noyo River, the 13-year trends have been negative and neutral, respectively (Spence 2016). However, the short-term (6-year) trend has been generally positive for all independent populations in the North-Central Coastal and Central Coastal strata, including the Noyo River and Pudding Creek (Spence 2016). Data from Van Arsdale Station likewise suggests that, although the long-term trend has been negative, run sizes of natural-origin steelhead have stabilized or are increasing (Spence 2016). Thus, we have no strong evidence to indicate conditions for winter-run populations in the DPS have worsened appreciably since the last status review (Williams *et al*. 2011).

Summer-run populations continue to be of significant concern because of how few populations currently exist. The Middle Fork Eel River population has remained remarkably stable for nearly five decades and is closer to its viability target than any other population in the DPS (Spence 2016). Although the time series is short, the Van Duzen River appears to be supporting a population numbering in the low hundreds. However, the Redwood Creek and Mattole River populations appear small, and little is known about other populations including the Mad River and other tributaries of the Eel River (*i.e*., Larabee Creek, North Fork Eel, and South Fork Eel).

In summary, the available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the last status reviews (Williams *et al*. 2011). Most populations for which there are population estimates available remain well below viability targets; however, the short-term increases observed for many populations, despite the occurrence of a prolonged drought in northern California, suggests this DPS is not at immediate risk of extinction.

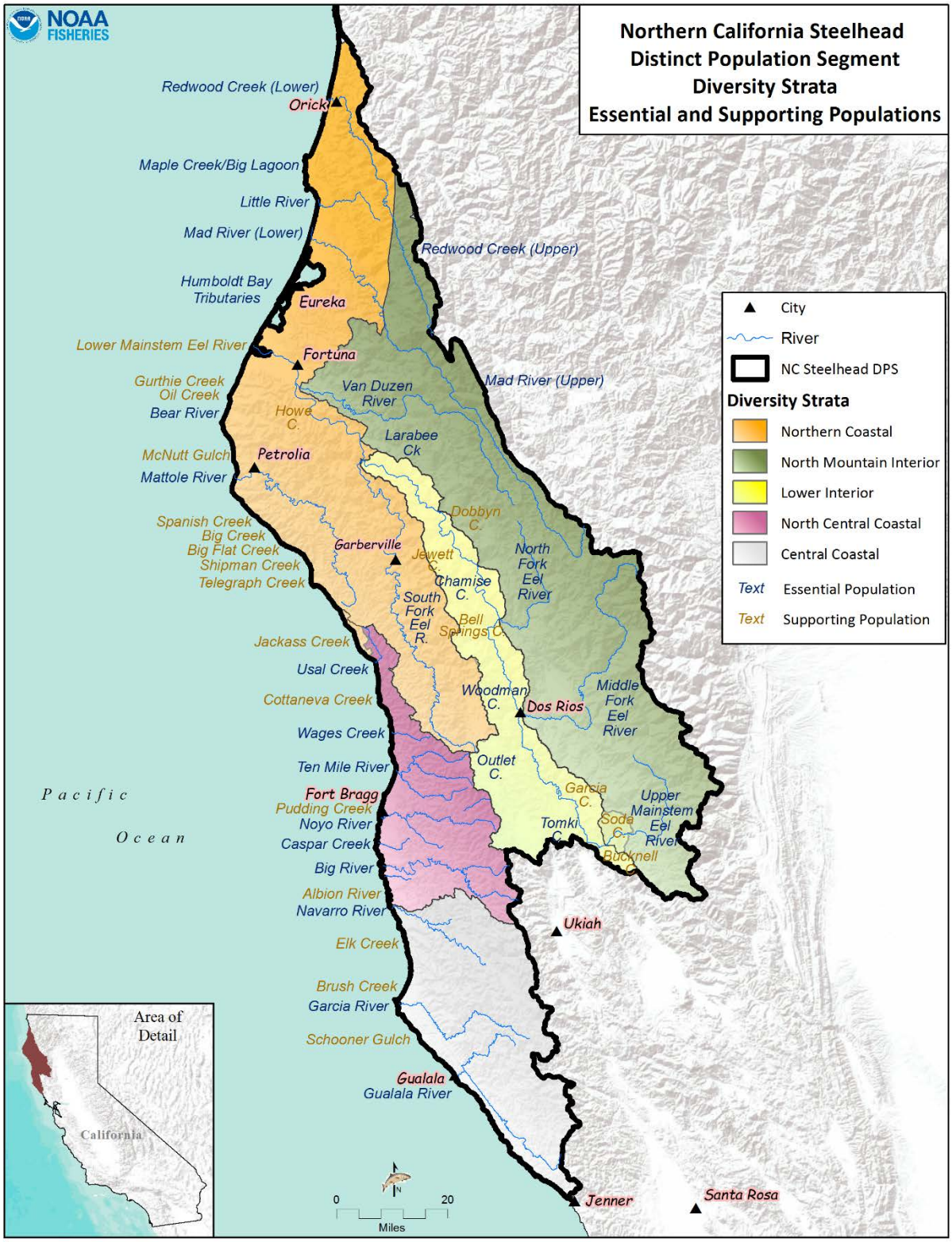

Figure 2: Map of Northern California steelhead DPS with diversity strata boundaries.

2.3.2 FIVE LISTING FACTORS ANALYSIS

Section 4(a)(1)(b) of the ESA directs us to determine whether any species is threatened or endangered because of any of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or man-made factors affecting its continued existence. Section 4(b)(1)(A) requires us to make listing determinations after conducting a review of the status of the species and taking into account efforts to protect such species. Below we discuss new information relating to each of the five factors as well as efforts being made to protect the species. The 2011 status review discusses a comprehensive list of threats associated with each listing factor; while that information is still valid, this review is focused on the top three to five threats and how those threats have changed since the previous review. Because the ranges of the CC Chinook salmon ESU and the NC steelhead DPS considerably overlap, the discussion below applies to both species, unless otherwise noted.

Listing Factor A: Present or threatened destruction, modification or curtailment of its habitat or range

Significant habitat restoration and protection actions at the Federal, state, and local levels have been implemented to improve degraded habitat conditions and restore fish passage. While these efforts have been substantial and are expected to benefit the survival and productivity of the targeted populations, we do not yet have evidence demonstrating that improvements in habitat conditions have led to improvements in population viability. The effectiveness of habitat restoration actions and progress toward meeting the viability criteria will be monitored and evaluated with the aid of new reporting techniques. Generally, it takes one to five decades to demonstrate such increases in viability. Below, we summarize several noteworthy restoration and protection actions implemented since the last review. We also summarize the primary threats to habitat conditions that remain.

Water Quantity and Quality

Many surface waters are polluted as water is discharged from agricultural operations, urban/suburban areas, and industrial sites. These discharges transport pollutants such as pesticides, sediment, nutrients, salts, pathogens, and metals into surface waters. Although conditions in most streams, rivers, and estuaries throughout the State are much improved from 40 years ago, the rate of improvements have slowed over time (SFES 2015). Contaminants such as polybrominated diphenyl ethers (PBDEs) and copper have declined over time, however many potentially harmful chemicals and contaminants of emerging concern (*e.g.* pharmaceuticals) have

yet to be addressed. Legacy pollutants such as mercury and polychlorinated biphenyls (PCBs) limit consumption of most fish, and directly and indirectly affect endangered fish populations, as well as their designated critical habitat.

In particular, urban storm water runoff is consistently toxic to fish and invertebrates (McIntyre *et al*. 2014, 2015). The array of toxicity is variously attributed to metals from motor vehicle brake pads; petroleum hydrocarbons from vehicle emissions of oil, grease, and exhaust; as well as residential pesticide use. Urban storm water toxicity has been linked to pre-spawn mortality of coho salmon (Scholz *et al*. 2012), the degree of impervious surface (Feist *et al*. 2011), and has been directly linked to effects at the population level (Spromber and Scholz 2011). Emphasis on wastewater treatment plant upgrades and new legislative requirements (State Water Resource Control Board (SWRCB) and Environmental Protection Agency (EPA)), development and implementation of total maximum daily load programs (TMDLs) (*i.e*., pathogens, selenium, pesticides, pyrethroids, methylmercury, heavy metals, salts, nutrients), and adoption of new water quality standards (*i.e*., Basin Plans), all aid in protecting beneficial uses for aquatic wildlife. In the future, we expect that pollutants of concern will be better controlled through the implementation of green infrastructure approaches (*i.e*., rain gardens, green roofs, and bio-swales) industry phase-out, and state bans.

In California, approximately 9,493 miles of rivers/streams and some 513,130 acres of lakes/reservoirs are listed as impaired by irrigated agriculture through section 303(d) of the Clean Water Act. Of these, approximately 2800 miles, or approximately 28 percent, have been identified as impaired by pesticides. In recent years, NOAA scientists have investigated the direct and indirect effects of pesticides on individual ESA listed species, the foodwebs on which they depend, and at the population level (Baldwin *et al*. 2009, Laetz *et al*. 2009, Macneale *et al*. 2010, Scholz *et al*. 2011). NMFS has consulted on seven pesticide batch ESA Section 7 consultations, and concluded that chlorpyrifos, diazinon, malathion, carbaryl, carbofuran, methomyl, bensulide, dimethoate, ethroprop, methidathion, naled, phorate, phosmet, 2,4-D, chlorothalonil, diuron, oryzalin, pendimethalin, and trifluralin, jeopardize the continued existence of ESA listed species and/or adversely modify critical habitat for salmonids across the West Coast Region (NMFS, 2008, 2009, 2010, 2011c, 2013).

New testing methods, reasonable and prudent alternatives (*i.e*., buffer requirements and no-spray zones), and other programs have been developed to begin minimizing impacts. For example, the Irrigated Land Regulatory Program (ILRP) regulates discharge from agricultural lands. This unique program requires agricultural operators to monitor the quality of water discharged to receiving water and implement management actions when impairments are detected.

Poor water quality pollution poses important challenges for the conservation and recovery of ESA listed species and their habitat. Innovative and sustainable solutions such as green infrastructure and low-impact design (LID) are needed to manage pollutants as close to the source as possible. If these solutions can be applied at a broader scale, LID technology, policies, and watershed scale programs have the potential to maintain and/or restore hydrologic and ecological functions in a watershed, thereby improving water quality for ESA listed species and the ecosystem on which the species depend.

Water quality and quantity associated with discharged flows from Scott Dam, Eel River, and Coyote Valley Dam[1], Russian River, pose a critical threat to the survival and recovery of ESA-listed salmonids. Both reservoirs are at near record low levels. Poor water years can result in unreliable water supply and extremely low reservoir storage elevations potentially leading to adverse water quality and quantity conditions for downstream rearing juvenile steelhead and upstream migrating adult Chinook salmon. Specifically, low reservoir storage elevations in these two reservoirs can lead to stressful water temperatures (*i.e.*, in excess 20°C) and significantly reduced flows for summer rearing steelhead and migrating adult Chinook salmon.

Additionally, chronic suspended sediment discharged from Coyote Valley Dam (CVD) on Lake Mendocino causes prolonged high turbid flows that are not directly attributed to low reservoir elevations. The Russian River Biological Opinion (NMFS 2008a), noted that CVD is also known to impact CC Chinook salmon by releasing highly turbid water for extended periods well after turbidity levels have diminished upstream of the mainstem's confluence with the East Branch and elsewhere in the Russian River's unregulated tributaries. When the bulk of the suspended sediment load is captured in reservoirs and released during the winter and spring as occurs with CVD, the result is degraded salmonid spawning and rearing habitat (Everest 1969; NMFS 2008a). Extended turbidity may also reduce the diversity of habitat for benthic invertebrates and eliminate certain taxa of invertebrates from the food chain reducing food availability for juvenile salmonids. As required by the Russian River Biological Opinion, the Army Corps of Engineers (Corps) is required to collect and analyze turbidity data to document increase in turbidity from flood control operations that adversely affect CC Chinook salmon rearing and spawning habitat on the mainstem Russian River between CVD and the City of Cloverdale. The Corps currently collects these turbidity data, and the analysis is ongoing.

Water quantity is a larger problem for summer rearing NC steelhead than for CC Chinook salmon. Juvenile Chinook salmon migrate to the ocean before water levels are the lowest, although water quantity can delay/limit adult Chinook salmon escapement. Existing surface

[1] This impacts CC Chinook salmon, CCC coho salmon and CCC steelhead but not NC steelhead, as that is south of their boundary.

water rights in California have over-appropriated approximately five times the natural mean annual runoff, and account for almost 1000 percent of natural surface water supplies (Grantham and Viers 2014). Although these statistics pertain to the entire state, surface and groundwater within the CC Chinook salmon ESU and NC steelhead DPS is likely overallocated to a similar, albeit slightly lower degree. The recently signed California legislation, Groundwater Sustainability Management Act (GSMA) (see discussion below under Listing Factor D), may improve the existing over-allocation of the state's groundwater resources, which is often hydrologically linked to surface flow in adjacent stream channels (see below under "Protective Efforts"). NMFS believes currently impaired habitat conditions due to reduced streamflow will generally persist across the ESU/DPS.

The threat of blocked fish passage resulting from instream diversion structures may be slightly reduced since the last status review, but remains a threat to CC Chinook salmon and NC steelhead. Within the NC steelhead and CC Chinook salmon DPS/ESU there are two major reservoirs that threaten survival and recovery (CVD and Scott Dam). In addition, CalFish's Passage Assessment Database (PAD)[2] as of August 2015, has 519 total manmade fish passage barriers and 661 partial or temporal manmade fish barriers in Mendocino, Sonoma, Trinity and Humboldt Counties. Some of these barriers include those in basins outside of the listed range of the species. A total of 159 remediated manmade barriers have been reported to CalFish (2015). The oldest record of a remediated barrier in CalFish is from 1970 but most records are from the 2000s (CalFish 2015). Fish passage has not been confirmed for these remediated barriers. While PAD was initially limited in its scope because many barriers were not documented, reporting and updating has increased in frequency.

A significant and growing new threat is the unpermitted damming and diversion of rural streams and rivers for the purpose of irrigating illicit marijuana gardens. Marijuana-related diversion dams are likely a paramount threat to salmonid survival and habitat function in many first and second-order streams located in remote, rural areas.

Rural Residential and Agriculture

Wine grapes are by far the largest legal agricultural product within the range. Short-term forecasts call for increased demand for premium wines, which is a large proportion of Sonoma and Mendocino County's production (Silicon Valley Bank 2014). Best available information suggests agricultural development continues at a modest pace, since the last status review within the range of NC steelhead and CC Chinook salmon.

[2] CalFish's PAD is a cooperative anadromous fish and habitat data program that documents and tracks fish passage barriers, among other things, throughout the State of California.

The above discussion focuses only on legal, county regulated agriculture. Marijuana cultivation is now a growing threat to salmon and steelhead recovery throughout California (especially in Mendocino, Humboldt and Trinity counties). Growers often dam and dewater creek channels to irrigate their marijuana gardens. Pesticides, fertilizers and poisons are commonly used without regard for their impacts on the environment (Bauer *et al.* 2015). This illicit agricultural component has grown exponentially since listing, and will continue to degrade salmonid habitat until adequate controls and regulations, such as those that govern legitimate agriculture are enacted.

The current trend of rural residential expansion with the NC steelhead and CC Chinook salmon ranges is unknown. However, anecdotal observations suggest rural residential land uses are expanding as small timber and other large landowners continue to subdivide and sell parcels of land.

Identified stressors associated with these threats include habitat fragmentation, agricultural and residential water diversions from rivers/streams, and point/non-point pollutant discharge (*i.e.*, sediment, pesticides, septic-waste *etc.*). These stressors have likely increased slightly since the last status review due to expanding agricultural acreage and rural residential, and will likely increase into the future until water scarcity curbs further development (see discussion under "Water Diversions").

Timber Harvest

Timber production is a dominant land use throughout the range of NC steelhead. On these timberlands, the generally impaired state of instream aquatic habitat is primarily a legacy effect from logging and yarding practices employed decades ago, when few environmental laws existed and regulatory oversight was limited. Unfortunately, many of these legacy effects (*e.g.*, high instream sediment loads, poor large wood debris (LWD) recruitment, *etc.*) continue to impact NC steelhead and CC Chinook salmon habitat at the present time, and will likely require decades to naturally "heal" as watersheds evolve and respond to altered geomorphic and hydrologic regimes.

Within the NC steelhead DPS and CC Chinook salmon ESU there are two important habitat conservation plans (HCPs) that likely have contributed to the conservation of the species. These include the Humboldt Redwoods Company (HRC) HCP, and the Green Diamond Resource (GDRC) HCP. The HRC (formerly PALCO) HCP was finalized in 1999 and is valid through 2049. The HCP covers approximately 210,000 acres of industrial timberlands in northern California and includes mitigation strategies related to timber management, forest road construction and maintenance, and rock quarrying. The HCP includes three major rivers within NC steelhead DPS

and CC Chinook salmon ESU: the Eel River, Van Duzen River, and Mattole River. The goals of the HCP are to achieve and move towards properly functioning aquatic conditions for anadromous salmonids within the management area covered by the HCP. To ensure habitat goals are met, the HCP relies heavily on watershed analysis, monitoring, and adaptive management tools. Monitoring reports from HRC suggest that many of the objectives in the HCP are being achieved. In most of their watersheds, freshwater habitat conditions appear to either be stable or improving since 2003 (Humboldt Redwood Company 2014.). In particular, a trend in declining summer water temperatures in coho bearing streams has been observed between 2001 and 2012 (HRC ATM Report 2013). All of these factors suggest that the HRC HCP is reducing the threat of timber harvest for the NC steelhead DPS.

The GDRC HCP was finalized in 2006 and is valid through 2056. The HCP covers approximately 410,000 acres in coastal northern California. The HCP affects all NC steelhead and CC Chinook salmon populations in the Eel and Van Duzen Rivers. One of the major mitigation activities of the GDRC HCP include removing 50% of high and moderate priority road sites within the first 15 years of plan implementation. From 2007 to 2014 GDRC has treated 2,009 sites saving 746,473 cubic yards of sediment and has spent $24,589,690 (GDRC 2015). These measures, coupled with provisions for riparian protection, mass wasting prevention, and adaptive management ensure that adverse impacts to steelhead and Chinook salmon rearing, migration, and spawning habitats are minimized or avoided. Three biennial reports for the GDRC HCP have been submitted to NMFS since 2009. These reports focus primarily on reporting turbidity, temperature and gravel permeability data, which in part characterizes the baseline conditions; in addition to informing future monitoring efforts. At this time, it is not possible to evaluate changes in habitat conditions resulting from HCP implementation.

The GDRC and HRC HCPs are expected to improve management of private timberlands in northern California. Despite the benefits to anadromous salmonid habitat resulting from implementation of the HRC and GDRC HCPs, timber harvest within the range of the NC steelhead DPS and CC Chinook salmon continues to be a threat because a large extent of land within the range is harvested and not covered by either HCP.

Road building associated with timber harvest, and rural road construction in general, can destabilize hillsides and increase erosional processes that deliver fine sediment to streams and rivers. Poorly designed or constructed stream-crossings, usually incorporating a type of cylindrical culvert or a flat-car bridge, can alter stream channel morphology and hydraulic characteristics both within, and upstream and downstream, of the road crossing, which can often preclude adult and juvenile fish from migrating upstream past the crossing. Due to recent advances in fish passage analysis (*i.e.*, Fish Crossing Program) and efforts by timber-land owners

to address fish passage barriers occurring on their land, many high-priority blockages have been addressed, although a still greater number of lower-priority sites remain. Overall, given the relatively high awareness that exists regarding the importance of fish passage remediation by state and federal regulators, the overall threat of timber roads as a fish passage impediment has likely lessened slightly since NC steelhead listing. Similarly, road-related erosion and the impact the resulting sediment has on instream habitat, is a continuing threat that has likely been reduced from the last status review due to new Forest Practice Rules (See Listing Factor D) adopted in 2013 and relatively high awareness amongst stakeholders. Nevertheless, decommissioning an old logging road (*i.e.*, outsloping and ripping the road bed, removing culverts and dips, replanting exposed soil, *etc.*) can be a costly endeavor. As a result, road restoration occurs at a slower rate compared to other restoration actions. Thus, while new road construction typically incorporates mitigation measures that minimize erosion, many legacy roads were constructed without those measures and will continue to erode and supply sediment to waterways into the future.

Protective Efforts

Marijuana Cultivation

Two recent developments offer promise in the effort to minimize the environmental impacts of marijuana cultivation in California, an industry made up of both legal and illicit operators that has expanded exponentially during the past decade. The North Coast Regional Water Quality Control Board (NCRWQCB) currently has a proposed waste discharge waiver for state-legal medicinal marijuana cultivation. The proposal attempts to regulate and manage waste discharge into surface water bodies in a manner similar to other agricultural industries in the state, such as vineyards and grazing, with a tiered approach that places prospective operations into one of 4 different levels based largely on the areal size of the operation. All growers regulated under the waiver program will be required to implement specific Best Management Practices identified by the NCRWQCB, with program compliance verified either through self-reporting (for the smaller farms) to inspection by state agency personnel for larger operations. While the marijuana cultivation waste discharge waiver shows promise toward minimizing water quality-related impacts resulting from marijuana cultivation, the realized benefit may be smaller than anticipated due to the suspected large number of illegal grows (*i.e.*, not for medicinal uses, but for black market sales) and the low likelihood that criminal operators will voluntarily register with a state agency.

Another state development that shows much stronger potential in minimizing marijuana cultivation impacts to the environment is the Medical Marijuana Regulation and Safety Act, which was signed into law in October 2015. This new law established a state-controlled

regulatory and enforcement program that will control the permitting, regulation, and taxing of the medical marijuana industry.

Russian River Habitat Focus Area

The Russian River watershed was selected as the first Habitat Focus Area under NOAA's Habitat Blueprint. This was an important step to increase the effectiveness of NOAA's habitat conservation science and management efforts by identifying places where NOAA offices work to meet multiple habitat conservation objectives on a watershed scale. As part of the Habitat Focus Area effort, NOAA has been working to rebuild Russian River salmonids to sustainable levels through habitat protection and restoration. NOAA's National Weather Service has been improving frost, rainfall, and river forecasts in the Russian River watershed through improved data collection and modeling for the purpose of decreasing withdrawals from streams for irrigation. NOAA is working to increase community resiliency to flooding damage through improved planning and water management strategies.

Potter Valley Block Water Releases

In 2002, NMFS issued a jeopardy biological opinion that addresses the impacts to Southern Oregon-Northern California (SONCC) coho salmon, CC Chinook salmon and NC steelhead from hydropower generation at the Potter Valley powerhouse and the Lake Mendocino powerhouse under current and future (2020) sediment conditions and water diversions from the Eel River Basin to the Russian River Basin. The jeopardy biological opinion contained a reasonable and prudent alternative (RPA) that called for implementing changes in river flow that would more closely resemble the natural hydrograph (NMFS 2002). NMFS expects the actions required by the RPA to substantially improve habitat conditions and survival rates for NC steelhead and SONCC coho salmon. In 2012, and twice during 2014, NMFS and CDFW jointly requested the project proponent (Pacific Gas and Electric) to make spring (2012, 2014, and 2015) and summer (2014) block water releases pursuant to RPA B.3 and D.1. Spring blockwater releases are primarily designed to encourage the timely emigration of juvenile Chinook salmon. Each of these spring blockwater releases presented different water supply constraints requiring different release strategies. These strategies range from temperature dependent cues, to sequential pulse releases, to mimicking a spring freshet. The purpose of the summer 2014 block water release was to enhance water quality (*i.e.*, temperature) conditions between Scott and Cape Horn dams and increase habitat availability and quality below Cape Horn Dam to Tomki Creek for rearing juvenile NC steelhead. Based on preliminary data from ongoing monitoring at the time of this status review, these releases appear to have been successful in meeting their intended objective. Since NMFS issued the biological opinion, these releases were the first time that RPA B.3 and D.1. have been utilized. Continued implementation of these elements of the RPA in the biological opinion will further reduce this threat.

Listing Factor B: Overutilization for commercial, recreational, scientific, or educational purposes

Chinook Salmon

Direct mortality in ocean Chinook salmon fisheries

Commercial and recreational ocean salmon fisheries in the Federal Exclusive Economic Zone (U.S. EEZ; 3 to 200 nautical miles offshore of California) off the coasts of Washington, Oregon, and California are authorized by NMFS under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Specifically, these fisheries are managed under the Federal Pacific Coast Salmon Fishery Management Plan (FMP). Pursuant to the MSA and consistent with the FMP, detailed management regulations are developed annually to respond to new information and the current status of each salmon stock.

Federal and state objectives for ocean salmon fisheries are sectioned by management area and species. Of these management areas, three (Cape Falcon to Humbug Mountain; Humbug Mountain to Horse Mountain; and Horse Mountain to U.S./Mexico Border) are primarily constrained by an important interplay between Sacramento River and Klamath River targeted Chinook salmon stocks and threatened CC Chinook salmon. Current information is insufficient to forecast the ocean abundance of CC Chinook salmon, however, the NMFS ESA consultation standard restricts the Klamath River fall-run (KRF) Chinook salmon age-4 ocean harvest rate to no more than 16.0 percent of the total harvest to limit impacts on this stock and other sensitive stocks. Due to this exploitation rate threshold, State and Federal fishing regulations are coordinated, and harvest of Chinook salmon is subject to seasonal closures, area and gear restrictions, and bag and size limits (78 FR 25865 ; CDFW 2013).

In ocean salmon fisheries, wild CC Chinook salmon are most commonly contacted from the Oregon state border to San Francisco, CA (Weitkamp 2010; Satterthwaite *et al.* 2014). Genetic stock identification of Chinook salmon from the Fort Bragg, CA area in 2010 and 2011 indicated catch per unit effort was similar for CC and KRF Chinook salmon in the early season and higher for CC Chinook salmon than KRF in July and August (Satterthwaite *et al.* 2014). Although CC Chinook salmon harvest does occur in northern California, mortality levels have likely been reduced through limits to KRF age-4 ocean harvest rates and commercial fishing area restrictions. However in 2013, the age-4 ocean harvest rate of KRF was estimated to be 19.6 percent.

In 2014, NMFS and CDFW considered use of an abundance-based fishery management (ABM) and determined that the collection of sufficient data to enable ABM will be difficult to achieve in the CC Chinook salmon ESU (O'Farrell *et. al* 2015). The level of data needed for ABM is greater

than the level of data currently collected, and is greater than the level of data that would be generated with full implementation of the CMP (O'Farrell *et. al* 2015). There are substantial technical difficulties associated with spawner surveys in the ESU and new programs would need to be developed to obtain ocean harvest data (O'Farrell *et. al* 2015). Looking toward the future, important steps would include: (1) addressing the technical challenges associated with implementation of the CMP and moving toward full implementation; (2) giving consideration to a pilot study aimed at assessing the feasibility of marking and tagging programs that would provide sufficient information for estimation of ocean harvest and enable cohort reconstruction assessments; and (3) identification of stable funding for this monitoring work (O'Farrell *et. al* 2015).

Indirect mortality from catch and release of undersized Chinook salmon

Ocean harvest of any undersized Chinook salmon is not permitted in California, however, indirect mortality may occur from catch and release of undersized CC Chinook salmon. Estimated mortality of released Chinook salmon in ocean fisheries (*e.g.,* KRF) ranges from approximately 12 to 42 percent depending on fish size, fishery, method, and location (Grover *et al.* 2002; PFMC 2007). Undersized Chinook salmon are routinely encountered in commercial and recreational fisheries and some degree of CC Chinook salmon mortality is inevitable. It is difficult to quantify the mortality of undersized CC Chinook salmon from catch and release methods because unmarked Chinook salmon that are caught could be either CC or KRF Chinook salmon.

Fisheries also can indirectly reduce diversity of life history strategies and alter the population structure, especially in small populations. There is a minimum size limit for harvest of Chinook salmon off the California coast, and older Chinook salmon can be removed from the population at a disproportionately higher rate. Over time this selective pressure can lead to a predominance of Chinook salmon spawning at a younger age, which could reduce the resiliency of a population to environmental variability. This population structure and life history effect is somewhat reduced for CC Chinook salmon because the exploitation rate is presumably lower than on targeted stocks such as KRF.

Bycatch in federal non-salmon fisheries

The PFMC manages three fisheries in Federal waters potentially affecting CC Chinook salmon and CCC and NC steelhead through fishery bycatch: Groundfish, Coastal Pelagic Species (CPS), and the Highly Migratory Species (HMS). The highest level of Chinook salmon bycatch occurs in the groundfish fishery; however, NMFS evaluated the Pacific Groundfish FMP in their 1999 biological opinion and determined groundfish fishery activities and implementing regulations were not likely to jeopardize the continued existence of listed salmon and steelhead (NMFS 1999b).

Chinook salmon are incidentally captured in fisheries targeting CPS but at relatively low levels (PFMC 2005). Furthermore, NMFS evaluated the CPS FMP in their 2010 biological opinion and determined fishery activities and implementing regulations were not likely to jeopardize any endangered or threatened species under their jurisdiction. HMS fisheries target various species of tunas, sharks, and billfishes as well as mahi-mahi. Although all listed salmonid ESUs and DPSs could occur in the area where HMS fishing occurs, there are no records indicating any instance of take of listed salmonids in any HMS fisheries (NMFS 2005).

Freshwater Fishing

The 2015-2016 California state sport fishing regulations allow retention of hatchery steelhead in some streams critical for CC Chinook salmon recovery. For Chinook salmon the regulations allow for a catch and release fishery in the Eel River; however, post hook and line mortality and associated reductions to spawning success are uncertain. Many streams where fishing is allowed do not have a hatchery, and these watersheds have a very low likelihood of supporting hatchery-origin steelhead. Recreational fishing on the Eel River and Russian River are particularly high, and anglers are likely to catch Chinook salmon at a high frequency if targeted during low-flow periods. Poaching and illegal retention is a threat in some populations. Recently the California Fish and Game Commission decreased this threat by implementing a low-flow closure on the Russian River and more protective low-flow fishing closures on other watersheds. CDFW has the authority under Title 14, California Code of Regulations, Section 8.00 to close select streams to fishing during specific months (depending on the area) when it determines that stream flows are below specific minimum flows or are inadequate to provide fish passage for migrating steelhead trout and salmon (depending on the area). CDFW has closed some waters to fishing in order to protect native salmon and steelhead from low water flows in California streams and rivers that have been significantly impacted by drought. Although fishing is prohibited in many areas and fines for violations are high, protection of summer steelhead populations requires special enforcement efforts (Moyle *et al.* 2008). Species identification and proper handling and release techniques, when incidental capture of CC Chinook salmon occurs, is critical to reduce the likelihood of mortality and ensure CC Chinook salmon adult survival. An outreach campaign in the Russian and Garcia Rivers has been implemented and is underway to raise angler awareness with informational press releases, fliers, and species identification signs at popular angling access points.

NC Steelhead

Overfishing

Ocean harvest is an insignificant source of mortality for the NC steelhead DPS because steelhead are rarely encountered. The impact of freshwater recreational angling is thought to be low for

steelhead in this DPS; however, the actual level of impact cannot be estimated with existing data. Recreational steelhead fishing is popular within this DPS and on the Mad River there is a bag limit of two hatchery steelhead. In streams where only catch and release fishing is allowed, all wild steelhead must be released without further harm. There are also significant restrictions on gear used for angling. During periods of decreased habitat availability (drought or low flow conditions), recreational fisheries have a greater impact on wild steelhead, and since the last status review, there have been several years of drought that may have resulted in higher impacts in some areas. However, in 2015 the California Fish and Game Commission adopted regulations that prohibit fishing for NC steelhead during low flow conditions. These new regulations only apply to twelve watersheds in Mendocino County. The regulations are intended to provide fishing opportunity when conditions allow for ample upstream and downstream movement by adult steelhead. These regulations will likely reduce the threat of recreational angling to NC steelhead during low flow periods.

Illegal Harvest

Illegal harvest of NC steelhead by sport or commercial fisherman is likely low, given the existing state ban on possessing wild steelhead in both the ocean and freshwater rivers – state and federal law includes significant fines for those caught possessing wild steelhead in California. However, poaching of summer-run fish is considered a problem in watersheds in the northern range of the DPS (NMFS 1996). Since the previous status review of this DPS, NMFS has worked with local stakeholders on outreach initiatives to reduce poaching incidents within the DPS. Specifically, NMFS, with the assistance from CDFW, NCRWQCB, Mendocino County Sheriff's Department, The Nature Conservancy, and the Manchester-Point Arena Band of Pomo Indians worked collaboratively to finalize a tribal resolution that eliminates harvesting NC steelhead from the Garcia River. As part of this effort, new fishing information signs outlining the State's fishing regulations for the Garcia River are posted throughout the watershed and these signs are expected to be posted in other watersheds. NMFS expects that a small amount of freshwater poaching may still occur within the Garcia River and elsewhere, and losing several adult fish may continue to significantly impact population productivity and genetic diversity in watersheds where current abundance is below the "high risk" threshold (per Spence *et al.* 2006).

CC Chinook and NC steelhead

Research and Monitoring

The quantity of take of CC Chinook salmon and NC steelhead authorized under ESA sections 10(a)(1)(A) and 4(d) for scientific research and monitoring remains low.

Listing Factor C: Disease or predation

Disease

The potential of disease outbreaks, due to introductions and straying of out-of-basin and other non-native fishes, are less likely than at the time of listing due to implementation of CDFW policies prohibiting interbasin transfers. Therefore, wild populations of NC steelhead and CC Chinook salmon are at less of a risk of disease outbreaks from a hatchery fish than they were previously. While there are no remaining CC Chinook salmon hatcheries, one hatchery program for NC steelhead is in operation on the Mad River. The threat of disease has been reduced at the Mad River hatchery by the use of well water, ultraviolet treatment of recirculated water and mandatory disease check of juveniles before release. NMFS has recently accepted an HGMP for Mad River Hatchery as sufficient.

Habitat conditions, such as low water flows and high temperatures, continue to exacerbate susceptibility to both disease and predation through increased physiological stress and physical injury. These conditions may be exacerbated by releases from reservoirs (primarily Lake Pillsbury and Lake Mendocino) when water storage is low due to drought conditions. There is no information regarding how low storage in these reservoirs influences disease outbreaks within either population; nevertheless the potential exists as noted in other watersheds (*i.e.,* Klamath basin) and therefore poses a threat to these populations as drought conditions continue.

Freshwater Predation

Introductions of non-native species and habitat modifications have resulted in increased predator populations and predator success rates in this DPS/ESU. Adult and juvenile steelhead and Chinook salmon encounter many natural predators, and the resultant loss in abundance and productivity is likely one of myriad stressors preventing the species from attaining population viability. Interactions between multiple stressors such as striped bass (*Morone saxatilis*) predation at small diversion dams and other altered habitat can also dramatically impact listed species (Sabal 2014). Sabal found that predation hotspots exist and estimated that striped bass consumption of out-migrating juvenile Chinook salmon to be between 10-29% when located in altered habitats (instream diversions). This research highlights the importance of examining the impacts of multiple stressors on ESA listed species.

Predation by robust (per historical standards) pinniped populations likely impact adult escapement in larger river systems where seals/sea lions tend to aggregate. Marine mammal population growth increased substantially following the passage of the federal Marine Mammal Protection Act in 1972. An indirect effect of urbanization is the resultant increase in opportunistic, generalist predators (*e.g.,* western gulls or raccoons) that utilize anthropogenic resources (*e.g.,*

landfills, garbage), to increase their local carrying capacity. For example, Osterback *et al*. (2013) determined that juvenile salmonid mortality from western gull predation in Central California populations was greater than previously estimated.

Introduced Sacramento pikeminnow is a serious predator limiting salmonid recovery (Yoshiyama and Moyle, 2010). Their populations have flourished with warmer water conditions, and they consume juvenile salmonids throughout the Eel River Basin. No significant eradication efforts have been conducted since the last status review. Data collected in the upper Eel River by Pacific Gas and Electric Company (2010) indicate that pikeminnow populations have decreased from peak numbers in the 1980s and 1990s, but monitoring efforts since 2005 show their abundance has been variable. Increased flows from the Potter Valley Project that began in 2005 (Jahn, 2010, pers. comm.) may have contributed to the decline in pikeminnow abundance. Overall, however, the predation threat to steelhead and Chinook salmon is thought to be unchanged since the last status review in 2011.

Listing Factor D: Inadequacy of existing regulatory mechanisms

Inadequate regulatory mechanisms have contributed substantially to the decline of the NC steelhead DPS and CC Chinook salmon ESU. In developing the 4(d) rule for this DPS (67 FR 1116), NMFS noted several Federal, State, and local regulatory programs that have been implemented to reduce threats to these and other species. Although many regulatory mechanisms and conservation efforts were in place at the time this DPS and ESU were listed, NMFS concluded they collectively still do not provide for the attainment of properly functioning habitat conditions that would protect and conserve the species. Below is our current assessment of these mechanisms and efforts.

Federal Efforts

Federal Water Management

The Federal Clean Water Act (CWA) is administered by the EPA and is intended to protect beneficial uses of water, including consideration of habitat for anadromous salmonids and other fishery resources. In practice, implementation of the CWA has not provided the desired level of protection for fishery resources, particularly with respect to non-point sources of pollution. Section 303(d)(1)(C) and (D) of the CWA requires states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards. TMDLs are a method for quantitative assessment of environmental problems in a watershed and identifying pollution reductions needed to protect drinking water, aquatic life, recreation, and other use of rivers, lakes, and streams. EPA established TMDLs for various constituents (sediment, pathogens, pesticides, nutrients, temperature and DO, *etc*.) in the range of this DPS and the State of California is

developing or has developed TMDLS for a number of impaired water bodies identified on the 303(d) list.

Historically, the impacts to fish habitat from agricultural practices have not been closely regulated. The State of California does not have regulations that directly manage agricultural practices, but instead relies on TMDLs to improve water quality from all sources and parties, including agricultural sources. The majority of TMDLS focus on sediment and temperature requirements and few focus on pesticide toxicity. Numerous streams within the range of this DPS are currently impacted by agricultural practices, but do not have established TMDLs and many are not scheduled for completion until 2019. In some instances, TMDLs may address all pollution sources including point sources such as sewage or industrial plant discharges, and non-point discharges such as runoff from roads, farm fields, and forests. TMDLs have the potential to provide long term benefits to listed salmonids and their habitat, but it will take time to develop and implement TMDL standards and to determine the magnitude of the benefits.

The EPA initiated section 7 consultation with NMFS' Office of Protected Resources for re-registering 37 pesticide active ingredients. Six biological opinions have been completed with NMFS concluding that: (1) the use of these pesticide ingredients is likely to jeopardize the continued existence of up to 27 listed salmonids ESUs and DPSs (NMFS 2008b, 2009, 2010, 2011, 2012, 2015) and (2) the use of these pesticide ingredients are likely to result in destruction or adverse modification of designated critical habitat of up to 25 ESUs and DPSs (NMFS 2008b, 2009, 2011, 2012) because of adverse effects on prey and water quality in freshwater rearing and spawning habitats and foraging areas. The jeopardy opinions contained reasonable and prudent alternatives and measures for reducing agricultural drift and runoff of pesticide products into aquatic habitats. The opinions noted that more data is needed to evaluate the efficacy of the RPAs for reducing impacts of these pesticides, with a particular focus on water and off-channel habitats; however, they also noted that it was uncertain whether the RPAs effectively control pesticides at their sources. Biological opinions for the remaining 4 pesticide active ingredients (insecticides, herbicides and fungicides) are ongoing and are expected to be completed by 2019.

Hatchery and Genetic Management Plans (HGMP)

The draft Mad River hatchery HGMP was prepared by CDFW. NMFS has determined that the HGMP application is complete but NMFS has not yet issued the HGMP. The HGMP is intended to promote the integration of wild steelhead into the hatchery broodstock to preserve genotypes, as well as to minimize inbreeding and outbreeding. Once finalized, the conservation actions required by the HGMP are expected to substantially improve the viability and abundance of natural steelhead populations in the Mad River and reduce the risk of hatchery production.

Fisheries Management and Evaluation Plan (FMEP)

Recreational, commercial, and tribal fisheries can be managed in a way that protects listed salmon and steelhead and allows them to recover. The 4(d) rule does not prohibit the take of listed fish in fisheries if a fishery management agency develops a FMEP and NMFS approves it. If an FMEP is implemented accordingly, take of listed species in the fisheries will be covered under the ESA. The primary goal of the FMEP is to devise biologically based fishery management strategies that ensure the conservation and recovery of listed ESUs. Currently there are no FMEPs for CC Chinook salmon or NC steelhead. An FMEP is needed to meet the 4(d) rule criteria for the freshwater fishing of NC steelhead on the Mad River. In addition one is needed to be developed for NC steelhead and CC Chinook salmon where catch and release is allowed.

State Efforts

Timber Harvest

At the time of the NC steelhead listing (65 FR 36074), the State Forest Practice Rules were found to inadequately protect salmonids. Many of the identified inadequacies have been ameliorated through regulation changes by the State Board of Forestry. The most notable rule changes with input from NMFS, CDFW, and other State agencies are the 2010 Anadromous Salmonid Protection Rules and the 2012 Road Rules. These rules have resulted in expanded stream-buffer widths, less damaging road and harvest techniques, and limits on riparian harvesting that will collectively improve instream and riparian habitat and function over the long-term. Additionally, some private timber companies are actively restoring damaged aquatic and upslope habitat, by increasing instream LWD volume or abating upslope erosion sources. However, State Forest Practice Rules that require analysis of cumulative watershed effects of proposed timber harvest practices have changed minimally since the NC steelhead listing and may still pose a threat. Potential revisions to specific Forest Practice Rules are currently being discussed by the Board of Forestry and Fire Protection, but there is no written proposal to date that would make these changes. NMFS anticipates reviewing and commenting on proposed Forest Practice Rules to ensure that they minimize adverse cumulative watershed effects and support the survival and recovery of NC steelhead and CC Chinook salmon.

State Water Management

The Groundwater Sustainability Management Act (GSMA) was signed into law in October 2014, and for the first time in California history regulates and manages the state's groundwater resources to ensure sustainability of the resource. More importantly, environmental beneficial uses, including cold water fisheries, are to be considered when balancing competing uses for an aquifer's safe yield, which suggests that minimizing groundwater pumping impacts on streamflow will be an integral part of future groundwater management. Unfortunately, the GSMA slowly phases in the new regulatory scheme (*e.g.*, overdrafted groundwater basins have

40 years to achieve a sustainable state), suggesting that meaningful streamflow improvement resulting from the act may be decades in the future. Given the current overallocation of surface and groundwater within the state, and the expected long delay in realizing tangible environmental improvement from the GSMA, NMFS believes currently impaired streamflow and habitat conditions will generally persist across the ESU/DPS during at least the next decade or two.

SWRCB's Division of Water Rights administers a water rights permitting system that controls utilization of waters for beneficial uses throughout the State. This system, while it contains provisions (including public trust provisions) for the protection of in-stream aquatic resources, does not provide an explicit regulatory mechanism to implement CDFG Code Section 5937 requirements to protect anadromous fish populations such as steelhead below impoundments.

SWRCB adopted a policy on February 4, 2014 for water quality control titled "Policy for Maintaining Instream Flows in Northern California Coastal Streams."[3] The policy contains principles and guidelines for maintaining instream flows for the purposes of water right administration and addresses coastal streams ranging from the Mattole River southward to San Francisco, including streams entering northern San Pablo Bay. This geographic area encompasses all or parts of five counties; Marin, Sonoma, Napa, Mendocino and Humboldt.

NCRWQB recently updated its North Coast Basin Plan to establish water quality standards for all of the northern California rivers and streams. These plans incorporate newly developed TMDL standards.

Overall, most Federal and State water management regulatory mechanisms are limited in their ability to provide robust protections for steelhead and Chinook salmon in this DPS and ESU or their habitat and are relatively unchanged since the last status review. As a consequence, they are a continuing threat to the DPS and ESU.

Illegal Marijuana Culture

Regulating and managing marijuana cultivation, while not specifically a land management issue, is nevertheless critically important in the effort to minimize environmental damage resulting from illegal marijuana grows. The issue of marijuana regulation will likely be a contentious topic in the coming few years -- a ballot initiative legalizing recreational use of marijuana is expected on the state ballot in 2016. While these political efforts may dramatically change the marijuana cultivation landscape in California, the efficacy of any regulatory scheme to minimize grow-

[3] http://www.waterboards.ca.gov/waterrights/water_issues/programs/instream_flows/docs/adopted_policy.pdf

related environmental impacts would depend on specific details unknown at this time. Having environmental advocates (*i.e.*, resource agencies or environmental NGOs) included as part of any legislative deliberations on the subject is critical toward crafting strong legalization laws that adequately and effectively minimize grow-related impacts.

County Ordinances

Mendocino and Humboldt Counties have no ordinance or effective regulation concerning agricultural grading or groundwater development. Sonoma County adopted their Vineyard Erosion and Sediment Control Ordinance (VESCO) in 2012, and aims to reduce sediment discharge into streams resulting from vineyard and orchard development. While VESCO may minimize potential erosion from these activities, the ordinance nevertheless fails to analyze the impact a vineyard's future water use may have on adjacent streams.

Listing Factor E: Other natural or manmade factors affecting its continued existence

Drought

California has experienced well below average precipitation in each of the past 4 water years (2012, 2013, 2014 and 2015), record high surface air temperatures the past 2 water years (2014 and 2015), and record low snowpack in 2015 (William *et al.* 2016). Some paleoclimate reconstructions suggest that the current 4-year drought is the most extreme in the past 500 or perhaps more than 1000 years (William *et al.* 2016). Anomalously high earth surface temperatures have made this a "hot drought", in which high temperatures substantially amplified annual water deficits during the period of below average precipitation (William *et al.* 2016).

The effects of this extended drought on water supplies and water temperatures are a major concern for salmonid populations in California. Drought conditions are known to reduce the amount of water available, resulting in reductions (or elimination) of flows needed for adult salmonid passage, egg incubation, and juvenile rearing and migration. The high incidence of illegal stream diversions has been especially stressful to salmonid populations during the past four years, since the greatest demand for irrigation water overlaps with the lowest summer baseflows. Drought will likely impact salmonids for several more years, since prolonged above-average precipitation is necessary to bring the state's surface and groundwater reserves back to normal levels.

Climate Change

Recent Trends in Marine and Environmental Conditions

California has experienced well below average precipitation in each of the past four water years (2012, 2013, 2014, and 2015), record high surface air temperatures the past two water years (2014

and 2015), and record low snowpack in 2015. Anomalously high surface temperatures have made this a "hot drought", in which high surface temperatures substantially amplified annual water deficits during the period of below average precipitation. These climate anomalies have likely had negative impacts on the freshwater, estuary, and marine phases for many populations of Chinook salmon, coho salmon, and steelhead. These impacts are not yet fully apparent in the adult return data that form the basis of our status reviews, but will likely be manifested in the return data over the next several years.

The strong 2015-2016 El Niño event is predicted to substantially reduce the odds for a repeat of the extreme warmth of the past two winters, extreme precipitation deficit experienced in California the past four winters, and the extreme warmth of the offshore waters of the Northeast Pacific Ocean that have persisted for most of the past two years. The past two years have also seen persistence in the warm phase Pacific Decadal Oscillation (PDO) pattern of North Pacific Ocean temperatures, and the warm phase of the PDO is likely to continue for another year because of it strong tendency for persistence and the expected El Niño influences on the Aleutian Low and related ocean currents in the next six months.

Williams et al. (2016) provides a more detailed discussion of these recent climate conditions and expected impacts.

Long-term Climate Change

Climate experts predict physical changes to ocean, river and stream environments along the West Coast that include: warmer atmospheric temperatures resulting in more precipitation falling as rain rather than snow; diminished snow pack resulting in altered stream flow volume and timing; increased winter flooding; lower late summer flows; a continued rise in stream temperatures; increased sea-surface temperatures; increased ocean acidity; sea-level rise; altered estuary dynamics; changes in the timing, duration and strength of nearshore upwelling, and altered marine and freshwater food-chain dynamics (see Williams et al. (2016) for a more detailed discussion of these and other projected long-term impacts due to climate change). These long-term climate, environmental and ecosystem changes are expected to in turn cause changes in salmon and steelhead distribution, behavior, growth, and survival. While an analysis of ESU/DPS-specific vulnerabilities to climate change by life stage has not been completed, Williams et al. (2016) summarizes climate change impacts that will likely be shared among salmon and steelhead ESUs/DPSs. In summary, both freshwater and marine productivity and survival tend to be lower in warmer years for most salmon and steelhead populations considered in this assessment. These trends suggest that many populations might decline as mean temperature rises. However, the magnitude and timing of these and other changes, and specific effects on individual salmon and steelhead ESUs/DPSs, remain unclear.

Marine Environment

In marine environments, ecosystems and habitats important to sub adult and adult salmonids are likely to experience changes in temperatures, circulation and chemistry, and food supplies (Feely *et al.* 2004, Brewer and Barry 2008, Osgood 2008, Turley 2008). Poor ocean survival is believed to have been a key factor in the decline of salmonid populations in California. Unusually warm ocean surface temperatures and associated changes in coastal currents and upwelling, known as El Niño conditions, have periodically occurred causing reductions in primary and secondary productivity and resultant changes in prey and predator species distributions. These ecosystem changes can significantly impact ocean survival of juvenile salmonids.

Much of the northeast Pacific Ocean, including parts typically used by California salmon and steelhead, experienced exceptionally high upper ocean temperatures beginning early in 2014, and areas of extremely high ocean temperatures continue to cover most of the northeast Pacific Ocean (William *et al.* 2016). A "warm blob" formed offshore of the Pacific Northwest region in fall 2013 (Bond *et al*. 2015). Off the coast of Southern and Baja California, upper ocean temperatures became anomalously warm in spring 2014, and this warming spread to the Central California coast in July 2014 (William *et al.* 2016). In fall 2014, a shift in wind and ocean current patterns caused the entire northeast Pacific domain to experience unusually warm upper ocean temperatures from the West Coast offshore for several hundred kms (William *et al.* 2016). In spring 2015 nearshore waters from Vancouver Island south to San Francisco mostly experienced strong and at times above average coastal upwelling that created a relatively narrow band (~50 to 100 km wide) of near normal upper ocean temperatures, while the exceptionally high temperature waters remained offshore and in coastal regions to the south and north (William *et al.* 2016).

Small Population Size

Many populations of NC steelhead and especially CC Chinook salmon have declined in abundance to levels that are well below low-risk abundance targets, and several are, if not already extirpated, likely below the high-risk depensation thresholds specified by Spence *et al.* (2008). These small populations are at risk from natural stochastic processes, in addition to deterministic threats, that may make recovery of this DPS/ESU difficult to achieve. As natural populations get smaller, stochastic processes may cause alterations in genetics, breeding structure, and population dynamics that may interfere with the success of recovery efforts and need to be considered when evaluating how populations may respond to recovery actions.

Invasive Species

Aquatic invasive species (AIS), are organisms (plants, animals, or pathogens) that impact the diversity or abundance of native species, the ecological stability of infested waters, and/or the commercial, agricultural, aquaculture or recreational activities dependent on such waters.[4] The myriad of pathways in which AIS can enter and are transported to coastal marine, estuarine, and riverine areas pose a significant management challenge. In coastal marine and fresh water environments, AIS have been shown to have major negative effects on the receiving communities where they often outcompete native species, reduce species diversity, change community structure, reduce productivity and disrupt food web function by altering energy flow among trophic levels (Cohen 1995, Cohen and Carlton 1998, Ruiz *et al.* 2000, Stachowicz and Byrnes 2006). There are multiple mechanisms of impact that directly affect salmonids, such as predation and infection (disease and parasitism), and indirectly such as competition, hybridization, and habitat alterations (Mack *et al.* 2000, Simberloff *et al.* 2005).

We need to understand the role of AIS in the decline of threatened and endangered fish across multiple scales (*i.e.,* individual populations, communities, and ecosystem process) in order to effectively manage and recover these species and systems in the face of global climate change and the full suite of stressors. In California, approximately half of the freshwater species, which include aquatic invasive plants, animals, and pathogens, are introduced; and as many as 40 introduced species may be present in individual watersheds. Despite the abundance of AIS (plants and invertebrates taxa), there is limited information to assess their impacts on aquatic ecosystems, thus the associated implications for habitats occupied by threatened and endangered salmonids is difficult to determine (Sanderson *et al.* 2009). Over the last five years, NOAA has made progress on increasing our understanding of AIS data availability, ongoing research, and strategies among relevant NOAA Line Offices. More studies are needed to specifically investigate the impacts of AIS on ESA-listed salmonid populations, their designated critical habitat, and species recovery.

NMFS recognizes that AIS pose potential risks and may reduce the number of juvenile salmon before they transition to adulthood. The cumulative AIS impacts are potentially quite large and should be considered in conjunction with the more commonly addressed impacts on salmonids. Control and management is necessary in areas where AIS are already established to prevent their further spread and lessen their impacts on native ecosystems.

[4] The definition of aquatic invasive species is derived from the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.

Hatchery Effects

Hatchery programs can provide short-term demographic benefits, such as increases in abundance during periods of low natural abundance. They also can help preserve genetic resources until limiting factors can be addressed. However, the long-term use of artificial propagation may pose risks to natural productivity and diversity. The magnitude and type of the risk depends on the status of affected populations and on specific practices in the hatchery program. Hatchery introductions may pose risks to natural steelhead populations via competition, genetic introgression, and disease transmission. CDFW adopted policies designed to ensure that the use of artificial propagation is conducted in a manner consistent with the conservation and recovery of natural, native steelhead stocks. The careful monitoring and management of current programs, and the scrutiny of proposed programs, is necessary to minimize impacts on listed species.

There are no current hatcheries within the CC Chinook salmon ESU, but if CC Chinook salmon populations continue to decline, studies are needed to investigate the need and feasibility of a broodstock conservation hatchery, especially along the Mendocino coast.

The Mad River NC steelhead hatchery continues to be operational, but was not included in the DPS listing in 2006 (71 FR 834), and at this time NMFS does not recommend the addition of Mad River hatchery steelhead to the DPS. Reneski (2010) found divergence between hatchery and natural steelhead in the Mad River. A final HGMP should be completed by the next 5-Year Status Review and the genetic similarities between hatchery and natural steelhead will be re-evaluated as part of the HGMP process.

Protective Efforts

New Zealand Mudsnail (*Potamopyrgus antipodarum*)

The New Zealand Mudsnail is rapidly invading California in large part because of people not cleaning their field/fishing gear or boats when moving to different or new aquatic locations. The increase in this invasive species is a concern for salmon species because they disrupt the food web, often replacing the native invertebrate that juvenile salmonids prey upon. Snails readily attach to or are wedged into the many cracks and crevices presented by waders, boot soles, nets, buckets, and boats. They can live for weeks in damp, cool conditions; can easily survive on field gear for long periods of time; and can be transferred to a new environment when that gear is reused. Education and outreach campaigns and signage have brought awareness to the practices needed to clean and remove snails from field gear and boats before going to a new location.

2.4 SYNTHESIS

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. Under ESA section 4(c)(2), we must review the listing classification of all listed species at least once every five years. While conducting these reviews, we apply the provisions of ESA section 4(a)(1) and NMFS' implementing regulations at 50 CFR part 424.

To determine if a reclassification is warranted, we review the status of the species and evaluate the five risk factors, as identified in ESA section 4(a)(1): (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; and (5) other natural or man-made factors affecting a species' continued existence. We then make a determination based solely on the best available scientific and commercial information, taking into account efforts by states and foreign governments to protect the species.

CC Chinook salmon ESU

Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the persistence of the California Coast Chinook salmon has not changed significantly since our last status review (NMFS 2011a).

The CC Chinook salmon ESU was listed as a threatened species in 1999 (64 FR 50394) and included all Chinook salmon populations from streams immediately south of the Klamath River in northern California to and including the Russian River. The threatened status of this ESU was reaffirmed in 2005, and seven small artificial propagation programs were also added to the listed ESU (70 FR 37160). Since 2005, all seven artificial programs have been terminated and remain so today. All hatchery fish from these programs have returned to naturally spawn. In the 2011 status review, NMFS investigated the Chinook salmon that were straying into coastal streams south of the Russian River (Williams *et al*. 2011). NMFS found that the Chinook salmon found in these coastal streams were just as likely to be Central Valley Fall-Run Chinook salmon as they were to be CC Chinook salmon (Williams *et al*. 2011). There has been no new genetic information to suggest that most of the observed Chinook salmon in these streams are predominantly from the CC Chinook ESU.

The Coastal Multispecies Recovery Plan Public Draft was released October 2015. The public draft addresses the CC Chinook salmon ESU, as well as the CCC and NC steelhead DPSs. This plan

includes draft recovery criteria for each listed species that are objective, measureable, and based on the best available and most up to date information on the biology of Chinook salmon and its habitat. Once the recovery plan is final the recovery criteria can be evaluated in the 5-Year Status Reviews. Since the recovery criteria specified in the public draft plan are subject to change, the SWFSC used the TRTs viability criteria as the basis for evaluating biological viability status in this review.

The lack of long-term population-level estimates of abundance for Chinook salmon populations in the CC Chinook salmon ESU continues to hinder assessment of status, though the situation has improved with implementation of the CMP in the Mendocino Coast Region and portions of Humboldt County (Spence 2016). There has been a mix in population trends, with some population escapement numbers increasing and others decreasing. Overall, there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review (Williams *et al*. 2011, Spence 2016).

At the ESU level, the loss of the spring-run life history type represents a significant loss of diversity within the ESU, as has been noted in previous status reviews (Good *et al*. 2005; Williams *et al*. 2011). Concern remains about the extremely low numbers of Chinook salmon in most populations of the North-Central Coast and Central Coast strata, which diminishes connectivity across the ESU. However, the fact that Chinook salmon have regularly been reported in the Ten Mile, Noyo, Big, Navarro, and Garcia rivers represents a significant improvement in our understanding of the status of these populations in watersheds where they were thought to have been extirpated (Spence 2016). These observations suggest that spatial gaps between extant populations are not as extensive as previously believed. In summary, the new information available since the last status review (Williams *et al*. 2011) does not appear to suggest there has been a change in extinction risk for this ESU.

Although conservation efforts for Chinook salmon have reduced some threats for this ESU, the threats described in the five listing factor discussion in section 2.3.2 have, with few exceptions, remained unchanged since the last review (NFMS 2011a and 70 FR 37160). Poor ocean conditions, drought and marijuana cultivation, in particular, have significant negative impacts on Chinook salmon populations in this ESU since the last review.

In summary, the best available information on the biological status of this ESU and the threats facing this ESU indicate that it continues to remain threatened.

NC Steelhead

The NC steelhead DPS was originally listed as a threatened species in 2000 (65 FR 36074) and comprises all winter-run and summer-run steelhead populations from Redwood Creek (Humboldt County) southward to, but not including the Russian River. In 2006, NMFS reaffirmed that this DPS was a threatened species and also listed two hatchery stocks as part of the DPS (71 FR 834). Since 2006 the Yager Creek and NF Gualala River were removed from the DPS after the 2011 status review. The Mad River hatchery stock was not included in the DPS in 2006 (71 FR 834), but it continues to be operational and a potential risk to the DPS. Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the persistence of NC steelhead has not changed significantly since our 2011 5-year status review (NMFS 2011b).

The Coastal Multispecies Recovery Plan Public Draft was released October 2015. The public draft addresses the CC Chinook salmon ESU, as well as the CCC and NC steelhead DPSs. This plan includes draft recovery criteria for each listed species that are objective, measureable, and based on the best available and most up to date information on the biology of steelhead and its habitat. Once the recovery plan is final the recovery criteria can be evaluated in the 5-Year Status Reviews. Since the recovery criteria specified in the public draft plan are subject to change, the SWFSC used the TRTs viability criteria as the basis for evaluating biological viability status in this review.

The availability of information on steelhead populations in the NC steelhead DPS has improved considerably in the past 5 years, thanks to implementation of the CMP across a significant portion of the DPS (Williams *et al* 2015). Nevertheless, significant gaps in information still remain, particularly in the Lower Interior and North Mountain Interior diversity strata, where there is very little information from which to assess status (Williams *et al* 2015). Overall, the available data for winter-run populations—predominately in the North Coastal, North-Central Coastal, and Central Coastal strata—indicate that all populations are well below viability targets, most being between 5% and 13% of these goals. There is a mix in trends regarding the longer and shorter time series. Thus, we have no strong evidence to indicate conditions for winter-run populations have worsened appreciably since the last status review (Williams *et al*. 2011, Williams *et al* 2015). Summer-run populations continue to be of significant concern. While one run is near the viability target, others are very small or there is a lack of data. In summary, the available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the last status reviews (Williams *et al*. 2011).

Although conservation efforts have reduced some threats facing this DPS, the threats highlighted in the five listing factor discussion in section 2.3.2 have with few exceptions remained unchanged since the last review (71 FR 834). Poor ocean conditions, water withdrawals, marijuana

cultivation and drought, in particular, have significant negative impacts on NC steelhead since the last review. In summary, the best available updated information on the biological status of and threats to NC steelhead DPS indicate it continues to remain a threatened species.

2.4.1 ESU/DPS VIABILITY AND STATUTORY LISTING FACTORS

- The Southwest Fisheries Science Center's review of updated information does not indicate a change in the biological risk category for CC Chinook salmon and NC steelhead since the time of the last status review (Williams *et al*. 2015).

- Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to CC Chinook salmon and NC steelhead persistence has not changed significantly since our 2011 status review.

3.0 RESULTS

3.1 CLASSIFICATION

CC Chinook salmon ESU

Based on the updated biological status of this ESU, and an updated review of the five listing factors and relevant conservation efforts, we recommend the ESU remain listed as threatened.

NC Steelhead DPS

Based on the updated biological status of this DPS, new information on the status of hatchery stocks in the DPS, and an updated review of the five listing factors and relevant conservation efforts, we recommend this DPS remain listed as threatened.

3.2 NEW RECOVERY PRIORITY NUMBER

CC Chinook salmon ESU

No change is recommended in the recovery priority number (5) for the CC Chinook salmon.

NC steelhead DPS

No change is recommended in the recovery priority number (5) for the NC steelhead DPS.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

In our review of the listing factors we identified several actions critical to improving the status of CC Chinook salmon and NC steelhead. NMFS provided a number of recommended actions in the 2011 status review that are still relevant at this time. In this review, we focus on the most important actions to pursue over the next 5 years.

- Appropriately allocate Pacific Coastal Salmon Recovery Funding to recover listed salmonids, and include adequate non-competitive funding for monitoring as recommended in the Coastal Multispecies Public Draft Recovery Plan (NMFS 2015).
- Continue the ongoing effort to implement the California Coastal Monitoring Program. Funding and implementation of a coordinated program are necessary to enable tracking the status of both DPS/ESUs and their component populations, evaluate the effectiveness of restoration and mitigation efforts for both DPS/ESUs, and to insure the monitoring program will meet data needs to conduct status reviews for all ESA listed species.
- CC Chinook salmon monitoring in the Eel River should be the top monitoring priority for that ESU.
- Develop funding for the continued implementation, refinement, and expansion of the Genetic Stock Identification (GSI) monitoring of Pacific salmon. This will help track ocean migrations of CC Chinook salmon, their origin, and an index of incidental capture and mortality rates in the commercial and recreational salmon fisheries.
- Finalize the Mendocino Redwood Company HCP. The Mendocino Redwood Company owns portions of six high priority recovery watersheds in Mendocino and Sonoma counties; watersheds currently supporting extant Chinook salmon, steelhead and coho salmon populations. HCP implementation is expected to facilitate the survival and recovery of CC Chinook salmon and NC steelhead.
- Work with the Mad River Hatchery to finalize and implement Hatchery and Genetic Management Plans (HGMPs) to preserve genotypes, minimize inbreeding and outbreeding, and to ensure a viable steelhead population. The conservation actions required by HGMPs are expected to substantially improve the genetic viability and abundance of natural steelhead populations over time and reduce the extinction risk caused by increased hatchery production.
- Work with CDFW to address illegal fisheries activities in the Eel and Russian rivers.
- Continue to develop protective regulations to minimize impacts from fishing during migratory periods (*e.g.*, until sandbars open naturally) within one mile of the river

mouths of the focus watersheds, and to improve freshwater sport fishing regulations to minimize take and incidental mortality of listed salmonids. Considerations may include low-flow closure thresholds, seasonal fishing closures, and angler outreach programs. Low-flow closures are especially needed on the mainstem Eel River, to reduce mortality from the catch and release fishery of Chinook salmon.

- Develop Fisheries Management and Evaluation Plans (FMEP) that: (1) incorporate delisting criteria; (2) determine impacts of fisheries management in terms of Viable salmonid population (VSP) parameters; (3) do not limit attainment of population-specific criteria; (4) annually estimate the commercial and recreational fisheries bycatch and mortality rate; (5) are specifically designed to monitor and track catch and mortality of wild and hatchery salmon and steelhead stemming from recreational fishing in freshwater and the marine habitats; and (6) provide for adaptive management options as needed to ensure actual fisheries impacts do not exceed those consistent with recovery goals.
- Implement and enforce AB 2121, which codified (in sections 1259.2 and 1259.4 of the California Water Code) CDFW and NMFS' Water Diversion Guidelines to ensure protective flows for all life stages of salmonids.
- Work with EPA, SWRCB, and local stakeholders to implement actions under section 303(d)(1)(C) and (D) of the Clean Water Act. This would require the State to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards.
- Develop water conservation measures at local and State levels to include a drought management plan for each watershed that is triggered by minimum flow requirements.
- Work with State agencies to minimize impacts from marijuana operations on listed salmonids.

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National Marine Fisheries Service
5-Year Review

California Coastal Chinook Salmon
and
Northern California Steelhead

Conclusion:
Based on the information identified above, we conclude:

- California Coastal Chinook salmon should remain listed as threatened.
- Northern California steelhead should remain listed as threatened.

REGIONAL OFFICE APPROVAL

Approve: _____
Date: 4/13/16

Alecia Van Atta
California Coastal Office
West Coast Region
NOAA Fisheries