Science, Service, Stewardship

2016 5-Year Review: Summary & Evaluation of Central California Coast Steelhead

National Marine Fisheries Service
West Coast Region

April 2016

5-YEAR REVIEW: CENTRAL CALIFORNIA COAST STEELHEAD

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
steelhead (*Oncorhynchus mykiss*)	*Central California Coast (CCC) steelhead*

TABLE OF CONTENTS

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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 collectively 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. The most recent listing determinations for most salmon and steelhead occurred in 2011. NMFS completed a 5-year status review in 2011 and concluded the status for threatened Central California Coast (CCC) steelhead should remain the same. This document summarizes NMFS's current 5-year review for the threatened CCC 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.

To identify DPSs of steelhead, we apply the joint U.S. Fish and Wildlife Service-National Marine Fisheries Service DPS policy (61 FR 4722) rather than the ESU policy. Under this policy, a DPS of steelhead must be discrete from other populations, and it must be significant to its taxon.

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, in 2005 and 2006 we completed new status reviews and ESA-listing determinations for West Coast salmon ESUs and steelhead DPSs.

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 reviews in 2011. In response to our request, we received no comments in regards to CCC steelhead during the public comment period.

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 CCC steelhead; and the information and views provided by the geographically based management teams. 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

Central California Coast steelhead was originally defined as an ESU, and later revised to a DPS. Due to identified threats to genetic integrity caused by hatchery activities, and population declines in Santa Cruz County, San Francisco Bay tributaries, and the Russian River, CCC steelhead was originally determined to be in danger of extinction (Busby *et al*. 1996 in Spence 2016). Upon review of new information, NMFS (1997) concluded that the ESU was not presently

in danger of extinction but was likely to become so in the foreseeable future[1] (Spence 2016). Following this, CCC steelhead was listed as a threatened species in 1997 (62 FR 43937) (Table 1). At the time of listing, both anadromous (steelhead) and resident (non-anadromous) forms of the species were considered part of the ESU; however, only the anadromous forms were 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 portions of the CCC steelhead, 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 CCC steelhead ESU as a steelhead-only DPS and reaffirmed that the 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 CCC steelhead.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
steelhead *(O. mykiss)*	**Central California Coast steelhead**	**FR notice:** 62 FR 43937 **Date:** 8/18/1997 **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 physical or biological features essential to 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 designated critical habitat for CCC steelhead in 2005 (Table 2).

[1] The change in opinion was prompted by new data showing that steelhead remained present in most watersheds in the Santa Cruz Mountains and were more abundant than previously thought (Spence 2016).

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)). NMFS originally promulgated 4(d) protective regulations for CCC steelhead in 2000 and then subsequently modified those regulations in 2005 (Table 2).

Table 2: Summary of rulemaking for 4(d) protective regulations and critical habitat for CCC steelhead.

Salmonid Species	ESU/DPS Name	4(d) Protective Regulations	Critical Habitat Designations
steelhead *(O. mykiss)*	**Central California Coast steelhead**	ESA section 9 applies; **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 CCC 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 CCC steelhead

Salmonid Species	ESU/DPS Name	Document Citation
steelhead *(O. mykiss)*	**Central California Coast steelhead**	Busby *et al*. 1996 Good *et al*. 2005 Bjorkstedt *et al*. 2005 Spence *et al*. 2008 Williams *et al*. 2011. Spence and Williams 2011 Spence *et al*. 2012 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 CCC 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).

1.3.6 RECOVERY PLAN OR OUTLINE

NMFS issued a public draft of the Coastal Multispecies Recovery Plan in October 2015, which includes CCC steelhead, and anticipates releasing a final plan in late 2016.

Table 4: Recovery Priority Number and Endangered Species Act Recovery Plan for CCC steelhead.

Salmonid Species	ESU/DPS Name	Recovery Priority Number	Recovery Plan
steelhead *(O. mykiss)*	**Central California Coast 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 CCC 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
Central California Coast steelhead	X	

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

ESU/DPS Name	YES	NO
Central California Coast steelhead	X	

Was the ESU/DPS listed prior to 1996?

ESU/DPS Name	YES	NO	Date Listed if Prior to 1996
Central California Coast 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?

In 1991 NMFS issued a policy on how the agency would delineate DPSs of Pacific salmon for listing consideration under the ESA (56 FR 58612) as ESUs. Under this policy a group of Pacific salmon populations is considered an ESU if it is substantially reproductively isolated from other con-specific populations, and it represents an important component in the evolutionary legacy of the biological species. The 1996 joint FWS-NMFS DPS policy (61 FR 4722) affirmed that a stock (or stocks) of Pacific salmon is considered a DPS if it represents an ESU of a biological species. Accordingly, in listing the CCC steelhead ESU under the ESU policy in 1997, NMFS treated the ESU as a DPS under the ESA. NMFS considers its ESU policy to be a detailed extension of the joint DPS policy and consequently will continue to use its ESU policy with respect to Pacific salmon. For steelhead, NMFS currently uses the joint DPS policy (71 FR 834) to delineate steelhead-only DPSs under the ESA.

2.1.1 SUMMARY OF RELEVANT NEW INFORMATION REGARDING THE DELINEATION OF CCC STEELHEAD DPS

ESU/DPS Boundaries

The previous viability assessment that included CCC steelhead (Williams *et al.* 2011) considered studies and genetic data not available at the time of listing, and determined that available information suggested boundary changes may be warranted for coastal California steelhead DPSs, including the CCC steelhead DPS (Williams *et al.* 2016). Subsequent to the 2011 viability assessment, relevant data analyzed by Bjorkstedt *et al.* (2005) was published by Garza *et al.* (2014) and, based on this new information, it was recommended that a Biological Review Team (BRT) form to assess the best available information relevant to DPS boundaries and potential changes (Williams *et al.* 2016). The BRT review has not yet been conducted so the current viability assessment (Willams *et al.* 2016) uses the preexisting coastal California steelhead DPS boundaries, including those for CCC steelhead. Thus, the existing CCC steelhead DPS boundaries remain unchanged and are accordingly considered in this status review.

Membership of Hatchery Programs

Two artificial propagation programs are considered to be part of the DPS: the Don Clausen Fish Hatchery[2], and Kingfisher Flat Hatchery (Monterey Bay Salmon and Trout Project) steelhead hatchery programs (71 FR 834). As part of this 5-year review, we have re-evaluated the status of these hatchery stocks and programs to determine whether they are still operational. The Don Clausen Fish Hatchery program, located in Sonoma County, is currently in operation and propagates steelhead collected from Dry Creek and the East Fork Russian River. The steelhead program at the Kingfisher Flat Hatchery, located in Santa Cruz County, has operated in past years, however it has not been implemented since the winter of 2013-2014.

The Don Clausen Fish Hatchery, located in the Dry Creek watershed continues to produce approximately 500,000 juvenile steelhead annually as part of mitigation for the loss of steelhead habitat behind Warm Springs Dam, and these fish are distributed throughout the upper and lower Russian River watershed (Spence 2016). In the last 15 years, the majority (> 95%) of steelhead arriving at the hatchery are marked fish of hatchery origin (Spence 2016).

[2] The Don Clausen Fish Hatchery, located at the Lake Sonoma Dam is also known as the Warm Springs Hatchery. This hatchery is operated in coordination with the Coyote Valley Fish Facility, and egg collection facility at Lake Mendocino in the Upper Russian River Watershed. Progeny from eggs collected at both facilities (Don Clausen/Warm Springs Hatchery and the Coyote Valley Fish Facility) are reared at the Don Clausen Fish Hatchery.

During years of operation, the Monterey Bay Salmon and Trout Project collect adult steelhead at two locations: the Felton Diversion Dam on the San Lorenzo River and a counting weir operated by NMFS' Southwest Fisheries Science Center on lower Scott Creek. Since trapping on Scott Creek began in 2003, the percentage of returning adults of hatchery origin captured at the weir has averaged 33% per year, with a range of 6% to 69% (J. Kiernan, NMFS SWFSC, pers. comm. 2015). Only wild fish from the two watersheds are spawned (separately) and juveniles are released to their natal watershed. Between 1999 and 2013, the Kingfisher Flat Hatchery facility has produced an average of approximately 33,840 juvenile steelhead for release per year (Monterey Bay Salmon and Trout Project 2013). Prior to 2003, some of the juvenile steelhead were released outside of the Scott Creek or San Lorenzo River basins.

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
Central California Coast steelhead		X

The Coastal Multispecies Recovery Plan Public Draft was released October 2015 (see 1.3.6 Recovery Plan or Outline). The public draft addresses the CCC steelhead DPS, as well as the NC steelhead DPS and the Chinook salmon ESU. 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. 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 viability criteria as the basis for evaluating biological viability status in this review.

The ESA requires recovery plans to incorporate (to the maximum extent practicable) objective, measurable criteria which, when met, would result in a determination in accordance with the provisions of the ESA that the species can be removed from the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12). The multispecies recovery plan includes

the following general types of recovery criteria: (1) population based biological criteria that consider future commercial, recreational and tribal fish harvest; (2) criteria that measure watershed health, (3) criteria that address the abatement and amelioration of threats to the species, and (4) criteria that address the five listing factors (NMFS, 2010).

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
Central California Coast 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
Central California Coast 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 CCC steelhead, and recovery criteria have not been finalized. See discussion above in section 2.2.1 regarding the general nature of the draft criteria.

2.3 UPDATED INFORMATION AND CURRENT SPECIES' STATUS

2.3.1 ANALYSIS OF VIABLE SALMONID POPULATION (VSP) CRITERIA

The following DPS 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.

Steelhead populations in the CCC steelhead are the most poorly monitored salmonid populations in the North-Central California Coast Recovery Domain. Population-level estimates of adult abundance are entirely lacking for 28 populations that constitute the North Coastal, Interior, Coastal San Francisco Bay, and Interior San Francisco Bay diversity strata (Figure 1). Only in the Santa Cruz Mountain stratum has implementation of the Coastal Monitoring Plan (CMP) been initiated, and here only recently. Thus, with the exception of the life-cycle monitoring station in Scott Creek, estimates of abundance span only 1-3 years for populations in this stratum. More limited monitoring efforts have produced data for a few partial populations, but the lack of data continues to make it extraordinarily difficult to assess the status and trends of populations in the

DPS. The scarcity of information on steelhead abundance in the CCC DPS continues to make it difficult to assess whether conditions have changed appreciably since the previous status review of Williams *et al*. (2011), which concluded that the population was likely to become endangered in the foreseeable future. In the North Coastal and Interior strata, steelhead still appear to occur in the majority of watersheds, though in the Russian River basin, the ratio of hatchery fish to natural origin fish returning to spawn remain largely unknown and continues to be a source of concern. New information from 3 years of CMP implementation in the Santa Cruz Mountain stratum indicates that population sizes are perhaps higher than previously thought. However, the downward trend in the Scott Creek population, which has the most robust estimates of abundance, is a source of concern. The status of populations in the two San Francisco Bay diversity strata remains highly uncertain, and it is likely that many populations where historical habitat is now inaccessible due to dams and other passage barriers are at high risk of extinction.

In summary, while data availability for this DPS remains poor, we find little new evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since publication of the last status review (Williams *et al*. 2011).

Figure 1: Map of Central California Coast steelhead with diversity strata boundaries.

2.3.2 FIVE-FACTOR 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 human-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.

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 Quality and Quantity

Water Quality

Many surface waters in the DPS 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 overtime (San Francisco Estuary Partnership 2015). Contaminants such as polybrominated diphenyl ethers (PBDEs), and copper have declined over time, however many potentially harmful chemicals and contaminants of emerging concern

(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 stream invertebrates (McIntyre *et al*. 2014, McIntyre *et al*. 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*. 2011); 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 and Environmental Protection Agency), 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 pollutants of concern will be better controlled through the implementation of green infrastructure approaches (*i.e*., rain gardens, green roofs, an 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*. 2012). NMFS has consulted on seven batched pesticide 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 modified critical habitat for salmonids across the West Coast Region (NMFS, 2008a, 2009, 2010, 2011b, 2013).

Since the 2011 status review, overall trends for water quality show improvements across California. New testing methods, reasonable and prudent alternatives (*i.e*., buffer requirements and no-spray zones), and 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.

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 Quantity

Existing surface 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). Dams are present in all strata[3] within the DPS, and are particularly prevalent in certain regions (*e.g.*, Russian River and San Francisco Bay tributaries). Dams affect habitat throughout the DPS by disrupting natural hydrologic patterns and impairing sediment transport, channel morphology, substrate composition, and water quality (including temperature and turbidity) within downstream reaches (Spence *et al*. 2008). Operations at reservoir-related dams in the DPS often affect downstream reaches by impairing flow timing and volume. These effects impair steelhead habitat and affect steelhead migration (see Impaired Passage, below), spawning, and rearing within the affected reaches[4]. In addition, the current drought has revealed that water storage within reservoirs in the DPS is unreliable in times of drought; reducing water availability and exacerbating these impairments. For example, during low storage levels, Coyote Valley Dam is known to release highly turbid water for extended periods well after turbidity levels in reservoir inflows and unregulated tributaries have diminished (NMFS 2008a). Turbid flows result in degraded salmonid spawning and rearing habitat (Everest 1969), and may impair food availability for juvenile salmonids by reducing habitat diversity for benthic invertebrates and eliminating certain guilds of invertebrates from the food chain. Similarly, extended periods of warm, turbid, and reduced flow releases have been noted at dams in the San Francisco Bay Area during periods of low storage (Leicester and Smith 2014).

[3] A search of the existing fish passage barriers within the DPS (CalFish 2015) indicates that dams exist in all populations within the DPS.

[4] None of the large reservoir-related dams in the DPS have passage programs, and in certain regions of the DPS, especially in the San Francisco Bay area, these impaired below-reservoir stream reaches often co-occur with reaches impaired by urbanization; preventing access to headwater habitat and confining fish to reaches impaired by multiple threats (see Impaired Passage).

In addition to surface water diversion, groundwater withdrawals also impair stream habitat by lowering groundwater resources[5]. This impairs volume, extent, timing, and temperature of surface flows. Within the DPS, groundwater withdrawals have significantly lowered groundwater in many streams draining to the San Francisco Bay – many of the reservoirs are operated to provide water storage and discharge that is used to recharge over-drafted aquifers. Also, several groundwater basins that occur within the DPS have been identified by the California Statewide Groundwater Elevation Monitoring Program as having basin priority rankings of Medium or High[6] (California Department of Water Resources [DWR], 2014A, 2014B), indicating that this threat affects groundwater basins and associated watersheds within the CCC steelhead DPS.

For the first time in California history, the Sustainable Groundwater Management Act (SGMA), signed into law in October 2014, will regulate and manage 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 SGMA slowly phases in the new regulatory scheme (*e.g.,* overdrafted groundwater basins have 40 years to achieve a sustainable condition), suggesting that meaningful streamflow improvement resulting from the act may be decades in the future. Given the current over-allocation of surface and groundwater within the state, and the expected long delay in realizing tangible environmental improvement from the SGMA, NMFS believes currently impaired streamflow and habitat conditions will generally persist across the DPS during at least the next decade or two.

In addition to the traditional diversion operations considered above, 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 were not a significant threat at the time of CCC steelhead listing, but are likely now the paramount threat to salmonid

[5] Groundwater resources are often hydrologically linked to surface flow in adjacent stream channels.

[6] California Statewide Groundwater Elevation Monitoring Program ranks basins based on: 1) overlying population; 2) projected growth of overlying population; 3) public supply wells; 4) total wells; 5) overlying irrigated acreage; 6) reliance on groundwater as the primary source of water; 7) impacts on the groundwater, including overdraft, subsidence, saline intrusion, and other water quality degradation; and 8) any other information determined to be relevant by the Department (DWR, 2014B). Basin Rankings: The Ukiah Valley, Petaluma Valley, Napa-Sonoma Valley, Santa Clara Valley, Santa Cruz Purisma Formation, and West Santa Cruz Terrace Basins have been identified as Medium Priority and the Soquel Valley has been identified as High Priority (California Department of Water Resources, 2014A).

survival and habitat function in many first and second-order streams located in remote, rural areas. These marijuana-related diversions represent a present, increasing threat to the DPS and are known to severely affect instream hydrology (drying out reaches), block passage, and result in the mortality of listed salmonids (See Agriculture, below for further discussion of this threat).

Estuary and Wetland Losses and Impairments

Lost wetland and estuarine habitat was identified as a factor at the time of listing and during the last 5 year review. Estuarine wetlands important to the support of CCC steelhead have been adversely affected by urbanization and historic land use practices (see Urbanization, below) and impairments remain present throughout the DPS. For example, fill associated with past development has resulted in the loss of approximately 79 percent of tidal marsh habitat and approximately 90 percent of all tidal wetlands in the San Francisco Bay (California State Coastal Conservancy *et al*. 2010). Further, important ongoing development stressors (*e.g.*, urban and agricultural development) continue to affect wetlands in California, and stream-associated salt marsh and wetland habitat have shown declining health and function due to urbanization effects (California Natural Resources Agency, 2010).

For populations along the coast, estuarine habitats consist primarily of seasonal, "bar-built" lagoons. The lagoons form in spring or summer as sandbars form separating the freshwater and marine environments. The lagoons provide a highly productive environment where rearing juvenile salmonids can experience rapid growth and where the brackish waters provide an opportunity for them to acclimate to saltwater prior to ocean entry. As with San Francisco Bay, past and present development for other land use activities and water resource development has decreased lagoon habitat extent and quality. In addition, management of lagoons throughout the DPS, such as sandbar breaching for flood control, recreation, and access, has altered natural lagoon function and the quality of rearing habitat.

Restoration efforts since the time of listing have helped to reverse estuarine and wetland losses throughout the DPS; however the threat remains. For example, substantial wetland (inclusive of both estuarine and freshwater wetlands) acquisition, restoration, and enhancement progress was made at the statewide level between 2000 and 2010 (California Natural Resources Agency 2010); and important improvements have been realized within the range of CCC steelhead DPS (*e.g.*, tidal marsh restoration within San Francisco Bay[7]). In addition, coastal lagoons have been studied

[7] Between 2009 and 2015, 6,300 acres were reconnected to tidal influence in the greater San Francisco Bay and are expected to transition (restore) to tidal marsh habitat (San Francisco Estuary Partnership 2015). These and other efforts have brought the total acreage of tidal marsh habitat in the San Francisco Bay to approximately 50,000 acres (San Francisco Estuary Partnership 2015). Recent tidal restoration examples include the restoration of significant areas

to better understand habitat and management needs. While these restoration and research efforts are important and beneficial, significant areas of estuarine habitat remain lost or impaired, such that estuarine function across the DPS remains impaired overall. These ongoing impairments coupled with the threat of ongoing development stressors (as indicated above), identify estuarine and wetland habitat impairments as a persistent threat to the species.

Timber Harvest

The effects of timber production on CCC steelhead remain the same since the last 5 year review. Timber production is a dominant land use within smaller private timber holdings that operate in the mountains of Santa Cruz and San Mateo Counties. The effects of 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 can often preclude adult and juvenile fish from migrating upstream past the crossing (see Impaired Passage, below), and can alter stream channel morphology and hydraulic characteristics both within, and upstream and downstream, of the road crossing.

On timberlands that operate in the mountains of Santa Cruz and San Mateo counties, existing instream aquatic habitat impairment is primarily a legacy effect from logging and yarding practices employed decades ago, when few environmental laws existed and regulatory oversight was limited. State Forest Practice Rules, which govern timber harvest on private lands (as occurs in the CCC steelhead DPS), have improved in recent years; however, certain regulatory protections within the DPS remain limited (see **Listing Factor D**, below). Where legacy effects persist (*e.g.*, high instream sediment loads, poor LWD recruitment, *etc.*) continued impact to CCC steelhead habitat will likely persist for decades until watersheds naturally "heal", evolve, and respond to the altered geomorphic and hydrologic regimes.

Agriculture

Agriculture was identified as a threat to the DPS at the time of listing and considered to be an ongoing threat during the last 5 year review. Associated stressors such as habitat fragmentation, agricultural water diversions from rivers/streams, and non-point pollutant discharge (*i.e.*, sediment, pesticides, *etc.*) have likely increased slightly since the time of listing due to expanding agricultural acreage, and new stressors exist such that agriculture and ranching is considered a current threat to the DPS.

formerly developed as production salt ponds (see http://www.southbayrestoration.org/), ongoing efforts at the Cullinan Ranch Project in the San Pablo Bay area of the greater San Francisco Bay to restore 1,500 acres of tidal marsh habitat (Ducks Unlimited n.d.), and planned efforts to restore 1,000 acres of tidal marsh at Sears Point in San Pablo Bay (Sonoma Land Trust 2015).

Agricultural acreage[8] in Sonoma County, a portion of which is located within the northern extent of the distribution of CCC steelhead and likely contains the highest percentage of agricultural acreage within the DPS, increased from 71,017 to 76,283 between 2005 and 2013 (approximately 7.4%) (Sonoma County 2005, 2013). Further south, the coastal areas of San Mateo County and portions of Santa Cruz County within the CCC steelhead DPS contain relatively little agricultural acreage compared to counties north of San Francisco Bay. Wine grapes are by far the largest agricultural product in Sonoma County, and short-term forecasts call for increased demand for premium wines (Silicon Valley Bank 2014). Similar trends may be reasonably expected in Napa County where viticulture is prominent. Meanwhile, growth of agriculture within coastal areas of San Mateo and Santa Cruz Counties is expected to be less prominent.

Marin and Sonoma counties are also home to extensive livestock/dairy industries. Livestock grazing can damage riparian and aquatic habitat when animals are not physically excluded from streams, leading to trampling and grazing streamside vegetation, and impairing instream substrate. Where high densities of livestock congregate, animal waste can enter streams either through direct defecation by individuals in the water, or indirectly as waste is conveyed downslope following rain or irrigation events. The spatial area within the CCC steelhead DPS utilized for grazing has likely remained relatively constant since the date CCC steelhead were initially listed, and significant progress in protecting riparian habitat has recently been realized. For instance, the Marin County Resource Conservation District has helped landowners properly fence riparian corridors that traverse their grazing lands, and Sonoma County amended their riparian corridor ordinance in 2014 to expand and clarify riparian protection requirements during land development activities (*i.e.*, urban development or agricultural grading). However, the ordinance largely "grandfathers" all currently active parcels, meaning only new grazing development must adhere to the ordinance. So, while the threat of grazing has likely improved somewhat since listing due to ongoing restoration work, truly significant improvement will likely prove elusive until all properties are required to follow laws protecting riparian resources.

In addition to traditional agriculture (including livestock grazing), illegal marijuana cultivation occurs within the DPS. Illegal marijuana cultivation was not identified as a threat at the time of listing, but has grown into a leading threat to salmon and steelhead recovery throughout California. Illegal growers often dam and dewater creek channels to irrigate their marijuana gardens, and pesticides, fertilizers and poisons are commonly used without regard for their

[8] Includes fruit, nut, vegetable and field crops, but excludes grazing and pasture lands. Crop reports for 2014 were not available.

impacts on the environment. This illicit agricultural component has likely grown significantly since listing, and will continue to degrade steelhead habitat until adequate controls and regulations, such as those that govern legitimate agriculture, are enacted.

Urbanization

The threat of urbanization has been present since the time of listing and since the previous 5 year review. Within the DPS, many important CCC steelhead watersheds that overlap with dense urban areas, such as the Russian River in the northern portion of the range, San Lorenzo River in the southern portion of the range, and all tributaries to the San Francisco Bay within the range, continually suffer aquatic habitat degradation resulting from urban stressors. As natural open space is transformed into urban neighborhoods and waterways are manipulated and engineered for flood control purposes, several hydrologic and aquatic habitat impacts predictably follow and adversely affect freshwater streams and estuarine habitats. During land use conversion (including flood control structure installation), much of the natural terrain is replaced by impervious surfaces (*e.g.*, pavement, structure roofs, *etc.*), causing rapid runoff of precipitation and shorter, more intense flows; and point and non-point pollution increases as oils, chemicals (*e.g*, fertilizers, pesticides, *etc.*) and other pollutants wash into streams following precipitation events. Further, urban development often encroaches onto the floodplain of creeks and rivers, destroying riparian and floodplain habitat. This eliminates refuge habitat important for fish during high flow events, and limits natural hydraulic/geomorphic processes that create and maintain complex instream habitat. In addition to riparian effects, estuarine wetlands important to CCC steelhead have also been adversely affected by urbanization and related land use practices (see Estuary and Wetland Loss and Impairment above).

Flood control projects associated with urbanized areas throughout the DPS have resulted in significant habitat losses. Within the San Francisco Bay Area, these impairments are particularly noteworthy. Many flood control channels at the Bay shoreline trap sediment, often leading to long-term maintenance problems and constraints to fish passage (see Impaired Passage, below) and ecological function. Performance problems associated with these flood control channels, most of which were built between the 1930s to the 1980s, are generally associated with design objectives and modeling applications used at the time. Designs typically focused on rapid conveyance of water out of the watershed, and applied simple hydraulic models with limited integration of river science, fluvial geomorphology, hydraulic engineering, and fisheries and wildlife ecology. Designs also typically failed to adequately consider the effects of grade control and vegetation removal. As a result, many flood control channels in the region are unsustainable and require significant efforts to maintain flood control objectives. These designs, and associated channel maintenance activities, have resulted in impaired instream habitat, loss of floodplain habitat, and poor passage conditions throughout the Bay Area.

The land development practices that led to much of the urbanized condition may have improved; however, the threat from urbanization persists. Local governments are now required to consider the environment in their management and development decisions. However, urban-related impacts are likely to worsen in the future as the Bay Area population grows by a predicted 30% between the years 2010 and 2040 (Association of Bay Area Governments 2013). Future urban expansion, coupled with the ongoing effects of water resource development, has the potential to further impair stream habitat within the DPS. Ongoing restoration and protection efforts will be important to counter the effects of urbanization and provide habitat that supports the DPS.

Impaired Passage

Complete and partial passage barriers throughout the DPS impair steelhead migration and rearing. Existing passage barriers are associated with a variety of land uses, including but not limited to: diversions, large and small dams[9], urbanization[10], road crossings (including legacy timber roads), and, more recently, illegal marijuana cultivation. These passage barriers impair or preclude access to important habitat and, where coincident with other habitat impairments, confine fish (either temporally or completely) to impaired reaches.

Many small legacy impediments identified prior to and after listing have been remedied, and modern fish passage standards are now incorporated into new (or rebuilt) diversion designs during federal and state permitting. However, significant existing impairments remain, and as this threat may not be static or limited to existing facilities and populations, new threats may arise. For example, altered hydrologic regimes (see Climate Change, below) coupled with the effects of urbanization and aging infrastructure may lead to new or exacerbated conditions (*e.g.*, worsening road crossings due to downcutting), and illegal marijuana cultivation may be an expanding threat. Also, the recently approved California State Water Bond (the 2014 Proposition 1) includes $2.7 billion for future reservoir and dam construction. Although potential reservoir sites have not yet been identified, the possibility remains that new water storage facilities, and associated affects, may be developed within the CCC steelhead DPS.

[9] A search of the existing fish passage barriers within the DPS (CalFish 2015) indicates that dams exist in all populations within the DPS and result in: 92 partial barriers; 98 temporal barriers; 24 temporal and partial barriers; 4 temporal and total barriers; 179 total barriers; and 301 barriers whose status is either unknown or unassessed.

[10] Including the flood control channels that provide flood protection in urban areas.

Lacking passage programs, large reservoir-related dams in the DPS, particularly in the greater San Francisco Bay Area, both limit steelhead distribution to downstream reaches impaired by urbanization, and preclude access to important upstream spawning and rearing habitat (Spence *et al*. 2008). Aside from exacerbation by the recent drought, these impairments are not new since the last review, and have likely remained the same since the initial listing of the CCC steelhead DPS; indicating this as a persistent threat to the DPS. On affected streams in the DPS, this threat truncates watersheds (*i.e*., geographically constricts the species' distribution), precludes access to historically important spawning and rearing reaches, confines populations to downstream low gradient reaches impaired by altered flow regimes (see *Water Quantity*, above) and, where coincident with urbanized areas, restricts steelhead distribution to reaches adversely affected by urbanization (see Urbanization, above). Nearly all populations within tributaries to the San Francisco Bay are affected. Although present since the time of listing and unchanged since the last 5 year review, the ongoing operation of reservoirs without passage programs is expected to perpetuate the ongoing extinction risk for these populations.

On timberlands that operate in the mountains of Santa Cruz and San Mateo Counties, existing passage impairments are primarily a legacy effect from practices employed decades ago. Given the relatively high awareness that exists regarding the importance of fish passage remediation and design, the threat of timber roads posing new fish passage impediments in the region has lessened. Also, due to efforts to address existing and legacy fish passage barriers, the overall passage condition on timber lands in the region has likely improved since listing; however, the condition has remained unchanged since the last 5 year review. However, while important passage barriers have been removed, a still greater number of lower-priority timber road-related sites remain and continue to impair steelhead movement. Also, legacy effects, where present, may persist for some time since decommissioning old logging roads (*i.e*., outsloping and ripping the road bed, removing culverts and dips, replanting exposed soil, *etc*.) can be expensive, and road restoration occurs at a slower rate compared to other restoration actions. Thus, while less immediate than other passage threats, identifying and addressing remaining barriers on timber lands remains an important action for the conservation of CCC steelhead.

Considering the importance of habitat accessibility for life cycle completion, the ongoing effects of existing barriers, and the potential for new barriers to develop in the future, passage impairment remains an important threat. Implementation of small- and large-scale passage restoration is needed to support the conservation of the DPS.

Protective Efforts

Marijuana Cultivation

Two developing programs offer promise in the effort to minimize the environmental impacts of marijuana cultivation in California. The North Coast Regional Water Quality Control Board (NCRWQCB) has implemented a waste discharge waiver for state-legal medicinal marijuana cultivation. The waiver program 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 four 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 in the northern part of the DPS, 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 recent passage of legislation assembling a state-controlled regulatory and enforcement program for the medicinal marijuana industry. The Medical Marijuana Regulation and Safety Act (MMRSA) will create a new state agency that will control the permitting, regulation and taxing of the medicinal marijuana industry. However, given the likely high cost of regulating and enforcing an entirely new (and formerly illegal) industry, the ability of the state to enforce the law and clean up environmental damage from illegal grows will remain uncertain until state funding levels to implement the MMSRA are finalized. Bolstering the staffs of the state agencies in charge of enforcement (*i.e.*, CDFW and NCRWQCB) is imperative toward MMSRA's success in minimizing environmental impacts.

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 NOAA's Habitat Focus Area, 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. NOAA's Office of Oceanic and Atmospheric Research is working

to increasing community resiliency to flooding damage through improved planning and water management strategies.

Habitat Improvement

Efforts to improve habitat conditions and restore access for CCC steelhead are ongoing throughout the range. The significance of past habitat impairments, their ongoing effects, and the threat of future habitat impairments remain current threats. However, ongoing efforts such as those being implemented to restore tidal marsh habitat (*e.g.*, restoration efforts discussed above for the San Francisco Bay area), study and manage coastal lagoons (*e.g.*, as for Pescadero Creek and San Lorenzo River lagoons), fund or facilitate restoration efforts (*e.g.*, through government-managed restoration programs, as well as those implemented by local government and important nonprofit partners) are improving habitat conditions. These important habitat restoration efforts are imperative and should be expanded.

State and Federal Drought Response

In January of 2014, the Governor of California proclaimed a State of Emergency due to drought conditions. In response, NMFS and CDFW developed the Voluntary Drought Initiative Program (VDI). The purpose of the program is to provide incentives to water users in high priority watersheds throughout the State to reduce the negative effects of the drought on salmon and steelhead. The Russian River was designated as one of three top priority watersheds for this program and is the only top priority watershed within the range of CCC Steelhead. To date, 116 VDI agreements have been signed (41 for water conservation and fish rescue, 71 for independent water conservation, and four for flow augmentation) – all are located in either Green Valley Creek, Dutch Bill Creek, Mill Creek, or Mark West Creek, except for one flow augmentation agreement in Porter Creek. The 41 water conservation and fish rescue VDI agreements have been signed with CDFW. The 71 independent water conservation agreements represent over 1,900 acres of vineyard, where landowners have pledged to reduce water demand by 25% over 2013 levels. Finally, the 4 flow augmentation agreements increased summer streamflow within Porter, Dutch Bill, and Green Valley creeks, primarily by releasing previously stored water into the stream channel. Stream flow gaging records within the region show measurable improvement in drought conditions for steelhead within portions of streams covered by the flow augmentation agreements. For the last 5 years, Porter Creek flow has been maintained annually for summer rearing flow in the lower 1.5 miles of stream, and an agreement in Dutch Bill Creek was implemented in 2015 and maintains approximately 1 mile of habitat. The two remaining flow augmentation projects in Green Valley Creek contributed to re-wetting of streams in approximately one half mile of stream.

In addition to voluntary efforts, in July of 2015 the State Water Resources Control Board (SWRCB) issued Emergency Enhanced Water Conservation and Additional Water User Information for the Protection of Specific Fisheries in Tributaries to the Russian River (CCR title 23, section 876) which, in part mandated reductions in water usage in areas identified by NMFS and CDFW as at greatest risk to salmonids due to the drought. Tangible improvements in streamflow have not been observed, but these actions have increased awareness of conservation issues locally and have stimulated much of the participation in VDI's.

Frost Protection

Water extraction from streams, or from hydraulically connected groundwater, specifically those aimed at protecting grape vines from frost damage, has the potential to strand newly emerged steelhead fry during the spring period. On October 1, 2014, the SWRCB Russian River Frost Protection Regulation went into effect. This regulation, which is being phased in over a 3 year period, will mitigate for these effects by controlling harmful stream stage changes. The use of water for frost protection is widespread in the basin and, particularly in the spring season with many frost events, this regulation is likely to promote an improvement in fry survival in tributaries, and portions of the mainstem, where steelhead spawn and rear. In addition, monitoring, risk assessment, and corrective action requirements under this regulation have generated considerable amounts of conservation activity in these areas.

Flood Protection Practices

In recent decades, Federal and local entities have recognized the issues caused by past flood control practices and are taking action to avoid perpetuating these problems into the future. Positive efforts include implementing designs that integrate fluvial geomorphology with hydraulic engineering, remove hydraulic constrictions, restore floodplains, and provide fish passage. In addition, climate change and the associated threats of sea level rise and more severe and frequent flooding has again made flood control a priority for many local governments and private citizens. This renewed focus on flood control can be seen as a positive or negative trend, depending on the approach taken. Rebuilding flood control structures in-kind will perpetuate ongoing habitat impacts. However, applying current knowledge regarding the resiliency of natural ecosystems to climate change and the ability of healthy ecosystems to support flood protection should integrate ecosystem considerations into flood control designs – potentially resulting in habitat restoration at a grand scale, and significantly improved flood risk management. To guide future flood control projects in a direction that results in improvements to both habitat and flood protection, increased regulatory oversight will be needed to ensure flood control projects are designed to achieve long-term hydraulic, geomorphic, and ecological sustainability. Resource agencies will need to play an active role in informing communities and local flood control entities (through outreach and regulation) of how innovative flood control

approaches can provide environmental benefits, long-term sustainability and cost-savings to flood protection efforts. Interagency review and coordination, and stakeholder involvement are likely to be integral to achieving these goals.

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

Overfishing

Overfishing as a threat to CCC steelhead survival has diminished significantly since the time of initial listing, but no significant changes have occurred to the overfishing listing factor since the last 5 year review (NMFS 2011a). Ocean harvest of steelhead is rare and an insignificant source of mortality for the DPS, and recreational fishing is limited to catch and release only of wild fish and retention of only hatchery produced fish (NMFS 2011a). During the past five years, a number of sport fishing regulation changes have gone into effect to better protect salmonids along portions of the California Coast. These have included modified low flow closures and complete seasonal closures in some populations (for CCC steelhead this includes populations within the streams of Sonoma and Marin counties) due to ongoing drought, and to reduce problematic harvest by limiting areas in which fish may be taken (*e.g.*, reach closures on Sonoma Creek). More recently (2014-2015), CDFW modified the sport fishing regulations to allow a daily bag limit of two adult hatchery steelhead (*i.e.*, adipose-clipped) from streams throughout the DPS. The intent of this regulation change is to better protect genetic integrity of the wild fish.

Illegal Harvest

Freshwater poaching or unintentional take of CCC steelhead may occur. Where current abundance is below the "high risk" threshold (as described in Spence *et al.* 2008), losing adult fish to poaching could significantly impact population productivity and genetic diversity. There is no new information to suggest the overall risk of illegal harvest has increased since the initial listing of the species and since the previous 5 year status review.

Scientific Collection, Research and Monitoring

Collection for scientific research and education programs is tightly controlled and monitored through the issuance of collection permits by NMFS and CDFW. The previous status review (NMFS 2011a) concluded scientific research and educational programs are believed to have had little or no impact on CCC steelhead populations, and no development during the past five years has altered that determination. This is consistent with the original listing (71 FR 834), which determined that collection for scientific research and education programs had little or no impact on populations in CCC steelhead DPS. Impacts associated with scientific collection are believed

to be unchanged since the last status review (NMFS 2011a) and not expected to be an important source of mortality for the DPS.

Listing Factor C: Disease or predation

Disease

Many common diseases exist in the wild that affect steelhead populations, but increased individual resistance and natural ecological dynamics limit disease outbreaks and any resulting population-level impacts. No new information has emerged since listing or since the previous 5 year review that would suggest disease impacts have elevated in the time since, or that disease impacts are more than a minor factor in the present depressed state of the CCC steelhead DPS.

Predation

Predation was not considered a significant threat to CCC steelhead conservation during the past status review or at the time of listing (NMFS 2011a, 71 FR 834); however, recent research indicates that predation may affect the DPS. Adult and juvenile steelhead 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. Predation by robust (per historical standards) pinniped populations likely impact adult steelhead escapement in larger river systems where seals/sea lions tend to aggregate (*e.g.*, Russian River and San Lorenzo River). Marine mammal population growth increased substantially following the passage of the federal Marine Mammal Protection Act in 1972. The impacts of the increased marine mammal population on steelhead predation within the DPS are poorly understood, but have not likely increased in the past 5-years or since listing. Meanwhile, recent research has shown that increased populations of other native predators may have a greater impact on salmonid populations than previously considered. 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.

Predation of CCC steelhead by introduced fish species, particularly various bass species, in the freshwater and marine environment is also poorly understood. Striped bass regularly occur in San Francisco and Tomales Bays, occasionally occur in coastal lagoons, and are found year round in the lower Russian River. Nearly all watersheds in the DPS support populations of introduced largemouth, smallmouth, or spotted bass. Additional studies are needed to better understand the predatory impacts these introduced species pose on steelhead populations throughout the DPS.

Protective Efforts

Don Clausen Fish Hatchery Program

CDFW operates the Don Clausen Fish Hatchery Program[11] to follow established disease prevention programs that safeguard both hatchery and wild populations within the Russian River. Guidelines exist for fish health and life history inspections, juvenile growth and monitoring, and treatments administered, which are reported in monthly and annual reports. Fish health status is evaluated and verified by CDFW pathologists prior to fish releases or fish transfers to another facility, and a cumulative five year disease history is maintained for each program and reported in appropriate facility reports. Both facilities strive for suggested water chemistry standards (IHOT 1995), which require water filtration and disinfection, heating or cooling, degassing and/or aeration, or other modifications to the quantity and quality of an existing water supply, to maintain or improve conditions. Measures implemented at Don Clausen Fish Hatchery Program facilities include:

- Pathogen-free water supply for each facility, particularly for egg incubation and early rearing.
- Water supply with acceptable temperature regimes for egg incubation, juvenile rearing and adult holding.
- Water supply with appropriate water chemistry profiles, including dissolved gases: near saturation for oxygen, and less than saturation for nitrogen.
- Water supply for egg incubation must not contain excessive organic debris, unsettleable solids or other characteristics that negatively affect egg quality and survival.
- Disinfecting equipment, including vehicles used to transfer eggs or fish between facilities, prior to use with any other fish lot or at any other location.
- Disinfecting water disposed of in properly designated areas.
- Sanitizing equipment used to collect dead fish prior to use in another pond and /or fish lot.

[11] Program includes operations at both the Don Clausen/Warm Springs Hatchery and the Coyote Valley Fish Facility.

The Kingfisher Flat Hatchery Program[12]

The Monterey Bay Salmon and Trout Project operates the Kingfisher Flat Hatchery Program. Methods implemented to protect and maintain fish health at this facility include, but are not limited to:

- Source water is sand filtered and sterilized by exposure to ultraviolet light. This filtration and sterilization process is implemented to prevent introduction of pathogens from outside the facility and to prevent disease transmission within the facility.
- Water supply is monitored to ensure chemistry, dissolved gasses, and temperature are within necessary ranges for egg incubation, juvenile rearing and adult holding.
- Equipment is disinfected prior to use with any other fish lot.

Listing Factor D: Inadequacy of existing regulatory mechanisms

Inadequate regulatory mechanisms have contributed substantially to the decline of the CCC steelhead DPS. Although many regulatory mechanisms and conservation efforts were in place at the time this DPS was listed, NMFS concluded that they were insufficient to provide for the attainment of properly functioning habitat conditions that would protect and conserve the species.

Federal Water Management

The 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 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

[12] This hatchery is also known as the Scott Creek Hatchery.

practices, but instead relies on the TMDLs under the CWA 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-the number one cause of stream impairment in California. 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. NMFS completed six biological opinions 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, 2011b, 2012) and (2) the of these pesticide ingredients are likely result in destruction or adverse modification of designated critical habitat of up to 25 ESUs and DPSs (NMFS 2008b, 2009, 2010, 2011b, 2012, 2015) 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.

Fisheries Management and Evaluation Plan

The primary goal of a Fisheries Management and Evaluation Plan (FMEP) is to devise biologically based fishery management strategies that ensure the conservation and recovery of listed DPSs and ESUs. If approved by NOAA and implemented accordingly, an FMEP allows fisheries-related take of listed species to be covered under the ESA. Some benefits of the FMEP approach are long-term management planning, more public involvement, and more certainty that there will be fishing opportunities in the future. However, there is not an FMEP in place for CCC steelhead, so the management benefits and fishing-related ESA take coverage benefits afforded by FMEPs are not currently realized for CCC steelhead. In order to address this, CDFW needs to develop an FMEP to cover CCC steelhead populations where fishing-related take occurs.

State Efforts

Timber Harvest

State Forest Practice Rules, which govern timber harvest on private lands (as occurs in the CCC steelhead DPS), have improved in recent years, resulting in rules providing expanded stream-buffer widths, less damaging harvest techniques, and limits on riparian harvesting that will collectively improve instream and riparian habitat and function over the long-term. However, certain regulatory protections within the DPS remain limited. For example, State Forest Practice Rules that require analysis of cumulative watershed effects of proposed timber harvest practices have changed minimally since CCC steelhead were originally listed, and Board of Forestry rules that provide additional no-cut buffer protections to certain Class II-Standard watercourses[13] do not apply to the area encompassing Santa Cruz and San Mateo Counties. However, improvements to cumulative watershed effects considerations may come with Forest Practice Rules that are currently being proposed by the Board of Forestry and Fire Protection; NMFS anticipates reviewing and commenting on these proposed Forest Practice Rules.

State Water Management. The SGMA, signed into law in October 2014, regulates and manages the state's groundwater resources to ensure sustainability of the resource for the first time in California history (see *Water Quantity*, above). As the state adapts to future climate variability combined with a period of accelerated population growth, the demands placed upon streams and rivers in the DPS will likely grow. 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. However, the SGMA 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.

Illegal Marijuana Cultivation

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. A ballot initiative legalizing recreational use of marijuana is expected on the state ballot in 2016, and a legislative effort to craft a bill legalizing recreational use may gain traction in 2015. While these political efforts may dramatically change the

[13] Board of Forestry Rules implemented in 1990 that provide additional no-cut buffer protections to certain Class II-Standard watercourses do not apply to the Southern Subdistrict of the Coast Forest. Santa Cruz and San Mateo Counties are located in the Southern Subdistrict of the Coast Forest.

marijuana cultivation landscape in California, the efficacy of any regulatory scheme to minimize grow-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.

Fishing Regulations

While state fishing regulations have seen recent (2014-2015) improvements to protect listed salmonids from recreational fishing during times of drought (see Listing Factor A above), these low flow regulations have not been fully developed for the entire DPS. For example, for the CCC steelhead DPS, closures have only been prescribed for Sonoma and Marin Counties. Extending these flow-based fishing closures to the southern portions of the DPS is needed and will better provide this protection to populations throughout the range.

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 (Williams *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 (Williams *et al.* 2016). 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 (Williams *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 salmon passage, egg incubation, and juvenile rearing and migration. The high incidence of illegal stream diversions associated with illegal marijuana cultivation 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 impacts 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 including steelhead. Since the previous status review in 2011 (NMFS 2011a), spring upwelling generally strengthened slightly off the Pacific Northwest coastline (NWFSC 2014[14]), suggesting adequate prey availability and relatively high ocean survival rates among CCC steelhead populations during most years. Conversely, anomalous warming of near-shore surface waters off central California during summer 2014 (SWFSC 2014[15]) may have decreased adult steelhead foraging success, since the warm water likely scattered baitfish and other prey organisms from traditional nearshore feeding areas.

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). 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 kilometers (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). The expected duration, pattern and causative mechanism of these rare

[14] http://www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/db-coastal-upwelling-index.cfm

[15] https://swfsc.noaa.gov/textblock.aspx?Division=FED&ParentMenuId=54&id=19435

and anomalous oceanographic phenomena are poorly understood at the present time. Yet the increased occurrence of these phenomena coinciding with a period of documented climate variation may suggest variant ocean conditions and weather patterns may become more prevalent if climate change accelerates in the future. Also, within estuarine systems, estuarine productivity is likely to change based on climate-related changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002).

Small Population Size

Many populations of CCC steelhead 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 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. Even though recent data suggests some CCC steelhead populations are doing better than others, all populations remain at severely depressed levels, suggesting stochastic processes continue to remain a high threat to the species.

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[16]. 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 and Carlton 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

[16] The definition of aquatic invasive species is derived from the nonindigenous aquatic invasive species nuisance aquatic prevention and control act of 1990.

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). 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 risk and may reduce the number of juvenile salmonids 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.

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. To acknowledge and adequately minimize these risks, NMFS is currently crafting Hatchery Genetic Management Plans (HGMP) for the two hatchery programs presently operating within the CCC steelhead DPS.

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 a new aquatic location. The increase in this aquatic invasive species is a concern for salmonid 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, and buckets. New Zealand mudsnails 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.

Scarce abundance data makes it extraordinarily difficult to definitively ascertain the status of the DPS and determine whether status has changed since the last status review (Spence 2016). In the North Coastal and Interior strata, steelhead still appear to occur in the majority of watersheds, and new information from 3 years of monitoring in the Santa Cruz Mountain stratum indicates that population sizes are perhaps higher than previously thought. However, monitoring and hatchery data in the Russian River watershed indicate a prevalence of hatchery fish over natural origin fish, and the Scott Creek population, which has the most robust population estimates in the DPS, has shown a downward abundance trend (Spence 2016). Further, the status of populations in the two San Francisco Bay diversity strata remains highly uncertain, and it is likely that many populations where historical habitat is now inaccessible due to dams and other passage barriers are likely at high risk of extinction (Spence 2016). In summary, while data availability for this DPS remains poor, there is little new evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since the last status review (Spence 2016).

Our analysis of the ESA section 4(a)(1) factors (see Factors A through E discussed within Section 2.3.2, above) indicates that the collective risk to the persistence of the CCC steelhead has not changed significantly since our last 2011 status review (NMFS 2011a). Improvements have been made in small fish passage barriers, and numerous habitat restoration projects have improved habitat conditions. Conversely, habitat problems are still common throughout the region, legacy effects persist in many areas, new urban growth threatens existing habitat, and many more

habitat improvements and protections are likely needed to achieve viability. Harvest rates remain relatively low and the protection afforded by some regulatory mechanisms, such as implementation of TMDLs, has increased, although existing regulatory mechanisms could be improved to better protect CCC steelhead. In particular, ongoing impacts from urbanization and diversion facilities (including small diversions as well as large dams) continue to impair habitat and limit species viability, and ongoing threats associated with urban expansion and illegal marijuana cultivation are expected to continue to adversely affect the DPS. These effects, as well as the impacts that climate change pose, remain a concern for long term conservation and recovery of the DPS.

After considering the biological viability of the CCC steelhead DPS and the current status of their ESA section 4(a)(1) factors, we conclude that the status has not improved significantly since the 2011 5-Year Status Review (NMFS 2011a).

2.4.1 ESU/DPS VIABILITY AND STATUTORY LISTING FACTORS

- The SWFSC's review of updated information does not indicate a change in the biological risk category for CCC steelhead since the time of the last status review (Williams *et al*. 2016).

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

3.0 RESULTS

3.1 CLASSIFICATION

Listing Status

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

Hatchery Membership

The CCC steelhead hatchery programs have not changed substantially from the previous ESA status review. Therefore, we do not recommend any changes in hatchery membership for the CCC steelhead DPS.

3.2 NEW RECOVERY PRIORITY NUMBER

No change is recommended in the recovery priority number (5) for the CCC 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 CCC 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. Improving conditions for CCC steelhead requires improved passage, habitat, flows, and population viability. Passage improvements are needed to remedy both partial and complete barriers to migration and reach-scale movement of adults and juveniles. Habitat improvements should include attention to in-stream and estuarine habitat complexity, and the geomorphic and watershed processes that support habitat function. Flow protections and improvements are needed to protect all life stages and habitat, and should support base (low) flows, natural-type hydrographs, and groundwater resources. Improved population monitoring is needed to better understand the status of populations and the DPS. The following identifies the most important actions to pursue over the next 5 years.

- Continue to implement the California Coastal Salmonids Monitoring Program. Funding and implementation of a coordinated program are necessary to enable tracking the status of CCC steelhead populations, evaluate the effectiveness of restoration and mitigation efforts within the DPS, and to insure the monitoring program will meet data needs to conduct status reviews for all ESA listed species. Efforts should include:
    - adult population monitoring for each core population, including those in San Francisco Bay tributaries;
    - study of how CCC steelhead use estuary habitats in San Francisco Bay; and
    - where CCC steelhead co-occur with CCC coho, expansion of survey duration and watershed extent to better capture steelhead data.
- Remedy existing complete and partial barriers to passage. While this effort is needed throughout the range, focus on areas subjected to past urban, rural, and timber development in the San Francisco Bay area and Santa Cruz Mountains area.
- Improve estuary management and support/restore estuary habitat and function (including lagoon barrier formation and breach timing) in coastal San Mateo and Santa Cruz counties by removing fill and infrastructure, and developing alternative methods of flood control.
- Support resiliency to climate change by allowing a full range of habitat for salmonids to exploit as environmental conditions shift. Maximize habitat connectivity, increase

in-stream complexity, shelter, substrate condition, and habitat diversity for all life stages. While this effort is needed throughout the range, focus on areas subject to urban, rural, and timber development in the San Francisco Bay area and Santa Cruz Mountains area.

- Restore and protect active channel area(s), floodways, and floodplains to accommodate natural fluvial processes. Focus on areas affected by urbanization in the San Francisco Bay and Santa Cruz Mountains areas.
- Implement innovative and sustainable green infrastructure and low-impact design (LID) projects to manage pollutants, support ecosystem and infrastructure resiliency, and protect steelhead habitat. If applied at a broad scales, LID technology, policies, and watershed programs may protect and/or restore hydrologic and ecological functions in watersheds and support infrastructure protection and maintenance, thereby simultaneously protecting water quality and habitat for ESA listed species, and protecting necessary infrastructure. While needed throughout the range, the most immediate needs are within the areas of the greater San Francisco Bay area characterized by aging infrastructure and increasing climate-change-related flood risk.
- Protect and restore flow by:
    - removing impervious surfaces, and creating or expanding flood retention land and groundwater recharge basins to reduce the flashiness of hydrographs and increase summer baseflow; and
    - 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 steelhead (or salmonids).
- 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 EPA, SWRCB, and local stakeholders to implement actions under section 303(d)(1)(C) and (D) of the Clean Water Act to treat urban and agricultural runoff from existing and future development. This would require the State to prepare and implement Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards.
- Work with Don Clausen Fish Hatchery and Kingfisher Flat Hatchery/Scott Creek (Monterey Bay Salmon and Trout Project) programs 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.

- 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.

- 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.

- Work with State agencies to minimize impacts from marijuana operations on listed salmonids.

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National Marine Fisheries Service
5-Year Review
for
Central California Coast Steelhead

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

- Central California Coast 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