8. Summary of DPS-Wide Recovery Actions

"The basic recovery strategy . . . mimics the strategy that the species exhibits in its natural distribution among the various watersheds in their unaltered state, and provides the most effective strategy . . . to ensure the long-term viability of individual populations, and the listed species as a whole."

South-Central California Coast Steelhead Recovery Planning Area: Recovery Actions
Hunt & Associates 2008

8.0 INTRODUCTION

The SCCCS Recovery Planning Area is characterized by severe to very severe degradation of habitat conditions along the lower mainstem river channels where urban and agricultural development is concentrated, while the upper mainstem and tributaries, often situated within the Los Padres National Forest, retain relatively high habitat values for anadromous *O. mykiss*. Dams, surface water diversions, and groundwater extractions have frequently disconnected the upper and lower portions of watersheds, as well as degraded instream and riparian habitats in both areas. Because the mainstem river channels are the conduits connecting upstream spawning and rearing habitats with the ocean, many recovery actions in watersheds impaired in this manner focus on reducing the severity of anthropogenic impacts along the mainstems. Encroachment into riparian areas and flood control activities that degrade instream habitat or restrict fish passage should be avoided or minimized in order to promote connectivity between the ocean and upstream spawning and rearing habitats. Additionally, degraded estuarine conditions stemming from filling, artificial sandbar manipulation, and point and non-point waste discharges are addressed by specific recovery actions for the SCCCS Recovery Planning Area.

This chapter describes DPS-wide recovery actions. DPS-wide recovery actions are recommendations designed to address widespread and often multiple threat sources across the SCCCS Recovery Planning Area. These actions address issues such as the inadequate implementation and enforcement of local, state, and federal regulations. Subsequent chapters describe BPG-specific conditions, the results of threats assessments for component watersheds, and the recommended recovery actions for each component watershed.

An array of natural and anthropogenic conditions has reduced the population size and historical distribution of the SCCCS DPS. Many of these causes of decline are systemic and persistent, crossing numerous geographic and political boundaries. The sources and reasons for decline are identified in Federal Register Notices and this Recovery Plan. Effectively addressing these causes of decline involves multiple challenges and opportunities that include: 1) development of new and effective implementation of current laws, policies, and regulations at the local, state, and federal levels; 2) securing adequate funding for implementation of recovery actions; 3)

developing strategic partnerships at the local, state, and federal levels; (4) assuring effective prioritization of restoration, threats abatement, and monitoring actions; and (5) conducting education and outreach.

8.1 DPS-WIDE RECOVERY ACTIONS

DPS-wide recovery actions addressing widespread threat sources include the following:

- Collaboration between water facility owners and operators, and local, state and federal agencies to ensure releases from water storage and diversion facilities will maintain surface flows necessary to support all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation, and rearing habitat.
- Collaboration between riparian landowners and the State Water Resources Control Board to minimize and manage withdrawals from riparian wells, and through the provision of technical assistance and grants, develop rain/runoff collection facilities to address out-of-stream water demands, and ensure adequate bypass flows necessary to support all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation, and rearing habitat.
- Collaboration with local, state and federal agencies on local flood control and management programs (*e.g.*, the Pajaro River Bench Excavation Program and U.S. Army Corps of Engineers lower Pajaro River Flood Control Program) to ensure these programs incorporate appropriate steelhead habitat protection and restoration provisions.
- Collaboration with local, state, and federal agencies and non-governmental organization in the acquisition of fee-title to parcels or establishment of conservation easements over selected stream and riparian corridors to protect steelhead migratory, spawning, and rearing habitats.
- Physically modify passage barriers (including the dams and diversion facilities identified in Table 7-2 and the BPG recovery action tables) to allow natural rates of migration to upstream spawning and rearing habitats.
- Finalize and implement the California Coastal Salmonid Population Monitoring Plan. Implementation of the California Coastal Monitoring Plan is essential for evaluating the long-term viability of SCCCS DPS as well as other species of listed salmonids in California.
- Prioritize restoration funds, notably the Pacific Coast Salmon Restoration Fund and California's Fisheries Restoration Grant Program (FRGP), in Core 1, 2, and 3 watersheds.
- Implement restoration projects to provide access to historical steelhead spawning and rearing habitats and increase egg-to-smolt life stage survival.
- Support agency actions to secure funding for, and engage in, full enforcement of relevant laws, codes, regulations and ordinances protective of steelhead and their habitats. Provide community education on the impacts of illegal take (including poaching) of wild steelhead and their progeny.
- Collaboration between CalTrans, counties, and others with oversight on road practices to reduce or remove transportation related barriers to upstream and downstream passage (including railroad bridges, abutments, and similar structures identified in BPG recovery action tables in Chapters 9-12).
- Collaboration between U.S. Forest Service and the California Department of Forestry to ensure that fire-suppression and post-fire

suppression activities are conducted in a manner which is protective of steelhead and steelhead habitats.

- Enhance protection of natural in-channel and riparian habitats, including appropriate management of flood-control activities (both routine maintenance and emergency measures), off-road vehicle use, and in-river sand and gravel mining practices commensurate with habitat and life history requirements of steelhead.
- Reduce water pollutants such as fine sediments, pesticides, herbicides, and other non-point and point source waste discharges (Total Maximum Daily Load) commensurate with habitat and life history requirements of steelhead. This should be accomplished through public education, watershed—management and appropriate management of public and private facilities releasing waste discharges (see Appendix F, Pesticide Application Best Management Practices).
- Complete a Fishery Management and Evaluation Plan for anadromous waters of the SCCCS DPS; assess impacts of angling on native *O. mykiss* above barriers which are currently impassable to upstream-migrating steelhead.
- Eliminate the stocking of hatchery-reared fish in anadromous waters; in waters where stocked fish may reach anadromous waters ensure that such fish are adequately controlled to prevent the introduction of hatchery-reared fish into anadromous waters.
- Convene a committee of agency personnel and scientists (*e.g.*, the CDFW, NMFS' Fisheries Science Centers, U.S. Fish and Wildlife Service) for the purpose of establishing a pilot conservation hatchery program for threatened steelhead consistent with the principles and purposes outlined in section 8.3 below.
- Assess the condition of and restore estuarine habitats through the control of fill, waste discharges, instream flows, and establishment of properly functioning riparian buffers on seasonal and permanent streams commensurate with the habitat and life history requirements of steelhead.
- Manage the artificial breaching and/or draining of coastal estuaries consistent with habitat and life history requirements of steelhead (including rearing juveniles and migrating adults).
- Evaluate and mitigate the effects of transportation corridors and facilities on estuarine fluvial processes. When vehicular, railroad, or utility crossings over estuaries are replaced, upgraded, retrofitted, or enlarged, reduce or eliminate existing approach-fill and maximize the clear spanning of upstream active channel(s), floodways, and floodplains to accommodate natural river and estuarine fluvial processes.
- Review California Department of Forestry's rules for timber harvest activities south of San Francisco, and modify, if necessary, to ensure that such activities do not adversely affect steelhead migration, spawning and rearing.
- Conduct research on the relationship between resident and anadromous forms of *O. mykiss*, and related population dynamics (*e.g.*, distribution, abundance, residualization, dispersal, and recolonization rates.
- Provide for the permanent curation of deceased *O. mykiss* specimens for the purpose of making available specimens for examination and study by present and future scientific researchers.
- Survey and monitor the distribution and abundance of non-native species of plants and animals that degrade natural habitats or compete with native species within watersheds identified as Core populations.

Conduct research on the life history of naturalized population of non-native species such as striped bass in the Pajaro, Salinas, and Carmel Rivers. Initiate efforts to eliminate, reduce, or control non-native and/or invasive species.

- Amend Army Corps Section 404 Clean Water Act (CWA) exemptions for farming, logging, and ranching activities; terminate Section 404(f) exemptions for discharges of dredged or fill material into U.S. waters (channelization) associated with agriculture, logging, ranching and farming; incorporate explicit steelhead habitat requirements into CWA Section 401 water certification permits and 303(d) listings to protect all life-history stages, including adult and juvenile steelhead migration, spawning, incubation and rearing.
- Incorporate appropriate elements of the South-Central California Steelhead Recovery Plan into the state-sponsored and funded Integrated Regional Watershed Management Plans (IRWMP) being developed for major watersheds of South-Central California under the Integrated Regional Watershed Management Planning Act of 2002.
- Coordinate with CDFW and the State Water Resources Control Board to ensure the effective implementation of California Fish and Game Code Sections 5935-5937 regarding the provision of fishways and fish flows associated with dams and diversions.
- Extend the California Water Code Section 1259.4 dealing with instream flows to protect instream beneficial uses, including native fishes, to SCCCS Recovery Planning Area, with appropriate provisions to address regional differences, including but not limited to construction of off-stream storage as alternative to direct diversions during the dry season.
- Streamline permitting processes for categories of projects (*e.g.*, off-channel winter water storage to reduce summer water withdrawals, installation of large woody debris, removal of smaller fish passage impediments, *etc*.) to reduce costs and length of time to implement recovery actions

8.2 RECOVERY ACTION NARRATIVES

Table 8-1 contains a narrative description of the types of recovery actions which are intended to address systemic threats identified throughout the watersheds within the SCCCS Recovery Planning Area, based upon the DPS threats assessments conducted by NMFS technical consultants, and the intrinsic potential analysis conducted by NMFS' TRT. These narratives describe the general nature and biological objectives of the recovery actions which must be implemented to achieve the goals, objectives, and meet the viability criteria, that are identified in Chapter 6, Steelhead Goals, Objectives and Criteria, and implement the recovery strategy in outlined in Chapter 7, Steelhead Recovery Strategy.

The Recovery Plan applies these recovery actions to individual watersheds (and in some cases individual facilities) to the extent information is available, in the recovery action tables for each watershed within the BPG Chapters 9 through 12. However, the general language of recovery actions does not dictate a specific means of achieving the biological objectives of the recovery actions (*e.g.*, assure effective fish passage, provide ecological effective flow regime, control nonpoint sources

of pollution or non-native species, or restore estuarine functions).

SCCCS DPS threats assessments were identified at a watershed scale, and do not necessarily identify site-specific threat sources in each reach of individual watersheds; therefore, many of the recovery actions call for more detailed threats assessment and analysis (*e.g.,* fish passage barrier inventories and assessments in watersheds where complete systematic barrier inventories are not available, or should be updated). Some recovery actions may involve the review and modification of local general plans and local coastal plans (along with other regional plans) to promote activities to restore and protect steelhead habitats.

Implementation of many recovery actions will require site-specific investigations to determine appropriate design details, and where appropriate, operational criteria for individual facilities. For example, the specific means of providing fish passage at a particular site or facility (*e.g.*, culvert, diversion, or dam), or the flow regime necessary to provide passage or sustain ecological effective rearing habitats, must be based on site-specific technical investigations such as those undertaken for recovery actions that have already been, or are in the process of being, implemented. Similarly, the recovery actions dealing with the control or elimination of non-native invasive species will require a watershed-wide, and in some cases, a reach-specific inventory and assessment of the species before the appropriate control measures can be identified and implemented.

Finally, recovery actions that involve development as defined by either the National Environmental Policy Act (NEPA) or the California Environmental Quality (CEQA) will require environmental review that could further refine individual recovery project alternatives, identify mitigation measures, and/ or require project monitoring, as part of the project permitting process.

Table 8-1. Recovery Actions Glossary.[1]

Threat Source	Recovery Action	Detailed Description
Agricultural Development	Develop, adopt, and implement agricultural land-use planning policies and standards	Develop, adopt, and implement land-use planning policies and development standards that restrict further agricultural encroachment within the active floodplain/riparian corridor. Restrict further development in these areas to protect *all O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation, and rearing, and their associated habitats. Plans should include incentives, including streamlining of applicable permitting processes, for agricultural related activities.
	Manage livestock grazing to maintain or restore aquatic habitat functions	Develop and implement a plan to manage livestock grazing to restore and/or protect riparian functions (*e.g.*, control stream bank and floodplain erosion, dissipate stream energy, capture sediment during high flows, *etc.*) to sustain aquatic habitat features (*e.g.,* physical diversity, cover, and water quality) essential for all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing. Plans should include incentives for construction and management of off-stream water for livestock, including streamlining of applicable permitting processes.
	Manage agricultural development and restore riparian zones	Develop and implement a plan to manage agricultural development outside of the active floodplain (generally defined by 2-5 year frequency flood event) to create an effective riparian buffer; restore and re-vegetate a minimum riparian buffer. Include provisions for properly functioning riparian conditions to allow the channel to maintain natural structural diversity, and protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats. The extent of the floodplain and riparian buffer shall be determined on a case-by-case basis taking into account site specific conditions. Plans should include incentives for construction and management of off-stream water for livestock, including streamlining of applicable permitting processes.
Agricultural Effluents	Develop and implement plan to minimize runoff from agricultural activities	Develop and implement a plan to reduce or eliminate nutrient and pesticide/herbicide runoff and sediment inputs into watercourses from agricultural activities. Reduction of agricultural runoff will help to provide water quality suitable for all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitat.

[1] The recovery actions are listed alphabetically here and in the recovery tables of Chapters 9-12 to aide consultation; the order is not intended to imply prioritization, which is indicated separately for each recovery action in individual watersheds identified in Chapters 9-12.

Threat Source	Recovery Action	Detailed Description
Culverts and Road Crossings (Passage Barriers)	Develop and implement plan to remove or modify fish passage barriers within the watershed	Develop and implement a plan to prioritize, remove and/or modify anthropogenic fish passage barriers within the watershed to allow natural rates of adult and juvenile *O. mykiss* migration between the estuary and upstream spawning and rearing habitats, passage of smolts and kelts downstream to the estuary and the ocean, and to reduce intrusion of development into the riparian corridor and restore sediment transport.
	Conduct watershed-wide fish passage barrier assessment	Conduct a watershed-wide fish passage barrier assessment between the ocean and all upstream spawning and rearing areas (including above known existing barriers in Core watersheds). A passage barrier assessment should use protocols identified in the CDFW's California Salmonid Stream Habitat Restoration Manual (Flosi *et al*. 2010, or the most current version).
Dams and Surface Water Diversions	Develop and implement water management plan for diversion operations	Develop and implement a water management plan to identify appropriate diversion rates for all surface water diversions to ensure maintenance of surface flows necessary to support all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, and suitable spawning, incubation, and rearing habitat. Plans should include provisions for development of off-stream storage of winter flow for summer irrigation use in exchange for reduced summer diversions, including streamlining of applicable permitting processes.
	Develop and implement water management plan for dam operations	Develop and implement an operational plan to optimize seasonal releases from dams to provide surface flows necessary to support all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation, and rearing habitats.
	Provide fish passage around dams and diversions	Develop and implement a plan to physically modify or remove fish passage barriers at dams, debris basins or diversions to allow natural rates of adult and juvenile *O. mykiss* migration between the estuary and upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.
Flood Control Maintenance	Develop and implement flood control maintenance program	Develop and implement a flood control maintenance program to minimize the frequency and intensity of disturbance to instream habitats and riparian vegetation (*e.g.*, modification of natural channel morphology and removal of native vegetation).
Groundwater Extraction	Conduct groundwater extraction analysis and assessment	Conduct hydrological analysis to identify groundwater extraction rates, effects to the natural pattern (timing, duration and magnitude) of surface flows in the mainstem, tributaries, and estuary, and effects on all *O. mykiss* life history stages, including

Threat Source	Recovery Action	Detailed Description
		adult and juvenile *O. mykiss* migration, spawning, incubation and rearing habitats.
	Develop and implement groundwater monitoring and management program	Develop and implement a groundwater monitoring program to guide management of groundwater extractions to ensure surface flows provide essential support for all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation and rearing habitats.
Levees and Channelization	Develop and implement plan to restore natural channel features	Develop and implement a plan to modify channelized or artificially stabilized portions of the mainstem and tributaries, wherever feasible, to restore natural channel features and habitat functions, including natural channel bottom morphology and riparian vegetation, to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats. Focus initial efforts on high value habitats.
	Develop and implement plan to vegetate levees and eliminate or minimize herbicide use near levees	Develop and implement a plan to vegetate levees with local native, wherever feasible, and eliminate or minimize the use of herbicides to control native vegetation adjacent to existing levees.
	Develop and implement stream bank and riparian corridor restoration plan	Develop and implement a stream bank and riparian corridor restoration plan to reduce channel incision, sedimentation from bank erosion, and reduce or eliminate the need for bank stabilization; wherever feasible, remove rip-rap and other artificial bank stabilization features on mainstems and tributaries. Replace these features with bio-engineered bank stabilization, or additional set-backs, to allow channels to maintain natural structural diversity.
Mining and Quarrying	Review and modify mining operations	Review aggregate and hard rock mining operations (past, current and future) for conformance with the National Marine Fisheries Services "Guidelines for Removal of Sediment from Freshwater Salmonid Habitat" (Cluer 2004). Modify current and future mining operations, where necessary, to comply with the relevant provisions of the guidelines, and remediate past (including terminated) operations to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats. Focus initial efforts on mining operation located within the bank full channel.
	Develop and implement plan to remove quarry and landslide debris from the channel	Develop and implement a plan to remove quarry and landside debris from the channel, maintain the channel free from such debris, and establish a riparian buffer with native, locally occurring species to protect all *O. mykiss* life history stages, including adult and juvenile *O. mykiss* migration, and spawning and rearing habitats.

Threat Source	Recovery Action	Detailed Description
Non-Native Species	Develop and implement watershed-wide plan to assess the impacts of non-native species and develop control measures	Develop and implement a watershed-wide (or reach-specific) plan to identify and determine the type, distribution and density of non-native species; assess their impacts on all *O. mykiss* life history stages; and eliminate or control non-native species of plants and animals (particularly fish and amphibians) where they are determined to be detrimental to riparian habitats. Restore riparian and adjacent upland areas with native, locally occurring plant species to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Develop and implement non-native species monitoring program	Develop and implement monitoring programs to track status and impacts of non-native species of plants and animals on all *O. mykiss* life history stages, particularly rearing juveniles.
	Develop and implement public education program on non-native species impacts	Develop and implement public education program (including signage at public access points) to inform the general public of the potential adverse effects of introducing non-native species into natural ecosystems.
Recreational Facilities	Manage off-road recreational vehicle activity in riparian floodplain corridors	Develop, adopt, and implement land-use policies and standards to manage off-road vehicular activity within the riparian/floodplain corridor of the mainstem and tributaries to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Review and modify development and management plans for recreational areas and national forests	Review development and management plans for recreational areas and national forest lands and modify to provide specific provisions to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats. Provide specific provisions for restoration and protection of creeks, rivers, estuaries, wetlands and riparian/floodplain areas, including an effective setback for all development adjacent to estuarine and riparian habitats. Regulate the use of day-use areas and other recreational facilities to minimize impacts to aquatic and wetland habitats to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Develop and implement public education program on watershed processes	Develop and implement a public education program (including signage at public access points) to promote public understanding of watershed processes (including the natural fire-cycle) and *O. mykiss* ecology to protect all life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.

Threat Source	Recovery Action	Detailed Description
Roads	Manage roadways and adjacent riparian corridor and restore abandoned roadways	Develop and implement a plan to manage roadways adjacent to riparian/floodplain corridors to reduce sedimentation, or other non-point pollution sources, before it enters natural watercourses to protect all steelhead life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats. Restore and re-vegetate abandoned roadways with native, locally occurring species.
	Retrofit storm drains to filter runoff from roadways	Develop and implement a plan to retrofit storm drains to filter runoff from roadways to remove sediments and other non-point pollutants before it enters natural watercourses to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Develop and implement plan to remove or reduce approach-fill for railroad lines and roads	Develop and implement a plan to remove or reduce approach-fill for railroad lines and roads and maximize the clear spanning of active channels, floodways, and estuaries to accommodate natural river and estuarine fluvial processes to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
Upslope/Upstream Activities	Develop and implement an estuary restoration and management plan	Develop and implement an estuarine restoration and management plan. To the maximum extent feasible, a plan should include restoring the physical configuration, size and diversity of the wetland habitats, eliminate exotic species, control artificial breaching of the sand bar, and establish an effective buffer to restore estuarine functions and promote *O. mykiss* use of the estuary.
	Review and modify applicable County and/or City Local Coastal Plans	Review applicable County and/or City Local Coastal Plans and modify to provide specific provisions, when applicable, for the protection of all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Review applicable Integrated Natural Resources Management Plans	Review Integrated Natural Resources Management Plans (INRMP) and modify, where applicable, to provide specific provisions for the protection and restoration of all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation, and rearing habitats.
Urban Development	Develop, adopt, and implement urban land-use planning policies and standards	Develop, adopt and implement urban land-use planning policies and development standards that restrict further development in the floodplain/riparian corridor to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing, habitats.

Threat Source	Recovery Action	Detailed Description
	Retrofit storm drains in developed areas	Develop and implement plan to retrofit storm drains in developed areas to control sediments and other non-point pollutants in runoff from impervious surfaces before it enters natural watercourses to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Develop and implement riparian restoration plan to replace artificial bank stabilization structures	Develop and implement riparian restoration plan throughout the mainstem and tributaries to replace artificial bank stabilization structures wherever feasible, and provide an effective riparian buffer on either side of mainstem and tributaries, utilizing native, locally occurring species, to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
Urban Effluents	Review California Regional Water Quality Control Boards Watershed Plans and modify Stormwater Permits	Review California Regional Water Quality Control Boards Regional Plans, and Stormwater Permits, and modify to include specific provisions for the protection of all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Review, assess and modify NPDES wastewater discharge permits	Review and assess National Pollution Elimination Discharge System (NPDES) wastewater discharge permits to determine effects of discharge on adult and juvenile *O. mykiss* life stages, including migration, spawning, and rearing habits. Modify discharge requirements, where necessary, to ensure discharge is adequate to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
	Review, assess and modify residential and commercial wastewater septic treatment facilities	Review and assess residential and commercial wastewater septic treatment facilities to determine effects of discharge on all *O. mykiss* life stages, including migration, spawning, and rearing habits. Modify septic systems, where necessary, to ensure discharges are adequate to protect all *O. mykiss* life history stages, including adult and juvenile migration, spawning, incubation and rearing habitats.
Wildfires	Develop and implement an integrated wildland fire and hazardous fuels management plan	Develop and implement an integrated wildland fire and hazardous fuels management plan, including monitoring, remediation and adaptive management, to reduce potentially catastrophic wildland fire effects to steelhead and their habitat and preserve natural ecosystem processes (including sediment transport and deposition).

8.3 CONSERVATION HATCHERIES

One potential recovery strategy involves the use of conservation hatcheries to preserve imminently threatened populations, or to accelerate restoration of steelhead runs by temporarily supplementing natural production (California Department of Fish and Wildlife and U.S. Fish and Wildlife Service 2010, California Department of Fish and Wildlife 2004, California Department of Fish and Wildlife and National Marine Fisheries Service 2001). Potential sources of wild steelhead within the SCCCS Recovery Planning Area include the facility operated at Sleepy Hollow on the Carmel River, Monterey County, and the land-locked wild steelhead population above Whale rock Reservoir on Old Creek, San Luis Obispo County.

While a conservation hatchery program[2] can complement the overall recovery effort, the role of such a program does not substitute for the extensive restoration of habitat function, value, and connectivity that is required to abate the threats to SCCCS DPS.

Conservation hatcheries can be used for a number of recovery related purposes, including: 1) providing a means to preserve local populations faced with immediate extirpation as a result of catastrophic events such as wildfires, toxic spills, dewatering of watercourses, *etc.*; 2) preserving the remaining genotypic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce short-term risk of extinction; 3) reintroduction of populations in restored watersheds; and 4) conducting research on SCCCS DPS stocks relevant to the conservation of the species. (See the discussion of research issues in Chapter 13, South-Central California Steelhead Research, Monitoring and Adaptive Management.)

Issues that should be considered prior to implementing a conservation hatchery program include: 1) conditions under which rescue, reestablishment or supplementation could be used in wild steelhead recovery; 2) methods for rescue, re-establishment or supplementation, and; 3) protocols for evaluating the effectiveness of such conservation hatchery functions over time. Conservation programs must be guided by scientific research and management strategies to meet program objectives recovering threatened or endangered populations (Flagg and Nash 1999).

Genetic resources that represent the ecological and genetic diversity of the species can reside in hatchery fish as well as in wild fish (Waples 2010). As a consequence, NMFS has extended protection under the Endangered Species Act (ESA) to certain hatchery fish programs which preserve the genetic legacy of the listed species and are managed as refugia populations (70 FR 37204, June 28, 2005).

8.3.1 Recovery Role of Conservation Hatcheries

The principal strategy of salmonid conservation and recovery is protection and restoration of healthy ecosystems upon which they naturally rely, consistent with the ESA's stated purpose to conserve "the ecosystems upon which endangered and threatened species depend" (ESA section 2(b)). However, recovery of depleted (or extirpated) populations depends on one or more recolonization events, a process that operates on an unpredictable timescale. Likewise, the viability of a depressed population, characterized by small size, fragmented structure, and impacted genetics (*e.g.*, bottlenecks, inbreeding, outbreeding depression, *etc.*), may be so compromised that its response to restoration or increased

[2] A conservation hatchery is a program that conserves and propagates steelhead taken from the wild for conservation purposes, and returns the progeny to their native habitats to mature and reproduce naturally.

availability of habitat is not sufficient to prevent extirpation populations from individual watersheds. (Araki *et al. 2009, 2008*, 2007a, 2007b, Berejikian *et al*. 2011, 2009, 2008, 2005, Kuligowski *et al*. 2005, Hayes *et al.* 2004). Either case may require management intervention to prevent immediate extirpation in order to attain self-sufficiency and sustainability in the wild.

There is considerable uncertainty regarding the ability of artificial propagation to increase population abundance over the long-term, and it cannot be assumed that artificial augmentation will reduce extinction risk. The artificial advantage given to hatchery fish during early life stages can result in a higher rate of return over that of natural fish escapement, and result in increasing hatchery fish representation in the natural population over time. There is a risk to the long-term viability of a population when depending on artificial augmentation to maintain and/or increase population abundance. Conservation hatcheries must therefore monitor the effects of the program on the natural population using criteria which would trigger modification to or cessation of the conservation program (Chilcote 2011, 2003, Paquet *et al*. 2011, Tatara *et al*. 2011a, 2011b, Fraser 2008, Myers *et al.* 2004, Ford 2002).

Conservation hatchery programs employing best management practices can reduce the likelihood of extinction by contributing to one or more of the viable salmonid population (VSP) parameters at the population and evolutionarily significant unit (ESU) or distinct population segment (DPS) levels (McElhany *et al*. 2000):

Abundance. Conservation hatchery fish may reduce extinction risk by increasing the total abundance of fish in a population in the short term, providing sufficient numbers to dampen deterministic density effects, environmental variation, genetic processes, demographic stochasticity, ecological feedback, and catastrophes.

Growth Rate. Conservation hatchery fish potentially increase the total abundance of successful natural spawners, thereby increasing the growth rate in the overall population comprised of natural-origin and hatchery-origin spawners in the natural environment.

Spatial Structure. Small populations are at risk of local and regional extirpations because of ongoing habitat loss and fragmentation, as well as dysfunctional expression of species behavior which can undermine the species sustainability. The introduction of conservation hatchery fish into suitable unoccupied habitat or for supplementing sparsely populated habitat concomitant with restoration projects that increase interconnected natural habitat may help reestablish natural spatial population structure.

Diversity. To conserve the adaptive diversity of salmonid populations, the selective pressures which drove their evolution and the natural processes which select for population fitness should be allowed to continue. Conservation hatcheries can conserve valuable genes and genotypes, if properly managed to minimize ecological and domestication effects on natural populations, conserve, and maximize genetic variability and life history diversity within and among stocks.

A conservation hatchery would provide an appropriate platform for undertaking appropriate research of the issues outlined above and could provide effective guidance in a conservation hatchery program to protect the currently depressed stocks and recover steelhead populations in the SCCCS Recovery Planning Area.

8.3.2 Basic Elements of a Conservation Hatchery Program

A conservation hatchery program must be:

1) Guided by a Hatchery and Genetic Management Plan, based on the best available scientific knowledge, and/or testable assumptions when information is lacking;

2) Consistent with the overall strategy, goals, objectives, and specific provisions of the Recovery Plan;

3) Based on an adaptive management, iterative process aimed at reducing uncertainty through monitoring and re-evaluation;

4) Supported by a monitoring component to:

a) evaluate the short- and long-term goals and objectives of the program;

b) determine if and when management protocols need revision;

c) determine when the program should adapt to evolving recovery needs and

d) determine when the conservation hatchery program is no longer needed.

5) Supported by a research program to investigate issues such as:

a) fish culture problems that arise within the program;

b) fish response to habitat, environmental challenges, pathogens, *etc.*;

c) factors which contribute to reduced fitness and reproductive success of hatchery fish in the natural environment; and

d) behavioral changes of conservation hatchery reared fish released into their natal waters that may lead to changes in the expression of different life history strategies (*e.g.*, anadromous or freshwater resident forms).

6) Contain criteria and a strategy for terminating the conservation hatchery program and re-directing resources to the rehabilitation of watershed processes and sustainable management of fish habitat.

8.3.3 Considerations for Establishing a Conservation Hatchery Program

An important consideration within the overall planning for recovery of threatened steelhead involves knowing when and where to start a conservation hatchery program (Flagg and Nash 1999).

The appropriate use for a conservation hatchery should be guided by several considerations: 1) the biological significance of the population; 2) genetic diversity; 3) population viability; and 4) the potential loss of populations exhibiting any of the first three characteristics. Each of these is described below. Additional considerations such as the location of a facility supported by a reliable water supply, and whether to use a regional facility versus small, local, and perhaps temporary facilities are also important.

Biological Significance of the South-Central Coast Steelhead populations. The biological significance of a population is expressed in the innate genetic and phenotypic characteristics, and other novel biological and ecological attributes (particularly attributes not observed in other conspecific populations). With regard to the threatened SCCCS DPS, the characterization of the historical steelhead population developed by the TRT provides evidence that certain watershed-specific populations possess a high

likelihood of genetic and phenotypic characteristics favoring survival in a spatially and temporally highly-variable environment. The inland populations (*e.g.*, Salinas, Arroyo Seco, Upper Salinas, Pajaro, Carmel, Arroyo Grande) extend over a broad and geographically diverse area, and are likely able to withstand environmental stochasticity and possess ecologically significant attributes not found in most other steelhead DPS populations.

Genetic Diversity. The amount of genetic diversity among individuals provides the foundation for a population to adapt to fluctuating environmental conditions, and contributes to their ability to adapt in response to longer-term changes (*i.e.,* such as climate changes). Generally, high genetic diversity favors growth and survival of individual populations. Genetic diversity of a population can be estimated quantitatively based on parameters, such as effective population size (N_e). The abundance of a population that falls below a specified N_e may be at risk of losing the necessary amount of genetic diversity which places the population at greater risk, particularly in stochastic environments. General guidelines or numerical values for N_e are specified in the literature for maintaining minimum N_e for individual populations (Meffe and Carroll 1997, Nielsen 1995, Glidden and Goudet 1994, Chesser *et al.* 1993, Crow and Kimura 1970), but may require further research specifically for populations of SCCCS DPS.

Population Viability. Whether a population is likely to be viable is another key consideration in determining the necessity of a conservation hatchery. In particular, information about population size, population growth rate, spatial structure, and diversity provide an indication of the sort of extinction risk a species faces. Generally, small populations have a higher risk of extinction than larger populations. With regard to the threatened SCCCS DPS, evidence indicates the populations are at high risk of extinction and are not currently viable.

Potential Population Loss. Finally, a population exhibiting any of the characteristics noted above that is threatened with imminent extirpation as a result of anthropogenic activities, natural catastrophic events such as wildfire or massive sedimentation, or a combination of the two, may be preserved by the temporary placement of representatives of such a population in a conservation hatchery, or other secure location.

For an example of guidelines for establishing a conservation hatchery program, see, California Department of Fish and Wildlife (2004) Recovery Strategy for Coho Salmon, Appendix H.

8.4 ESTIMATED TIME TO RECOVERY AND DELISTING

NMFS's interim recovery planning guidance (2010a) recommends Recovery Plans "indicate the anticipated year that recovery would be achieved. Estimates should be carried through to the date of full recovery, *i.e.,* when recovery criteria could be met. There may be extreme cases in which estimating a date and cost to recovery is not possible due to uncertainty in what actions will need to be taken to recover the species." In those circumstances "an order of magnitude for cost and some indication of time in terms of decades, should be provided if at all possible."

Estimates of the time to recovery entails three basic elements: time to complete all major recovery actions + time for habitat to respond + time for the listed species to respond to recovery actions:

Regarding the time to complete all major recovery actions, this component should reflect:

- the longest time any recovery action would take to complete, assuming that all recovery actions began more or less immediately (or within ten years) of completion of the Recovery Plan; and
- sufficient funding to complete recovery actions.

Regarding the time for habitat to respond to recovery actions, this component should reflect:

- the longest time the habitat recovery would take; and
- the variation in the extent of needed habitat restoration (extremely degraded habitat could have longer restoration estimates).

Regarding the time for the species to respond to recovery actions, this component should reflect:

- the number of generations of demographic targets which must be met to delist; and
- the length of a complete ocean multi-decadal cycle, (or 60 years).

The precision of any estimate of time to recover and delist a species is necessarily governed by the specificity these individual components can be estimated.

Completion of a majority of the recovery actions is estimated to vary from five to ten years, though some of the larger, more complicated recovery actions (such as the physical or operational modification of larger dams) may take several decades. The recovery of habitat could vary depending on the type of habitat (*e.g.*, migration, freshwater spawning and rearing, or estuarine habitat), with some migration and estuarine habitats taking less time, and some spawning and rearing habitats taking more time to respond to recovery actions.

As with the completion of recovery actions, it is estimated these time frames would vary in a majority of cases to from 5 to 15 years, though the response of some habitats may take longer, depending on severity of damage, as well as rainfall and runoff patterns. The time for the species to respond to recovery actions is the most challenging component to estimate for a variety of reasons including; the dependency of anadromous runs and spawning and rearing success upon rainfall and runoff patterns. These patterns can be cyclic, and may also be significantly influenced by projected climate changes, and uncertainties regarding aspects of the demographics of SCCCS steelhead (*e.g.*, rate of dispersal between populations, rate of switching between resident and anadromous life cycle strategies).

Given the above estimates, and the need to meet the DPS recovery run size criterion during poor ocean conditions (measured over a multi-decadal cycle of 60 years), the time to recovery can be provisionally estimated to vary from 80 to 100 years. A modification of the provisional population or SCCCS DPS viability criteria resulting in smaller run-sizes, or the number or distribution of recovered populations could shorten the time to recovery. Delays in the completion of recovery actions, time for habitats to respond to recovery actions, or the species' to respond to recovery actions would extend the time to recovery.