



Proposed Recovery Strategy



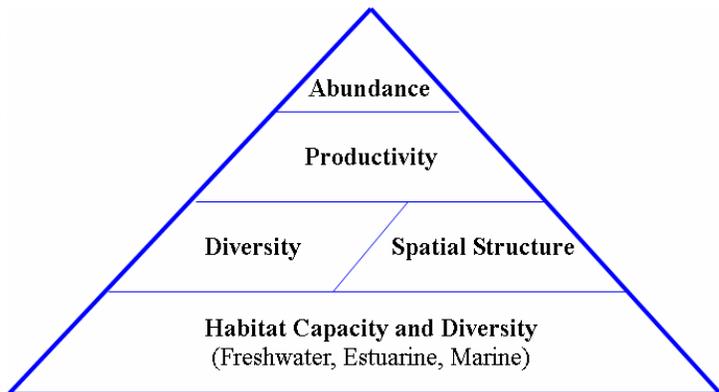
Photograph by: National Marine Fisheries Service

The goal of this recovery plan is to ensure the long-term viability of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead using effective partnerships with regional stakeholders. Recovery plans are not regulatory documents and successful implementation and recovery of listed species will require the support, efforts and resources of many entities, from Federal and state agencies to individual members of the public.

Viable Salmonid Populations

This recovery plan is developed using the foundational principles of viable salmonid populations (VSP), which includes measures of abundance, productivity, spatial structure and diversity. Together, these parameters are applied to determine whether a species or populations are viable, and to develop strategies and approaches for developing recovery criteria and measuring progress.

Large populations are resilient to environmental variability while small populations generally are at greater risk. Productivity, or population growth rate, provides information on important demographic processes such as population trends over time. Genetic and life-history diversity are important in that they allow species to use a wide array of environments, respond to short-term changes in the environment, and survive long-term environmental change. Spatial structure reflects how abundance is distributed among available or potentially available habitats and how it can affect overall extinction risk and evolutionary processes that may alter a population's ability to respond to environmental change. Finally, viable populations require a network of complex and interconnected habitats, which are created, altered, and maintained by natural physical process. Habitat condition and function drives carrying capacity and directly influences species diversity.





Diversity Groups

Bridging the gap between species and population levels are Diversity Groups. Diversity groups are biogeographic regions of similar climatological, hydrological, and geological characteristics that historically supported, and in some cases still support, numerous self-sustaining spawning populations. The Diversity Groups in the Central Valley include:

- ❑ **Basalt and Porous Lava Diversity Group** - Upper Sacramento and Battle Creek watersheds;
- ❑ **Northwestern California Diversity Group** - Streams that enter the mainstem Sacramento River from the northwest, such as Clear Creek;
- ❑ **Northern Sierra Nevada Diversity Group** - Streams tributary to the Sacramento River from the east, from Mill Creek to the Mokelumne River; and
- ❑ **Southern Sierra Nevada Diversity Group** - San Joaquin River tributaries from the east.

Core Populations

Three priority levels have been established to help guide recovery efforts for watersheds that are currently occupied:

- ❑ **Core 1 Populations:** Are highest priority, have a known ability or potential to support viable populations, and have the capacity to respond to recovery actions.
- ❑ **Core 2 Populations:** Are also an important part of the recovery strategy because they have high potential to support geographically diverse populations, but at lower abundance levels.
- ❑ **Core 3 Populations:** Provide for connectivity between populations, and serve as stepping stones for dispersal and re-colonization, especially during wet years.

Reintroduction Priorities

Addressing the primary threats and risk factors for each species will require reintroducing populations to historic but currently unoccupied habitats. These areas include watersheds that are currently inaccessible because of existing dams (e.g., Little Sacramento River and McCloud River), and watersheds that are currently accessible, but not utilized (e.g., winter-run in Battle Creek). The recovery plan identifies candidate areas for reintroduction. Primary watersheds have the highest potential to support spawning populations of anadromous fish, while secondary watersheds have less potential, or more information is needed to assess reintroduction potential.

Priority Recovery Actions

The Recovery Plan includes priority 1 and priority 2 actions. Priority 1 recovery actions are critical to undertake across broad geographic scales and within core watersheds. Priority 2 actions must be taken to prevent a significant decline in a species short of contributing to extinction. Priority actions target Core 1 populations in the Sacramento River Basin and Core 1 and Core 2 populations in the San Joaquin River Basin. Core 2 populations are included in the San Joaquin because the current magnitude of threats combined with very low population abundance has substantially increased population risk and any existing population needs to be stabilized as soon as possible. Priority recovery actions also are proposed for the primary candidate reintroduction areas.



Proposed Recovery Goals, Objectives and Criteria



Photograph by: Thomas Dunklin

NMFS' Endangered and Threatened Species Recovery Planning Guidance describes the recovery planning goal as the long-term sustainability of an endangered or threatened species and, therefore, delisting of the species. The guidance requires recovery plans to identify science-based objectives and measurable biological criteria to delist (remove from the Endangered Species Act) or downlist (change a species status from endangered to threatened) a species. The objectives and criteria are built upon the technical input and guidance provided by the Central Valley Technical Recovery Team (TRT) and input from stakeholders during public workshops and co-manager reviews.

Recovery Goals

The overarching goal of this Recovery Plan is the removal of the Sacramento River winter-run Chinook salmon ESU, Central Valley spring-run Chinook salmon ESU, and Central Valley steelhead DPS from the Federal List of Endangered and Threatened Wildlife using effective partnerships to implement recovery actions. Recovery and long-term sustainability of an endangered or threatened species requires:

- Adequate reproduction for replacement of losses due to natural mortality (disease and stochastic events)
- Sufficient genetic robustness to avoid inbreeding depression and allow for adaptation
- Sufficient habitat (type, amount, and quality) for long-term population maintenance
- Elimination or control of threats

Recovery Objectives

The Recovery Plan is designed to ultimately achieve objectives for the species at the Diversity Group level, and at the population level (i.e. watershed level) for the four Viable Salmonid Population criteria of abundance, productivity, diversity, and spatial structure. Objectives addressing these requirements include demographic parameters, reduction or elimination of threats to the species (the listing factors), and any other particular vulnerability or biological needs inherent to the species.

Recovery Criteria

The Endangered Species Act requires that recovery plans, to the maximum extent practicable, incorporate objective, measurable criteria which, when met, would result in a determination in accordance with the provisions of the ESA that the species be removed from the Federal List of Endangered and Threatened Wildlife and Plants. Recovery criteria are proposed for Core 1 and Core 2 populations. The Recovery Plan also includes "downlisting criteria," that would need to be met to reclassify winter-run Chinook salmon from endangered to threatened.



ESU/DPS-level Recovery Criteria	
Winter-run Chinook salmon	At least three populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction
Central Valley spring-run Chinook salmon	At least one population in the Northwestern California Diversity Group at low risk of extinction
	At least two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction
	At least three populations in the Northern Sierra Diversity Group (because of their geographic proximity, Mill and Deer Creek are considered part of the same meta population at low risk of extinction)
	At least two populations in the Southern Sierra Diversity Group at low risk of extinction
	Core 2 populations present in each Diversity Group
Central Valley Steelhead	At least two populations in the Northwestern California Diversity Group at low risk of extinction
	At least two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction
	At least three populations in the Northern Sierra Diversity Group (because of their geographic proximity, Mill and Deer Creek are considered part of the same meta population at low risk of extinction)
	At least two populations in the Southern Sierra Diversity Group at low risk of extinction
	Core 2 populations present in each Diversity Group
Population-level Criteria for Existing Populations	
Population Priority	Criteria
Core 1 populations must meet low-risk extinction criteria	Census population size ¹ is >2500 adults
	-or-
	Effective population size ² is >500
	No productivity decline is apparent
Core 2 populations must meet moderate-risk extinction criteria	No catastrophic events occurring or apparent within the past 10 years
	Hatchery influence is low
	Census population size is 250 to 2500 adults
	-or-
	Effective population size is 50 to 500 adults
Core 2 populations must meet moderate-risk extinction criteria	Productivity: Run size may have dropped below 500, but is stable
	No catastrophic events occurring or apparent within the past 10 years
	Hatchery influence is moderate or hatchery operates as a conservation hatchery using best management practices
	Hatchery influence is low
Down listing Criteria for Winter-run Chinook Salmon	
Population	Criteria
Sacramento River mainstem must meet low-risk extinction criteria	Census pop size is >2500 adults, or effective pop. is >500
	No productivity decline is apparent
	No catastrophic events occurring or apparent within the past 10 years
	Conservation hatchery influence uses best management practices
Reintroduced population must meet moderate-risk extinction criteria	Census pop. size is 250 to 2500 adults, or effective pop. size is 50 to 500
	Productivity: Run is stable
	No catastrophic events occurring or apparent within the past 10 years
	Livingston Stone National Fish Hatchery (or other required source stock hatchery operates as a conservation hatchery using best management practices

¹The absolute population size. ²The number of individuals in a population that contribute offspring to the next generation

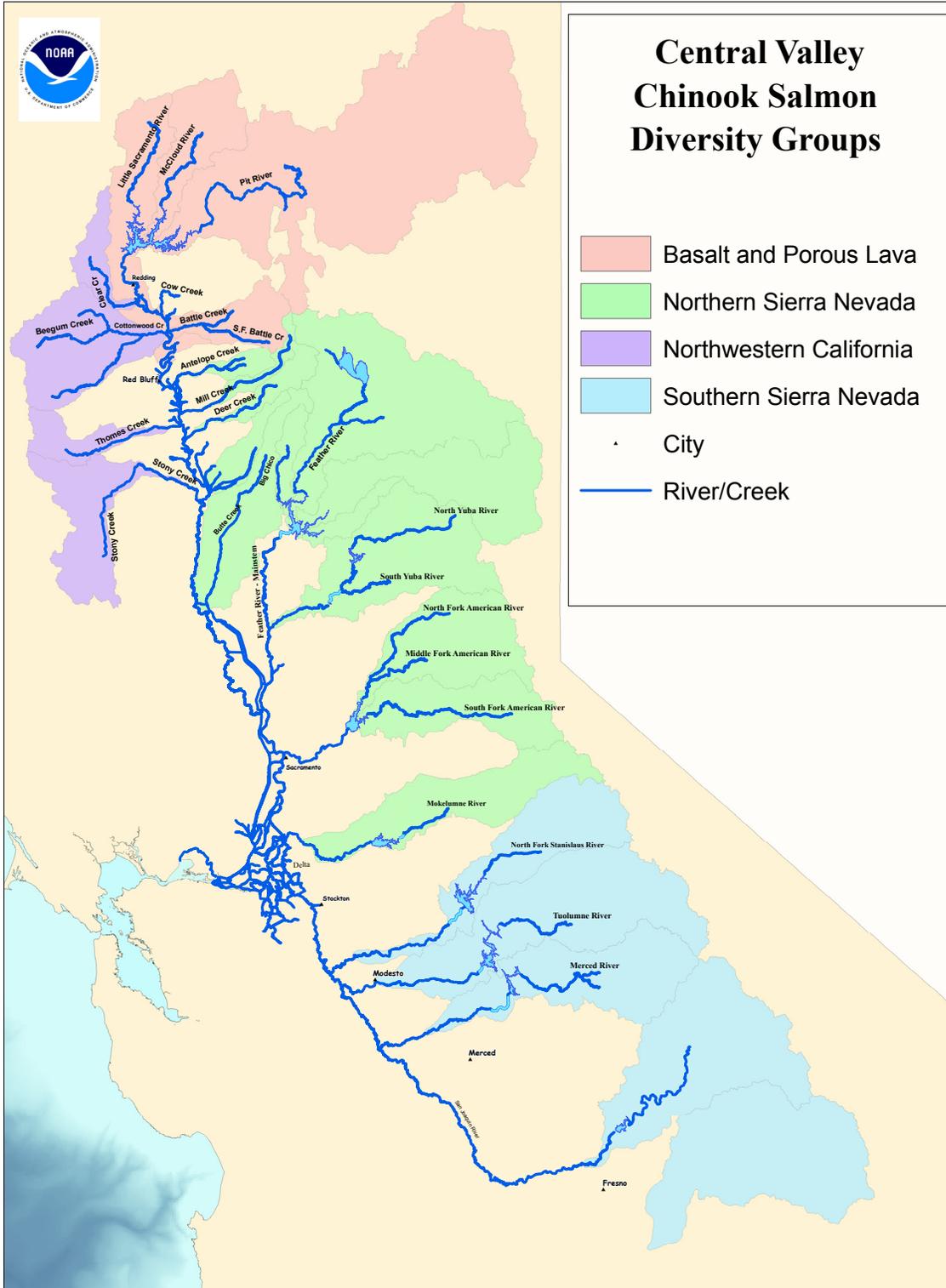


California's Central Valley



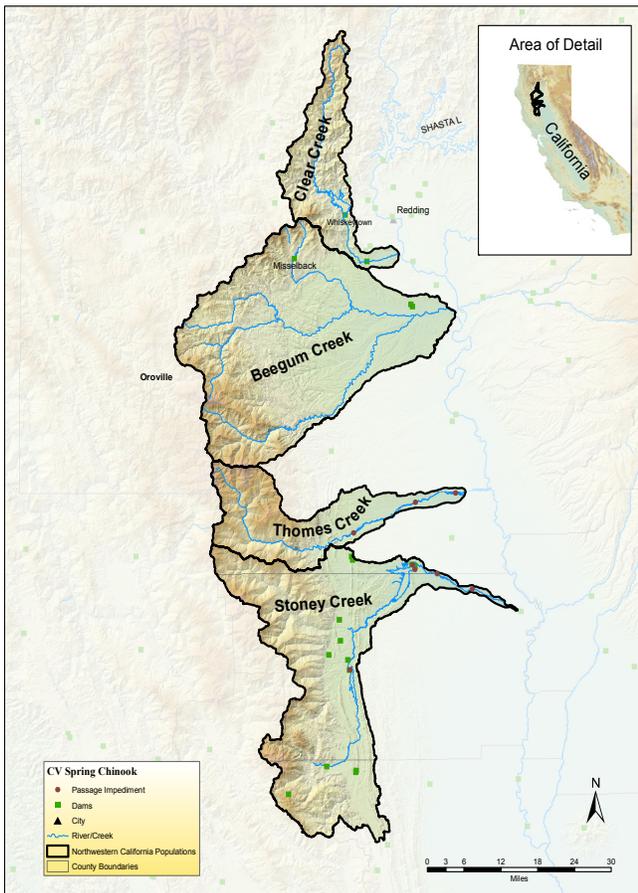


Central Valley Chinook Salmon Diversity Groups





Northwestern California Diversity Group



Recovery Foundation Populations and Areas

Core 1 Populations

- Clear Creek spring-run and steelhead
- Cottonwood Creek steelhead

Core 2 Populations

- Cottonwood spring-run
- Thomes Creek steelhead

Priority Areas for Reintroduction

- No priority watersheds in this diversity group have been identified for reintroduction

Key Threats

- Hybridization between fall-run and spring-run Chinook salmon in Clear Creek
- Physical habitat alteration (particularly associated with limited supplies of instream gravel), affecting adult spawning habitat suitability
- Water temperatures and water quality affecting adult immigration and holding, spawning and embryo incubation
- Flow conditions (i.e., low flows) affecting juvenile rearing and outmigration
- Gravel mining and passage on Thomes Creek
- Lack of biological data for steelhead in the Diversity Group

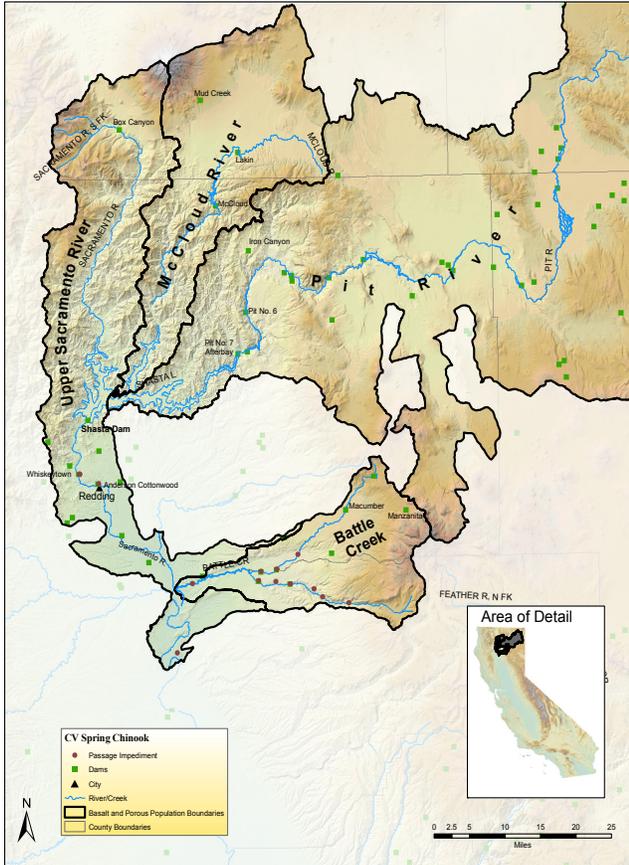


Priority 1 Recovery Actions

- Provide for the long-term operation of the Clear Creek spring-run separation weir
- Develop a spawning gravel budget and implement a long-term augmentation plan in Clear Creek, and use flow management to optimize spawning weighted usable area in consideration of hydrologic limitations and life stage requirements
- Develop a real time water temperature model to track the coldwater pool in Whiskeytown Reservoir and budget releases to Clear Creek to meet daily water temperature of 60°F at the Igo gauge from June 1 to September 15 and 56°F from September 15 to October 31
- Develop and implement optimal Clear Creek flow schedules that mimic natural hydrograph (including spring pulse flows and winter spillway releases to restore a proper functioning system)
- Implement gravel mining best management practices to allow for unimpeded upstream and downstream passage conditions for all life stages of steelhead
- Implementation of a comprehensive life history monitoring plan for Central Valley steelhead that will result in basin-wide (Sacramento and San Joaquin) estimates of hatchery and wild steelhead population abundance, production, diversity and distribution



Basalt and Porous Lava Diversity Group



Recovery Foundation Populations and Areas

Core 1 Populations

- Sacramento River winter-run
- Battle Creek spring-run and steelhead
- Cow Creek steelhead

Core 2 Populations

- Upper Sacramento River (Keswick to Red Bluff) spring-run and steelhead
- Redding-area tributary steelhead

Priority Areas for Reintroduction (Primary Areas)

- Little Sacramento River (Winter-run, spring-run, steelhead)
- McCloud River (Winter-run, spring-run, steelhead)
- Battle Creek (Winter-run)

Key Threats

- Passage impediments/barriers affecting adult immigration and holding and spawning at Red Bluff, Keswick and Shasta Dams
- Flow conditions and water temperatures below Keswick and Shasta Dams affecting all life stages
- Introggression of fall- and spring-run below Keswick and Shasta Dams
- Loss of flow and temperature related migration cues affecting *O. mykiss* anadromy
- Lack of biological data for steelhead in the Diversity Group



Priority 1 Recovery Actions

- Develop and implement a phased reintroduction plan to re-colonize winter-run, spring-run, and steelhead to the Little Sacramento and McCloud Rivers above Shasta and Keswick Dams
- Decommission the Red Bluff Diversion Dam and install NMFS-approved, state-of-the-art fish screens at the Tehama Colusa Canal diversion point
- Develop and implement a reintroduction plan to re-colonize winter-run, spring-run and steelhead to historic habitats after implementation of the Battle Creek Restoration Program
- Develop and implement ecological flows that are consistent with the life history requirements of salmon and steelhead
- Improve the cold water management in Shasta Reservoir through carry-over storage and improvements to the temperature control device to minimize adverse effects to salmon and steelhead
- Develop a long-term gravel augmentation plan to enhance spawning habitat downstream of Keswick and Shasta Dams
- Implement a comprehensive life history monitoring plan for Central Valley steelhead that will result in basin-wide (Sacramento and San Joaquin) estimates of hatchery and wild steelhead population abundance, production, diversity and distribution



Northern Sierra Diversity Group



Recovery Foundation Populations and Areas

Core 1 Populations

- Antelope Creek steelhead
- Mill Creek spring-run and steelhead
- Deer Creek spring-run and steelhead
- Butte Creek spring-run
- Lower Yuba River spring-run and steelhead

Core 2 Populations

- Antelope Creek spring-run
- Big Chico Creek steelhead
- Butte Creek steelhead
- Lower Feather River steelhead and spring-run
- Lower American River steelhead

Priority Areas for Reintroduction (Primary Areas)

- Upper Yuba River (spring-run)
- American River (steelhead)

Key Threats

- Large passage impediments/barriers affecting adult immigration and holding and spawning (Oroville, Englebright, Folsom, and Camanche Dams)
- Small seasonal passage impediments/barriers and low flow conditions potentially affecting adult immigration and holding and spawning on Antelope, Mill, Deer, Big Chico, and Butte Creeks, and on the Feather and Yuba Rivers
- Warm water temperatures below dams affecting juvenile rearing and outmigration and adult immigration and holding distribution and survival



National Marine Fisheries Service

Central Valley Salmon and Steelhead Recovery Plan

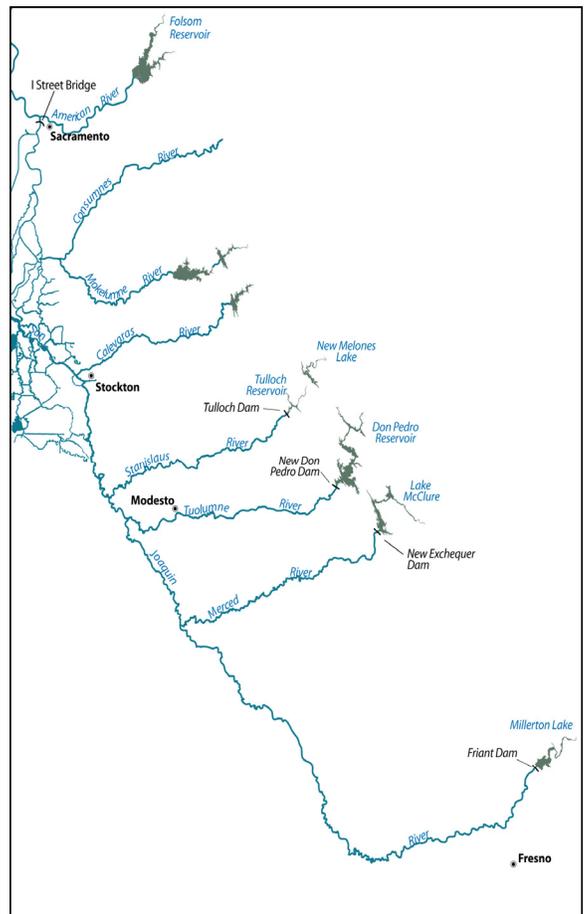
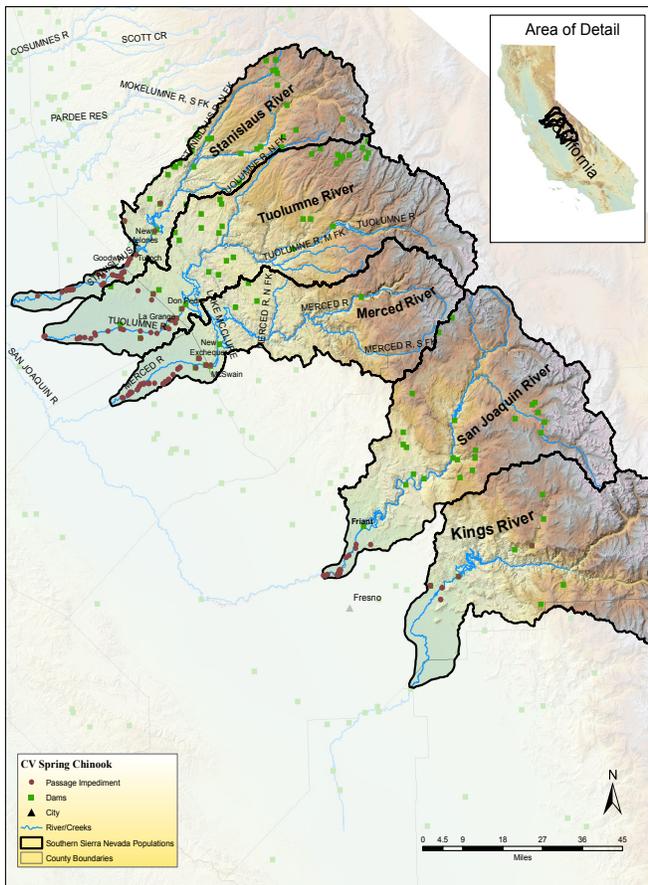
- Hatchery effects associated with redd superimposition (where different spawning adults use the same area), competition for habitat and genetic integrity affecting adult spawning
- Competition for spawning habitat between natural- and hatchery-origin salmon and steelhead and the resultant effects on the genetic fitness of the natural population
- Loss of riparian habitat and instream cover affecting juvenile rearing and outmigration;
- Loss of floodplain habitat affecting juvenile rearing and outmigration
- Upper watershed disturbance and potential for fire risk
- Predation by non-native fish species
- Lack of biological data for steelhead in the Diversity Group

Priority 1 Recovery Actions

- On Antelope Creek, restore instream flows during migration periods through water exchange agreements that provide reliable alternative water supplies, and restore connectivity of the migration corridor
- Implement a Mill Creek anadromous fish passage study that will evaluate fish passage at all agricultural diversions to determine if they meet NMFS' fish passage criteria. Design and install state-of-the-art fish passage facilities at diversions that currently do not meet the passage criteria, and conduct a study designed to determine adult fish passage flows
- Eliminate and abate sources of chronic sediment delivered to Mill Creek from roads
- Develop and implement a water exchange agreement on Deer Creek with dedicated fish passage flows, construct state-of-the-art inflatable dams and install fish ladders
- Implement the Deer Creek Flood Improvement Project
- Develop, implement and evaluate a Butte Creek flow test to improve the coldwater holding habitat availability and spawning distribution of adult salmon
- Implement the use of a weir in the Feather River to spatially segregate spring-run Chinook salmon and fall-run Chinook salmon during their spawning migrations
- Develop a hatchery genetic management plan for the Feather River Fish Hatchery,
- Construct steelhead side channel habitats using carrying capacity models sufficient to support a viable naturally spawning population of steelhead in the lower Feather River
- Implement facilities modifications(s) to achieve Feather River water temperatures at least as protective as the Settlement Agreement For Licensing of the Oroville Facilities
- Develop and implement a salmon reintroduction plan to re-colonize historic habitats above Englebright Dam
- Improve spawning habitat in the lower Yuba river by gravel injection programs
- Develop and implement a steelhead reintroduction plan to re-colonize historic habitats above Folsom Dam, and implement physical and structural modifications to the American River Division of the CVP in order to improve water temperature management
- Evaluate and, if feasible, develop and implement a fish passage program for Camanche and Pardee dams
- Implement steelhead monitoring to attain estimates of hatchery and wild steelhead population abundance, production, diversity and distribution



Southern Sierra Diversity Group and Mainstem San Joaquin River



Recovery Foundation Populations and Areas

Core 1 Populations

- Calaveras River steelhead

Core 2 Populations

- Lower Stanislaus River steelhead
- Lower Tuolumne River steelhead
- Lower Merced River steelhead

Priority Areas for Reintroduction

- San Joaquin River from Friant Dam downstream to the Merced River



Key Threats

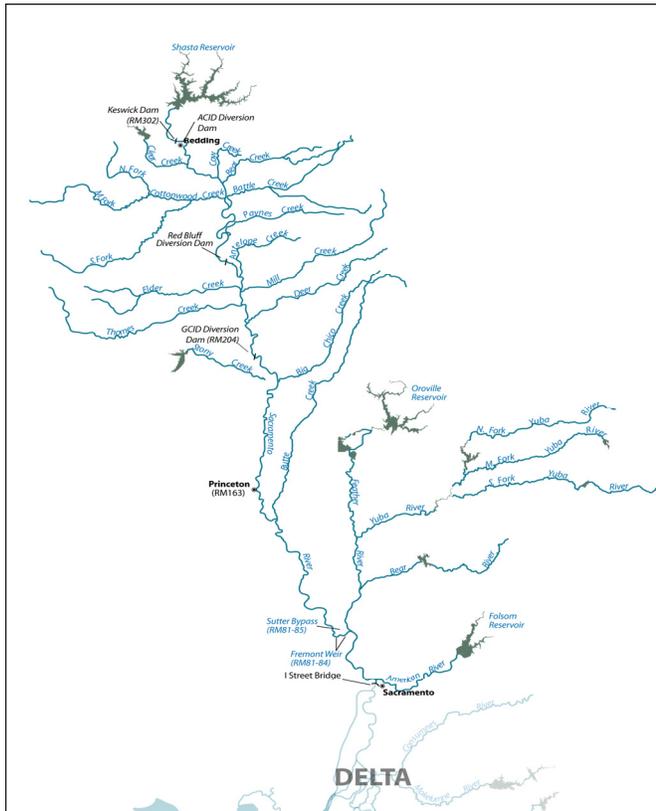
- Large passage impediments/barriers affecting adult immigration and holding and spawning (Goodwin, LaGrange, Crocker, and Friant Dams)
- Small seasonal passage impediments/barriers and low flow conditions potentially affecting adult immigration and holding and spawning on the Mokelumne, Calaveras, and San Joaquin Rivers
- Warm water temperatures below dams affecting juvenile rearing and outmigration and adult immigration and holding distribution and survival
- Hatchery effects associated with genetic integrity of adult spawning
- Competition for spawning habitat between natural- and hatchery-origin salmon and steelhead and the resultant effects on the genetic fitness of the natural population
- Loss of riparian and floodplain habitat affecting juvenile rearing and outmigration;
- Loss of floodplain habitat affecting juvenile rearing and outmigration
- Predation by non-native fish species
- Lack of biological data for steelhead in the Diversity Group

Priority 1 Recovery Actions

- On the Stanislaus River, evaluate and, if feasible, develop and implement a fish passage program for Goodwin, New Melones and Tulloch dams
- On the Stanislaus River, manage cold water pools behind Goodwin, New Melones and Tulloch dams to provide suitable water temperatures for all downstream life stages
- On the Calaveras River develop long-term instream flow schedules and requirements based on physical habitat modeling and critical riffle analysis
- Establish a minimum carryover storage level at New Hogan Reservoir that meets the instream flow and water temperature requirements in the lower Calaveras River
- Remove or modify all fish passage impediments in the lower Calaveras River to meet NMFS fish passage criteria
- Evaluate and, if feasible, develop and implement a fish passage program for La Grange and Don Pedro dams on the Tuolumne River
- Manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages on the Tuolumne River
- Fund and implement a comprehensive steelhead monitoring program
- Develop and implement a suite of actions to improve salmon and steelhead outmigration survival through the lower San Joaquin River by:
 - Restore floodplain habitat, and implement ecological flow schedules to create frequently activated floodplain, reducing contaminants; and implementing remedies for the biological oxygen demand and low dissolved oxygen levels in the Stockton Deep Water Ship channel that delay or impede fish migration



Mainstem Sacramento River



Recovery Foundation Populations and Areas

- Populations of winter- and spring-run Chinook salmon and steelhead spawn in the upper reaches of the Sacramento River below Keswick Dam. The priority of these populations is described in the regional summary of the Basalt and Porous Lava Flow Diversity Group.

Key Threats

- Warm water temperatures and modified flows below dams affecting juvenile rearing and outmigration and adult immigration and holding
- Loss of riparian habitat and instream cover affecting juvenile rearing and outmigration
- Loss of floodplain habitat affecting juvenile rearing and outmigration
- Levee maintenance actions that reduce the conservation value of migration and rearing corridors
- Predation by non-native fish species
- Juvenile fish injury and mortality at unscreened water diversions
- Degraded water quality from agricultural and urban runoff
- Lack of biological data for steelhead in the Diversity Group

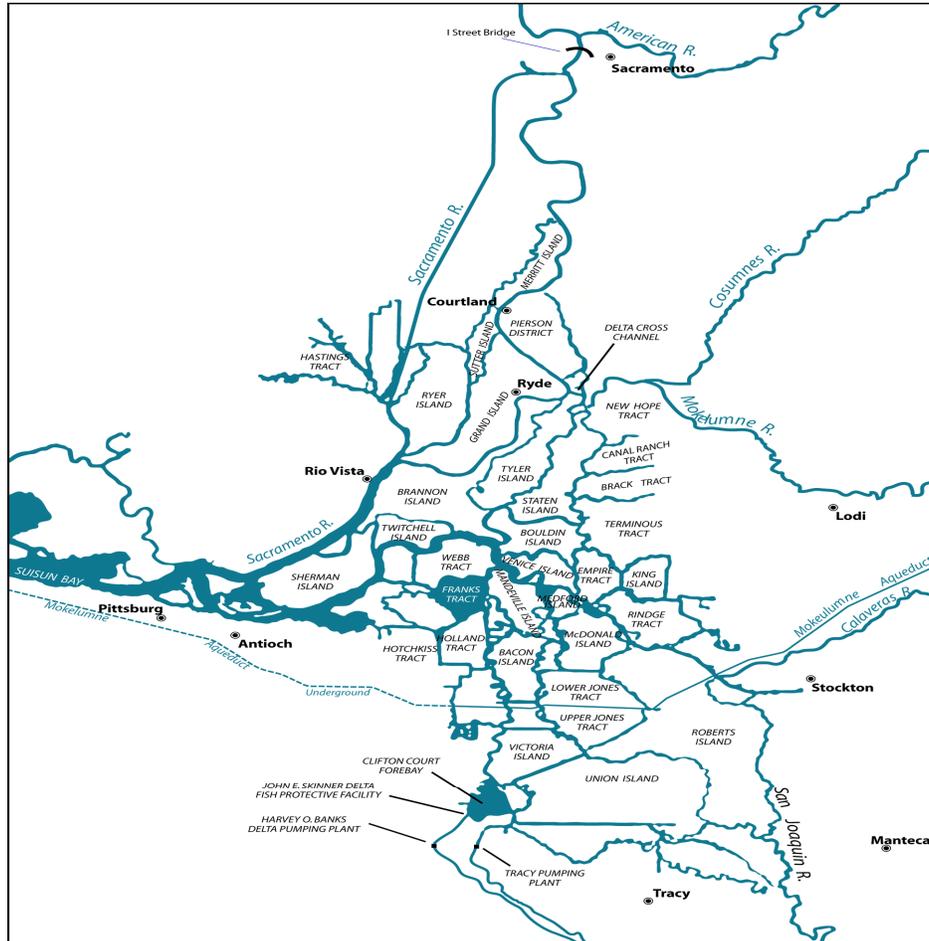


Priority 1 Recovery Actions

- Implement a river flow management plan that balances carryover storage needs with instream flow needs for winter-run and spring-run Chinook salmon based on runoff and storage conditions, including flow fluctuation and ramping criteria
- Develop an ecological flow tool for the Sacramento River below Keswick and Shasta Dams and use in conjunction with Frequently Activated Floodplain principles (regular inundation of floodplains for defined periods of time) and hydrodynamic river models to create and implement a floodplain inundation program that allows for existing functional floodplains to be activated in two out of three years for at least seven days between mid-March to mid-May
- Relocate the M&T Ranch fish screen and water diversion from its current location to a downstream, geomorphically stable, river reach and relocate the 300,000 cubic yards of dredged gravel to upstream reaches of the Sacramento River for spawning habitat enhancement
- Develop an entrainment monitoring program to determine the level of take at individual diversions. Prioritize diversions based on this monitoring and screen those that are determined to have substantial impacts at the population level based on NMFS approved peer reviewed juvenile survival models
- Restore and maintain a continuous stretch of riparian habitat and functioning floodplains of an appropriate, science-based width to maintain ecologically viable flood-prone lands along both banks of the Sacramento River downstream to Colusa. Pursue these opportunities, consistent with efforts conducted pursuant to Senate Bill 1086 (SB 1086), to create a meander belt from Keswick Dam to Colusa to recruit gravel and large woody debris, to moderate temperatures and to enhance nutrient input
- Restore a continuous 100-mile stretch of riparian habitat and functioning floodplains of an appropriate, science-based width to maintain ecologically viable flood-prone lands along both banks of the Sacramento River between Colusa and Sacramento
- Separate levee systems from active river and estuary channels, restore dendritic channel systems in areas where this habitat feature existed historically, and allow for the natural development of floodplain habitats
- Implement programs and measures designed to control non-native predatory fish (NMFS 2007b), including harvest management techniques and programs for non-native predators (e.g., striped bass, largemouth bass, and smallmouth bass) based on NMFS approved peer reviewed juvenile survival models
- Implementation of a comprehensive life history monitoring plan for Central Valley steelhead that will result in basin-wide (Sacramento and San Joaquin) estimates of hatchery and wild steelhead population abundance, production, diversity and distribution



Bay-Delta Region and the Pacific Ocean



Key Threats

- Modified flow regimes through the Delta causing reverse flow and flow routing to the South Delta during migration periods
- Loss of riparian habitat and instream cover affecting juvenile rearing and outmigration
- Loss of floodplain habitat affecting juvenile rearing and outmigration
- Levee maintenance actions that reduce the conservation value of migration and rearing corridors
- Predation by non-native fish species
- Entrainment at unscreened diversions
- Water quality from agricultural and urban runoff
- Fish passage impediments/barriers for immigrating adults in the Sacramento Deepwater Ship Channel, Yolo Bypass, and at Lisbon Weir
- Bycatch of listed species in commercial recreational and marine fisheries



Priority 1 Recovery Actions

- Develop alternative water operations and conveyance systems that ensure multiple and suitable salmonid rearing and migratory habitats for all Central Valley salmonids and that restore the ecological flow characteristics of the Delta ecosystem.
- Large-Scale Habitat Restoration – Identify funding and direct restoration of 80,000 acres of tidal marsh, 130,000 acres of terrestrial grasslands, and 60,000 acres of floodplain habitat. Floodplain habitats should be restored to appropriate elevations using Frequently Activated Floodplain principles and modeling. The habitats should be along primary migration and rearing corridors, and connected in ecologically beneficial ways. This will require separating levee systems from active river and estuary channels, restoring dendritic channel systems in areas where this habitat feature existed historically, and allowing for natural developmental processes to maintain habitats
- Following the first autumn flows exceeding 15,000 cfs at Wilkins Slough, maintain suitable rearing and migratory habitats for emigrating winter-run salmon throughout the Sacramento River and distributaries in the Delta through the end of April.
- Provide pulse flows of at least 20,000 cfs measured at Freeport periodically during the winter-run emigration season to facilitate outmigration past Chipps Island (i.e., December-April).
- Implement programs and measures designed to control non-native predatory fish (e.g., striped bass, largemouth bass, and smallmouth bass), including harvest management techniques
- Enhance the Yolo Bypass by re-configuring Fremont and Sacramento weirs to (1) improve fish passage through Fremont weir for multiple species; (2) enhance lower Putah Creek floodplain habitat; (3) improve fish passage along the toe drain/Lisbon weir; (4) enhance floodplain habitat along the toe drain; and (5) create annual spring inundation to fully activate the Yolo Bypass floodplain
- Water Conservation Improvements - Reduce state-wide water use by 20 percent per capita by 2020. This effort should take into account regional differences and find ways to improve agricultural efficiency as well as urban water use efficiency
- Develop a monitoring program to determine the level of entrainment at individual diversions. Prioritize diversions based on this monitoring and screen those that are determined to have substantial impacts at the population level, based on NMFS approved peer reviewed juvenile survival models
- Develop a comprehensive governance system that has reliable funding, takes advantage of established and effective ecosystem restoration and science programs, and has clear authority to determine priorities and strong performance measures
- Develop an ecosystem-based salmon fishery management plan that considers multi-trophic interactions, ocean currents, upwelling patterns, ocean temperatures, and other relevant factors, and implement restrictions that limit harvest of listed anadromous salmonids
- Work with PFMC and NMFS to implement restrictions that limit harvest of listed anadromous salmonids in commercial and recreational fisheries considering mechanisms such as: (1) genetic stock identification (GSI) – develop a research, testing and monitoring plan to test this technology and establish optimal bycatch levels based on GSI data; (2) review, assess and modify seasonal and area harvest restrictions and closures; (3) NMFS, CDFG and USFWS coordinate with the Southwest Fisheries Science Center to convene a science panel to review potential measures such as mass marking and mark selective fisheries and make recommendations to improve the identification of listed stocks in the Ocean; (4) consider using hot spot closures in commercial and recreational fisheries when large numbers of listed fish become congregated in certain areas