# EXECUTIVE SUMMARY
# OF THE RECOVERY PLAN FOR
# SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON, CENTRAL VALLEY SPRING-RUN CHINOOK SALMON, AND CALIFORNIA CENTRAL VALLEY STEELHEAD

**Introduction:** Recovery is the process by which listed species and their ecosystems are restored and their future is safeguarded to the point that protections under the Endangered Species Act (ESA) are no longer needed. The goal of this Recovery Plan is to recover the endangered Sacramento River winter-run Chinook salmon Evolutionarily Significant Unit (ESU), the threatened Central Valley spring-run Chinook salmon ESU, and the threatened California Central Valley steelhead Distinct Population Segment (DPS). Recovering these species and the Central Valley, San Francisco Bay-Delta Estuary, and Pacific Ocean ecosystems that support them will be challenging and will require shifts in societal values. Californians must work together towards a conservation ethic and practice that ensures wild salmon and steelhead are an important part of coastal California and Central Valley culture for many generations to come.

**Background:** The rivers draining the Great Central Valley of California ("Central Valley") and adjacent Sierra Nevada and Cascade Range once were renowned for their production of large numbers of Pacific salmon (Clark 1929; Skinner 1962 *in* Yoshiyama *et al.* 1998). The Central Valley rivers and creeks historically have been the source of most of the Pacific salmon produced in California waters (CDFW 1950, 1955; Fry and Hughes 1951; Skinner 1962; CDWR 1984 *in* Yoshiyama *et al.* 1998). Chinook salmon *(Oncorhynchus tshawytscha)* historically were, and remain today, the only abundant salmon species in the Central Valley (Eigenmann 1890; Rutter 1908 *in* Yoshiyama *et al.* 1998), although small numbers of other salmon species also have occurred occasionally in its rivers (Collins 1892; Rutter 1904a, 1908; Hallock and Fry 1967; Moyle *et al.* 1995 *in* Yoshiyama *et al.* 1998). Steelhead (anadromous *O. mykiss)* were common in Central Valley tributaries (USFC 1876; Clark 1973; Latta 1977; Reynolds *et al.* 1993 *in* Yoshiyama *et al.* 1998), but records for them are few and fragmented, partly because they did not support commercial fisheries (Yoshiyama *et al.* 1998).

Populations of native Chinook salmon and steelhead have declined dramatically since European settlement of the Central Valley in the mid-1800s. California's salmon resources began to decline in the late 1800s, and continued to decline in the early 1900s, as reflected in the decline of Chinook salmon commercial harvest.

The total commercial catch of Chinook salmon in 1880 was 11 million pounds; by 1922 it had dropped to seven million pounds, and it reached a low of less than three million pounds in 1939 (Lufkin 1996).

Another major factor affecting anadromous salmonids during this period was hydraulic gold mining, which began in the 1850s. By 1859, an estimated 5,000 miles of mining flumes and canals diverted streams used by salmonids for spawning and nursery habitat. Habitat alteration and destruction also resulted from the use of hydraulic cannons, and from hydraulic and gravel mining, which leveled hillsides and sluiced an estimated 1.5 billion cubic yards of debris into the streams and rivers of the Central Valley (Lufkin 1996).

Despite the prohibition of hydraulic mining in 1894, habitat degradation continued. Habitat quantity and quality have declined due to: construction of levees and barriers to migration, modification of natural hydrologic regimes by dams and water diversions, elevated water temperatures, and water pollution from agriculture and industry (Lufkin 1996).

Although the effects of habitat degradation on fish populations were evident by the 1930s, rates of decline for most anadromous fish species increased following construction of major water project facilities (USFWS 2001), which primarily occurred around the mid- 1900s. Many of these water development projects completely blocked the upstream migration of Chinook salmon and steelhead to spawning and rearing habitats, and altered flow and water temperature regimes downstream from terminal dams. As urban and agricultural development of the Central Valley continued, numerous other stressors to anadromous salmonids emerged and continue to affect the viability of these fish today. Some of the more important stressors include: the high demand for limited water supply resulting in reduced instream flows, increased water temperatures, and highly altered hydrology in the Sacramento-San Joaquin Delta, barriers to historic habitat, widespread loss of tidal marsh, riparian and floodplain habitat, poor water quality, commercial and/or recreational harvest, and predation from introduced species such as striped bass.

**Recovery Strategy**: Recovery of winter-run Chinook salmon, spring-run Chinook salmon, and steelhead across such a vast and altered ecosystem as the Central Valley will require a broadly focused, science-based strategy. The scientific rationale for the strategy in this plan focuses on two key salmonid conservation principles. The first is that functioning, diverse, and interconnected habitats are necessary for a species to be viable. That is, salmon and steelhead recovery cannot be achieved without providing sufficient habitat. Anadromous salmonids persisted in the Central Valley for thousands of years because the available habitat capacity and diversity allowed species to withstand and adapt to environmental changes including catastrophes such as prolonged droughts, large wildfires, and volcanic eruptions.

To help return the habitat capacity and diversity in the Central Valley to a level that will support viable salmon and steelhead, we have identified and prioritized recovery actions based on a comprehensive life stage-specific threats assessment. Minimizing or eliminating stressors to the fish and their habitat in an efficient and structured way is a key aspect of the recovery strategy.

The second salmonid conservation principle guiding the recovery strategy is that a species' viability is determined by its spatial structure, diversity, productivity, and abundance (McElhany *et al*. 2000). Abundance and population growth rate are self-explanatory parameters that are clearly important to species and population viability, while spatial structure and diversity are just as important, but less intuitive. Spatial structure refers to the arrangement of populations across the landscape, the distribution of spawners within a population, and the processes that produce these patterns. Species with a restricted spatial distribution and few spawning areas are at a higher risk of extinction from catastrophic environmental events (e.g., a single landslide) than are species with more widespread and complex spatial structure. Species or population diversity concerns the phenotypic (morphology, behavior, and life-history traits) and genetic characteristics of populations. Phenotypic diversity allows more populations to use a wider array of environments and protects populations against short-term temporal and spatial environmental changes. Genetic diversity, on the other hand, provides populations with the ability to survive long-term changes in the environment. It is the combination of phenotypic and genetic diversity expressed in a natural setting that provides populations with the ability to adapt to long-term changes (McElhany *et al.* 2000).

Bridging the gap between the species and population levels are population groups or salmonid ecoregions, which are delineated based on climatological, hydrological, and geological characteristics. The Central Valley Technical Recovery Team (TRT) identified four population groups (hereafter referred to as diversity groups) that Chinook salmon historically inhabited in the Central Valley:

- The basalt and porous lava diversity group composed of the upper Sacramento River, McCloud River, Pit River and Battle Creek watersheds;

- The northwestern California diversity group composed of streams that enter the mainstem Sacramento River from the northwest;
- The northern Sierra Nevada diversity group composed of streams tributary to the Sacramento River from the east, and including the Mokelumne River; and
- The southern Sierra Nevada diversity group composed of streams tributary to the San Joaquin River from the east.

Based on the two scientific principles described above and on a comparison of current species viability, relative to historic viability, the basic strategy put forth in this recovery plan is to secure all extant populations and to reintroduce populations to historic habitat such that each salmonid diversity group in the Central Valley supports viable populations. The TRT concluded that recovery of winter-run Chinook salmon, spring-run Chinook salmon, and steelhead would require that no more populations are allowed to become extirpated and that habitat must be expanded to allow for the establishment of additional populations (Lindley *et al.* 2007).

The primary means of securing existing populations is to reduce or eliminate threats to those populations and their habitats. To help guide threat abatement efforts, watersheds and recovery actions have been prioritized. Watersheds that are currently occupied by at least one of the listed Chinook salmon and steelhead species have been prioritized among three levels. Of highest priority are core 1 populations, which have been identified, based on their known ability or potential to support independent viable populations. Core 1 populations form the foundation of the recovery strategy and must meet the population-level biological recovery criteria for low risk of extinction set out in Table 5-1. NMFS believes that core 1 populations should be the first focus of an overall recovery effort. Core 2 populations are assumed to have the potential to meet the moderate risk of extinction criteria set out in Table 5-1. These dependent populations are of secondary importance for recovery efforts. Core 3 populations are present on an intermittent basis and are characterized as being dependent on other nearby populations for their existence. The presence of these populations provides increased life history diversity to the ESU/DPS and is likely to buffer against local catastrophic occurrences that could affect other nearby populations. Connectivity between populations and genetic diversity may be enhanced by working to recover smaller core 3 populations that serve as stepping stones for dispersal. General guidance for how this watershed prioritization should be applied is that if a core 1 watershed and a core 2 (or 3) watershed had a similar problem affecting salmon and/or steelhead, then efforts should be directed at fixing the problem in the core 1 watershed first.

Unoccupied habitats that historically supported winter-run Chinook salmon, spring-run Chinook salmon, or steelhead have been prioritized regarding fish reintroductions. These unoccupied habitats have been prioritized as primary areas, candidates, or have been ruled out as places to reintroduce one or more of the species. Primary areas for reintroductions are areas where there is a known high likelihood of success based on species-specific life history needs, and available habitat quality and quantity. Specific primary reintroduction areas include the McCloud River, Battle Creek, the Yuba River, and the San Joaquin River. Candidate areas for reintroduction are unoccupied habitats that require further study of their potential for successful reintroductions. Some areas that were historically accessible to anadromous salmonids, but are no longer because of dams, have been excluded from consideration for reintroductions because they are so critically impaired by hydroelectric development and channel inundation that we felt efforts should be focused on areas with a higher potential for success.

Because recovery of winter- and spring-run Chinook salmon and steelhead will require implementation over a large landscape and over an extended period of time, a stepwise strategy has been adopted, based on the prioritization of watersheds and recovery actions. As this Recovery Plan is implemented over time, additional information will become available to help determine the degree to which the threats have been abated, to further develop understanding of the linkages between threats and population responses, to identify any additional threats, and to evaluate the viability of Chinook salmon and steelhead in the Central Valley.

**Recovery Goals, Objectives, and Criteria:** 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 California Central Valley steelhead DPS from the Federal List of Endangered and Threatened Wildlife (50 C.F.R. 17.11). The objectives and criteria to accomplish this goal builds upon the technical input and guidance provided by the TRT, and much of the following discussion is taken directly from information developed by the TRT (Lindley *et al.* 2004; 2006; 2007).

In order for the Chinook salmon ESUs and the steelhead DPS to achieve recovery, each diversity group must be represented, and population redundancy within the groups must be met to achieve diversity group recovery. Therefore, ESU-level recovery criteria include the following:

**Winter-run Chinook salmon ESU**:

- Three populations in the Basalt and Porous Lava Diversity Group at low risk of extinction

**Spring-run Chinook salmon ESU** and **Central Valley steelhead DPS**:

- One population in the Northwestern California Diversity Group at low risk of extinction
- Two populations in the Basalt and Porous Lava Diversity Group at low risk of extinction
- Four populations in the Northern Sierra Nevada Diversity Group at low risk of extinction
- Two populations in the Southern Sierra Nevada Diversity Group at low risk of extinction
- Maintain all Core 2 populations at moderate risk of extinction.

Recovery criteria at the population level were established by the Central Valley TRT and are included in this recovery plan (and apply to all three species), as described in Lindley *et al*. (2007). The TRT incorporated the four viable salmonid population parameters (McElhany *et al*. 2000) into assessments of population viability, and two sets of population viability criteria were developed, expressed in terms of extinction risk. The first set of criteria deal with direct estimates of extinction risk from population viability models. If data are available and such analyses exist and are deemed reasonable for individual populations, such assessments may be efficient for assessing extinction risk. In addition, the TRT also provided simpler criteria. The simpler criteria include population size (and effective population size), population decline, catastrophic rate and effect, and hatchery influence. For a population to be considered at low risk of extinction (i.e., < 5 percent chance of extinction within 100 years), the population viability assessment must demonstrate that risk level or all of the following criteria must be met:

- Census population size is >2,500 adults -or- Effective population size is >500
- No productivity decline is apparent
- No catastrophic events occurring or apparent within the past 10 years

- Hatchery influence is low (see Figure 4-1).

Additionally, threat abatement criteria must be met demonstrating that specific threats have been alleviated. The following threat abatement criteria have been established to ensure that each of the five ESA listing factors are addressed before a species can be delisted:

- Populations have unimpeded access to Core 1, 2, and 3 watersheds and, if necessary, assisted access to primary watersheds for reintroduction. Man-made structures (e.g., bridges and water diversions) affecting these watersheds and in migratory habitat must meet NMFS salmonid passage guidelines for stream crossings and screening criteria for anadromous salmonids (Listing Factors 1, 4, and 5)

- Utilization for commercial, recreational, scientific, and educational purposes is managed, such that all Core 1 populations meet the low extinction risk category for abundance (see Table 5-1) (Listing Factor 2)

- Hatchery programs are operated so that all Core 1 populations meet the low extinction risk criteria for hatchery influence (see Table 5-1) (Listing Factors 3 and 5)

- Migration and rearing corridors meet the life-history, water quality and habitat requirements of the listed species, such that the corridor supports multiple viable populations (Listing Factors 1, 3, 4, and 5)

- Core 1, 2, 3, and target watersheds, have water quality and habitat conditions and characteristics that support all life-history stages (Listing Factors 1, 3, 4, and 5)

- Adequate funding, staffing, and training are provided to State and Federal regulatory agencies to ensure the ecosystem and species protections of state and federal requirements are properly implemented, such that the species are improving in status until their ultimate delisting, at which point the species status should remain stable (Listing Factor 4)

- Standardized monitoring of populations and their habitats across the ESUs/DPS evaluates species viability, the effectiveness of recovery actions, and measures progress towards recovery (Listing Factors 4 and 5).

**Recovery Actions**: This Recovery Plan establishes a strategic approach to recovery, which identifies and prioritizes recovery actions at the Statewide, Central Valley wide, and site-specific levels. Three steps were taken to prioritize recovery actions as they are presented in this plan. First, results from the threats assessment and prioritization process (described in Appendix B) were used to guide the identification of watershed- and site-specific recovery actions for each diversity group and population. This step prioritized recovery actions separately for each species. The second step to prioritize recovery actions was undertaken through consideration of specific actions that benefit multiple species and populations. Results from the second step included tables of recovery actions listed in descending order of priority by geographic region (e.g., Delta, mainstem Sacramento River, Diversity Group) based on multiple species benefits. These first two steps were the only steps taken to prioritize recovery actions that were presented in the Co-Manager Review Draft Recovery Plan. Based on feedback from co-managers, it was apparent that the priority with which recovery actions should be undertaken was not clear. To address this, we implemented a third step and prioritized each of the region-specific recovery actions according to three categories. Priority 1 actions are those critical actions that address threats that generally ranked among the most important threats to one or more of the species; priority 2 actions address threats of moderate importance, and priority 3 actions are among the least important to implement. Actions were identified as priority 1, 2, or 3 based on the first two prioritization steps and on the best professional judgment of agency co-managers, including biologists from CDFW, USFWS, USFS, and NMFS.

Prioritized recovery actions for each of the following scales or regions are described in chapter 6 in the form of implementation tables: California-wide, Central Valley-wide, Pacific Ocean, San Francisco Bay, Delta, mainstem Sacramento River, mainstem San Joaquin River, and each of the four diversity groups. These implementation tables describe each action, the time frames and, if possible, the costs associated with it. Cost estimates have been provided wherever practicable, but in some cases where the uncertainties regarding the exact nature or extent of the recovery actions is unknown, these costs estimates can only be provided after site-specific investigations are completed.

Investment in recovery of salmon and steelhead will result in economic, societal and ecosystem benefits. Monetary investments in watershed restoration projects can promote the economy in a myriad of ways. These include stimulating the economy directly through the employment of workers, contractors and consultants, and the expenditure of wages and restoration dollars for the purchase of goods and services. Habitat restoration projects have been found to stimulate job creation at a level comparable to traditional infrastructure investments such as mass transit, roads, or water projects (Oregon Watershed Enhancement Board 2010). In addition, viable salmonid populations provide ongoing direct and indirect economic benefits as a resource for fish, recreation, and tourist related activities. Dollars spent on salmon and steelhead recovery will promote local, state, Federal and tribal economies, and should be viewed as an investment with both societal (clean rivers, healthy ecosystems) and economic returns.

The largest direct economic returns resulting from recovered salmon and steelhead are associated with sport and commercial fishing. On average 1.6 million anglers fish the Pacific region annually (Oregon, Washington and California) and 6 million fishing trips were taken annually between 2004 and 2006 (NMFS 2010a). Most of these trips were taken in California and most of the anglers lived in California. The California salmon fishery is estimated to generate $118 to $279 million in income annually, and provide roughly two to three thousand jobs (Michael 2010). With a revived sport and commercial fishery, these substantial economic gains and the creation of jobs would be realized across California, but most notably for river communities and rural coastal counties.

Many of the actions identified in this Recovery Plan are designed to improve watershed-wide processes which will benefit many native species of plants and animals (including other state and federally listed species) by restoring natural ecosystem functions. In addition, restoration of habitat in watersheds will provide substantial benefits for human communities. Some of these benefits are: improving and protecting the quality of important surface and ground water supplies; reducing damage from flooding resulting from floodplain development; and controlling invasive exotic animal and plant species which can threaten water supplies and increase flooding risk. Restoring and maintaining healthy watersheds also enhances important human uses of aquatic habitats, including outdoor recreation, ecological education, field based research, aesthetic benefits, and the preservation of tribal and cultural heritage.

The final category of benefits accruing to recovered salmon and steelhead populations are even more difficult to quantify and are related to the ongoing costs associated with maintaining populations that are at risk of extinction. Significant funding is spent annually by entities (Federal, State, local, private) in order to comply with the regulatory obligations that accompany populations that are listed under the ESA.

Important activities, such as water management for agriculture and urban use, are now constrained to protect ESA listed populations of salmon and steelhead. Examples of these types of obligations include such requirements as: section 7 consultations, development and implementation of Habitat Conservation Plans, the provision of fish passage at impassible barriers, and a high degree of uncertainty for the regulated entities. Recovering the salmonid populations so the protections of the ESA are no longer necessary will also result in elimination of the regulatory requirements imposed by the ESA, and allow greater flexibility for land and water managers to optimize their activities and reduce costs related to ESA protections. Salmon recovery is best viewed as an opportunity to diversify and strengthen the economy while enhancing the quality of life for present and future generations.

**Implementation**: It is a challenging undertaking to facilitate a change in practice and policy that reverses the path towards extinction of a species to one of recovery. This change can only be accomplished with effective outreach and education, strong partnerships, focused recovery strategies and solution-oriented thinking that can shift agency and societal attitudes, practices and understanding. Implementation of the recovery plan by NMFS will take many forms and is described in the NMFS Protected Resources Division Strategic Plan 2006 (NMFS 2006a). The Recovery Planning Guidance (NMFS 2006b) also outlines how NMFS shall cooperate with other agencies regarding plan implementation. These documents, in addition to the ESA, shall be used by NMFS to set the framework and environment for plan implementation. The PRD Strategic Plan asserts that species conservation (in implementing recovery plans) by NMFS will be more strategic and proactive, rather than reactive. To maximize existing resources with workload issues and limited budgets, the PRD Strategic Plan champions organizational changes and shifts in workload priorities to focus efforts towards "*…those activities or areas that have biologically significant beneficial or adverse impacts on species and ecosystem recovery* (NMFS 2006a)." The resultant shift will reduce NMFS engagement on those activities or projects not significant to species and ecosystem recovery.

NMFS actions to promote and implement recovery planning shall include:

- Coordinating priorities and actions with the Anadromous Fish Restoration Program, the Ecosystem Restoration Program, and other key funding sources.
- Creating and maintaining partnerships with fish and water stakeholder groups, including Federal, State, and local governments, water agencies, fishing groups, and watershed conservation groups.

- Formalizing recovery planning goals on a program-wide basis to prioritize work load allocation and decision-making (to include developing the mechanisms to make implementation (e.g., restoration) possible)
- Supporting outreach and education programs.
- Facilitating a consistent framework for research, monitoring, and adaptive management that can directly inform recovery objectives and goals.
- Establishing an implementation tracking system that is adaptive, web-based, and pertinent to support the annual reporting for the Government Performance and Results Act, Biennial Recovery Reports to Congress and the 5-Year Status Reviews.

NMFS' efforts must be as far-reaching (beyond those under the direct regulatory jurisdiction of NMFS) as the issues adversely affecting the species. Thus, to achieve recovery, NMFS will need to promote the recovery plan and provide needed technical information and assistance to other entities that implement actions that may impact the species' recovery. For example, NMFS will work with key partners on high priorities such as facilitating passage assessment and working with Counties to ensure protective measures consistent with recovery objectives are included in their General Plans.

Many complex and inter-related biological, economic, social, and technological issues must be addressed in order to recover anadromous salmonids in the Central Valley. Policy changes at the Federal, State and local levels will be necessary to implement many of the recovery actions identified in this Recovery Plan. For example, without substantial strides in habitat restoration, fish passage, and changes in water use, recovery will be difficult if not impossible. In some cases, conflicting regulatory mandates that influence water and aquatic resources management will need to be resolved. Most importantly, recovering winter-run Chinook salmon, spring-run Chinook salmon, and steelhead will require a focused effort that secures existing populations, re-establishes populations in watersheds that historically supported them, and restores the ecological function of the habitats upon which the species depend for their long-term survival.