SOUTHERN OREGON NORTHERN CALIFORNIA COAST COHO SALMON RECOVERY PLAN SUMMARY
Keys to Understanding

habitat

definition

recovery

Photo: Thomas Dunklin

BACKGROUND

NOAA's National Marine Fisheries Service (NMFS) prepared a draft Recovery Plan for the protection and restoration of coho salmon in the Southern Oregon Northern California Coast (SONCC) Evolutionarily Significant Unit (ESU). SONCC coho were listed as a threatened species under the Endangered Species Act (ESA) in 1997. The ESA requires the National Marine Fisheries Service (NMFS) to develop recovery plans for all listed salmon species; therefore, this recovery plan was developed to comply with the law.

The SONCC coho salmon ESU includes all populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda. Critical habitat for SONCC coho salmon was designated on 1999 as all accessible reaches of rivers (including estuarine areas and tributaries) within the ESU. The SONCC ESU spans two states (Oregon and California) and 13 counties (Coos, Douglas, Curry, Josephine, Jackson, Klamath, Del Norte, Siskiyou, Humboldt, Trinity, Mendocino, Lake, Glen). Land ownership is primarily public but much of the ESU is under private ownership, concentrated in the low-lying valleys. Major land uses on private land include agriculture, ranching, timber harvest, and urban and residential development.

The plan identifies actions that may be taken to stop the downward trend of the species and return the species to a viable, naturally self-sustaining condition.

The Plan establishes criteria for delisting SONCC coho salmon and presents recovery actions necessary to reduce stresses and threats for species recovery. Using the biological foundations and framework developed by NMFS and other scientists (e.g., Technical Recovery Team), the plan focuses on coho salmon populations as the fundamental unit for recovery, as well as on the physical and ecological processes that form the habitat conditions necessary for fulfilling life stage needs. Implementation of the plan will allow limited resources to be applied to the highest priority recovery actions. Although not regulatory, recovery plans are the central organizing tool for guiding each species' progress towards recovery.

The development of this plan is an iterative process which relies upon input and comments from NMFS staff, co-managers, and the general public. Previous drafts were reviewed by personnel from State and Federal agencies, tribes, and the Center for Independent Experts (CIE). The information and issues raised by the co-managers and the CIE were considered during preparation. After the comment period, all comments will be considered and the plan will be finalized.

Why Southern Oregon Northern California Coast (SONCC) coho salmon?

- The SONCC coho salmon ESU is a species listed under the Endangered Species Act because they are in danger of becoming extinct. Although a wide range of important protective efforts have been implemented in both Oregon and California prior to listing, these efforts have not yet sufficiently reduced threats or restored populations.
- They are evolutionarily unique and are an important part of our national heritage.
- Their numbers have dramatically declined from historical levels.

What about other species of fish in the same geographic area?

Other fish species will also benefit from improvements to coho salmon habitat.

Why a recovery plan?

Because the ESA requires NMFS to develop recovery plans for all listed species as a means by which to organize and coordinate recovery of the species.

Didn't the states already prepare recovery plans?

The state of California released the Recovery Strategy for California Coho Salmon in 2005, and the Oregon Department of Fish and Wildlife held an expert panel to assess the limiting factors and threats affecting SONCC coho salmon in Oregon and released their report in 2010. These documents were key resources while developing this draft plan. Because the documents were not developed to meet the same legal requirements NMFS must meet, they did not include all the elements needed for a federal recovery plan.

Is this plan voluntary or required?

NMFS is required to prepare a plan. Implementation of specific recovery actions is voluntary. The plan is not a law and it is not a regulation; it is a roadmap, guidance, and resource for people, organizations, and governments willing and able to take action to help the fish.

What does "viable" mean?

To be viable, an ESU must be sufficiently resilient to be likely to persist for the next 100 years even without the protections of the ESA. When SONCC coho salmon are viable, enough fish will spawn in the wild and return year after year so they are likely to persist in the long run. The species also has to be resilient enough to survive periodic catastrophic changes in the environment, including natural events such as floods, earthquakes, storms, and decreases in ocean productivity.

What is the goal of this recovery plan?

The primary goal is to be able to "delist" the coho salmon – improve its status so that it is naturally self sustaining and no longer threatened with extinction.

What's delisting? Who makes the decision?

Under the ESA, listing and delisting of marine species, including salmon, are the responsibility of NMFS. If a fish or other species is listed as threatened or endangered, legal requirements to protect it come into play. When NMFS decides through scientific review that the species is doing well enough to survive without ESA protection, NMFS will "delist" it. This decision must be based on the best available science concerning the current status of the species and its prospects for survival.

What is broad-sense recovery?

Broad-sense recovery is a state past ESU viability in which an ESU is sufficiently abundant, productive, and diverse that the ESU as a whole is self-sustaining, and provides significant ecological, cultural, and economic benefits to society.

A FRAMEWORK FOR RECOVERY

Conceptual foundations and context

NMFS appointed a team of scientists with expertise in salmon species to provide scientific support for SONCC coho salmon recovery planning. This technical recovery team (TRT) included biologists from state, federal and tribal government agencies. The TRT produced two documents: the historic population structure of the SONCC coho salmon ESU (Williams et al. 2006) and the viability framework (Williams et al. 2008).

The TRT documents are the foundation of the recovery plan. They established demographic delisting criteria. These criteria, along with rules as to which combinations of populations could be used, led to the number of adults needed in each population. These population targets, along with the threats assessment, drove development of recovery actions.

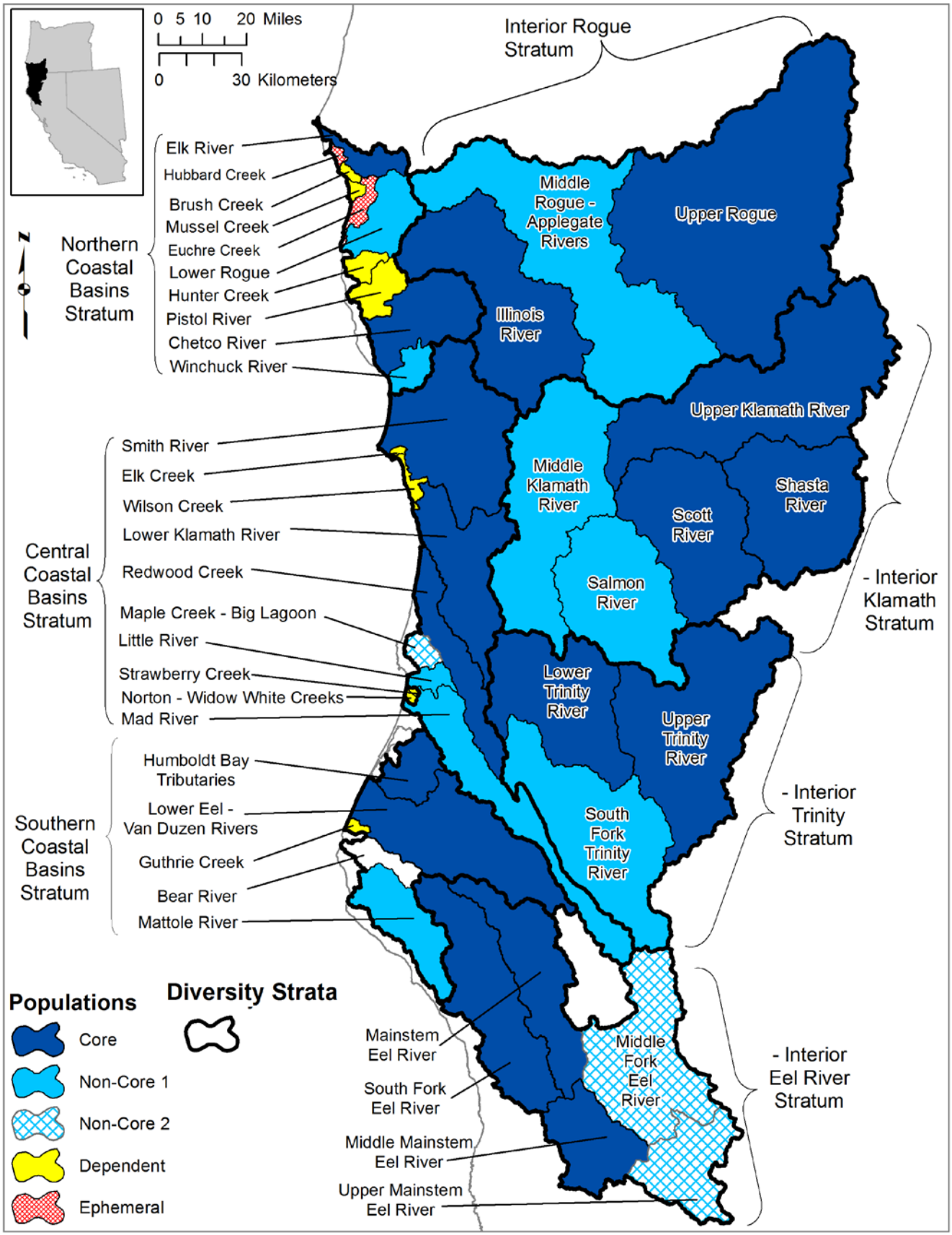
Williams et al. (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU. These populations were further grouped into seven diversity strata based on the geographical arrangement of the populations and basin-scale genetic, environmental, and ecological characteristics. Six of the populations are not described in detail because further information showed they are too small to qualify as populations. A map showing the populations and diversity strata is shown on the following page.

What is an "Evolutionarily Significant Unit" (ESU)?

Most of the time, salmon return to spawn in the streams where they were born. However, they occasionally "stray" and mate where conditions are right, perhaps in an adjacent stream. The result is that salmon populations that are geographically widespread may have some amount of genetic similarity within portions of their range. They are linked because of straying, and differentiated because of long-term adaptation to different environments.

An ESU is defined as a group of Pacific salmon or steelhead trout that (1) is substantially reproductively isolated from other groups of the same species and (2) represents an important component of the evolutionary legacy of the species. ESUs are defined on the basis of geographic range as well as genetic, behavioral, and other traits.

All Pacific salmon belong to the family Salmonidae and the genus *Oncorhynchus*. Coho salmon are the species *Oncorhynchus kisutch*. NMFS identified seven ESUs within this species, including The Southern Oregon Northern California Coast (SONCC) coho salmon ESU.



This map shows the populations and diversity strata in the SONCC coho salmon ESU. NMFS classified each of the populations (excluding ephemeral populations) in the SONCC coho ESU into one of three categories: core (C), non-core independent (NCI), and dependent (D).

Extinction and Recovery Trajectories

The abundance of fish is low in many of the populations in the SONCC coho salmon ESU. Populations with few individuals are not only more vulnerable to environmental variations (e.g. drought), they are also subject to particular dynamics resulting from small population size. For example, there are genetic issues, including genetic drift and inbreeding, spawners may have difficulty finding mates, and predation pressure may be higher because there are fewer fish for predators to eat. The longer a population remains small, the more likely it is to succumb to these factors and go extinct. Such dynamics are sometimes referred to as an "extinction vortex" in which once a population is reduced to a small size, it is difficult for that population to recover. In such cases, improvement in habitat conditions alone may be insufficient; it may be necessary to use artificial propagation (conservation hatcheries) to replenish population numbers.

PLAN DEVELOPMENT METHODOLOGY

Population Classification

The TRT utilized the concept of the Viable Salmonid Population (VSP) (McElhany et al. 2000) to describe the characteristics of a healthy salmonid population. The VSP concept includes four parameters: abundance, productivity or growth rate, spatial structure, and diversity (defined in recovery criteria section, below). All four parameters must be met to maintain diversity throughout the ESU, provide connectivity among populations to maintain long-term viability and genetic processes, and provide a buffer against potential catastrophic risks.

How did NMFS classify populations, and what are the recovery targets for each type?

Core: These independent populations are judged most likely to become viable most quickly. As described in Appendix C, core populations were chosen based on factors such as current habitat quality, current abundance and distribution of coho salmon, land use, and prospects for future improvement. Recovery targets are in the thousands of fish, and will result in a low risk of extinction for each population.

Non-core 1: These independent populations are judged to have lesser potential for rapid recovery than the core populations. Recovery targets are in the hundreds of fish, and will result in a moderate risk of extinction for each population.

Non-core 2: These populations are judged to have low potential to recover as self-sustaining populations. The recovery target is juvenile occupancy in years following spawning of cohorts that experienced good marine survival. This occupancy will demonstrate the populations are supporting the independent populations.

Dependent: These populations probably played a supporting role in the ESU historically due to their small size, and were likely not always occupied by coho salmon. The recovery target is the same as for Non-Core 2 populations.

Populations were classified as dependent or independent based on their historic population size (Williams et al. 2006). Williams et al. (2006) provided guidelines for which populations could be at low risk of extinction and moderate risk of extinction and still make up a viable ESU. To apply these guidelines, NMFS further classified populations into four categories. These categories were defined by the first VSP parameter: the number of adults each population must produce in order to achieve a viable ESU (see box at left for more information). These classifications were combined with the TRT's population-specific adult spawner targets to determine the population size criterion for each population. These criteria, which are a type of delisting criteria, are detailed in Chapter 6.

What is a population profile?

A population profile is a description of one of the populations in the SONCC coho salmon ESU, including a summary of available habitat data, population data, an assessment of stress and threats, and a list of recovery actions. Profiles were prepared for every independent and dependent population. The 39 profiles make up Chapters 7 to 43 of the recovery plan.

Why were population profiles created?

Population profiles were prepared so that NMFS could better understand all the available information about each population's status, its habitat condition, and the stresses and threats affecting it. This information was used to identify the role each population would play in recovery of the ESU.

Limiting Factor (Stress) and Threat Assessment

When the SONCC coho salmon ESU was listed, NMFS identified the factors that had led to its decline. These factors are associated with specific stresses and threats, which were assessed for each population to determine the extent to which they limit that population. The methods used for the threats assessment are described in Appendix B.

The following sections list the stresses and threats included in the assessment. These stresses and threats are explained in detail in Chapter 3.

The most critical, wide-ranging factor in the decline of SONCC coho salmon is habitat loss and degradation. The sustainability of anadromous salmonid populations depends upon suitable habitat conditions. Accordingly, most of the stresses and threats relate to habitat characteristics.

What is a limiting factor?

A limiting factor is an environmental factor that limits the growth or activities or an organism or that restricts the size of a population or its geographic range.

What is a stress?

Stresses are attributes of the ecology of a particular life stage of coho salmon that are impaired, directly or indirectly, by human activities. For example, impaired water quality, specifically high water temperature, can impair growth of or kill juvenile coho salmon.

Why Limiting Factor (Stress)?
Why not one or the other?

Both terms are used in order to bridge differences in terminology used between concepts.

What is a threat?

A threat is an activity or process that has causes, is causing, or may cause a stress. For example, land management activities may require withdrawal of water from a river. This reduced flow can result in higher water temperature, impairing water quality and harming or killing coho salmon.

Stresses

- Lack of Floodplain and Channel Structure
- Impaired Water Quality
- Altered Hydrologic Function [timing of volume of water flow]
- Impaired Estuary/Mainstem Function
- Degraded Riparian Forest Conditions
- Altered Sediment Supply
- Increased Disease/Predation/Competition
- Barriers [to migration]
- Adverse Fishery-Related Effects
- Adverse Hatchery-Related Effects

Threats

- Dams/Diversions
- Agricultural Practices
- Channelization/Diking
- Timber Harvest Practices
- Roads
- Urban/Residential/Industrial Development
- Road-Stream Crossing Barriers
- Climate Change
- Invasive/Non-Native Alien Species
- Hatcheries
- Fire (High Intensity)
- Mining/Gravel Extraction

Identification of recovery actions

Problematic stresses and threats must be reduced to be consistent with the threat abatement criteria. These criteria are a type of delisting criteria and are explained in detail in Chapter 6. Stress and threat abatement criteria describe the extent of threat or stress reduction necessary for ESU recovery, which defined the scope, intensity, and priority of the stress- and threat-related recovery actions.

RECOVERY GOALS, OBJECTIVES, AND CRITERIA

The goal of the recovery plan is to restore and recover SONCC coho salmon and their habitat to the point where the ESU no longer needs the protections of the ESA and can be delisted. There are two kinds of delisting criteria:

- Biological viability criteria and
- Stress and threat abatement criteria.

Biological Viability Criteria

Biological Viability Criteria for the Southern Oregon Northern California Coast Coho Salmon ESU

Abundance: The number of individuals in a population. Abundance targets are shown on page 10 of this summary. *The numeric criteria for number of spawners in each core and non-core independent population must be met, on average, over a 12 year period.*

Productivity: The population growth rate, measured as the spawner-to-spawner ratio (returns per spawner or recruits per spawner). *On average in a 12-year period, the population growth rate in core populations must be positive, even during poor marine survival conditions.*

Spatial Structure: The geographic distribution of individuals in the population. *For all core and non-core-1 populations, on average over a 12 year period at least 70% of the accessible habitat must support juveniles. For all non-core 2 and dependent populations, 20% of accessible habitat must support juveniles in years following spawning of cohorts that experienced high marine survival.*

Diversity: All the genetic and phenotypic (life history, behavioral, and morphological) variation within a population. The proportion of hatchery-origin spawners (pHOS) must not exceed 0.10 in any population, and documented variation in migration timing, age structure, size and behavior must be retained.

Photo: Thomas Dunklin

Coho salmon spawning in the Jacoby Creek watershed (Humboldt Bay population) on 12/16/2010.

Stress and Threat Abatement Criteria

In order to achieve viability of the ESU, the stresses and threats affecting SONCC coho salmon and their habitat must be abated to levels that allow for long-term self-sustainability. In order to make a delisting decision, NMFS will examine whether the listing factors (described above in the Current Stresses and Threats section) have been addressed, such that delisting is not likely to result in reemergence of the threats. The major stress and threat abatement criteria are described on the following pages.

Stress Abatement Criteria

- All stresses are abated to the point where habitat conditions are within the range of conditions suitable for all life stages of coho salmon in targeted areas. These targeted areas will be identified as part of a comprehensive habitat survey to occur in each population after the recovery plan is final.
- Barriers do not limit access to targeted areas.
- All estuaries contain estuarine wetland habitat and connected off-channel habitat (back and side channels, tidal channels, wetlands, beaver ponds, etc) to support needed population sizes.

Threat Abatement Criteria

- For threats to habitat, threats are reduced so that stress abatement criteria are achieved.
- Regulatory programs that govern land use and resource extraction have been enacted, enforced, monitored, and adaptively managed and are adequate to ensure effective protection of SONCC coho salmon habitat, including water quality, water quantity, stream structure, and function, and to attain and maintain the biological viability criteria in this recovery plan.
- Regulatory programs are in place and are being adequately implemented, monitored, evaluated and adaptively managed to manage fisheries at levels consistent with the biological recovery criteria of the recovery plan.

Photo: Thomas Dunklin

Coho salmon digging redd in the Jacoby Creek watershed (Humboldt Bay population) on 12/16/2010.

The following table shows population type and minimum number of spawners needed for ESU recovery. Populations are categorized into core (C) (**bold** in table), non-core 1 (NC-1), non-core (NC-2) and dependent (D).

Diversity Stratum	Population Name	Population Type	Number Spawners Needed for Recovery
Northern Coastal Basins	**Elk River**	C	2,400
	Lower Rogue River	NC-1	320
	Chetco River	C	4,500
	Winchuck River	NC-1	230
	Mill Creek	D	none*
	Brush Creek	D	none*
	Hunter Creek	D	none*
	Pistol River	D	none*
Central Coastal Basins	**Smith River**	C-	6,800
	Lower Klamath River	C	5,900
	Redwood Creek	C	4,800
	Maple Creek/Big Lagoon	NC-2	none*
	Little River	NC-1	140
	Mad River	NC-1	550
	Elk Creek	D	none*
	Wilson Creek	D	none*
	McDonald Creek	D	none*
	Strawberry Creek	D	none*
	Norton/Widow White Creek	D	none*
Southern Coastal Basin	**Humboldt Bay tributaries**	C	5,700
	Lower Eel/Van Duzen rivers	C	7,900
	Bear River	NC-2	none*
	Mattole River	NC-1	1,000
	Guthrie Creek	D	none*
	McNutt Gulch	D	none*
Interior – Rogue River Basin	**Illinois River**	C	11,800
	Mid. Rogue/Applegate Rivers	NC-1	2,700
	Upper Rogue River	C	16,100
Interior – Klamath River	Middle Klamath River	NC-1	450
	Upper Klamath River	C	8,500
	Salmon River	NC-1	460
	Scott River	C	8,800
	Shasta River	C	8,700
Interior – Trinity River	South Fork Trinity River	NC-1	970
	Lower Trinity River	C	3,900
	Upper Trinity River	C	7,300
Interior – Eel River	**South Fork Eel River**	C	9,600
	Mainstem Eel River	C	4.700
	Mid. Fork Eel River	NC-2	none*
	Mid. Mainstem Eel River	C	6,400
	Upper Mainstem Eel River	NC-2	none*

*delisting criterion: 20% of accessible habitat is occupied in years following spawning of cohorts that experienced good marine survival.

RECOVERY ACTIONS

The plan describes a series of voluntary actions to improve prospects for recovery of the Southern Oregon Northern California Coast coho salmon.

Recovery of healthy, abundant coho salmon populations within the of SONCC coho salmon ESU is likely to happen only if people are willing to work together. The proposed recovery actions are designed to address the full range of limiting factors for all life cycle stages of SONCC coho salmon and are intended to improve the health and habitat.

This section provides of a brief overview of the types of actions that are proposed, organized by stress and threat. The full plan provides additional details. For a summary of recovery actions, see the Recovery Strategy section. A comprehensive list of actions, organized by population, is in the last table of each population profile. The cost for each action, and the potential lead, is shown in Appendix F.

Riparian Forest Conditions

Increase wood recruitment, bank stability, shading, and food subsidies by increasing coniferous riparian vegetation (plant conifers or thin vegetation as needed, remove invasive species), developing planning guidelines or ordinances that protect riparian stands and the wood already in the stream, amending California and Oregon Forest Practice Rules, improving grazing practices, improving long-range planning, educating landowners, and reducing fire hazards.

Why are riparian forests important to coho salmon?

Riparian (near-stream) forests are essential components of salmon habitat and provide a variety of benefits:

- Shade helps maintain cool water temperatures
- When large trees die and fall into the water, they create pools and shelter
- Roots stabilize stream banks and reduce erosion
- Vegetation provides habitat for insects that can fall into the stream and become salmon prey.

Riparian restoration in the Thompson Creek watershed (Applegate River) with willow and alder trees established following planting in February 2004.

Photo Applegate River Watershed Council

Floodplain and Channel Structure

Increase channel complexity by increasing large woody debris. In the short-term, this can be accomplished by adding wood to channels. A more permanent solution is to let riparian trees mature and grow larger (see Riparian Forests Conditions below), providing natural replenishment of wood as trees die and fall into stream channels. Where feasible, expanding the range of beavers could substantially improve habitat complexity (see photo at right) and have other beneficial effects to habitat.

Reconnect the floodplain by removing or setting back (move away from stream channel) levees and dikes. This will provide coho salmon juveniles with access to slow-water habitats such as side-channels and off-channel ponds that are critically important during winter and spring high flows.

Photo: Eli Asarian

Channel-spanning large wood jam on East Fork Mill Creek (Smith River population), provides excellent summer and winter rearing habitat for coho salmon. With many pieces of wood, this restoration project created habitat much more complex than conventional projects that use only a few pieces.

Photo: Yurok Tribe

Waukell Creek side channel near the Klamath River Estuary during high flow event on 12/13/2006, demonstrating good floodplain connectivity.

What is floodplain connectivity?

Floodplains are the relatively low-lying lands alongside rivers and streams that are occasionally inundated during high flows and floods. Floodplain connectivity refers to the ability of the stream to periodically overflow its banks. Although we call this “flooding” and perceive it as something to avoid, especially when houses and roads are at stake, it is flooding that makes the soil fertile, replenishes wetlands with nutrients, seeds, and organic matter, and enriches the rivers and streams for the fish and other aquatic life.

Upstream floodplains can also diminish the force of the floodwaters and prevent more extensive flooding downstream. Planning realistically and providing undeveloped areas for rivers to flood can protect adjacent property from damage.

Why is large wood important to salmon?

Large woody debris (LWD) means big chunks of wood, such as root wads or trees fallen into or across the channel.

- In all forested rivers and streams, large wood plays a key role in shaping the channel.
- It creates pools and hiding places, providing salmon with protection from predators.
- It helps filter sediment to provide clean gravel for spawning.
- It provides organic matter to feed the small invertebrates that salmon feed on.

Hydrologic Function (Water Flow)

Improve timing or volume of flow by conserving water, improving agricultural practices, establishing a statewide groundwater permitting process, changing the timing or volume of flow releases, and reducing diversions.

Increase water storage by increasing water retention and recharge through maintaining open space lands, managing runoff, and maintaining water storage structures.

Photo: Brock Dolman

Beaver pond provides excellent cover and slow-water habitat on Boise Creek near its confluence with the Klamath River on 5/14/2010. Beaver ponds improve hydrologic function by raising water tables and increasing connectivity between groundwater and surface water.

Water Quality

Reduce water temperature and increase dissolved oxygen by increasing flow, increasing the amount of cold water, reducing warm water inputs, and increasing coniferous riparian vegetation to provide shade.

Protect cold water by developing an emergency plan to protect cold water refugia during warm periods, and developing an educational program about the best land management practices.

Reduce pollutants by developing educational programs for conservation partners, removing pollutants from streams, reducing point- and non-point source pollution, and improving regulatory mechanisms.

Why is water quality important to coho salmon?

One of the most important ecological requirements of coho salmon is cold, clean, well-oxygenated water.

High summer water temperature is one of the most widespread (and greatest) stressors in the SONCC coho salmon ESU. Increased water temperature, even at sub-lethal levels can inhibit migration, reduce growth, stress fish, reduce reproductive success, inhibit smoltification, contribute to outbreaks of disease, and alter competitive dominance.

Other water quality parameters of concern in some coho salmon populations are elevated turbidity, low dissolved oxygen, and high pH. Pesticides and other toxins are also potential concerns in watersheds with urban areas and/or agriculture.

Fencing to keep cattle out of the riparian area of Big Springs Creek (Shasta River population). The stream is a critically important coldwater refugia.

Photo: NMFS

Sediment

Reduce the amount of sediment (dirt) that gets to streams by maintaining, upgrading, or decommissioning roads; improving grazing practices, developing grading ordinances, improving timber harvest practices, stabilizing slopes, and reducing the risk of catastrophic fire.

Improve spawning habitat by adding spawning gravels to river reaches below dams, because dams prevent replenishment of gravels from upstream sources.

Photos: Pacific Coast Fish, Wildlife and Wetlands Restoration Association

Before (top) and after (bottom) road decommissioning in Salmon Creek watershed (Humboldt Bay population) in the Headwaters Forest Reserve. This project will reduce fine sediment delivery to Salmon Creek.

Fish Passage

Improve access to watershed by removing barriers including structural, thermal, flow, and sediment barriers.

Decrease mortality associated with barriers by screening diversions.

Photo: Five Counties Salmonid Conservation Program

Improved stream crossing on Lindsay Creek (Mad River population) with arch culvert and natural stream bottom. Previous culvert was undersized and impeded fish passage.

What causes excess fine sediment?

Erosion is natural process but human activities such as road construction, timber harvest, agriculture, and development can disturb land and make it more vulnerable to erosion. Rain and melting snow then wash fine sediment (silt and sand) into streams, especially during major storms.

How does it harm coho salmon?

Excess fine sediment is detrimental to coho salmon in several ways:

- Reduced water clarity, making it more difficult for juvenile salmon to feed.
- Filled pools, simplifying salmon habitat.
- Clogged pore spaces in gravels and cobbles, depriving salmon of place to hide from predators and swift currents. This can also retard intergravel flow, reducing the formation of beneficial pockets of cold water.
- Reduced populations of invertebrates that are the preferred prey of salmon.

Estuary/Mainstem

Protect existing estuarine habitat by limiting development and fill, and maintaining and strengthening current estuarine protection measures.

Restore connectivity of tidally influenced habitat by reconnecting slough and tidal wetlands to estuary where opportunities exist, removing or replacing tidegates, setting back or removing dikes and levees, and increasing coniferous riparian vegetation.

Improve estuarine habitat by developing and implementing site-specific plans to restore this habitat.

Increase tidal exchange of water by removing barriers, installing bridges, and setting back dikes or levees

Photo: Thomas Dunklin

Klamath River estuary.

Photo: Pacific Coast Fish, Wildlife and Wetlands Restoration Association

Connection between Hookton Slough and Salmon Creek (Humboldt Bay population) was restored with a new tide gate.

Disease/Predation/Competition

Reduce disease by disrupting the disease cycle for identified pathogens, and conducting research and monitoring to better understand the disease cycle.

Reduce predation and competition by reducing the abundance of predatory or competing species such as Sacramento pikeminnow, brown trout, and New Zealand mud snail.

Fishery-Related Effects

Reduce effects of fishing by incorporating SONCC coho salmon VSP delisting criteria when formulating fishery management plans for fisheries that affect SONCC coho salmon, and limiting fishing impacts to those consistent with recovery.

Hatchery-Related Effects

Reduce adverse genetic effects of hatcheries by changing hatchery practices and reducing the number of hatchery origin spawners.

Reduce adverse ecological effects of hatcheries by changing hatchery practices and reducing competition with and predation from stocked salmonids.

Low Population Dynamics

Prevent extirpation by reducing mortality of coho salmon and considering implementation of enhancement programs (conservation hatcheries).

Monitoring and Research

Increase knowledge and understanding of population status, trends, habitat by monitoring the number and distribution of coho salmon, the condition of their habitat, and the status of threats affecting them.

MONITORING AND ADAPTIVE MANAGEMENT

Monitoring

The recovery plan describes monitoring to assess population status and trends, and the extent of stress reduction and threat abatement.

Population status and trends monitoring

Monitoring of population status and trends would occur over four phases: The initial phase, the intermediate phase, the delisting phase, and the post-delisting phase. Monitoring varies depending on whether a population is core, non-core 1, non-core 2, or dependent, and on how close populations are to meeting their delisting criteria.

One life cycle monitoring station (LCM) would be established in each diversity stratum. The number of adults, number juveniles, and survival rates would be measured annually at each LCM, beginning in the initial phase and continuing through the post-delisting phase. In addition, the following monitoring would occur in each phase.

Initial Phase

The initial phase would begin as soon as possible. During the initial phase, juvenile occupancy surveys would be carried out in all core and non-core 1 populations, except those with LCMs. These surveys would alternate three years on, three years off, during an initial phase and a delisting phase.

Intermediate phase

The intermediate phase begins when the 12-year geometric mean of approximately 50 percent of the core populations with LCMs meet the low-risk spawner threshold (e.g., 4 of 7 populations). Alternatively, this phase would be triggered when the number of spawners in all of the core populations with LCMs is at least 50% of the low-risk spawner threshold. During the intermediate phase, the number of coho salmon spawners in each core population would be estimated each year. In addition, juvenile occupancy would be estimated in each non-core 1 population, for three consecutive year classes, in every other generation.

Delisting Phase

The delisting phase would be triggered when the 12-year geometric mean of approximately 90 percent of the core populations meets the low-risk spawner threshold (e.g., 15 of 17 populations). Alternatively, this phase would be triggered when the number of spawners in all of the core populations is at least 90% of the low-risk spawner threshold. During the delisting phase, spawner, juvenile occupancy, and life history diversity surveys would be carried out in all core and non-core 1 populations each year, and juvenile occupancy surveys would be carried out in all non-core 2 and dependent populations each year.

Post-Delisting Phase

The post-delisting phase would be triggered when the species is delisted and would continue for 12 years to assess whether SONCC coho salmon can continue to be viable without the protections of the ESA.

Photo: U.S. Forest Service

A rotary screw trap in lower Grayback Creek (Illinois River population).

Stresses and threats monitoring

Stresses

The following summary describes recommended monitoring in order track stresses. Additional monitoring is described in Chapter 5.

- Conduct a comprehensive survey of habitat in all populations, as soon as possible in both freshwater and estuarine areas. After this survey is complete, monitor habitat indicators for applicable limiting factors (stresses) every ten years in core and non-core 1 populations, and every fifteen years in non-core 2 and dependent populations.
- Annually monitor the hydrograph in core and non-core 1 populations where altered hydrologic function was ranked a high or very high limiting factor (stress).
- Annually estimate bycatch from commercial, recreational, and tribal fisheries in all freshwater, tidal, and ocean areas.

Photo: www.krisweb.com

Humboldt Fish Action Council snorkel survey in Freshwater Creek (Humboldt Bay population), 2004.

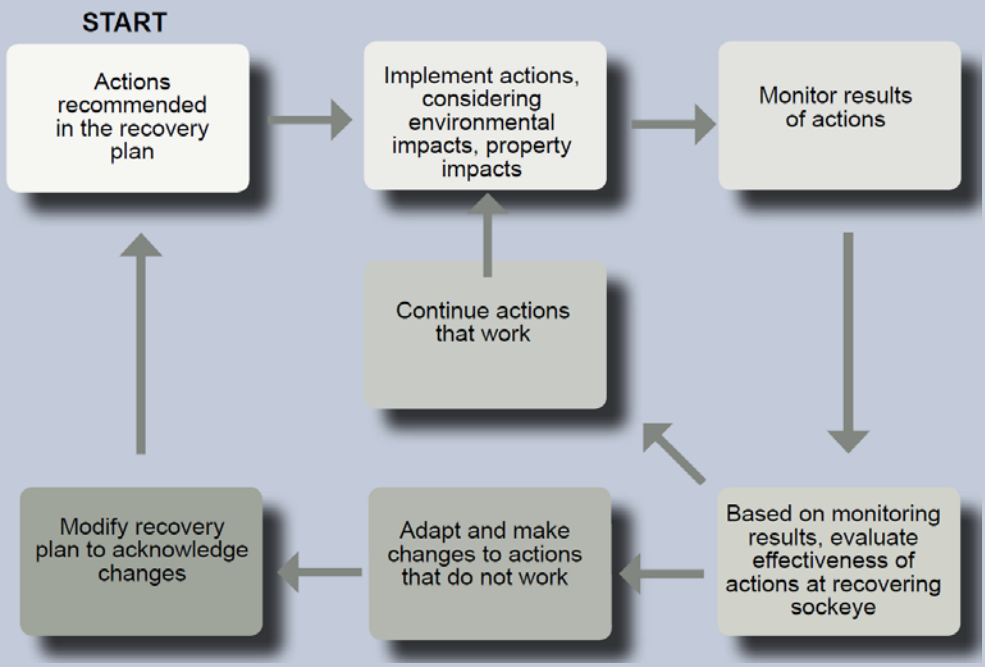
Threats

The following summary describes recommended monitoring in order track threats. This monitoring would be carried out every five years as part of the status review.

- Describe the status and trend of limiting factors (stresses) related to timber harvest, high-intensity fire, agricultural practices, channelization/diking, urban/residential/industrial development, mining/gravel extraction, hatcheries, and climate change.
- Describe the status and trends of road treatments and road density, barriers, high-intensity fires, urban/residential/industrial development, channelization/diking, mining/gravel extraction, and invasive species.

What is Adaptive Management?

Adaptive management is the process of adjusting management actions and/or directions based on new information. The new information comes from monitoring the results of actions and evaluating their effects against existing hypotheses. Then the recovery actions can be continued or changed to be more effective.



Adaptive Management

An adaptive management framework is proposed to use monitoring information to evaluate the effectiveness of recovery plan implementation. Hypotheses will be tested with data collected during monitoring, and management actions will be guided by the results of these tests. See boxes above and at right for more information.

Data collection, evaluation, and reporting

There are a large number of federal, tribal, state, and local entities collecting data relevant to SONCC coho recovery planning. The recovery plan calls for these efforts to be better coordinated and for data to be compiled into centralized databases.

What is a hypothesis?

A hypothesis is a statement that can be proved or disproved by further inquiry. It is an invitation to look for more information. A scientific hypothesis is based on some kind of evidence or observation, and it describes either a possible causal relationship or just a relationship of some sort.

It does not matter whether a hypothesis is precise or wildly speculative; the important thing is whether it can be proven or disproven, and how the evidence is obtained. For example, a hypothesis about the trend in habitat condition may be "Water temperature is getting cooler". The question is not where the hypothesis came from but what can be done with it. What's the evidence? How can it be proved or disproved?

IMPLEMENTATION

The Priority and Importance of Recovery Actions

When choosing recovery actions to implement, conservation partners should consider both the priority and importance rankings. Each recovery action has been assigned a priority number, designed to call out those actions necessary to prevent extinction or a significant negative impact to the ESU. Each recovery action can also be assigned an importance ranking. This ranking takes into account the priority of the action as described above, whether the action addresses a key limiting factor (one which has the greatest impact on current population viability), and whether the population size is low enough for it be subject to detrimental population processes.

Implementation Schedule

The last table in Chapters 7 through 45 lists the population-specific recovery actions that make up the SONCC coho salmon recovery program, along with information about each action. Appendix F provides additional information about each action. Together, the tables and Appendix F make up the implementation schedule. Example rows from the tables are included on the following page.

Conservation Partners

To achieve success, the plan must be implemented. NMFS alone has neither the resources nor the authority to implement most recovery actions. Communication, coordination, and collaboration with a wide variety of conservation partners is essential to the implementation of the recovery plan. In addition, recovery plans must be designed so that all conservation partners, whether they were involved in writing the plan or not, understand the rationale behind the recovery program, buy into the program, and recognize their role in its implementation. NMFS is committed to working with stakeholders throughout the entire recovery process, from planning through implementation to recovery and delisting.

The primary roles of NMFS in plan implementation will be to champion the recovery strategy, and provide the needed technical information and expertise to other entities implementing the plan or contemplating actions that may impact the species' chances of recovery, and implement recovery actions where practicable.

Who are the "conservation partners"?

A conservation partner is anyone who has an interest in the recovery of the species.

Conservation partners may include other bureaus within NMFS, other government agencies, affected landowners, academic scientists, conservation organizations, industry, etc.

Future of the Recovery Plan

Planning for the recovery of a threatened or endangered species is tantamount to trying to capture a moving target that is rapidly diminishing over the horizon. Coaxing the species back from the brink and then adapting conditions so it can remain requires flexibility and the ability to alter course midstream while at the very least maintaining a stable population to allow time for research and management actions to take hold. A recovery plan must do all of this and more. In so doing a recovery plan must be a living document, easily refocused on the changing needs of the listed species. This recovery plan will be a living document, which will change in response to new information.

Coordination among State, Tribal or Federal agencies, academic institutions, private individuals and organizations, commercial enterprises, and other affected parties is perhaps the most essential ingredient for recovering a species. In view of such a broad scope of conservation partners, it is imperative that each become vested and active in the continuing efforts to promote and implement the recovery plan. This can be accomplished throughout the recovery process by facilitating a sense of ownership and accomplishment as each recovery action is fulfilled.

Example rows from the recovery action implementation schedule for the Smith River (Table 15-5 at end of Chapter 15):

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-SmiR.2.1.1	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Smith River Plain, Estuary, tributaries, Rowdy, Chrome, and Spokane creeks	3
SONCC-SmiR.2.1.1.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-SmiR.2.1.1.2	*Place instream structures, guided by assessment results*					
SONCC-SmiR.2.2.2	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Restore natural channel form and function	Smith River Plain, Rowdy and Domnie creeks	2
SONCC-SmiR.2.2.2.1	*Assess channelized reaches and develop a plan for reconstructing a natural meandering channel*					
SONCC-SmiR.2.2.2.2	*Reconstruct channelized reaches guided by the plan*					

Example rows from Appendix F, providing additional details (costs and lead entities) for each recovery action:

Appendix F: Cost and Lead Agency for Recovery Actions

ActionID	Step ID	Cost 5yrs	Cost 10yrs	Cost 15yrs	Cost 20yrs	Cost 25yrs	Cost >25yrs	Total Cost	Lead Entity
Population: Smith River									
SONCC-SmiR.2.1.1									
	SONCC-SmiR.2.1.1.1	$34,015						$34,015	CDFG
	SONCC-SmiR.2.1.1.2	$10,957,000						$10,957,000	CDFG
	Action Total:	*$10,991,015*						*$10,991,015*	
SONCC-SmiR.2.2.2									
	SONCC-SmiR.2.2.2.1	$34,015						$34,015	CDFG
	SONCC-SmiR.2.2.2.2	$290,700						$290,700	CDFG
	Action Total:	*$324,715*						*$324,715*	

BROAD-SENSE RECOVERY STRATEGY

The plan defines what is believed to be necessary for the SONCC ESU to be viable and potentially delisted. Successful delisting involves achieving the level of recovery defined in Chapter 4 (Recovery Goals, Objectives, and Criteria) and will result in a few populations in each stratum being viable and the other populations being at moderate, high, or very high risk of extinction. Viable core populations may someday be able to withstand some level of incidental impact from commercial fisheries targeting hatchery fish, but will have little ability to withstand direct harvest. Returning wild coho spawners will number in the several thousands, but will not be numerous enough to be seen spawning throughout the ESU. Cultural and ecological benefits of having numerous coho salmon and other salmon and steelhead populations spawning throughout the ESU will likely not be achieved under a scenario where just delisting is afforded.

For many people, delisting is not enough. For example, the Oregon Plan for Salmon and Watersheds and the public advisory group that helped develop Oregon's Native Fish Conservation Policy recognized the importance of conserving healthy, diverse populations of salmon and steelhead at levels that provide recreational, economic, cultural and aesthetic benefits to present and future citizens. Such a desired status is also considered in ESA recovery plans (see Lower Columbia River Recovery Plan; NMFS 2009) and has been called "broad sense recovery". The term "broad sense recovery" represents the long-term goal of this plan.

In contrast to ESA recovery, "broad-sense" salmon recovery is a more open-ended concept that does not have a single definition; rather, it can mean different things to different people. "Broad sense recovery goals" reflect societal values in addition to biological ones. ESA recovery and broad sense recovery are not inconsistent; in fact, they share a common vision of ensuring that naturally sustainable salmon populations persist into the future.

NMFS is committed to pursuing both types of salmon recovery and one of the guiding principles for SONCC coho salmon recovery planning was to make the ESA and broad-sense recovery processes as congruent as possible. Chapter 4 of the plan includes more information about broad-sense recovery of the SONCC ESU.

What is "Broad-Sense Recovery"?

Broad sense-recovery is the goal of having populations of naturally produced salmon sufficiently abundant, productive, and diverse (in terms of life history and geographic distribution) that they ESU as a whole (a) will be self-sustaining, and (b) will provide significant ecological, cultural, and economic benefits (. This goal is consistent with ESA delisting, but is designed to achieve a level of performance for the ESU and its constituent populations that is more robust than that needed to remove the ESU from ESA protection. Broad sense recovery will require additional resources and effort; however, with larger population numbers, salmon in the SONCC coho ESU could provide valuable additional benefits to society.

Photo: NMFS

Coho salmon adult in Freshwater Creek (Humboldt Bay population).