Executive Summary

Need for Recovery

Thousands of coho salmon once returned to spawn in the rivers and streams of Northern California and Southern Oregon. Not long ago, these watersheds provided conditions that supported robust and resilient populations of coho salmon that could persist under dynamic environmental conditions. The combined effects of fish harvest, hatcheries, hydropower operations, and habitat alterations caused by land management led to declines in these populations. The National Marine Fisheries Service's (NMFS) evaluation of declining coho salmon abundance and productivity, as well as range reductions and diminished life-history diversity, supported the decision to list the Southern Oregon/Northern California Coast (SONCC) Evolutionarily Significant Unit (ESU) of coho salmon as a threatened species under the Endangered Species Act (ESA) in 1997, a decision that was reaffirmed in 2005.

Recovery can only be achieved through coordinated efforts to build strong conservation partnerships. Conservation partners may be individuals, groups, and government or non-government organizations including NMFS, industry, or tribes who have an interest in the recovery of SONCC coho salmon. The ESA envisions recovery plans as the central organizing tool for guiding each species' recovery process. The recovery plan is a road map to recovery – it lays out where we need to go and how best to get there. The SONCC Coho Salmon ESU recovery plan (Plan) was developed to provide a roadmap to recovery of this species which conservation partners can follow together. Specifically, the Plan is designed to guide implementation of prioritized actions needed to conserve and recover the species by providing an informed, strategic, and voluntary approach to recovery that is based on the best available science. Use of a recovery plan ensures that recovery efforts target limited resources effectively and efficiently. The Plan also provides recovery targets to work toward, as well as criteria by which progress toward recovery will be tracked.

Current Species Status (Chapter 2)

The SONCC Coho Salmon ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon and Punta Gorda, California, as well as coho salmon produced by three artificial propagation programs: Cole Rivers Hatchery, Trinity River Hatchery, and Iron Gate Hatchery. An ESU is comprised of groups of populations with geographic and evolutionary similarities that are considered a "species" under the ESA. NMFS originally listed the SONCC coho salmon ESU as threatened under the ESA in 1997 (62 FR 24588, May 6, 1997). In 2005, following a reassessment of its status and after applying NMFS' hatchery listing policy, NMFS reaffirmed its status as threatened and also added several hatchery programs to the listed ESU (70 FR 37160, June 28, 2005).

NMFS issued guidelines in 1990 (55 FR 24296, June 15, 1990) for assigning listing and recovery priorities. Three criteria are assessed to determine NMFS' species' priority for recovery plan development, implementation, and resource allocation: 1) magnitude of threat; 2) recovery potential; and 3) existing conflict with activities such as construction and development. The recovery priority number for the SONCC coho salmon ESU is 1, as reported in the 2011-2012

Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species (NMFS 2013).

In 2006, NMFS modeled the historic population structure of the SONCC coho salmon ESU (Williams et al. 2006; Chapter 2, this volume). Each population is described in terms of its modeled capacity to support rearing juvenile coho salmon, based on the intrinsic ability of the habitat to support this life stage. This capacity is described as Intrinsic Potential or IP. Williams et al. (2006) calculated the number of kilometers of IP for each population. The role each population played in the historic function of the ESU is primarily based on how much IP it contains. Populations with more than 34 IP-km are described as independent because, due to their size, they are not dependent on strays from nearby populations to persist over time. Populations with from 5 to 34 IP-km are described as dependent because they are too small to persist without immigration from independent populations. NMFS grouped populations with similar geologic and genetic features into seven diversity strata (Williams et al. 2006). Williams et al. (2006) originally described 45 populations in the SONCC coho salmon ESU (Williams et al. 2006), but this recovery plan describes 40 populations, due to the recalculation of the amount of IP in some populations and exclusion of populations with less than 5 IP-km. Figure ES-1 shows the SONCC coho salmon ESU, including all 40 populations and seven diversity strata.

Populations with extremely low numbers of spawning adults can suffer from depensatory effects, which are problems with successful reproduction such as spawners being too scarce to find each other. The number of spawners needed to avoid depensatory effects is called the depensation threshold. Based on the amount of IP-km in each population, this recovery plan describes the extinction risk of each independent population. An independent population with spawner numbers below the depensation threshold is at high risk of extinction. Currently, over three quarters of SONCC coho salmon independent populations are at high risk of extinction (Figure ES-2). In a recovered ESU, these populations would be at moderate or low risk of extinction.
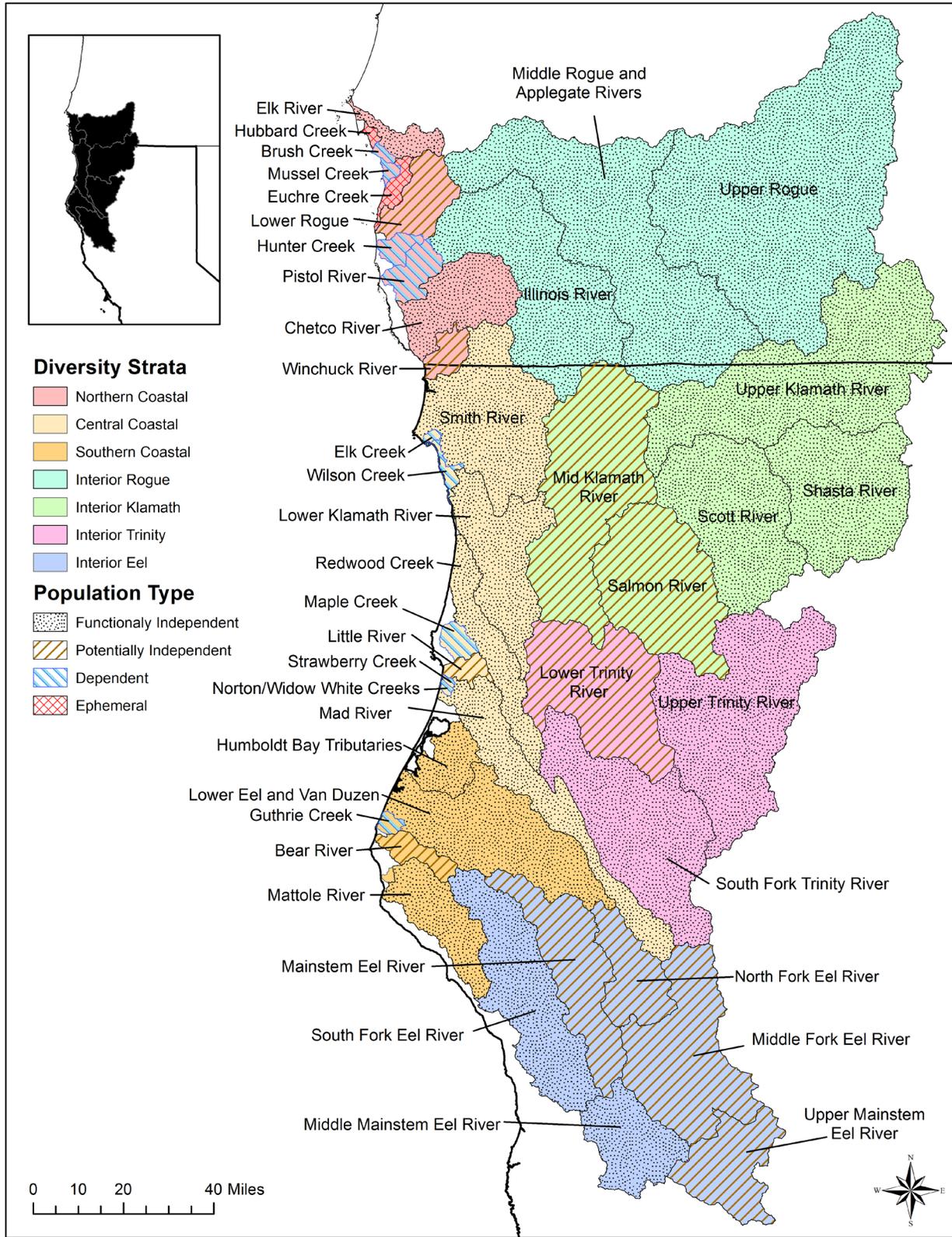
Figure ES-1. Populations and diversity strata of the SONCC coho salmon ESU.
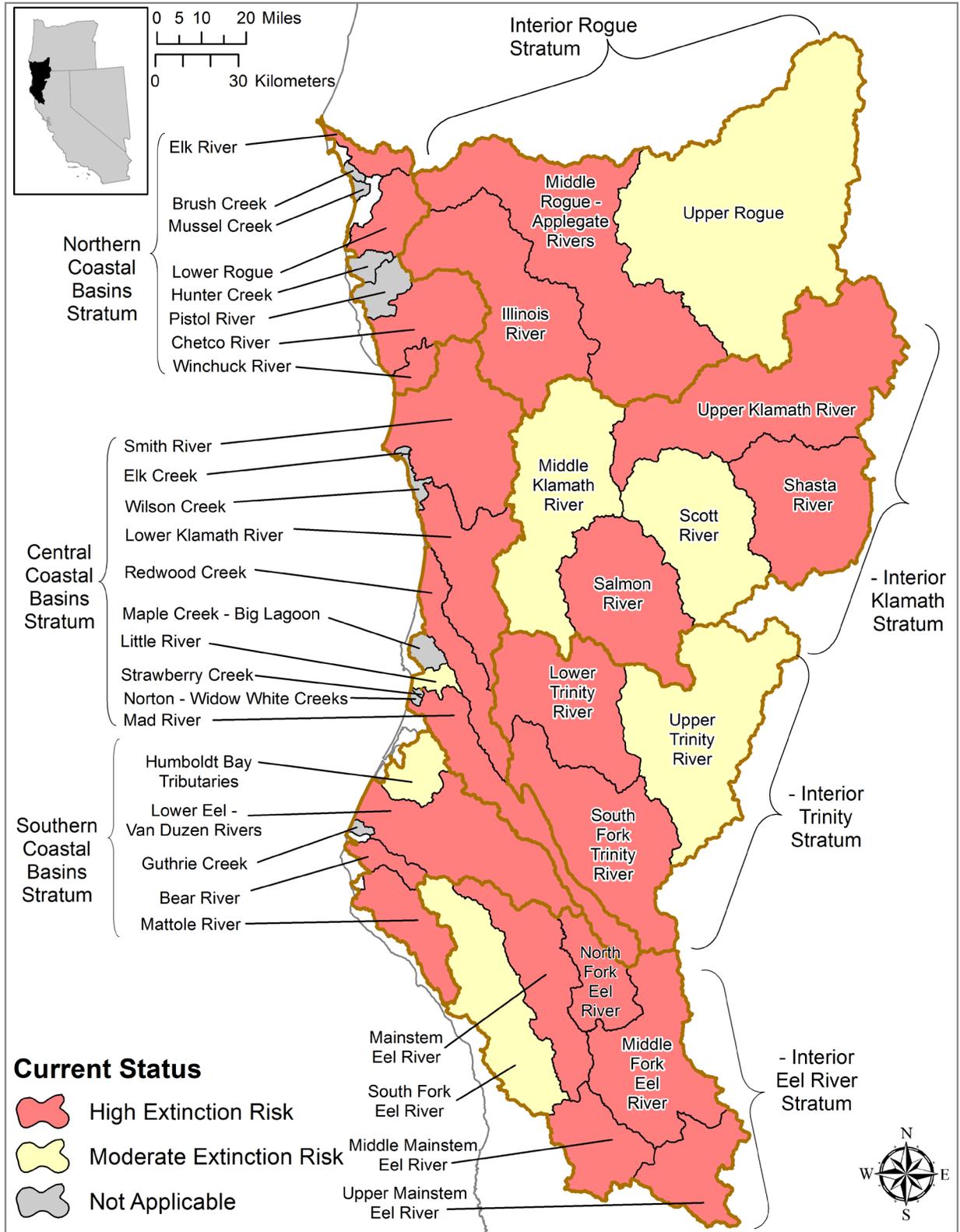
Figure ES-2. Current extinction risk of independent populations in the SONCC coho salmon ESU.
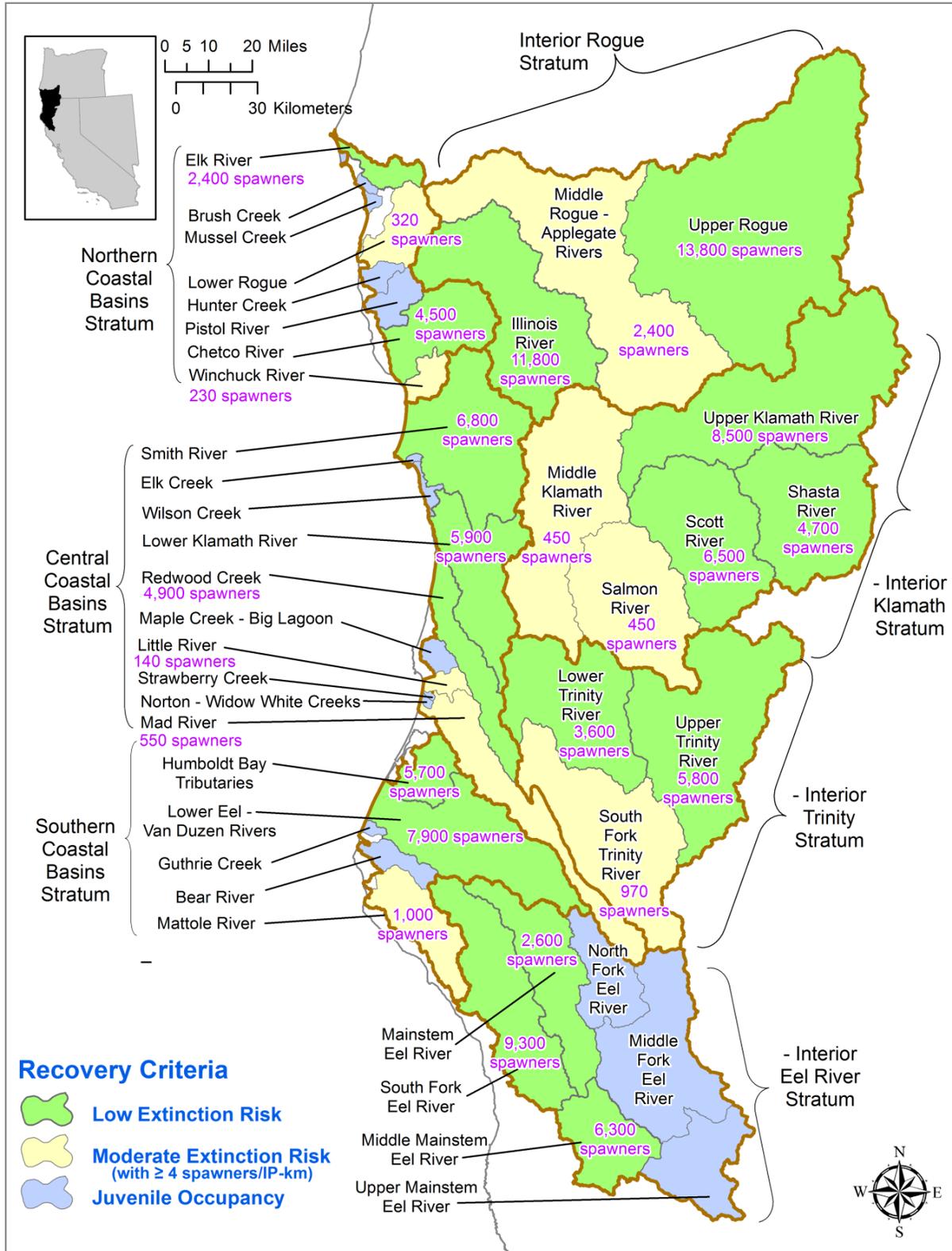
Figure ES-3. Minimum target extinction risk and recovery criteria for each population.

Stresses and Threats (Chapters 3 and 7 to 46)

Stresses are the physical, biological, or chemical conditions and associated ecological processes that that may impede SONCC coho salmon recovery. These are the factors that the fish feel, such as disease, limited habitat access, insufficient instream flows, impaired water quality, and insufficient amount and quality of habitat. Threats are those activities or impacts that cause or contribute to stresses such as hydropower, diversions, land management, invasive species, fish harvest, timber harvest, and hatcheries. The Plan includes recovery actions to restore various aspects of coho salmon habitat, and SONCC coho salmon recovery also depends on ongoing efforts to change past and current practices that diminish salmon habitat.

Chapter 3 describes the stresses and threats that NMFS believes are currently limiting populations from producing enough adults to avoid a high risk of extinction. Chapters 7 to 46 rank these stresses and threats for each population, and contain tables that describe the actions needed to reduce these stresses and threats. Chapters 7 to 46 also describe the key limiting stresses and threats for each population. Key limiting stresses and threats are those stresses and threats that are the most pressing factors limiting recovery of populations. Recovery actions to address key limiting stresses and threats often have a higher priority than those to address other stresses and threats. The key limiting stresses and threats for each population are shown in Table ES-1.

The lack of floodplain and channel structure is a key limiting stress in nearly all coastal populations and about half of interior populations. Good floodplain structure is present when the river retains areas off the main channel such as ponds and old oxbows. These areas are particularly important for coho salmon as they provide refuge from high winter flows. Good channel structure is present when there are sufficient pools and instream structure, such as complex wood jams. In coastal populations, the most common key limiting threat (52% of populations) is channelization, which results in straightening and simplification of the stream channel and reduction of off-channel habitat. In a third of all populations and 63% of interior populations, the amount of water in streams and rivers is insufficient for coho salmon needs, making altered hydrologic function another prevalent key limiting stress. In 35% of all populations and 71% of interior populations, dams and diversions are a key limiting threat, as they lead to a reduction in the amount of water in streams and rivers.

Table ES-1. SONCC coho salmon ESU populations and their key limiting stresses and threats.

Stratum	Populations	Key Limiting Stresses		Key Limiting Threats	
Northern Coastal Basin	Elk River	Structure	Water Quality	Agriculture	Channelization
	Brush Creek	Structure	Riparian	Roads	Timber Harvest
	Mussel Creek	Structure	Riparian	Timber Harvest	Channelization
	Lower Rogue River	Structure	Water Quality	Roads	Development
	Hunter Creek	Structure	Riparian	Roads	Timber Harvest
	Pistol Creek	Structure	Riparian	Roads	Timber Harvest
	Chetco River	Structure	Riparian	Channelization	Development
	Winchuck River	Structure	Water Quality	Channelization	Development
Central Coastal Basin	Smith River	Structure	Estuary	Channelization	Agriculture
	Elk Creek	Structure	Riparian	Channelization	Development
	Wilson Creek	Structure	Riparian	Roads	Timber Harvest
	Lower Klamath River	Structure	Sediment	Channelization	Agriculture
	Redwood Creek	Structure	Estuary	Channelization	Roads
	Maple Creek/Big Lagoon	Structure	Sediment	Roads	Timber Harvest
	Little River	Structure	Sediment	Roads	Agriculture
	Strawberry Creek	Estuary	Barriers	Barriers	Channelization
	Norton/Widow White Creek	Structure	Riparian	Channelization	Roads
	Mad River	Structure	Sediment	Roads	Mining
Southern Coastal Basin	Humboldt Bay tributaries	Structure	Estuary	Channelization	Roads
	Lower Eel/Van Duzen Rivers	Structure	Estuary	Channelization	Dam/Diversion
	Guthrie Creek	Structure	Sediment	Timber Harvest	Agriculture
	Bear River	Structure	Riparian	Roads	Timber Harvest
	Mattole River	Structure	Hydro Function	Dam/Diversion	Development
Interior Rogue River	Illinois River	Structure	Hydro Function	Dam/Diversion	Roads
	Middle Rogue/Applegate Rivers	Structure	Hydro Function	Dam/Diversion	Development
	Upper Rogue River	Structure	Hydro Function	Agriculture	Development
Interior Klamath	Middle Klamath River	Structure	Water Quality	Dams/Diversion	Fire
	Upper Klamath River	Hydro Function	Barriers	Dam/Diversion	Roads
	Shasta River	Hydro Function	Water Quality	Dam/Diversion	Agriculture
	Scott River	Hydro Function	Riparian	Dam/Diversion	Agriculture
	Salmon River	Structure	Riparian	Fire	Climate Change
Interior Trinity	Lower Trinity River	Structure	Hydro Function	Channelization	Hatcheries
	South Fork Trinity River	Hydro Function	Water Quality	Dam/Diversion	Roads
	Upper Trinity River	Hydro Function	Hatchery Effects	Dam/Diversion	Hatcheries
Interior Eel	Mainstem Eel River	Structure	Water Quality	Dam/Diversion	Invasive Species
	Middle Mainstem Eel River	Hydro Function	Sediment	Dam/Diversion	Roads
	Upper Mainstem Eel River	Hydro Function	Barriers	Dam/Diversion	Roads
	Middle Fork Eel River	Structure	Water Quality	Channelization	Roads
	South Fork Eel River	Structure	Hydro Function	Dam/Diversion	Roads
	North Fork Eel River	Water Quality	Sediment	Roads	Fire

Recovery Strategy (Chapters 4 and 6)

The goal of this Plan is to recover the SONCC coho salmon ESU to the point where the species no longer needs the protections afforded by the Federal ESA and can be removed from the ESA list of threatened and endangered species. A recovered SONCC coho salmon ESU will be naturally self-sustaining, and the factors that caused it to be listed will be sufficiently reduced to allow it to persist over time.

The strategy to recover SONCC coho salmon is to carry out recovery actions to restore habitat and reduce stresses and threats, so that populations will rebuild to the levels needed to play their respective roles in recovery, as described in Figure ES-3. These levels are associated with target minimum extinction risks, also shown in Figure ES-3.

Each population must play a role in rebuilding to a recovered ESU. These roles are described in Williams et al. (2008). A certain number of independent populations must be at low risk of extinction to achieve recovery. These populations are called "Core populations" in this plan. A subset of remaining independent populations must be at moderate risk of extinction (and recover to hundreds to low thousands of fish). These populations are called "Non-Core 1 populations". The remaining populations don't need a minimum number of fish, instead they must have sufficient habitat occupied by juvenile fish. These populations are called "Dependent" and "Non-Core 2" populations. Figure ES-4 shows the role of each population.

In 2008, NMFS developed an assessment framework to track the SONCC coho salmon ESU's progress toward recovery (Williams et al. 2008 and Chapters 2 and 4 of this plan). The framework describes a needed configuration of populations with different numbers of spawning adults in various populations such that populations will play different roles in recovery (i.e., when describing core, non-core, dependent) but does not identify which independent populations will be core and which will be non-core. This recovery plan describes which populations will be core and non-core, and identifies the number of spawning adults needed and the needed spatial distribution of juvenile fish for each population. The number of spawning adults needed is based on the population's role in recovery and on the amount of modeled IP-km in each population.
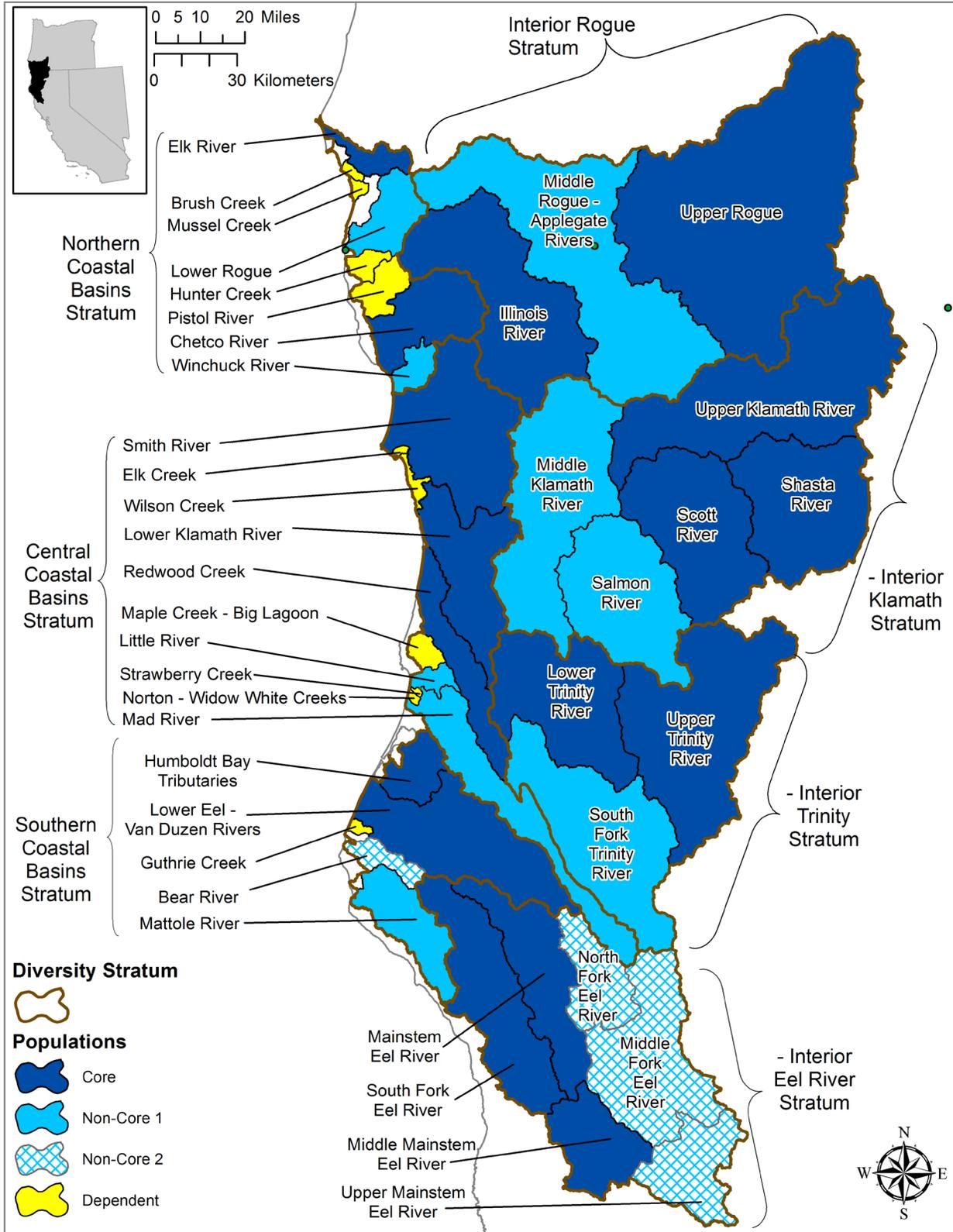
Figure ES-4. The role of each population in the recovery of the SONCC coho salmon ESU.

Table ES-2 shows the recovery objectives and criteria for each population type. There are recovery objectives for four biological parameters of each population: spawner abundance, productivity (growth rate), spatial structure, and diversity (Table ES-2). The Plan's recovery criteria, explained in Chapter 4 and shown in Table ES-2, describe how progress toward each recovery objective will be measured.

Table ES-2. Recovery objectives and criteria by Viable Salmonid Population parameter.

VSP Parameter	Population Role	Biological Recovery Objective	Biological Recovery Criteria[1]
Abundance	Core	Achieve a low risk of extinction[2]	The geometric mean of wild adults over 12 years meets or exceeds the "low risk threshold" of spawners for each core population[2,3,4]
	Non-Core 1	Achieve a moderate or low risk of extinction[2]	The annual number of wild adults is greater than or equal to four spawners per IP-km for each non-core population[2]
Productivity	Core and Non-Core 1	Population growth rate is not negative	Slope of regression of the geometric mean of wild adults over the time series ≥ zero[4]
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed	Annual within-population juvenile distribution ≥ 80%[4] of habitat[5,6] (outside of a temperature mask[7])
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity	≥ 80% of accessible habitat[4] is occupied in years[8] following spawning of cohorts that experienced high marine survival[9]
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish	Proportion of hatchery-origin adults (pHOS) < 0.05
	Core and Non-Core 1	Achieve life-history diversity	Variation is present in migration timing, age structure, size and behavior. The variation in these parameters[10] is retained.

[1] All applicable criteria must be met for each population in order for the ESU to be viable.

[2] See Table 4-2 for specific spawner abundance requirements needed to meet this objective.

[3] In the Shasta River, Upper Trinity River, and Upper Rogue River populations, IP above some anthropogenic dams was excluded from the spawner target, so the low-risk threshold for these populations is based on the IP downstream of those dams.

[4] Assess for at least 12 years, striving for a coefficient of variation (CV) of 15% or less at the population level (Crawford and Rumsey 2011).

[5] Based on available rearing habitat within the watershed (Wainwright et al. 2008). For purposes of these biological recovery criteria, "available" means accessible. 80% of habitat occupied relates to a truth value of +1.0,(true: juveniles occupy a high proportion of the available rearing habitat within the watershed (p. 56, Wainwright et al. 2008).

[6] The average for each of the three year classes over the 12 year period used for delisting evaluation must each meet this criterion. Strive to detect a 15% change in distribution with 80% certainty (Crawford and Rumsey 2011).

[7] Williams et al. (2008) identified a threshold air temperature, above which juvenile coho salmon generally do not occur, and identified areas with air temperatures over this threshold. These areas are considered to be within the temperature mask.

[8] If young-of-year are sampled, sampling would occur the spring following spawning of the cohorts experiencing high marine survival. If 1+ juveniles are sampled, sampling would occur approximately 1.5 years after spawning of the cohorts experiencing high marine survival, but before outmigration to the estuary and ocean.

[9] High marine survival is defined as 10.2% for wild fish and 8% for hatchery fish; Sharr et al. 2000. If marine survival is not high, then this criterion does not apply.

[10] This variation is documented in the population profiles in Chapters 7 to 46 of this plan.

Recovery Actions

Chapters 5 and 7 to 46 include over 4,000 recovery action steps and their respective priorities. Recovery actions are designed to address acute issues by reducing threats, and to restore processes which create and maintain good coho salmon habitat by reducing stresses. Recovery actions include removal of or establishment of passage at dams; reducing unpermitted diversions; ensuring sufficient water quantity and quality; restoring in-channel habitat and upslope ecological function; and creating suitable estuarine nurseries. In addition, managing fisheries, reducing detrimental effects of land use activities; decreasing disease and non-native predator species, and operating hatcheries consistent with recovery goals are essential. Each recovery action is assigned a priority. The priority of each action is based on whether it will prevent a significant decline in the population or habitat, whether it addresses a key limiting stress or threat, whether it would help a population at high risk of extinction, and whether it would benefit coho salmon immediately.

Monitoring & Adaptive Management (Chapter 5)

Monitoring is necessary to assess the recovery of SONCC coho salmon by determining if specific recovery criteria are met, and to evaluate whether changes in the recovery strategy are necessary. The Plan identifies acceptable sampling standards and the necessary data to be collected over time, including measuring the abundance and distribution of coho salmon in each population. The adaptive management element offers a feedback loop for continuous scientific evaluation of the foundational scientific framework, monitoring, and recovery action aspects of the Plan so that new information can suggest whether to add or discontinue actions or strategies. Web-based recovery action implementation tracking tools are under development.

Benefits of Recovery

Achieving delisting of SONCC coho salmon by implementation of the recovery actions identified in the Plan is estimated to cost approximately $5 billion over the amount of time needed to recover the species (just over 100 years). Approximately $1.6 billion of that total cost is associated with monitoring actions required to meet delisting criteria. While a significant investment, the recovery of SONCC coho salmon will concurrently result in a wide array of economic, societal and ecosystem benefits. The largest economic returns resulting from recovered coho salmon populations are associated with sport and commercial fishing. For example, the California commercial and recreational salmon fisheries are estimated to generate a total of $118-279 million[1] in income annually, and provide roughly two to three thousand jobs. These figures will increase as salmon runs increase, providing both economic gains and more commercial and recreational fishing opportunities. With a revived sport and commercial fishery, these substantial economic gains and the creation of jobs would be realized across the SONCC coho salmon range, most notably for river communities and coastal counties.

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[1] Employment impacts of CA salmon fishery closures in 2008 and 2009. University of the Pacific. Available at: http://forecast.pacific.edu/BFC%20salmon%20jobs.pdf

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The economy will also be stimulated through the employment of workers needed to implement recovery projects. Habitat restoration projects stimulate job creation at a level comparable to traditional infrastructure investments such as mass transit, roads, or water projects[2]. Every dollar invested in watershed restoration projects travels through the state's economy. Design, implementation, and maintenance of habitat restoration projects require hiring consultants, contractors, employees, and field crews, and purchasing equipment, goods and services. People hired to carry out such projects spend their wages on goods and services in their local communities. In Oregon, 90% of investments in habitat restoration have been shown to stay in the state[2].

Many of the actions identified in this plan are designed to improve watershed-wide processes which benefit many native species of plants and animals (including other state and federally protected species) by restoring ecosystem functions. In addition, restoration of habitat provides substantial benefits for human communities such as: 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.

Summary

The Plan provides a comprehensive roadmap for the recovery of SONCC coho salmon to be followed by conservation partners. Recovery will require implementation of actions that conserve and restore the key biological, ecological, and landscape processes that support the ecosystems upon which coho salmon populations depend. The Plan identifies specific recovery actions that protect or restore coho salmon or their habitat and outlines a monitoring and evaluation program to guide its adaptive management elements so that the most effective means of achieving recovery will be utilized. Biological recovery goals, objectives and measurable criteria, and web-based management tools, will provide for a mechanism to track recovery progress. 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.

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[2] The Economic Impacts of Forest and Watershed Restoration in Oregon, Available at: http://www.oregon.gov/OWEB/MONITOR/job_creation_local_economies.shtml