4. Conservation and Recovery Goals, Objectives, and Criteria

Chapter 4 describes the goals that frame the State of Oregon's, the State of California's and NMFS's path toward recovery of SONCC coho salmon.

- First, the populations must reach desired levels of biological viability and the recovery effort must reduce the impact of the stresses (limiting factors) and threats in order to warrant removal of the SONCC coho salmon ESU from the threatened and endangered species list (referred to in this plan as either delisting or ESA recovery). Chapter 4 describes the goals and proposed criteria that must be met to delist.

- Second, the States of California and Oregon seek to rebuild wild populations to reach 'broad sense recovery' to provide for sustainable fisheries and other ecological, cultural and social benefits. Section 3.2 describes broad sense recovery goals.

Each population serves a role in recovery. Williams et al. (2008) described the characteristics of a viable ESU which includes different roles for core, non-core, and dependent populations (as explained in Chapter 2). Based on an assessment of the stresses (limiting factors) and threats affecting each of the 39 populations in the ESU (methodology in Appendix B, results in Volume II), as well as a number of other factors such as the current population status, NMFS determined which independent populations were likely to most rapidly respond to recovery actions and meet spawner abundance targets (Appendix C). These populations are designated "core populations." The remaining independent populations are designated "non-core populations." In a fully recovered ESU, core populations must be at low risk of extinction, and non-core populations which are not extirpated must be at a moderate risk of extinction. Basins that once supported dependent populations, as well as basins that once supported independent populations which are extirpated, must support emigrants from other populations. The delisting criteria for each population are described below.

NMFS expects that as habitat is restored and key threats are abated, more coho salmon will be produced. Therefore, the recovery strategy relies on restoration of sufficient habitat to produce the minimum number of spawners needed for each independent population, and in some areas abatement of threats (such as hatcheries in the Trinity basin) which can confound recovery efforts even if habitat is restored. To restore habitat, related stresses (limiting factors) and threats must be sufficiently reduced. The delisting criteria associated with each stress (limiting factor) and threat are detailed below.

Many recovery actions are identified to abate the stresses (limiting factors) and threats in each population. If all these actions are implemented and additional stresses (limiting factors) and threats do not arise, the SONCC coho salmon ESU will have a high probability of meeting the delisting criteria.

4.1 ESA Recovery Goals

The goal of this recovery plan is to prevent the extinction of Southern Oregon/Northern California Coast Coho Salmon (Oncorhynchus kisutch) in the wild and to ensure the long-term persistence of viable, self-sustaining populations of coho salmon distributed across the SONCC

Recovery Domain. . When the SONCC coho salmon ESU is viable, NMFS will consider it recovered, and delist. A viable SONCC coho salmon ESU will be naturally self-sustaining, with a low risk of extinction. To delist, the recovery criteria for both biological and stress (limiting factor) and threat abatement must be met. Recovery of SONCC coho salmon require not only a viable ESU, but also a demonstrated reduction in the stresses (limiting factors) and threats affecting SONCC coho salmon. The specific recovery objectives and criteria are provided below

Delisting criteria are objective, measurable criteria that, when met, would result in a determination by NMFS that the ESU is not likely to become endangered within the foreseeable future throughout all or a significant portion of its range. The delisting criteria described here are not necessarily the only set of criteria that would result in delisting. In addition, as new information emerges, NMFS may revisit the delisting criteria. The status review process is described in Chapter 6.

4.1.1 Biological Objectives

NMFS developed biological objectives based on ESU and population viability metrics established by Williams et al. (2008) and McElhany et al. (2000). At the ESU level, SONCC coho salmon must demonstrate representation, redundancy, connectivity, and resiliency. Representation relates to the genetic and life history diversity of the ESU, which is needed to conserve its adaptive capacity. Redundancy addresses the need to have a sufficient number of populations so the ESU can withstand catastrophic events (NMFS 2010). Connectivity refers to the dispersal capacity of populations to maintain long-term demographic and genetic processes. Resiliency is the ability of populations to withstand natural and human-caused stochastic events, and it depends on sufficient abundance and productivity. For the SONCC coho salmon ESU to demonstrate representation, redundancy, connectivity, and resiliency; core populations must be viable and well distributed; the risk of extinction for non-core populations must be at least moderate; and dependent populations must contain functioning habitat for all life stages of coho salmon.

At the population level, biological recovery objectives are based on the viable salmonid populations (VSP) parameters ((McElhany et al. 2000). SONCC coho salmon populations must achieve sufficient abundance, growth rate, spatial structure, and diversity. Spawner abundance is an important parameter because, all else equal, small populations are at greater risk of extinction than larger populations. Large populations are generally better able to withstand the detrimental effects of environmental variation, genetic processes, demographic stochasticity, ecological feedback, and catastrophes than small populations (Shaffer 1981). Productivity describes the growth rate of a population. Spatial distribution is important to reduce extinction risks from genetic risks and demographic stochasticity. A population’s spatial distribution depends on habitat quality (including accessibility), population dynamics, and dispersal characteristics of individuals in the population. Genetic diversity allows species to adapt to a variety of environments that provide for the needs of the species and protects against short-term environmental change while also providing the genetic material necessary to survive environmental change.

4.1.2 Biological Recovery Criteria

The biological criteria highlight the need for a continuous set of functional populations across the ESU, which together form the basis for a viable ESU. Because core and noncore populations provide the foundation of a viable ESU, specific biological criteria (Table 4-1 and Table 4-2) were developed for these populations based on the viability criteria described in Chapter 2. The viability criteria describe what is needed for the ESU to be viable, but do not prescribe particular criteria for each population, allowing recovery planners to determine the best means to meet the viability criteria. The biological recovery criteria, which are described in Table 4-1, describe what populations must look like to meet the viability criteria. Populations must meet the biological recovery criteria described in Table 4-1 in order for the ESU to be delisted. The biological recovery criteria described in this section reflect NMFS' opinion of how to best achieve a viable ESU most quickly. These biological recovery criteria require that populations demonstrate sufficient abundance, productivity, spatial structure, and diversity. The proposed NMFS approach, built upon the foundation provided by Williams et al (2006 and 2008), allows for refining viability thresholds and perhaps even criteria as critical monitoring and research of biological and habitat attributes is implemented across the ESU. As more information becomes available and NMFS gains greater understanding of the dynamics of these populations and the ESU, updated viability assessments can be conducted and appropriate refinements can be made. New information, data, research, and time series information longer than several generations could suggest either greater or lower values for the various criteria.

Table 4-1. Biological recovery objectives and criteria for SONCC coho salmon.

VSP Parameter	Population Type	Recovery Objective	Recovery Criteria
Abundance	Core	Achieve a low risk of extinction[1].	The geometric mean of wild spawners over 12 years at least meets the "low risk threshold" of spawners for each core population[1, 2]
	Non-Core 1	Achieve a moderate or low risk of extinction[1]	The annual number of wild spawners meets or exceeds the moderate risk threshold for each non-core population[1, 2]
Productivity	Core and Non-Core 1	Population growth rate is not negative.	Slope of regression of the geometric mean of wild spawners over the time series ≥ zero[2]
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed	Annual within-population distribution ≥ 70%[4] of habitat[3,4] (outside of a temperature mask[5])
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity	20% of accessible habitat[4] is occupied in years following spawning of cohorts that experienced good marine survival[6]
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish.	Proportion of hatchery-origin spawners (pHOS) ≤ 0.10
	Core and Non-Core 1	Achieve life history diversity.	Variation is present in migration timing, age structure, size and behavior. Variation in these parameters which is documented in recovery plan is retained.

[1] See Table 4-2 for specific spawner abundance requirements.
[2] 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).
[3] Based on available rearing habitat within the watershed (Wainwright et al. 2008). In NMFS' definition, "available" means accessible. 70% of habitat occupied relates to a truth value of approximately 0.60, providing a "high" certainty that juveniles occupy a high proportion of the available rearing habitat (Wainwright et al. 2008).
[4] 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).
[5] 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.
[6] High marine survival is defined as 10.2% for wild fish and 8% for hatchery fish; Sharr et al. 2000.

Table 4-2. The minimum number of spawners (combination of males and females) needed in each independent (Ind.) population to meet delisting criteria for SONCC coho salmon.

Diversity Stratum	Independent Population	Population Type	Minimum Number of Spawners[1]
Northern Coastal Basins	Chetco River	Core	4,500
	Elk River	Core	2,400
	Lower Rogue River	Non-Core 1	320
	Winchuck River	Non-Core 1	230
Interior-Rogue River	Upper Rogue River	Core	16,100
	Illinois River	Core	11,800
	Middle Rogue and Applegate rivers	Non-Core 1	2,700
Central Coastal Basins	Lower Klamath River	Core	5,900
	Redwood Creek	Core	4,800
	Mad River	Non-Core 1	550
	Smith River	Core	6,800
	Maple Creek/Big Lagoon	Non-Core 2	None- Juv. Occupancy
	Little River	Non-Core1	140
Interior Klamath River	Shasta River	Core	8,700
	Scott River	Core	8,800
	Upper Klamath River	Core	8,500
	Salmon River	Non-Core 1	460
	Middle Klamath River	Non-Core 1	450
Interior-Trinity River	Upper Trinity River	Core	7,300
	Lower Trinity River	Core	3,900
	South Fork Trinity River	Non-Core 1	970
Southern Coastal Basins	Mattole River	Non-Core 1	1,000
	Humboldt Bay tributaries	Core	5,700
	Lower Eel and Van Duzen rivers	Core	7,900
	Bear River	Non-Core 2	None- Juv. Occupancy
Interior-Eel River	South Fork Eel River	Core	9,600
	Middle Mainstem Eel River	Core	6,400
	Mainstem Eel River	Core	4,700
	Middle Fork Eel River	Non-Core 2	None- Juv. Occupancy
	Upper Mainstem Eel River	Non-Core 2	None- Juv. Occupancy

[1] See Table 4-1 for recovery criteria. Abundance estimates should strive for a CV of 15 percent or less at the population level (Crawford and Rumsey 2011).

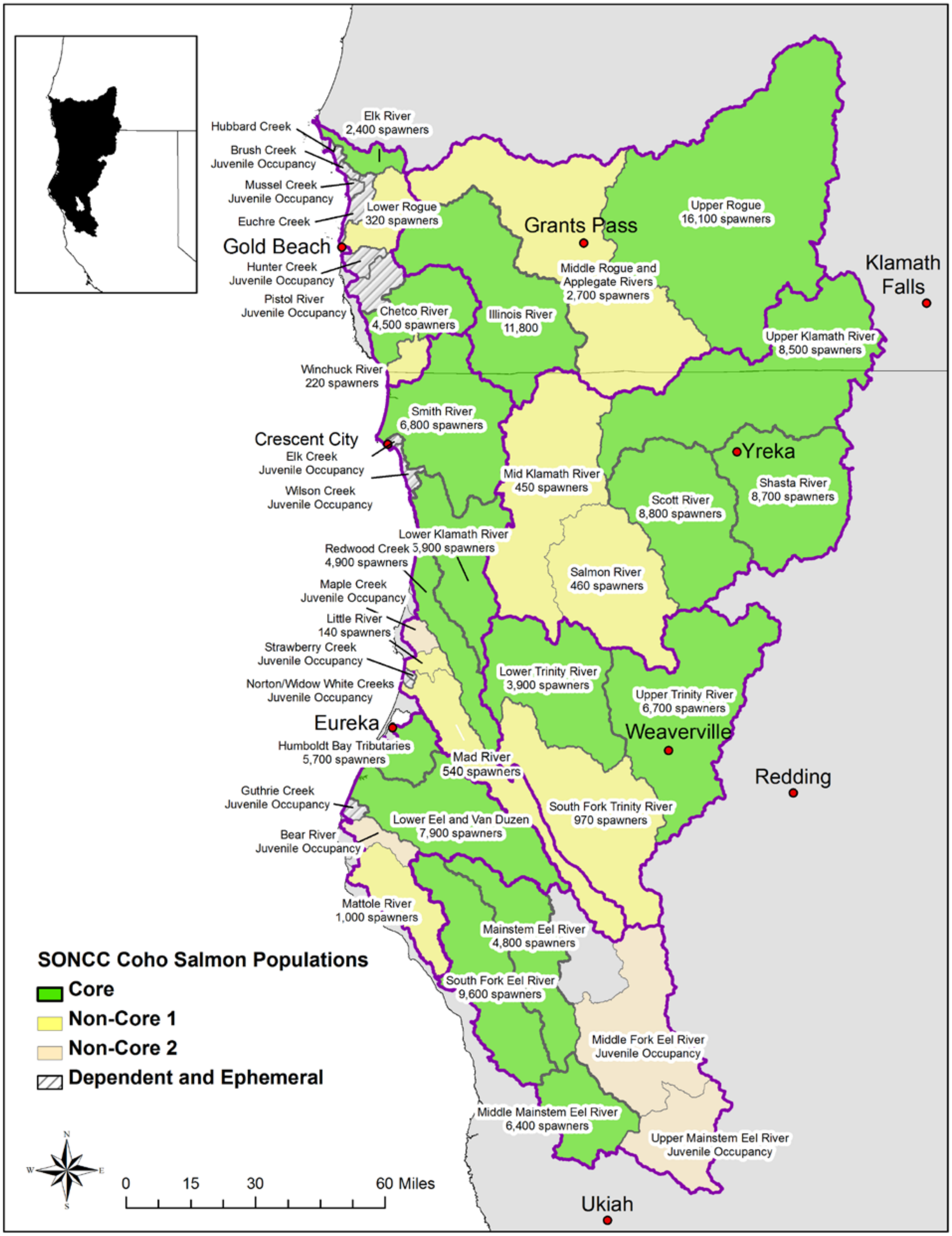

Figure 4-1. Location of core, non-core, and dependent populations and their minimum spawner requirements.

Choice of low-risk threshold

Rationale for choice of low-risk threshold

The following text, excerpted from Williams et al. 2006, explains the rationale behind the low-risk threshold value.

> The establishment of the low-risk threshold of 40 spawners/IP km for the smallest populations was largely dictated by the threshold for viability-in-isolation proposed by Williams et al. (2006) and supported by empirical data and various modeling efforts reported in the literature. To accommodate our assumption that for larger populations a comparable percentage reduction in habitat is less likely to result in a substantial increase in extinction risk as it would in smaller populations, we assume that a population with ten-fold additional habitat potential than the smallest population requires an average spawner density of half that of the smallest population. This captures our general conclusion that the larger the historical population, the more it can depart from historical conditions and remain viable. The function we propose to capture this is a linear decline in required density between 40 spawners/IP km in the smallest populations to 20 spawners/IP km in the watersheds with greater than 10-fold the habitat potential of the minimum watershed (i.e., IP km > 340). The development of this latter reference point was by the NCCC TRT (Spence et al. 2008) after much review and discussion, and although it is based largely on expert opinion, it provides results that are qualitatively consistent with the general hypotheses relating watershed size and density to spatial structure, diversity, and other factors that influence population persistence. The benefits of our approach for these criteria are that it establishes a population-specific abundance that is scaled to the amount of potential habitat and avoids the use of fixed abundance criteria. In addition, this approach captures the elements of spatial structure and diversity that contribute to viability without rigidly defining what the spatial structure must look like. For instance, in a large watershed the density criteria could be satisfied either by having fish distributed throughout the watershed at moderate densities or by having high densities in portions of the available habitat. Each of these scenarios has advantages and disadvantages for population persistence perspective. For example, moderate densities spread throughout a watershed may be more resilient to localized disturbances than populations with more localized groups of fish at densities near carrying capacity densities. Conversely, localized areas of high productivity may be critical for population persistence during periods of unfavorable environmental conditions (Nickelson and Lawson 1998). The amount and distribution of productive habitat available to a population is dynamic and may change over time, especially given the dynamic nature of the geographic area of the SONCC ESU. Currently, we lack the appropriate data to make more spatially explicit criteria on spatial structure, but believe our approach captures the essence of the spatial structure and diversity elements outline by McElhany et al. (2000) for viable salmon populations. Future research and monitoring may allow for the development of explicit population-specific distribution criteria.

Comparison of targets to historical abundance estimates

The following text, excerpted from Williams et al. 2008, describes how the low-risk threshold abundance targets compare to historical fish abundance data.

> Comparisons of historical abundance estimates and hypothetical density-based abundance targets for coastal watersheds in Oregon suggest that our methods do not overestimate the historical carrying capacities of coho salmon populations. Historical abundance estimates for Oregon populations were based on cannery records from 1892 to 1915 (Meengs and Lackey 2005). Meengs and Lackey (2005) estimated historical run sizes from cannery pack records through a series of steps including 1) converting salmon pack data (in cases) into pounds of salmon caught (by assuming a certain constant "waste" in processing); 2) converting pounds of salmon captured into numbers of adult fish (by assuming an average weight for adult fish of 4.46 kg); 3) converting numbers of harvested salmon into an estimate of total population sizes (assuming a specific catch efficiency rate); and 4) using the five years of highest abundance in each watershed as indicative of run size. The abundance targets that would result from application of our density-based criteria are well below, by an order of magnitude, historical estimates of abundance (Table 4-3). In all cases, the target abundance expressed as a percent of the historical estimates of abundance range between 3% and 12% (Table 4-3).
>
> Meengs and Lackey (2005) also estimated salmon run sizes for the Rogue River for the late 1800s based on extrapolations from cannery pack. The historical estimate of coho salmon for the Rogue River was 114,000 and for Chinook salmon it was 154,000 (Meengs and Lackey 2005). The TRT has delineated four independent populations in the Rogue River Basin. The Lower Rogue River population unit is part of the Northern Coastal Basin diversity stratum. The Illinois River population unit, the Middle Rogue/Applegate rivers population unit, and the Upper Rogue River population unit make up the Interior – Rogue River diversity stratum. The ESU viability criterion (detailed in Section 3.2) requires 50% of the stratum total for the spawner density criteria be met for a stratum to be viable, which equates to 22,650, or about 20% of the estimated historical abundance for the greater watershed.
>
> In summary, where there are estimates of historical abundances of coho salmon to compare with abundance targets based on spawner density, the methods described in Williams et al. (2008) do not appear to overestimate the historical carrying capacities of coho salmon populations.

Table 4-3. Comparison of abundance estimates and hypothetical density-based abundance targets for coastal watersheds in Oregon. IP km are integrated IP km values as described by Williams et al. (2006).

Population	Historical estimates of abundance derived from cannery records (Meengs and Lackey 2005)	IP km	Estimated historical spawner density (spawners/IP km)	Projected abundance target based on MRSD (20 spawners/IP km)[a]	Projected abundance target as percent of historical estimate
Nehalam	236,000	1,116	211	22,300	9.3%
Tillamook	234,000	537	436	10,700	4.7%
Nestucca	107,000	299	358	6,800	6.4%
Siletz	122,000	310	394	6,800	5.6%
Siuslaw	547,000	902	607	18,000	3.3%
Yaquina	65,000	385	169	7,700	12.3%
Alsea	153,000	466	328	9,300	5.9%
Coquille	342,000	883	387	17,700	5.3%
Coos	161,000	552	292	11,000	6.8%

[a] – The Nestucca and Siletz populations have less than 340 IP km, therefore the MRSD values used for these calculations were 23 spawners/IP km for the Nestucca population and 22 spawners/IP km for the Siletz population.

Possible change to low-risk threshold

NMFS developed biological recovery criteria based on the productivity, spatial structure, and diversity components of the viability salmonid population (VSP) framework described by McElhany et al. (2000). Chapter 4 describes the abundance biological recovery criteria for all four VSP parameters, including the low-risk threshold abundance targets identified by Williams et al. (2008). Future research is needed to determine whether the low-risk threshold abundance target could be decreased if the other VSP parameters are well-estimated. Recovery actions for this research are identified for each core population in its respective population profile, to be carried out after these VSP parameters have been monitored for twelve years during the delisting phase.

4.1.3 Stress (Limiting Factor) and Threat Abatement Objectives and Criteria

A number of stresses (limiting factors) currently affect the quantity and quality of habitat for SONCC coho salmon and limit their abundance, spatial structure, diversity, and productivity. Establishing criteria for the listing factors helps ensure that the causes of decline have been abated prior to delisting SONCC coho salmon. To delist SONCC coho salmon, the objectives and criteria for stresses and threats abatement must be met. These stresses and threats abatement objectives and criteria are presented below (Table 4-4 and Table 4-5), and organized according to the five listing factors introduced in Chapter 3. Criteria for some stressors are based on reference data values which reflect the habitat needs of coho salmon. Use of these indicators to determine the stress ranks is described in Appendix B and is summarized in Table 4-4 and Table 4-5.

Table 4-4. Recovery objectives and criteria for the stress (limiting factor) and threat abatement.

Listing Factor	**Stress/Threat**	**Recovery Objective**	**Recovery Criteria**
A. Habitat Destruction, Modification or Curtailment	Lack of floodplain and channel structure	*Good*[1] quality habitat must be available to support SONCC coho salmon populations.	Floodplain and channel structure has at least *good*[1] conditions suitable for all life stages of coho salmon in targeted areas (to be determined)[2].
	Altered sediment supply		Sediment supply has at least *good*[1] conditions suitable for all life stages of coho salmon in targeted areas (to be determined)[2] of core and non-core independent populations[2].
	Altered hydrologic function		Hydrologic function has at least *good*[1] conditions suitable for all life stages of coho salmon in targeted areas (to be determined)[2] of core and non-core independent populations[2].
	Impaired water quality		Water quality has at least *good*[1] conditions suitable for all life stages of coho salmon in targeted areas (to be determined)[2].
	Degraded riparian forest		Riparian forest conditions has at least *good*[1] conditions suitable for all life stages of coho salmon in targeted areas (to be determined)[2].
	Barriers		Barriers do not limit access to targeted areas (locations to be determined)[2].
	Impaired Estuary Function		All estuaries in the ESU contain estuarine wetland habitat and connected off-channel habitat (e.g., back and side channels, sloughs, tidal channels, alcoves, wetlands, beaver ponds) suitable for supporting rearing coho salmon[3].
A. Habitat Destruction,	Roads, Timber	Threats must be	The recovery criteria for all the stresses (limiting

Listing Factor	Stress/Threat	Recovery Objective	Recovery Criteria
Modification or Curtailment	Harvest, Channelization, Diking, Agricultural Practices, Dams, Diversions, Mining, Gravel Extraction, and Urbanization	sufficiently abated to result in *good*[1] quality habitat for all life stages of SONCC coho salmon in all populations.	factors) associated with Listing Factor A are met.
B. Over-utilization for commercial, recreational, scientific or educational purposes	Fisheries Bycatch	Commercial, recreational and tribal fisheries impacts must not exceed those levels consistent with SONCC coho salmon recovery.	Commercial, recreational and tribal fisheries impacts do not exceed those levels consistent with SONCC coho salmon recovery.
	Collection	Collection impacts must not exceed those levels consistent with SONCC coho salmon recovery.	Collection impacts do not exceed those levels consistent with SONCC coho salmon recovery.
C: Disease and predation	Disease	Disease and predation must not limit SONCC coho salmon recovery.	Mean mortality and infection from diseases is not higher than natural background levels[4] for coho salmon juveniles and adults in populations where disease is identified as a high or very high stress (limiting factor).
	Predation		Predation and competition from introduced species and hatchery-origin salmonids do not impede recovery of SONCC coho salmon.

Listing Factor	Stress/Threat	Recovery Objective	Recovery Criteria
D: The inadequacy of existing regulatory mechanisms	Land and resource management	Regulatory mechanisms have been maintained and/or established and are being implemented in a way that allows the desired status of the ESU and its constituent populations, as defined by the biological criteria in this recovery plan, to be attained and maintained.	• Regulatory programs that govern land use and resource extraction are in place, enforced, monitored, and adaptively managed and are adequate to ensure effective protection of salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in this recovery plan. • Regulatory programs are in place and are being implemented, monitored, evaluated and adaptively managed adequately to manage fisheries at levels consistent with the biological recovery criteria of this recovery plan. • Regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.
Factor D: The inadequacy of existing	Hatchery management		All hatcheries affecting SONCC coho salmon have NMFS-approved HGMPs, and the effects[5] of the

Listing Factor	Stress/Threat	Recovery Objective	Recovery Criteria
regulatory mechanisms			hatchery are within the levels described in the respective HGMP.
Factor E: Other natural or man-made factors affecting continued existence	Climate change	Natural or anthropogenic threats must not limit SONCC coho salmon recovery.	Recovery criteria for parts of Listing Factor A (altered hydrologic function, impaired water quality, degraded riparian forest conditions, impaired estuary/mainstem function, disease/predation/competition) and parts of Listing Factor D (land and resource management) are met[6].
	Invasive species		Regulatory measures to prevent additional or minimize spread of existing exotic species have been developed and implemented.

1 Based on all of the applicable indicators outlined in Table 4-5.

2 Specific targeted areas will be identified through the habitat assessment identified as the first step of the habitat monitoring protocol (Chapter 5).

3 The location and extent of habitat needed will be identified by studies to completed during recovery plan implementation. These studies are described in the recovery actions identified for each population with an estuary.

Background levels of Ceratomyxa shasta are likely to be in the lowest range of disease we currently observe. In 2011, under good flow and water quality conditions, Ceratomyxa shasta was detected in 16.5 percent (106/644) and Parvicapsula minibicornis was detected in 45.4 percent (133/292) of Klamath Chinook salmon juveniles (True 2011). Chinook salmon are a reasonable surrogate for coho salmon.

5 The concept of the proportion of natural influence (PNI), developed by the Hatchery Science Review Group (HSRG 2004), may be a useful tool for limiting the risks of fitness loss in natural populations due to straying of hatchery fish.

6 These portions of these listing factors were chosen to meet this criterion because they address the stresses (limiting factors) associated with the threat of climate change, as identified in Table 3-2.

Table 4-5. Indicators of aquatic habitat suitability for coho salmon for applicable stresses (limiting factors). (Kier Associates and NMFS 2008 for all stress indicators but disease; True 2011 for disease stress indicators).

Stress (Limiting Factor)	Indicators	Good	Very Good
Lack of Floodplain and Channel Structure	Pool Depths	3-3.3 ft	> 3.3 ft.
	Pool Frequency (length)	41-50%	>50
	Pool Frequency (area)	21-35%	>35%
	D50 (median particle size)	51-60 & 95-110 mm	60-95 mm
	LWD (key pieces[1]/100 m)	2-3	>3
	LWD <20 ft. wide[2]	54-84 pieces[3]/mi	>85 pieces[3]/mi
	LWD 20-30 ft. wide[2]	37-64 pieces[3]/mi	>65 pieces[3]/mi
	LWD >30 ft. wide[2]	34-60 pieces[3]/mi	>60 pieces[3]/mi
Altered Sediment Supply	% Sand <6.4mm (wet)	15-25%	<15%
	% Sand <6.4mm (dry)	12.9-21.5%	<12.9%
	% Fines <1mm (wet)	12-15%	<12%
	% Fines <1mm (dry)	8.9-11.1%	<8.9%
	V Star (V*)	0.15 - 0.21	<0.15
	Silt/Sand Surface (% riffle area)	12-15%	<12%
	Turbidity (FNU)[4]	120-360 hrs > 25 FNU	<120 hrs >25 FNU
	Embeddedness (%)	25-30	<25
Impaired Water Quality	pH (annual maximum)	8.25-8.5	<8.25
	D.O. (COLD) (mg/l 7-DAMin)	6.6-7.0 mg/l	>7.0 mg/L
	D.O. (SPAWN) (mg/l 7-DAMin)	10.1-11 mg/l	>11.0 mg/l
	Temperature (MWMT[5])	16-17° C	<16° C
	Aq Macroinverts (EPT)	19-25	>25
	Aq Macroinverts (Richness)	31-40	>40
	Aq Macroinverts (B-IBI)	60.1-80	>80
Degraded Riparian Forest Conditions	Canopy Cover (% shade)	71-80%	>80%
	Canopy Type (% Open + Hardwood)	20-30%	<20%
	Riparian Condition (conifers >36" dbh / 1000ft for 100 ft wide buffer)	125.1-200	>200
Disease	Ceratomyxa shasta juvenile infection rate	No greater than background levels: As of 2011, background level was 17%	

Stress (Limiting Factor)	Indicators	Good	Very Good
Disease	Parvicapsula minibicornis juvenile infection rate	No greater than background levels: As of 2011, background level was 45%	

1 Key pieces of large woody debris are pieces with a minimum diameter of 60 cm (2 feet) and a minimum length of 100 m (33 feet) (Foster et al. 2001).
2 The number of pieces of wood in streams with a wetted width of less than 20 feet, between 20 and 30 feet, or greater than 30 feet (TNC 2006).
3 Pieces of wood are defined as all wood pieces that are greater than 12 inches in diameter at 25 feet from the large end (TNC 2006).
4 Formazin Nephelometric Units.
5 Maximum weekly maximum temperature: Average of the daily maximum temperatures during the warmest 7-day period of the year.

4.2 Broad-Sense Restoration

Once SONCC coho salmon is delisted, returning wild coho salmon spawners may number in the tens of thousands, but may not be numerous enough to maximize all available spawning habitat throughout the ESU. Many streams may remain unoccupied by coho salmon. Tens of thousands of fish may not be enough to maintain a fishery. Cultural, economic, and ecological benefits of having numerous coho salmon spawning throughout the ESU are not maximized under a scenario where only delisting is achieved. While the delisting criteria need to be specific and measurable, broad-sense restoration is open-ended.

The recovery objectives and criteria define which populations must be at low risk of extinction to delist, but other populations have the potential to achieve a low risk of extinction as well. Broad-sense restoration means maximizing the viability of all populations. The goal of broad-sense restoration is to achieve a low risk of extinction for all independent populations in the SONCC, both core and non-core populations. Broad sense restoration is a long-term goal. Enhancing the abundance, spatial structure, diversity and productivity of the non-core and dependent populations beyond the recovery objectives and criteria is not required. However, doing so would increase resiliency of SONCC coho salmon, with associated opportunities for cultural, economic, and ecological benefits.

All 39 populations of SONCC coho salmon have a profile that summarizes available scientific data and other pertinent information, including the stresses (limiting factors) and threats affecting that population. These population profiles help guide restoration and recovery efforts for coho salmon and their habitats. Not only are the population profiles useful for guiding recovery, but they are also available for stakeholders to use to implement broad-sense restoration. The recovery action table in each profile includes actions needed for each population to contribute to ESU viability. Implementing recovery actions that are necessary to provide for recovery of the species/ESU (i.e., actions with priorities 1-3) pertain to the delisting criteria. Implementing all recommended actions (i.e., non-prioritized actions [NA]) in addition to the actions necessary to provide for recovery of the species/ESU would facilitate broad-sense restoration.

4.2.1 Oregon's Broad-Sense Recovery Goal

Oregon's broad sense recovery goal is to achieve populations of naturally produced salmon and steelhead which are sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) that the ESU as a whole (a) will be self-sustaining, and (b) will provide significant ecological, cultural, and economic benefits.

This recovery goal was developed under Oregon's native fish conservation policy (ODFW 2003b) to fulfill the mission of the Oregon Plan for Salmon and Watersheds (State of Oregon 1997). The Oregon Plan for Salmon and Watersheds is founded on the principle that citizens throughout the region value and enjoy the substantial ecological, cultural and economic benefits that derive from having healthy, diverse populations of salmon and steelhead. The 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 needed to remove the ESU from ESA protection. Broad-sense recovery incorporates ESA delisting goals in the sense that ESA delisting goals would be achieved first during an extended and stepwise process of achieving broad sense recovery goals.

Oregon's broad-sense recovery goal for the SONCC coho salmon ESU has not yet been agreed upon by a public advisory committee. The goal described above was developed for other recovery plans in Oregon and will be used as a placeholder until a public advisory committee has been formed and provided guidance on the broad-sense goal for Oregon SONCC coho populations.

Oregon's broad-sense recovery goal is consistent with one of the goals in the State of California's Recovery Strategy for California Coho Salmon (CDFG 2004). Goal VI of that plan reads: "Reach and maintain coho salmon population levels to allow for the resumption of Tribal, recreational, and commercial fisheries for coho salmon in California."

4.2.2 Oregon's Broad Sense Recovery Criteria

The State of Oregon developed broad-sense criteria that go beyond the criteria for ESU delisting. These broad-sense criteria are designed to attain population goals that will provide significant ecological, cultural, and economic benefits consistent with the Oregon Plan (State of Oregon 1997).

Oregon's broad-sense recovery criteria are:

• All SONCC coho salmon populations have a "very low" extinction risk and are "highly viable"[1] over 100 years throughout their historic range; and

• The majority of SONCC coho salmon populations are capable of contributing social, cultural, economic and aesthetic benefits on a regular and sustainable basis.

[1] Having a "very low" extinction risk is equivalent to being "highly viable" in the parlance of population status assessment for recovery plans. A "highly viable" naturally-producing salmonid population with a "very low" extinction risk has less than a 1% probability of extinction over a 100-year period, corresponding to at least a 99% persistence probability. Probabilities result from an integrated assessment of the population's abundance, productivity, spatial structure, and diversity statuses