10. Lower Rogue River Population

- Northern Coastal Stratum
- Non-Core, Potentially Independent Population
- High Extinction Risk
- 320 Spawners Required for ESU Viability
- 198 mi^2
- 81 IP km (50 mi) (24% High)
- Dominant Land Uses are Timber Harvest and Agriculture
- Principal Stresses are ‘Lack of Floodplain and Channel Structure’ and ‘Impaired Water Quality’
- Principal Threats are ‘Roads’ and ‘Urban/Residential/Industrial Development’

10.1 History of Habitat and Land Use

Historically, beaver ponds created ideal habitat for coho salmon and likely existed in side channels of the valley floor and in the lowlands of tributaries all the way to the estuary [Oregon Department of Fish and Wildlife (ODFW) 2005b]. Timber near the coast was in stands separated by large meadows, which were regularly burned by Native Americans (Hicks 2005). Anglo-American settlement began with the gold rush in 1853. Canneries were established as early as 1861 (Hicks 2005) on the shores of the estuary and thrived until salmon stocks were depleted around 1930. Around the same time, larger wood jams which interfered with net fishing or shipping were removed (Hicks 2005). Grazing was once widespread in the Lower Rogue River watershed (Hicks 2005), with tens of thousands of sheep and cattle feeding in upland prairies. In the early to mid-1900s, agricultural use shifted to development of dairies, which led to the clearing of riparian vegetation from river terraces for conversion to pasture (Hicks 2005). Streams with mild gradient and broad valleys (ideal coho salmon habitat) were ideal pasture land, so forests were cleared to accommodate grazing which led to simplified channels.

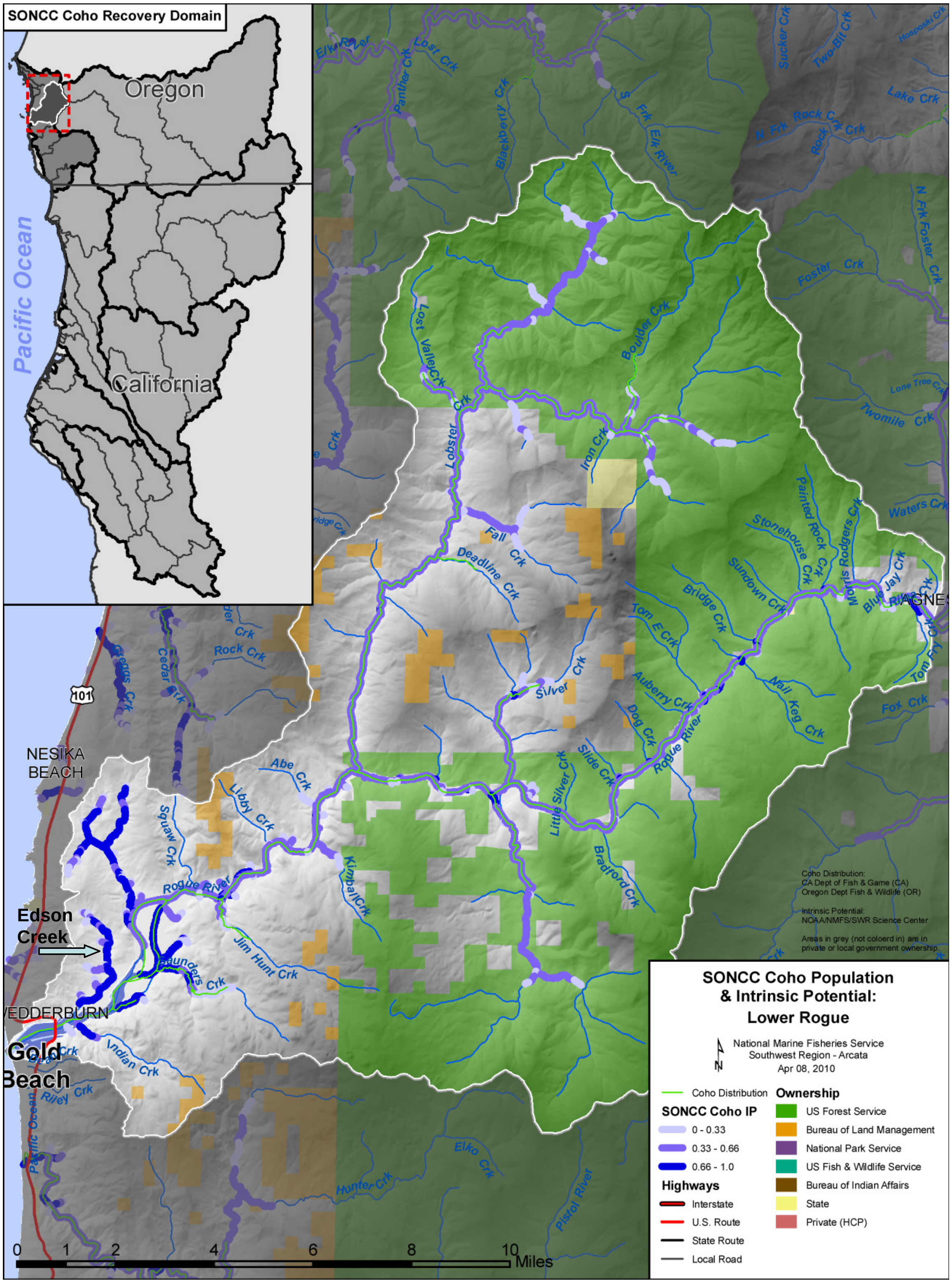

Figure 10-1. The boundaries of the Lower Rogue River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2010a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Rogue diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

The most profound change to the Lower Rogue River resulted from logging after World War II (U.S. Forest Service (USFS) 2000a). Most old growth timber in the Lower Rogue River subbasin has been logged (USFS 1996b, 2000a; Hicks 2005), with remnant patches scattered on federal lands in basins like Quosatana, Silver, and Lobster creeks as well as in inner gorge tributaries of the mainstem Rogue River below Agness. The flood of 1964 devastated Lower Rogue River tributary channels and a wave of sediment swept through the lower mainstem (USFS 2000a). Low gradient streams (formerly the best sites for coho salmon spawning and rearing) were the most impacted by sediment depositions. Logging on public lands resumed after 1970 and another wave of sediment was unleashed (USFS 1996b). The Lower Rogue continues to be impacted by the timber harvest that occurred on National Forest land during the 1970s and 1980s. During this period, harvests and expanding road networks were increasingly located on steep ground, and subsequent landslides during storm events contributed massive inputs of fine sediments into streams (USFS 2000a). Aquatic habitat remains compromised by elevated water temperatures and sediment levels decades after the initial impacts.

Mainstem Rogue River flow was diminished due to construction of Lost Creek Dam in the Upper Rogue in the 1970s (Figure 10-1), but flows from the dam were later increased to prevent the loss of spring-run Chinook salmon and are now thought to be adequate for mainstem ecosystem function of the Lower Rogue (Hicks 2005). Before disturbance, the estuary occasionally barred up and formed a lagoon (Hicks 2005). The Rogue River mouth now remains open due to the construction of jetties in 1960 to maintain navigability, which changed the estuary circulation and accelerated currents (Hicks 2005). Marina development eliminated the largest track of saltwater wetlands, and levees further upstream cut off access to tributaries and sloughs. The human population of Gold Beach is modest (1,847) and not believed to be increasing. Effects of urbanization and residential development in the Lower Rogue River subbasin are moderate (Hicks 2005), but domestic water use and wastewater treatment related to rural development are regional concerns (Southwest Oregon Resource Conservation and Development Council (SO RC&D) 2003).

10.2 Historic Fish Distribution and Abundance

While the Rogue River basin still produces many coho salmon, the indigenous stock adapted to the Lower Rogue River subbasin is diminished in range and abundance (USFS 2000a). Meengs and Lackey (2005) used the cannery data from near the mouth of the Rogue River in the late 1880s to estimate annual catches of 114,000 adult coho salmon; however, there is no way to know how many of these fish were returning specifically to the lower Rogue River area. Because this subbasin constitutes about 6 percent of the entire Rogue watershed area, an estimate of approximately 7,000 coho salmon could have spawned in the Lower Rogue River. Williams et al. (2006) used models to estimate that the Lower Rogue had 80.9 intrinsic-potential kilometers (IP km) of coho salmon habitat, with the highest IP habitats concentrated mostly in tributaries near the estuary (Figure 10-1). An estimated 37 coho salmon spawners would be needed to fully utilize each IP km, and would have produced an annual coho salmon population of 3,000 adults (Williams et al. 2008).

The highest IP (IP >0.66) habitat for coho salmon in the Lower Rogue River is in Indian, Saunders, God Wants You, Jerrys Draw and Edson creeks and an unnamed northern estuarine tributary (Figure 10-1). Jim Hunt Creek has a small patch of high IP at its confluence with the mainstem Rogue River. Steep tributaries upstream of Lobster Creek, such as Silver, Quosatana and Tom Fry creeks also have high IP reaches just above their confluence with the mainstem Rogue River. Table 10-1 lists all tributaries with the highest IP coho salmon habitat. Alluvial flats of the Lower Rogue mainstem also have segments of high IP habitat all the way up to Agnes, especially downstream of tributaries that add coarse sediment for spawning and flatten stream gradient locally.

Table 10-1. Tributaries with instances of high IP reaches (IP > 0.66) from Williams et al. (2006).

Stream Name	Stream Name
Edson Creek	Quosatana Creek
God Wants You Creek	Rogue River- Estuary
Indian Creek	Rogue River- Lower Mainstem
Jerrys Draw	Saunders Creek
Jim Hunt	Silver Creek
Kimball	Tom Fry Creek

10.3 Status of Lower Rogue River Coho Salmon

Spatial Structure and Diversity

Although they contain high IP (>0.66), the following areas are not known to currently support coho salmon: Edson Creek, Kimball Creek, Jim Hunt Creek, Indian Creek, Saunders Creek, and unnamed north-side tributaries to the estuary. Monitoring reports for the years 1998 through 2004 indicated that coho salmon are well distributed but at low levels in Lobster Creek, Quosatana Creek, Silver Creek, and Tom Fry Creek (ODFW 2005a). Many reaches in these streams are not prime coho salmon habitat due to the steep gradient (USFS 2000a). Genetic diversity has likely diminished as coho salmon have disappeared from productive tributaries and the population has declined. In addition, most spawners are of hatchery origin (Jacobs et al. 2002)

Population Size and Productivity

In 2001, Rogue River basin-wide monitoring indicated 32,962 adult coho salmon (Oregon State University (OSU) 2009, ODFW 2009b); however, ODFW (2009a) estimated a maximum of 235 spawners in the Lower Rogue River during the period 2000 to 2008 (Table 10-2). These escapement estimates suggest one year class may be weaker than the others – that observed in 2000, 2003, and 2006. The highest three year running average in the period 2000-2008 was 172 (from 2001 to 2003).

Table 10-2. Estimates of annual spawning escapement. Coho salmon escapement for the Lower Rogue River, 1998 to 2008.

Year	Population Estimate	Year	Population Estimate	Year	Population Estimate
1998	0	2002	205	2006	35
1999	0	2003	75	2007	193
2000	59	2004	127	2008	184
2001	235	2005	127		
Source: ODFW 2009a.					

Surveys completed from 1998 to 2003 (Hicks 2005) in the Lower Rogue River subbasin found coho salmon spawners in lower Lobster Creek (19 individuals), South Fork Lobster Creek (46 individuals), Silver Creek (18 individuals), and Quosatana Creek (5 individuals). During juvenile coho salmon surveys (ODFW 2005a) in the Lobster Creek watershed from 1998 to 2004, presence was zero of four years in Boulder Creek, one of two years in Deadline Creek, one of seven years in North Fork Lobster Creek, and four of six years in lower Lobster Creek. South Fork Lobster Creek, on National Forest land, is the only site with observed annual juvenile coho salmon presence, but juvenile density there is very low (0.000 to 0.110 coho salmon per m^2) (ODFW 2005a). The growth rate of the Lower Rogue River coho salmon population is unknown but likely negative, given that successful recruitment is consistent only in the South Fork Lobster Creek.

Huntley Park seine mark-recapture seine estimates occur in the Lower Rogue River (river mile 8) and are the most robust and precise estimates of adult coho salmon abundance in the Rogue River (ODFW 2011a). It is impossible to determine, with existing information, how many of the estimated coho salmon at Huntley Park were returning to the Lower Rogue River as opposed to other sub-basins in the Rogue River basin. The trend in abundance at Huntley Park can inform whether the population is at high risk of extinction according to the population decline criterion (Williams et al. 2008). The three year running average number of adults estimated at Huntley Park has declined at an annual rate of 12% over the last 12 years (1-2), greater than the 10% decline associated with a high risk of extinction (Williams et al. 2008). Therefore, the population is at high risk of extinction due to its sharply declining productivity.

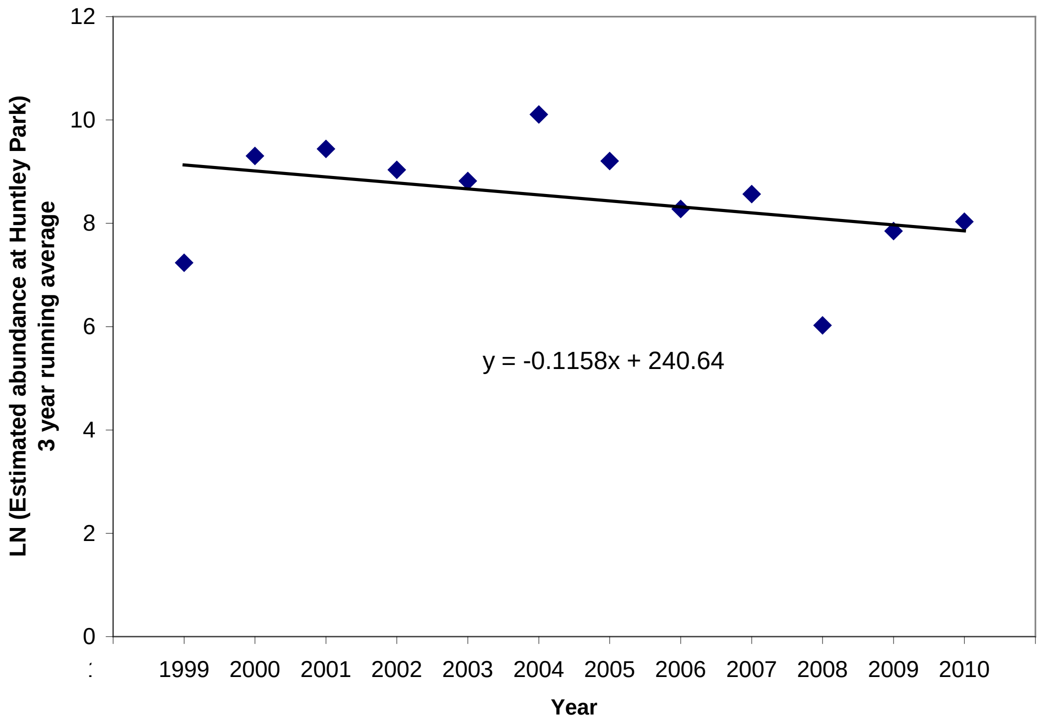

Figure 10-2. Rate of decline of estimated population abundance at Huntley Park, 1999-2010. (Data from ODFW 2011a).

Extinction Risk

The Lower Rogue River coho salmon population is not viable and at high risk of extinction. Although the three year running average of the estimated number of spawners from 2006 to 2008 exceeds the depensation threshold, the estimated number of spawners at Huntley Park has declined at a rate greater than 10% over the past four generations (Figure 1-2) and more than 5% of spawning adults are likely of hatchery origin (Figure 10-2.

Role in SONCC Coho Salmon ESU Viability

With an estimated 3,000 adult coho salmon produced annually before the 1800s (Williams et al. 2008), the Lower Rogue River was likely a source of strays for adjacent dependent populations of coho salmon such as Euchre and Hunter creeks. If restored, the Lower Rogue River population could serve as an occasional source of immigrants to larger nearby independent populations such as those in the Elk River and the interior Rogue River. Restored habitat in the Lower Rogue River and its tributaries would provide for connectivity between populations which assists metapopulation function in the SONCC coho salmon ESU.

10.4 Plans and Assessments

State of Oregon

Expert Panel on Limiting Factors for Oregon's SONCC coho salmon populations

ODFW (2008b) convened a panel of fisheries and watershed scientists as an initial step in their development of a recovery plan for Oregon's SONCC coho salmon populations. Deliberations of the expert panel provided ODFW with initial, strategic guidance on limiting factors and threats to recovery. Based on the input of panel members, concerns for the Lower Rogue River are as follows:

> Key concerns for the Lower Rogue River were primarily loss of over-winter tributary habitat for juveniles, especially in the lowlands which are naturally very limited in this system and have been impacted by past and current forestry practices and rural residential development. Another key concern is limited habitat complexity for pre-smolts due to a loss of large wood transport into the freshwater portions of the estuary. Secondary concerns were related to high water temperatures in tributaries for summer parr (excluding the mainstem, where rearing is not expected) due to land management and reduced estuarine habitat for pre-smolts and smolts due to past and current forestry practices and rural residential development.

Rogue River TMDL

The Rogue River TMDL (Oregon Department of Environmental Quality 2008) includes an extensive treatise on the water quality impairment of the Upper Rogue River and its tributaries and describes mechanisms that drive pollution of different types, including bacteria, temperature, sedimentation, pH, and dissolved oxygen.

Lobster Creek TMDL and Water Quality Management Plan

The Lobster Creek TMDL and Water Quality Management Plan (ODEQ 2002b) were developed to abate temperature problems in this major Lower Rogue River tributary. A shade model was used in the TMDL process to gauge needs for recovery of riparian zones. ODEQ (2002b) also acknowledged that sediment contributions play a role in channel changes and increased water temperature.

Cumulative Effects of Southwest Oregon Coastal Land Use on Salmon Habitat

OSU Oak Creek Labs conducted a study funded by ODFW and the Oregon Department of Forestry (ODF) to determine relationships between forest harvest and Pacific salmon productivity (Frissell 1992). The study evaluated watersheds along the Oregon coast extending from the Sixes River to the California-Oregon border from 1986 to 1992. The principal findings were as follows: (1) Compared to streams draining mature old growth forests, streams in heavily logged basins had one third less pool area, supported a reduced diversity of Pacific salmon species, and were more likely to have actively eroding banks; (2) Channel instability in heavily logged basins coincided with high failure rates for in-stream structures; (3) Erosion rates have increased basin wide, contributing to chronic habitat damage in downstream alluvial valleys leading to depression or elimination of mainstem spawning populations of Pacific salmon; and (4) With logging rotations of 30 to 50 years, large portions of drainage basins are deforested and made vulnerable to increased erosion before aquatic habitat and fish populations have recovered from the previous episode of disturbance.

Southwest Oregon Salmon Restoration Initiative

The Southwest Oregon Salmon Restoration Initiative provides the framework for coho salmon recovery in southwest Oregon (Prevost et al. 1997) and helped foster formation of watershed councils. This document was prepared as part of a Memorandum of Understanding between ODFW and the National Marine Fisheries Service (NMFS). Many of the recommended restoration measures have been carried out, but others are pending. Prevost et al. (1997) also identified 'core areas' for coho salmon recovery that overlap with areas of high coho salmon density and habitat quality. Streams with this designation include the upper South Fork of Lobster Creek, Quosatana Creek, and Silver Creek.

Lower Rogue Watershed Council

Lower Rogue Watershed Assessment

This extensive assessment on the Lower Rogue River subbasin (Hicks 2005) includes historical accounts, descriptions of land use and aquatic habitat, and a wealth of information on factors that might limit coho salmon and restoration opportunities.

10.5 Stresses

Table 10-3. Severity of stresses affecting each life stage of coho salmon in the Lower Rogue River. Stress rank categories and assessment methods are described in Appendix B, and the data used to assess stresses for the initial threats assessment (described in Appendix B) is presented in Appendix H.

	Stresses (Limiting Factors)	Egg	Fry	Juvenile[1]	Smolt	Adult	Overall Stress Rank
1	Lack of Floodplain and Channel Structure[1]	Medium	Very High	Very High[1]	Very High	Medium	Very High
2	Impaired Water Quality[1]	Medium	Very High	Very High[1]	Very High	Medium	Very High
3	Impaired Estuary/Mainstem Function	-	High	High[1]	Very High	High	Very High
4	Altered Sediment Supply	High	High	High	High	High	High
5	Degraded Riparian Forest Conditions	-	High	High	High	Medium	High
6	Adverse Hatchery-Related Effects	Medium	Medium	Medium	Medium	Medium	Medium
7	Altered Hydrologic Function	Medium	Medium	Medium	Low	Low	Medium
8	Increased Disease/Predation/Competition	Low	Low	Low	Low	Low	Low
9	Barriers	-	Low	Low	Low	Low	Low
10	Adverse Fishery-Related Effects	-	-	-	-	Low	Low

[1] Key limiting factor(s) and limited life stage(s).

Limiting Stresses, Life Stages, and Habitat

The primary stresses to SONCC coho salmon in the Lower Rogue River are the lack of floodplain and channel structure, degraded water quality resulting from high water temperature, and impaired estuarine function. Juveniles are the most limited life stage, due to insufficient summer and winter rearing habitat. Recovery is extremely unlikely without additional summer and winter rearing habitat. Overall, these findings are consistent with those of the Oregon Expert Panel (ODFW 2008b) (Section 10.4), but the expert panel considered water temperature to be only a secondary, not primary, concern. The highest historic IP coho salmon habitat is in the western part of the watershed (Williams et al. 2008), where the land is privately owned and land management is likely to be more intensive. The greatest effects of this management are the loss of rearing habitat when land was reclaimed, and degradation of the remaining habitat by high water temperatures resulting from the lack of mature trees in the riparian zone and the reduction of the amount of water in the river by diversions.

Lack of Floodplain and Channel Structure

The floodplain and channel structure of the Lower Rogue River is highly impaired and constitutes a major limiting stress for coho salmon. Edson Creek has been channelized in many reaches and lacks large wood and pool-riffle structure necessary to support juvenile coho salmon. Libby Creek is one of the most altered Lower Rogue River tributaries due to the dam constructed above its confluence with the Lower Rogue River to create a recreational fishing pond. Channel structure and transport capacity has been completely disrupted in lower Jim Hall Creek and Kimball Creek.

ODFW habitat surveys show poor pool frequency for the upper South Fork Lobster Creek (<10 percent) and fair (10 to 20 percent) conditions in the upper-most reach of the North Fork and one of its tributaries. Pool frequencies increase to good (20 to 35 percent) in the lower reaches of the North Fork (NF) and South Fork (SF) Lobster Creek. The average maximum pool depths ranged from less than 2 feet deep to 3.3 feet deep, with the deepest pools located in lower Lobster and Quosatana creeks. Quosatana Creek has re-developed pool depths of up to 10 feet (USFS 1996b), but it still flows subsurface near its confluence with the Rogue River due to accumulations of fine sediment.

Impaired Water Quality

Water quality in the Lower Rogue River is very poor and constitutes a major limiting stress for coho salmon (USFS 1996b, 2000a; ODEQ 2002b, 2008; Hicks 2005). Coho salmon have a low tolerance for elevated water temperatures (McCullough 1999) and this factor consequently poses a very high level of stress for Lower Rogue coho salmon fry, juveniles and smolts. The ODEQ (2002b, 2008) limit for maximum weekly maximum water temperature (MWMT) is 64° Fahrenheit, which is compatible with coho salmon recovery. Only 36 percent of Lower Rogue locations surveyed met this standard (SO RC&D 2003), and cooler locations were in headwater areas that are too steep for coho salmon to access (USFS 2000a). Inner gorge tributaries of the mainstem Rogue River below Agness have recovered to optimal salmonid rearing temperatures (e.g., Bradford Creek at 59.5 to 61.7° F), providing critical summer refugia. Tom Fry Creek also has a half-mile reach above the mouth that is suitable for coho salmon rearing (USFS 2000a). The Quosatana Creek MWMT from 1991 to 1999 ranged from a low of 66.4° F to a high of 70.9° F (USFS 2000a). Recovery of pool depth in Quosatana Creek (USFS 1996b) may help re-establish cool water temperatures, due to seepage of groundwater from adjacent alluvial deposits, which have been shown to create a deep layer of cold water in healthy streams (U.S. Environmental Protection Agency (EPA) 2003a, ODEQ 2008).

The Lower Rogue River is recognized as having elevated nutrient levels (i.e., phosphorous; ODEQ 2010), but because the source of these nutrients is upstream, solutions to the problem are described in other Rogue River basin profiles. Libby Pond in the Lower Rogue subbasin appears highly enriched with nutrients and has substantial algae blooms. Conditions are conducive to the proliferation of toxic algae, a recognized problem in other Oregon lakes (Jones et al. 2008).

The Oregon Department of Agriculture (Riley 2009) currently has no pesticide data for the south coast Oregon, yet this may be a significant but little recognized region-wide problem for salmonids (Ewing 1999, Laetz et al. 2009).

Impaired Estuary/Mainstem Function

The Rogue River estuary is highly altered and retains little of its historic function downstream of Highway 101 (Figure 10-3; Hicks et al. 2008). Studies elsewhere in Oregon show estuarine tributaries and sloughs can be some of the most important habitat types for rearing coho salmon juveniles (Koehler and Miller 2003, Miller and Sadro 2003, Koski 2009). The lack of habitat in the Rogue River estuary that can be used for refugia likely results in high rates of predation from birds, fish, and pinnipeds. Numerous barriers in tributaries flowing into the estuary prevent use of these important rearing habitats and inhibit proper tidal exchange and greatly diminish opportunities for non-natal rearing in cooler coastal climates. The tributary on the north side of the estuary has been completely channelized and all of the wetlands near its mouth have been filled. Fine sediment from Saunders Creek has also partially filled Snag Patch Slough at its mouth (Hicks 2005).

Figure 10-3. Aerial photo of the Rogue River estuary. Photo shows the boat basin (right), jetties, levees and shoreline development. Photo from Hicks (2005).

Altered Sediment Supply

Altered sediment supply poses an overall high stress to coho salmon in the Lower Rogue River. Sediment contribution from landslides and erosion occurs naturally in the Lower Rogue River basin; however, roads, timber harvest, and bank erosion following removal of riparian vegetation have elevated fine sediment input. Excess fine sediment reduces coho salmon egg viability and may reduce food for fry, juveniles and smolts. Accumulation of excess fine sediment has caused several creeks in the Lower Rogue River subbasin (Quosatana Creek, Jim Hunt Creek, and Kimball Creek) to flow subsurface. Low pool frequency and depth throughout the Lower Rogue River basin are likely due to elevated levels of fine sediment partially filling pools, a lack of scour-forcing obstructions such as large wood, and in some reaches diminished scour due to channel widening. The USFS (1996b, 2000a) and Hicks (2005) recognize elevated fine sediment transport as a major Lower Rogue River limiting stress for salmonids.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions are recognized as the major driving force of water temperature problems in the Rogue River basin (ODEQ 2002b, 2008). These conditions also contribute to the lack of large wood in stream channels in the Lower Rogue (USFS 1996b, 2000a; Hicks 2005). The lack of large woody debris and high water temperatures contribute to the limiting stresses for this population – lack of floodplain and channel structure and impaired water quality. Past land use has led to replacement of riparian conifers with hardwoods on both public and private forest lands in the Lower Rogue River subbasin (USFS 1996b, 2000a; Hicks 2005). Additionally, one of the more important riparian species (Port Orford Cedar) is experiencing a disease epidemic causing loss of this important riparian species in Quosatana Creek (USFS 1996b), and Frissell (1992) recognized the loss of this species as regionally significant.

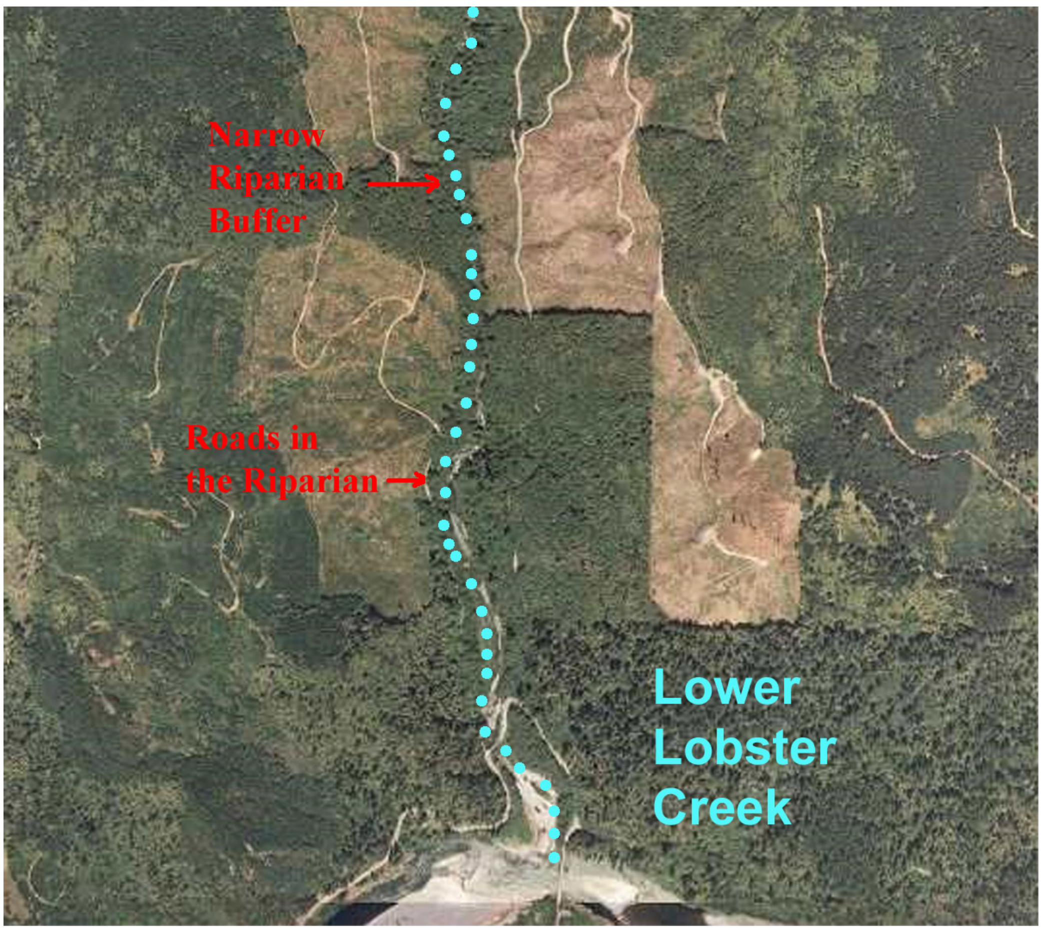

Figure 10-4. Aerial photo of Lower Lobster Creek at its convergence with the mainstem Rogue River. Convergence is at bottom of photo, which shows clear cuts, insufficient buffer widths, high road density and near stream roads. The stream course is shown in blue dots. (Terra Server, www.terraserver.com).

Adverse Hatchery-Related Effects

The effects of hatchery fish on all life stages of coho salmon are described in Chapter 3. No hatcheries or artificial propagation occur in the Lower Rogue population area, but there is an active hatchery in the Rogue River basin. Cole Rivers Hatchery is downstream of Lost Creek

Dam (RM 157) in the Upper Rogue River subbasin. Genetic stress due to introduction of out-of-basin genetic material is not a current concern, because broodstock are currently selected from those fish which return to the hatchery (ODFW 2008d). Hatchery fish are stocked under conditions designed to make them leave the system quickly (ODFW 2008d), but are nonetheless expected to influence wild smolts to some degree. Eighty-two percent of coho spawners observed in Lower Rogue River tributaries in 2001 were of hatchery origin (Jacobs et al. 2002). Adverse hatchery-related effects pose a medium risk to all life stages, due to the presence of Cole Rivers Hatchery in the Rogue River basin (Appendix B).

Altered Hydrologic Function

Water used for agriculture and residential developments in the Lower Rogue River subbasin is modest relative to mainstem flows. The USFS (2000a) rated hydrologic risk as moderate due to timber harvest and road construction, particularly in the transient snow zone. Extensive logging and road building have been hypothesized to diminish summer base flows (Montgomery and Buffington 1993) and likely contributed to increased peak flows. The loss of surface flow in creeks like Jim Hall and Kimball creeks may be due to aggradation, changes in net water yield, or a combination of the two. There is a side channel in the main river at the confluence with Edson Creek, which is the upper extent of the estuary, and cool flows from the tributary may create an important refugium that could be diminishing with increasing residential water use.

Increased Disease/Predation/Competition

Although above-optimal water temperatures can elevate disease risk for coho salmon (McCullough 1999), there are currently no documented problems in the Lower Rogue River. Hicks (2005) raised questions about predation in the simplified estuary, because the lack of cover reduces their ability to avoid predators.

Barriers

High road densities on private lands in the Lower Rogue River subbasin result in a high number of road-stream crossings that are potential juvenile and adult migration barriers. However, surveys have already identified most of the problems in potential coho salmon streams and many of these passage issues have been addressed or have plans in place to be addressed in the near future (Prevost et al. 1997, Hicks 2005). The USFS (2000a) addressed all fish passage problems related to culverts in the NF and SF Lobster Creek and will continue to improve fish passage at road-stream crossings as funds become available. Myers (2001) reported successful fish passage projects on private land in Lobster and Silver creeks.

Adverse Fishery-Related Effects

NMFS concluded that federally- and state-managed fisheries in Oregon are not likely to jeopardize the continued existence of the SONCC coho salmon ESU (Appendix B).

10.6 Threats

Table 10-4. Severity of threats affecting each life stage of coho salmon in the Lower Rogue River. Threat rank categories and assessment methods are described in Appendix B, and the data used to assess threats for the initial threats assessment (described in Appendix B) is presented in Appendix H.

	Threats	Egg	Fry	Juvenile	Smolt	Adult	Overall Threat Rank
1	Roads	Medium	Very High	Very High	Very High	Medium	Very High
2	Urban/Residential/Industrial	Medium	High	High	High	Medium	High
3	Channelization/Diking	Low	High	High	High	Low	High
4	Timber Harvest	Low	High	High	High	Low	High
5	Mining/Gravel Extraction	Low	Low	High	High	High	High
6	Hatcheries	Medium	Medium	Medium	Medium	Medium	Medium
7	Agricultural Practices	Low	Medium	Medium	Medium	Low	Medium
8	Dams/Diversion	Low	Medium	Medium	Medium	Low	Medium
9	Climate Change	Low	Low	Medium	Medium	Medium	Medium
10	High Intensity Fire	Low	Low	Low	Low	Low	Low
11	Road-Stream Crossing Barriers	-	Low	Low	Low	Low	Low
12	Invasive Non-Native/Alien Species	-	Low	Medium	Medium	-	Medium
13	Fishing and Collecting	-	-	-	-	Low	Low

Roads

High road densities, numerous road-stream crossings, and roads on steep slopes combine to pose a critical threat to most coho salmon life history phases in the Lower Rogue River subbasin. The road density in the Lower Rogue River exceeds 2.5 miles of road per square mile (mi/mi^2) of watershed. NMFS (1995) set a limit for road density of 2 mi/mi^2 to protect anadromous salmonids in the interior Columbia River basin to limit sources of fine sediment mobilization. Roads have contributed substantially to increased landsliding and fine sediment yield, including failures at stream crossings (USFS 1996b, 2000a). The most severe erosion potential is when multiple road-stream crossings fail in a single tributary. This occurs when a crossing washes out and creates a slug of debris and fine sediments that wash out crossings further downstream. Miles of Lower Rogue channels have been scoured by these debris torrents, resulting in flattened stream profiles that may require decades to recover. The loss of riparian conifers will require even more time to replace. Private lands feature large numbers of near-stream roads and roads on slopes of greater than 50 percent (Hicks 2005). Most timber haul roads are not surfaced, and chronically contribute fine sediment to streams, although measures are being taken to remedy the problem in Lobster Creek (ODEQ 2002b).

Urban/Residential/Industrial Development

The city of Gold Beach encroaches on the estuary of the Rogue River. Impervious surfaces related to development contribute stormwater runoff and non-point source pollution, as observed elsewhere in the Rogue River basin (ODEQ 2008). Commercial development along the north bank confines the lower estuary. Residential development also occurs in the Lower Rogue River riparian zone upstream to Lobster Creek and may contribute pollutants from leaking septic systems. The high severity of this threat is due to concentrated impacts in areas of the highest IP coho salmon habitat, specifically in Edson Creek, Indian Creek, Saunders Creek, and in the estuary.

Channelization and Diking

Channelization and diking has greatly altered low gradient Lower Rogue River tributaries, the lower mainstem, and the estuary. Channel alteration of Edson Creek and the unnamed northern tributary of the estuary have had the greatest impact on coho salmon production in the Lower Rogue River subbasin because of the extent of high IP coho salmon habitat occurring there. Levees and dikes have been constructed to protect residential or commercial property in the lower seven miles of the Rogue River, decreasing summer and winter coho salmon juvenile rearing habitat and disconnecting the river from its floodplain. Some remaining side channels located in the lower portions of the population area maintain some rearing habitat capacity (Hicks 2005). Side channels cannot reform on the north side of the upper estuary, because of the levees that protect grazing land and a gravel mining operation.

Timber Harvest

Sixty percent of the Lower Rogue River watershed is in federal ownership, and this land currently has low levels of timber harvest. Reeves et al. (1993) found that the rate of timber harvest in Oregon coastal watersheds should not exceed 25 percent of a watershed to minimize risks and disturbances to aquatic resources. The study covered a period of 30 years (Reeves 2003) and watersheds exceeding that level of harvest did not maintain channel integrity or Pacific salmon species diversity. Therefore, the threat from timber harvest on private land will likely remain high. However, logging on public land is now largely restricted to selective harvests in previously logged areas in order to improve forest health. The greatest risk from timber harvest is on private industrial timberlands that are managed under the Oregon Forest Practices Act.

Mining/Gravel Extraction

Gravel mining is ongoing on the terrace of the Lower Rogue River estuary. There are gravel operations on both the north and south banks of the estuary in areas with some of the best restoration opportunities for creating mainstem rearing refugia for coho salmon.

Hatcheries

Hatcheries pose a medium threat to all life stages in the Lower Rogue River sub-basin. The rationale for these ratings is described under the "Adverse Hatchery-Related Effects" stress.

Agricultural Practices

Livestock have been eliminated from prairies on public land (USFS 2000a), but on private land grazing may have significant effects on coho salmon. Pasture in the historic estuarine floodplain restricts side channel development that could provide refugia for rearing coho salmon. Across the subbasin, channel changes caused by conversion of forest to pasture in the highest IP coho salmon habitat are a major inhibitor of coho salmon recovery. Ongoing livestock grazing only contributes to the threat. The primary stream reaches impacted are the unnamed tributary on the north bank of the estuary and Edson Creek. The Oregon Department of Agriculture currently has no means of tracking pesticide use near the Lower Rogue River (Riley 2009), but agricultural use of these substances could be affecting coho salmon (see Water Quality).

Dams/Diversions

Libby Pond on Libby Creek is the only known impoundment within the Lower Rogue River subbasin that prevents access to historical coho salmon habitat. Concerns related to diversions, water use, and stream flows are restricted to Edson and Indian creeks. Problems with the base flow of Edson Creek are likely a combination of surface flow and groundwater extraction for agricultural and residential water use. The city of Gold Beach has a 0.77 cubic feet per second (cfs) water right on Indian Creek (USFS 2000a). Flow depletion is a factor known to contribute to stream warming (Poole and Berman 2001), resulting in loss of potential coho salmon habitat.

Climate Change

Climate change in this region will have the greatest impact on juveniles, smolts, and adults. Although the current climate is generally cool, modeled regional average temperature shows a moderate increase over the next 50 years (see Appendix B for modeling methods). Average temperature could increase by up to 1.5°C in the summer and by 1°C in the winter. Annual precipitation in this area is predicted to stay within the natural range of current variability however seasonal patterns in precipitation likely will occur (Mote and Salathe 2010). Overall, the range and degree of variability in temperature and precipitation are likely to increase in all populations. The vulnerability of the estuary and coast to sea level rise is moderate to high in this population. Juvenile and smolt rearing and migratory habitat are most at risk to climate change. Rising sea level may impact the quality and extent of wetland rearing habitat by inundating freshwater marshes or wetlands with saltwater.

High Intensity Fire

Proximity to the coast and high rainfall make fire risk less of an issue in the Lower Rogue River than in watersheds like the Applegate or Illinois in the interior of the Rogue River basin. Crowded stands of small-diameter trees have increased fire danger (SO RC&D 2003), and such stands are common on private timber lands.

Road-Stream Crossing Barriers

Coho salmon can access most of the Lower Rogue River watershed. Surveys of barriers have been conducted in all lower tributaries and in Lobster and Silver creeks (Hicks 2005) and most issues with fish passage at road-stream crossings have been resolved (Myers 2001). The Libby Pond is a current barrier although it is not a road-stream crossing.

Fishing and Collecting

The directed recreational fishery for hatchery coho salmon in Oregon likely encounters more coho salmon than the Chinook salmon directed fisheries that account for much of the bycatch mortality of SONCC coho salmon. This is because coho salmon are the targeted species in the directed fisheries. The exploitation rate associated with this and other freshwater fisheries in Oregon has been found to be low enough to not likely jeopardize the continued existence of the ESU (Good et al. 2005). The standard applied to make that determination was a jeopardy standard, not a species viability standard, because no recovery objectives to achieve species viability had been established for SONCC coho salmon at that time (NMFS 1999). Regional-scale effects may be enough to impede recovery of the Interior Rogue River diversity stratum, even if they are not severe enough to jeopardize the continued existence of the ESU. Specifically, wild coho salmon in the Rogue River basin likely experience more exploitation effects than those in other areas, because they co-occur with the adult hatchery coho salmon that were produced in the Rogue's Cole Rivers Hatchery, return to the Rogue River to spawn, and are targeted there by recreational fishermen.

NMFS has authorized future collection of coho salmon for research purposes in the Lower Rogue River subbasin. NMFS has determined these collections are not likely to jeopardize the continued existence of the SONCC coho salmon ESU.

Invasive Non-Native/Alien Species

New Zealand mudsnails are known to be present in the Lower Rogue River population area. The mudsnail is a parthenogenic (i.e., asexual) livebearer with high reproductive potential, often reaching densities greater than 100,000/m² in suitable habitat (Portland State University (PSU) 2011). Due to the rapid population growth rates, New Zealand mudsnails may account for the majority of the invertebrate biomass in colonized areas. This species is known to out-compete native invertebrates and contributes little food value to salmonids.

10.7 Recovery Strategy

The most important factor limiting recovery of coho salmon in the Lower Rogue River is the amount of suitable rearing habitat for juveniles. The processes that create and maintain such habitat must be restored. Channel complexity should be improved by constructing off-channel ponds or backwater habitat, reconnecting the wetlands and estuary to the river, restoring wetlands, and limiting development and fill. To increase instream structure, large wood should be added where the channel is stable, to provide structure until natural sources of large wood (mature coniferous and hardwood forests) are re-established next to the stream. Areas adjacent to the stream should be replanted and subsequently thinned to re-establish mature streamside forest as a source of large wood recruitment.

The most immediate need for habitat restoration and threat reduction in the Lower Rogue River is in those areas currently occupied by coho salmon, such as Snag Patch Slough in the estuary, the oxbow at the mouth of Edson Creek, and upper Lobster Creek. The least disturbed aquatic habitat would be a good place to start for restoring vital rearing habitat. Unoccupied areas must also be restored to provide habitat for coho salmon recovery, and the least disturbed areas with IP should be considered first for restoration: South Fork Lobster Creek, North Fork Lobster Creek, Indian Creek, and Saunders Creek (Reeves et al. 1995).

Table 10-5 on the following page lists the recovery actions for the Lower Rogue River population.

Table 10-5. Recovery action implementation schedule for the Lower Rogue River population.

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.1.1.6	Estuary	Yes	Improve connectivity of tidally-influenced habitat	Reconnect estuarine habitat	Estuary, Unnamed Tributary	3
SONCC-LRR.1.1.6.1	*Assess the tidal wetland habitat and develop a plan to reconnect the tributary*					
SONCC-LRR.1.1.6.2	*Reconnect tidal wetlands and tributary, guided by the plan*					
SONCC-LRR.1.2.7	Estuary	Yes	Improve estuarine habitat	Increase regulatory oversight that protects existing estuarine habitat	Undisturbed intertidal and shallow subtidal habitats in the lower estuary, such as the spit forming inside the jetties and the shore near the Coast Guard station.	2
SONCC-LRR.1.2.7.1	*Limit development near tidally influenced habitat, and maintain or strengthen current protection measures*					
SONCC-LRR.1.2.8	Estuary	Yes	Improve estuarine habitat	Restore estuarine habitat	Estuary	3
SONCC-LRR.1.2.8.1	*Assess coho use of different estuarine habitats and develop a plan to enhance those habitats (i.e. brackish wetlands, tidal sloughs, salt marshes, and tidally influenced freshwater)*					
SONCC-LRR.1.2.8.2	*Restore tidally influenced habitats, guided by the plan*					
SONCC-LRR.1.2.25	Estuary	Yes	Improve estuarine habitat	Assess estuary and tidal wetland habitat	Estuary	3
SONCC-LRR.1.2.25.1	*Identify parameters to assess condition of estuary and tidal wetland habitat*					
SONCC-LRR.1.2.25.2	*Determine amount of estuary and tidal wetland habitat needed for population recovery*					
SONCC-LRR.2.1.9	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2
SONCC-LRR.2.1.9.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-LRR.2.1.9.2	*Place instream structures, guided by assessment results*					
SONCC-LRR.2.2.10	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	3
SONCC-LRR.2.2.10.1	*Develop program to educate and provide incentives for landowners to keep beavers on their lands*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.2.2.10.2	*Implement beaver program (may include reintroduction)*					
SONCC-LRR.10.2.26	Water Quality	Yes	Reduce pollutants	Reduce point- and non-point source pollution	Population wide	2
SONCC-LRR.10.2.26.1	*Identify pollution sources, and develop a strategy to meet objective*					
SONCC-LRR.10.2.26.2	*Implement strategy to prevent pollution*					
SONCC-LRR.16.1.12	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Incorporate SONCC coho salmon VSP delisting criteria when formulating salmonid fishery management plans affecting SONCC coho salmon	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3
SONCC-LRR.16.1.12.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-LRR.16.1.12.2	*Identify fishing impacts expected to be consistent with recovery*					
SONCC-LRR.16.1.13	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Limit fishing impacts to levels consistent with recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	2
SONCC-LRR.16.1.13.1	*Determine actual fishing impacts*					
SONCC-LRR.16.1.13.2	*If actual fishing impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery*					
SONCC-LRR.16.2.14	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Incorporate SONCC coho salmon VSP delisting criteria when formulating scientific collection authorizations affecting SONCC coho salmon	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3
SONCC-LRR.16.2.14.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-LRR.16.2.14.2	*Identify scientific collection impacts expected to be consistent with recovery*					
SONCC-LRR.16.2.15	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Limit impacts of scientific collection to levels consistent with recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3
SONCC-LRR.16.2.15.1	*Determine actual impacts of scientific collection*					
SONCC-LRR.16.2.15.2	*If actual scientific collection impacts exceed levels consistent with recovery, modify collection so that impacts are consistent with recovery*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.27.1.16	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate abundance	Population wide	3
SONCC-LRR.27.1.16.1	*Perform annual spawning surveys*					
SONCC-LRR.27.1.17	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate juvenile spatial distribution	Population wide	3
SONCC-LRR.27.1.17.1	*Conduct presence/absence surveys for juveniles (3 years on; 3 years off)*					
SONCC-LRR.27.1.18	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Track indicators related to the stress 'Fishing and Collecting'	Population wide	2
SONCC-LRR.27.1.18.1	*Annually estimate the commercial and recreational fisheries bycatch and mortality rate for wild SONCC coho salmon.*					
SONCC-LRR.27.2.19	Monitor	No	Track habitat condition	Track habitat indicators related to spawning, rearing, and migration	Population wide	3
SONCC-LRR.27.2.19.1	*Measure indicators for spawning and rearing habitat. Conduct a comprehensive survey*					
SONCC-LRR.27.2.19.2	*Measure indicators for spawning and rearing habitat once every 10 years, sub-sampling 10% of the original habitat surveyed*					
SONCC-LRR.27.2.20	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Lack of Floodplain and Channel Structure'	All IP habitat	3
SONCC-LRR.27.2.20.1	*Measure the indicators, pool depth, pool frequency, D50, and LWD*					
SONCC-LRR.27.2.21	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Degraded Riparian Forest Condition'	All IP habitat	3
SONCC-LRR.27.2.21.1	*Measure the indicators, canopy cover, canopy type, and riparian condition*					
SONCC-LRR.27.2.22	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Altered Sediment Supply'	All IP habitat	3
SONCC-LRR.27.2.22.1	*Measure the indicators, % sand, % fines, V Star, silt/sand surface, turbidity, embeddedness*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.27.2.23	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Water Quality'	All IP habitat	3
SONCC-LRR.27.2.23.1	*Measure the indicators, pH, D.O., temperature, and aquatic insects*					
SONCC-LRR.27.2.24	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Estuarine Function'	All IP habitat	3
SONCC-LRR.27.2.24.1	*Identify habitat condition of the estuary*					
SONCC-LRR.27.1.28	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Track life history diversity	Population wide	3
SONCC-LRR.27.1.28.1	*Describe annual variation in migration timing, age structure, habitat occupied, and behavior*					
SONCC-LRR.27.2.29	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Hydrologic Function'	Population wide	3
SONCC-LRR.27.2.29.1	*Annually measure the hydrograph and identify instream flow needs*					
SONCC-LRR.27.1.30	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Refine methods for setting population types and targets	Population wide	3
SONCC-LRR.27.1.30.1	*Develop supplemental or alternate means to set population types and targets*					
SONCC-LRR.27.1.30.2	*If appropriate, modify population types and targets using revised methodology*					
SONCC-LRR.27.2.31	Monitor	No	Track habitat condition	Determine best indicators of estuarine condition	Estuary	3
SONCC-LRR.27.2.31.1	*Determine best indicators of estuarine condition*					
SONCC-LRR.7.1.4	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide	2
SONCC-LRR.7.1.4.1	*Revise Oregon Forest Practice Act Rules in consideration of IMST (1999) and NMFS (1998) recommendations*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.7.1.5	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Lower Lobster Creek	3
SONCC-LRR.7.1.5.1	*Determine appropriate silvicultural prescription for benefits to coho salmon habitat*					
SONCC-LRR.7.1.5.2	*Thin, or release conifers, guided by prescription*					
SONCC-LRR.7.1.5.3	*Plant conifers, guided by prescription*					
SONCC-LRR.7.1.27	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	BLM lands	3
SONCC-LRR.7.1.27.1	*Manage timber harvest (and associated activities) on Federal lands in accordance with the Aquatic Conservation Strategy of the NWFP to achieve riparian and stream channel improvements for coho salmon*					
SONCC-LRR.8.1.1	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	SF and NF Lobster, Silver, Saunders, and Indian creeks	3
SONCC-LRR.8.1.1.1	*Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective*					
SONCC-LRR.8.1.1.2	*Decommission roads, guided by assessment*					
SONCC-LRR.8.1.1.3	*Upgrade roads, guided by assessment*					
SONCC-LRR.8.1.1.4	*Maintain roads, guided by assessment*					
SONCC-LRR.8.1.2	Sediment	No	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	3
SONCC-LRR.8.1.2.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					