10. Lower Rogue River Population

Northern Coastal Stratum

Non-Core 1, Potentially Independent Population

High Extinction Risk

Population likely below depensation threshold

320 Spawners Required for ESU Viability

198 mi^2 watershed (58% Federal ownership)

81 IP-km (50 IP-mi) (24% High)

Dominant Land Uses are Timber Harvest and Agriculture

Key Limiting Stresses are 'Lack of Floodplain and Channel Structure' and 'Impaired Water Quality'

Key Limiting Threats are 'Roads' and 'Urban/Residential/Industrial Development'

Highest Priority Recovery Actions

• Improve timber harvest practices by revising Oregon Forest Practices Act • Reduce road-stream hydrologic connection • Re-connect and restore estuarine habitat	• Increase large woody debris (LWD), boulders, or other instream structure • Increase instream flows • Reduce impacts of mining

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.

The most profound change to the Lower Rogue River resulted from timber harvest after World War II (U.S. Forest Service (USFS) 2000a). Most old growth timber in the Lower Rogue River sub-basin has been logged (USFS 1996b,USFS 1996a and 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. Timber harvest 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 sub-basin 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).

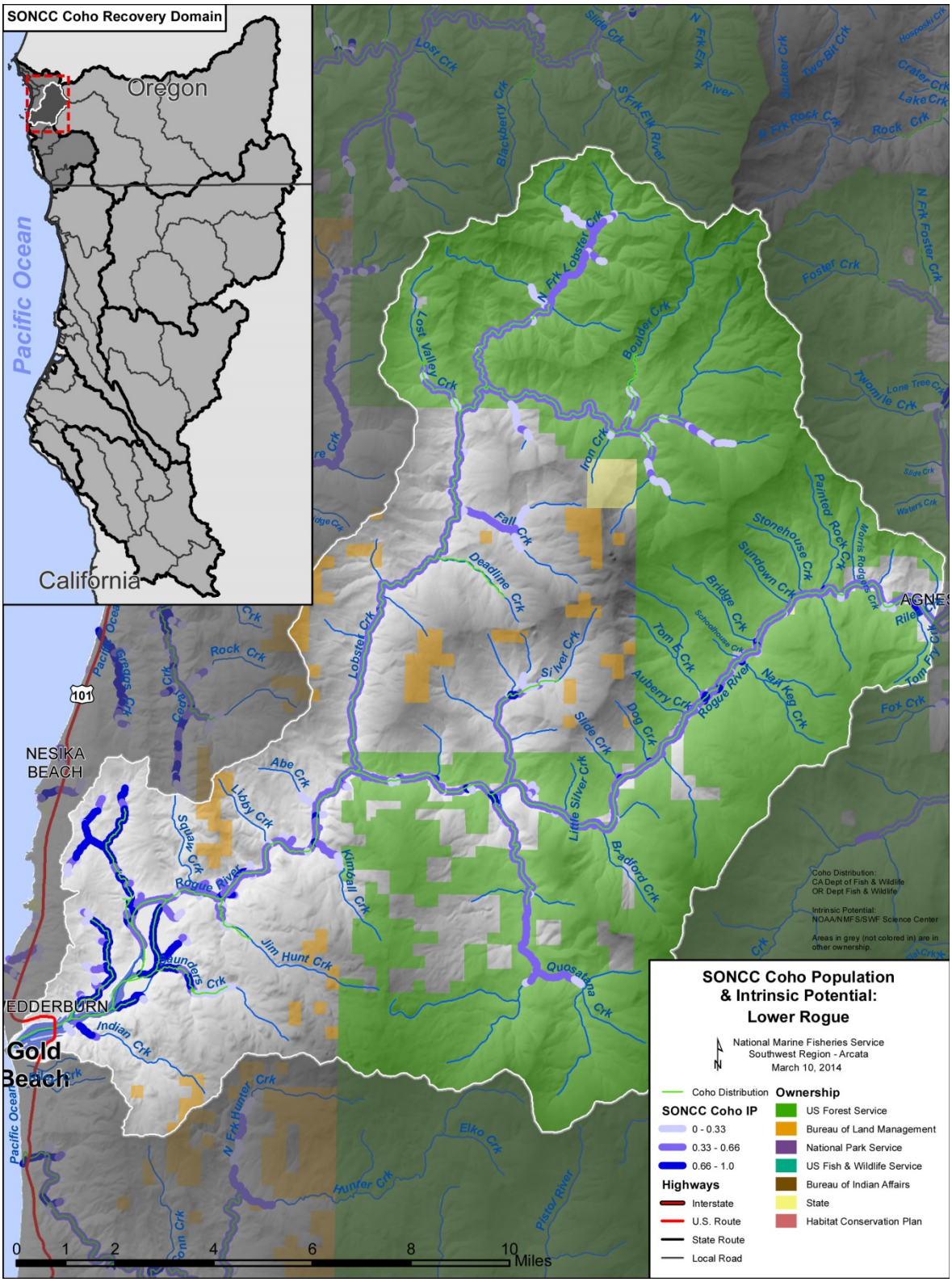

Figure 10-1. The boundaries of the Lower Rogue River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2013a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

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 sub-basin 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 sub-basin constitutes about 6 percent of the entire Rogue watershed area, 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, Ranch and Edson creeks (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 high IP reaches (IP > 0.66) Williams et al. (2006).

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

10.3 Status of Lower Rogue River Coho Salmon

Spatial Structure and Diversity

Although they contain high IP (>0.66) habitat, Jim Hunt Creek, Kimball Creek, Ranch Creek and Indian Creek are not known to currently support coho salmon. 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). The Lower Rogue Watershed Council (2010) also found coho salmon in Edson Creek, Ranch Creek, and Saunders Creek. However, coho salmon spawners have not been seen in Ranch Creek since 2002, which indicates the potential presence of a new barrier (Lower Rogue Watershed Council 2010). 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.

Population Size and Productivity

In 2001, there were an estimated 32,962 adult coho salmon in the Rogue Basin (Oregon State University [OSU] 2009, ODFW 2009b). Using a different methodology, ODFW (2013b) 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 coho salmon escapement for the Lower Rogue River (ODFW 2013b)

. Year	Population Estimate	Year	Population Estimate	Year	Population Estimate
1998	0	2003	75	2008	184
1999	0	2004	127	2009	193
2000	59	2005	127	2010	0
2001	235	2006	35	2011	44
2002	205	2007	193	2012	0

Surveys completed from 1998 to 2003 (Hicks 2005) in the Lower Rogue River sub-basin 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, fish were present in 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.

The number of adult coho salmon is estimated using a seine-recapture method at Huntley Park in the Lower Rogue River (river mile 8). These data provide the most robust and precise estimates of adult coho salmon abundance in the Rogue River (ODFW 2013b). It is impossible to determine, with existing information, how many of the estimated coho salmon at Huntley Park are returning to the Lower Rogue River as opposed to other sub-basins in the Rogue River basin. However, 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 number of adults estimated at Huntley Park has declined at an annual rate of 11% over the last 12 years (Figure 10-2), 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.

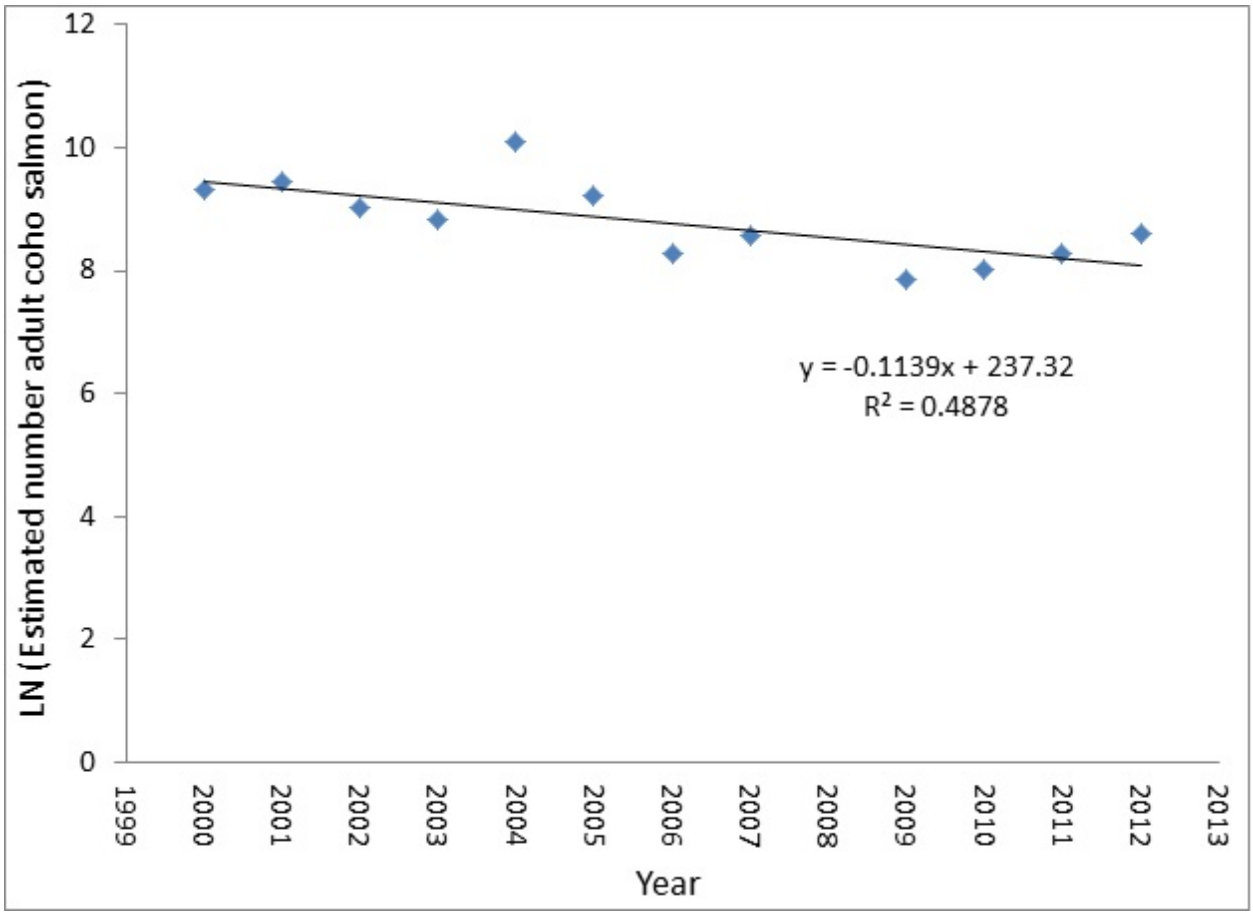

Figure 10-2. Rate of decline of estimated population abundance at Huntley Park. Data source: ODFW 2013b.

Extinction Risk

The Lower Rogue River population is at high risk of extinction because the ratio of the three consecutive years of lowest abundance within the last twelve years to the amount of IP-km in a watershed is less than one, the criterion described by Williams et al. (2008). NMFS' determination of population extinction risk is based on the viability criteria provided by Williams et al. 2008 (Table 3, pg. 17). These viability criteria reflect population size and rate of decline. As Williams et al. (2008) provided no viability criteria for assessing moderate and high risk based on spatial structure and diversity, spatial structure and diversity were not considered in NMFS' determination of population extinction risk.

Role in SONCC Coho Salmon ESU Viability

The Lower Rogue River population is a non-core, Potentially Independent population within the Northern Coastal diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, but strongly influenced by immigration from other populations such that they did not exhibit independent dynamics (Williams et al. 2006). The Lower Rogue River population is strongly influenced by upstream populations in the Rogue River basin, as well as coastal populations such as the Chetco River. Adult strays from these

populations spawn and interact with coho salmon in the Lower Rogue River. To contribute to stratum and ESU viability, the Lower Rogue River non-core population needs to have at least 320 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Furthermore, the Lower Rogue River population will contribute toward stratum and ESU viability by providing rearing, migratory, and refugia habitat to other nearby populations.

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 timber harvest 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.

Oregon Plan for Salmon and Watersheds
http://www.oregon.gov/OPSW/about_us.shtml

The state of Oregon developed a conservation and recovery strategy for coho salmon in the SONCC and Oregon Coast ESUs (State of Oregon 1997). The Oregon Plan for coho salmon is comprehensive and includes voluntary actions for all of the threats currently facing coho salmon in these ESUs and involves all relevant state agencies. Reforms to fishery harvest and hatchery programs were implemented by ODFW in the late 1990s. Many habitat restoration projects have occurred across the landscape in headwater habitat, lowlands, and the estuary. The action plans, implementation, and annual reports can be found at the web site.

Lower Rogue Watershed Council

Lower Rogue Watershed Assessment

This extensive assessment on the Lower Rogue River sub-basin (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, assessment methods, and data used to assess stresses are described in Appendix B.

Stresses		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	High	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	Very 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	Medium	Medium	Medium	Medium	Medium
10	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Medium	Low

[1]Key limiting stresses and limited life stage.

Key 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), 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 wetlands were filled, 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 Hunt 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 1996a).

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 1996a) 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 (USEPA) 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 sub-basin 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, S., pers. comm. 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 sub-basin (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 1996a, 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 sub-basin (USFS 1996a, 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 1996a), and Frissell (1992) recognized the loss of this species as regionally significant.

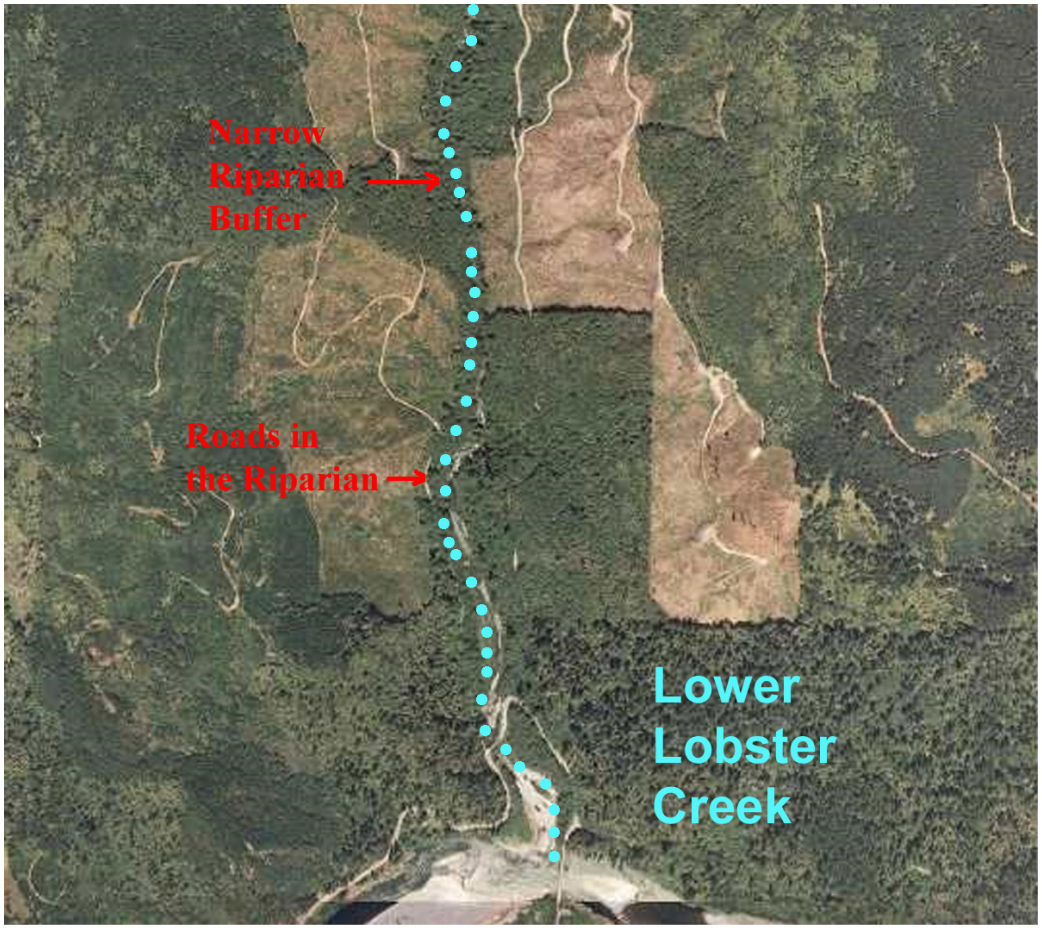

Figure 10-4. Aerial photo of Lower Lobster Creek at its convergence with the mainstem Rogue River. Convergence is at bottom of photo, which shows clear cuts, insufficient buffer widths, high road density and near stream roads. The stream course is shown in blue dots. (Terra Server, www.terraserver.com).

Adverse Hatchery-Related Effects

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 William L. Jess Dam (RM 157) in the Upper Rogue River sub-basin. 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 sub-basin 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 timber harvest 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 important refugia 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. Port Orford Cedar root-rot is a disease which is negatively impacting this important riparian species region-wide (Frissell 1992).

Barriers

High road densities on private lands in the Lower Rogue River sub-basin 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. There is likely a barrier issue on Ranch Creek, which contains a substantial amount of high IP coho salmon habitat in a strategic location low in the basin. After implementing passage projects in upper Ranch Creek, the Lower Rogue Watershed Council found coho salmon spawning in 2001 and 2002 (Lower Rogue Watershed Council 2010). But the council did not find spawners from 2003 through 2012 and attribute it likely to presence of a barrier downstream (Lower Rogue Watershed Council 2010).

Adverse Fishery- and Collection-Related Effects

Based on estimates of the fishing exploitation rate, as well as the status of the population relative to depensation and the status of NMFS approval for any scientific collection (Appendix B), these activities pose a medium stress to adults and a low stress to juveniles and smolts.

10.6 Threats

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

Threats		Egg	Fry	Juvenile[1]	Smolt	Adult	Overall Threat Rank
1	Roads[1]	Medium	Very High	Very High[1]	Very High	Medium	Very High
2	Timber Harvest	High	High	High	High	Medium	High
3	Urban/Residential/Industrial Dev.[1]	Medium	High	High[1]	High	Medium	High
4	Channelization/Diking	Low	High	High	High	Low	High
5	Mining/Gravel Extraction	Low	Low	Medium	Medium	Medium	Medium
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 Severity 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	Medium	Low
[1]Key limiting threats							

Key Limiting Threats

The two key limiting threats, those which most affect recovery of the population by influencing stresses, are roads and urban/residential/industrial development.

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 sub-basin. 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 1996a, 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).

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, G., pers. comm. 2003) and watersheds exceeding that level of harvest did not maintain channel integrity or Pacific salmon species diversity. Timber harvest 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. Intense harvest rates on private lands in Lobster Creek (see Figure 10-4) and Silver Creek are double or triple the rates recommended by Reeves et al. (1993). It is likely the effects from these harvest practices are why juveniles were not present in Lobster Creek 4 of 6 years in the ODFW juvenile sampling (ODFW 2005a).

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 likely contributes 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 Ranch Creek have had the greatest impact on coho salmon production in the Lower Rogue River sub-basin because of the extent of high potential 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. Nearly all of the tidal wetlands have been channelized or diked and

are no longer available to coho salmon. Development of the boat basin and marina along the south side of the river eliminated valuable tidal wetlands that provided off-channel habitat for coho salmon rearing and holding.

Mining/Gravel Extraction

Gravel mining is ongoing on the terrace of the Lower Rogue River estuary. There is a gravel operation on the south bank of the estuary. There was an operation of the north bank, but it has not removed from the river for several years. These areas have some of the best restoration opportunities for creating mainstem rearing refugia for coho salmon. The USFS has 9 gold mining claims on their land in Lobster Creek.

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 sub-basin, 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 Ranch Creek and Edson Creek. The Oregon Department of Agriculture currently has no means of tracking pesticide use near the Lower Rogue River (Riley, S., pers. comm. 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 sub-basin 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 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 Severity 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

Based on estimates of the fishing exploitation rate, as well as the status of the population relative to depensation and the status of NMFS approval for any scientific collection (Appendix B), these activities pose a medium threat to adults and a low stress to juveniles and smolts.

Invasive Non-Native/Alien Species

New Zealand mud snails are known to be present in the Lower Rogue River population area. The mud snail 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 mud snails 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). The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

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. Recovery actions for monitoring and research are listed in tables at the end of Chapter 5.

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-LRR.7.1.4	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide, primarily Lobster Creek	1
SONCC-LRR.7.1.4.1	*Determine how to revise Oregon Forest Practice Rules so that they do not limit recovery of SONCC coho salmon and make appropriate revisions*					
SONCC-LRR.7.1.4.2	*Adopt rules for fish-bearing streams sufficient to protect both water quality and fish habitat*					
SONCC-LRR.7.1.4.3	*Adopt rules to increase protection of non-fish-bearing streams that address practices that adversely impact water quality and fish habitat*					
SONCC-LRR.7.1.4.4	*Ensure management measures for landslide prone areas include protection of water quality and fisheries habitat*					
SONCC-LRR.7.1.4.5	*Until more permanent regulatory mechanisms can be put in place, immediately adopt interim rules that increase protection for salmon habitat in forested areas, including increased natural recruitment of large wood on perennial and intermittent streams likely to deliver wood downstream, increased shade on all perennials, and protective buffers on small intermittent streams*					
SONCC-LRR.2.1.9	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	All streams where coho salmon would benefit immediately	2a
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.2.1.50	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2b
SONCC-LRR.2.1.50.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-LRR.2.1.50.2	*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	All streams where coho salmon would benefit immediately	2a
SONCC-LRR.2.2.10.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for land owners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-LRR.2.2.10.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-LRR.2.2.10.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.2.2.51	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	2b
SONCC-LRR.2.2.51.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for land owners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-LRR.2.2.51.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-LRR.2.2.51.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-LRR.10.2.26	Water Quality	Yes	Reduce pollutants	Reduce point- and non-point source pollution	All streams where coho salmon would benefit immediately	2a
SONCC-LRR.10.2.26.1	*Identify pollution sources, and develop a strategy to minimize input to stream channels*					
SONCC-LRR.10.2.26.2	*Implement strategy to minimize pollution*					
SONCC-LRR.10.2.49	Water Quality	Yes	Reduce pollutants	Reduce point- and non-point source pollution	Population wide	2b
SONCC-LRR.10.2.49.1	*Identify pollution sources, and develop a strategy to minimize input to stream channels*					
SONCC-LRR.10.2.49.2	*Implement strategy to minimize pollution*					
SONCC-LRR.28.1.1	Roads	Yes	Reduce sediment delivery to streams	Reduce road-stream hydrologic connection	SF and NF Lobster, Silver, Saunders, Indian creeks, and all areas where coho salmon would benefit immediately	2a
SONCC-LRR.28.1.1.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-LRR.28.1.1.2	*Decommission roads, guided by assessment*					
SONCC-LRR.28.1.1.3	*Upgrade roads, guided by assessment*					
SONCC-LRR.28.1.1.4	*Maintain roads, guided by assessment*					
SONCC-LRR.28.1.57	Roads	Yes	Reduce sediment delivery to streams	Reduce road-stream hydrologic connection	Population wide	2b
SONCC-LRR.28.1.57.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-LRR.28.1.57.2	*Decommission roads, guided by assessment*					
SONCC-LRR.28.1.57.3	*Upgrade roads, guided by assessment*					
SONCC-LRR.28.1.57.4	*Maintain roads, guided by assessment*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.2.4.8	Floodplain and Channel Structure	No	Improve estuarine habitat	Restore estuarine habitat	Areas of the estuary where coho salmon would benefit immediately	2a
SONCC-LRR.2.4.8.1	*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.2.4.8.2	*Restore tidally influenced habitats, guided by the plan*					
SONCC-LRR.2.4.53	Floodplain and Channel Structure	No	Improve estuarine habitat	Restore estuarine habitat	Population wide	2b
SONCC-LRR.2.4.53.1	*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.2.4.53.2	*Restore tidally influenced habitats, guided by the plan*					
SONCC-LRR.2.5.6	Floodplain and Channel Structure	No	Improve tidal exchange of water	Reconnect estuarine habitat	Mouth of Ranch Creek and areas of the estuary where coho salmon would benefit immediately	2a
SONCC-LRR.2.5.6.1	*Assess the tidal wetland habitat and develop a plan to reconnect the tributary*					
SONCC-LRR.2.5.6.2	*Reconnect tidal wetlands, guided by the plan*					
SONCC-LRR.2.5.54	Floodplain and Channel Structure	No	Improve tidal exchange of water	Reconnect estuarine habitat	Population wide	2b
SONCC-LRR.2.5.54.1	*Assess the tidal wetland habitat and develop a plan to reconnect the tributary*					
SONCC-LRR.2.5.54.2	*Reconnect tidal wetlands, guided by the plan*					
SONCC-LRR.2.7.33	Floodplain and Channel Structure	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	All streams on private lands where coho salmon would benefit immediately	2a
SONCC-LRR.2.7.33.1	*Assess grazing contribution to sediment delivery, pollutants, and impaired riparian conditions*					
SONCC-LRR.2.7.33.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-LRR.2.7.33.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.2.7.55	Floodplain and Channel Structure	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Population wide	2b
SONCC-LRR.2.7.55.1	*Assess grazing contribution to sediment delivery, pollutants, and impaired riparian conditions*					
SONCC-LRR.2.7.55.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-LRR.2.7.55.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-LRR.2.2.48	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	All streams where coho salmon would benefit immediately	2a
SONCC-LRR.2.2.48.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-LRR.2.2.48.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-LRR.2.2.52	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	Population wide	2b
SONCC-LRR.2.2.52.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-LRR.2.2.52.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-LRR.22.3.36	Urban, Residential, Industrial Development	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Increase regulatory oversight	All coho salmon bearing streams	2b
SONCC-LRR.22.3.36.1	*Strengthen city and county ordinances to limit development within the 100 year channel migration zone*					
SONCC-LRR.22.3.36.2	*Strengthen city and county ordinances to limit development within the 50 year flood elevation*					
SONCC-LRR.28.1.2	Roads	Yes	Reduce sediment delivery to streams	Improve regulatory mechanisms	Population wide	2b
SONCC-LRR.28.1.2.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					
SONCC-LRR.2.4.7	Floodplain and Channel Structure	No	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.	2b
SONCC-LRR.2.4.7.1	*Strengthen city and county ordinances to limit development near tidally influenced habitat, and maintain or strengthen current protection measures*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.2.7.5	Floodplain and Channel Structure	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Lower Lobster Creek and Federal lands	2b
SONCC-LRR.2.7.5.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-LRR.2.7.5.3	*Plant conifers, guided by the plan*					
SONCC-LRR.2.7.56	Floodplain and Channel Structure	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Population wide	2d
SONCC-LRR.2.7.56.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-LRR.2.7.56.3	*Plant conifers, guided by the plan*					
SONCC-LRR.26.1.47	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2b
SONCC-LRR.26.1.47.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-LRR.2.2.44	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Improve regulatory mechanisms	Population wide	2b
SONCC-LRR.2.2.44.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					
SONCC-LRR.10.2.37	Water Quality	No	Reduce pollutants	Increase regulatory oversight	Population wide	2b
SONCC-LRR.10.2.37.1	*Strengthen city and county ordinances to minimize new impervious surfaces and require treatment to current standards*					
SONCC-LRR.10.2.37.2	*Strengthen city and county ordinances to require treatment to current standards when existing impervious surfaces are expanded, reconditioned, reconstructed or replaced*					
SONCC-LRR.10.2.37.3	*Develop local regulatory mechanisms that limits development and reduces amount of total impervious area through incentives*					
SONCC-LRR.2.7.34	Floodplain and Channel Structure	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Federal lands	3b
SONCC-LRR.2.7.34.1	*Monitor effects of livestock grazing on coho salmon habitat and adjust or discontinue grazing if effects of livestock grazing on salmon habitat are limiting coho recovery*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LRR.7.1.27	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	BLM lands	3b
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, or with the updated ACS guidance contained in newly revised Resource Management Plans or Land and Resource Management Plans, in order to achieve riparian and stream channel improvements for coho salmon*					
SONCC-LRR.5.1.35	Passage	No	Improve access	Remove barrier	Ranch Creek	3c
SONCC-LRR.5.1.35.1	*Identify barrier(s) preventing fish passage into Ranch Creek*					
SONCC-LRR.5.1.35.2	*Remove barrier(s) preventing passage into Ranch Creek*					
SONCC-LRR.10.2.32	Water Quality	Yes	Reduce pollutants	Reduce pesticides	Population wide	3d
SONCC-LRR.10.2.32.1	*Develop a pesticide management plan*					
SONCC-LRR.10.2.32.2	*Implement pesticide management plan and technical assistance program*					
SONCC-LRR.1.2.25	Estuary	No	Improve estuarine habitat	Assess and improve estuary and tidal wetland habitat	Estuary	3d
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 and develop a plan for restoration*					
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	3d
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 level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-LRR.16.1.13	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Reduce fishing impacts to levels that do not limit recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-LRR.16.1.13.1	*Determine actual fishing impacts*					
SONCC-LRR.16.1.13.2	*If actual fishing impacts limit attainment of population-specific viability criteria, modify management so that fishing does not limit attainment of population-specific viability criteria*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
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	3d
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 level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-LRR.16.2.15	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Reduce impacts of scientific collection to levels that do not limit recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-LRR.16.2.15.1	*Determine actual impacts of scientific collection*					
SONCC-LRR.16.2.15.2	*If actual scientific collection impacts limit attainment of population-specific viability criteria, modify collection so that impacts do not limit attainment of population-specific viability criteria*					
SONCC-LRR.10.7.46	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-LRR.10.7.46.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-LRR.10.7.46.2	*Supply marine-derived nutrients to streams guided by the plan*					

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