13. Chetco River Population

- Northern Coastal Stratum
- Core, Functionally Independent Population
- High Extinction Risk
- 4,500 Spawners Required for ESU Viability
- 356 mi^2
- 135 IP km (84 mi) (8% High)
- Dominant Land Uses are 'Recreation' and 'Agriculture'
- Principal Stresses are 'Lack of Floodplain and Channel Structure' and 'Degraded Riparian Forest Conditions'
- Principal Threats are 'Channelization/Diking' and 'Urban/Residential/Industrial Development'

13.1 History of Habitat and Land Use

Historically, the mouth of the Chetco River and the surrounding low lying bottom lands were dominated by salt water and fresh water marshes. The population area was forested with a diversity of habitat types which supported abundant life (U.S. Forest Service (USFS) 1996a). The lower Chetco River was the center of coho salmon productivity in this population (Maguire 2001f), coinciding with areas that have the highest intrinsic potential (IP >0.66) coho salmon habitat. Large floating wood jams changed location on lower Chetco River gravel bars, scouring holes as they moved. Beaver were also abundant in the lower portions of the river and estuary and likely contributed to habitat complexity (Maguire 2001f).

The discovery of gold in the interior Chetco River basin in the 1850s precipitated the first major alteration to fish habitat. Miners excavated river terraces, leaving a lasting footprint on some stream channels. Although some of this activity occurred upstream of the range of coho salmon, it released fine sediment that affected downstream reaches. Near the coast, logging intensity increased. In the early 1900s, a railroad was constructed and timber was exported from the lower tributary, Jacks Creek.

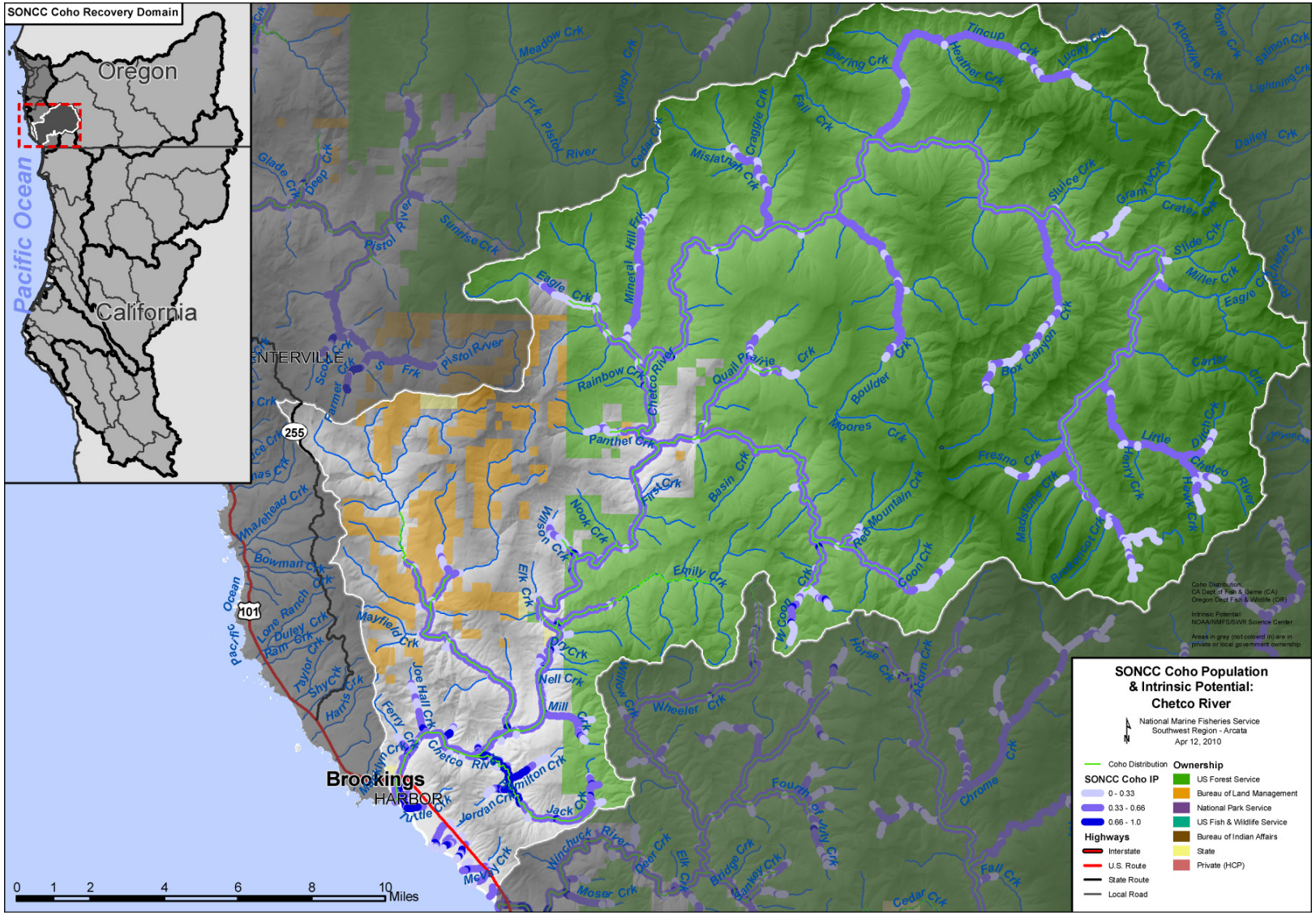

Figure 13-1. The geographic boundaries of the Chetco River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2010a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Rogue diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

After World War II, logging and road building on public and private lands increased and resulted in widespread disturbance. The 1964 flood delivered massive amounts of fine sediment that filled in deep pools, changed channel configuration, and eliminated much of the coho salmon habitat (Maguire 2001f). This loss was likely greatest in the mainstem, South Fork, Eagle Creek, and Panther Creek. Long-time fishermen of the Chetco River recounted that formerly deep pools were filled and the river bar was so aggraded that you could drive on it after the flood (Maguire 2001f). Logging on U.S. Forest Service lands and private land continued through the 1970s and 1980s. Land management practices have resulted in the replacement of large streamside conifers with hardwoods in most of the population area (USFS 1996a; Maguire 2001f).

The estuary was altered by the construction of levees at the mouth in 1962 to improve navigation to the ocean (Figure 13-1). Long-time residents remember that before the levees were constructed, a sand bar formed in late summer which created a lagoon with connections to tributaries and wetlands (Maguire 2001f). Levee construction disconnected wetlands and streams that were vital coho salmon habitat, and also changed the salinity and other water quality parameters by altering the tidal exchange. The harbor continues to be dredged periodically to keep the entrance open to navigation.

13.2 Historic Fish Distribution and Abundance

The Chetco River coho salmon population is not well studied and there is little trend data, but local residents described coho salmon in the Chetco River as formerly abundant and the target of a "net fishery" (Maguire 2001f). The lower tributaries were subject to extensive fishing pressure, with Tuttle Creek noted as having particularly large runs of coho salmon (Maguire 2001f).

The Oregon Department of Fish and Wildlife (ODFW) believe that the "abundance of coho salmon has been reduced due to modification of low gradient streams" (Maguire 2001f). The lower mainstem Chetco, North Fork Chetco, and Jacks Creek are identified as the most suitable reaches for juvenile rearing (IP > 0.66) in the entire basin (Williams et al. 2006). Small patches of high IP habitat also occur at the mouths of lower and middle Chetco River tributaries and in upstream areas of the South Fork and its tributary, Coon Creek. Moderate IP reaches occur in many upper tributaries. Table 13-1 lists tributaries with high IP (>0.66) reaches.

Table 13-1. Tributaries with instances of high IP reaches (IP > 0.66). (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Chetco Estuary	Jack Creek	North Fork Chetco
Emily Creek	Joe Hill Creek	SF Chetco/Coon Creek
Hamilton Creek (tributary of Jack Creek)	Lower Chetco River	Tuttle Creek
Jordan Creek (tributary of Jack Creek)	Mill Creek	Wilson Creek

13.3 Status of Chetco River Coho Salmon

Spatial Structure and Diversity

Coho salmon occur in many parts of the Chetco River population area and juvenile coho salmon have been found in the upper mainstem reaches in the Kalmiopsis Wilderness (ODFW 2005a). Coho salmon are present in several tributaries throughout the population area including tributaries in the upper-most portions of the watershed (USFS 1996a). Coho salmon are present in the majority of the IP habitat identified by Williams et al 2006.

Although the genetic structure of the population has not been studied, it is likely that diversity has been diminished as the population has declined, consistent with the known dynamics of small populations (Chapter 2). The ODFW Expert Panel expressed concern that out-of-basin hatchery-produced coho salmon may stray into the Chetco River and affect the genetic integrity of the wild population (ODFW 2008b). However, hatchery effects were not considered a stress or threat to this population given the small number of strays thought to affect the Chetco River.

Population Size and Productivity

The USFS (1996a) characterized Chetco River coho salmon as relatively scarce, which indicates their population has diminished greatly from the historic levels described in Maguire (2001f). The Expert Panel stated that the Chetco River coho population has a very low abundance and is verging on extirpation (ODFW 2008b). Population estimates for 1998 to 2008 for the Chetco River are shown in Figure 13-2. The range of estimates is from zero to 665 adults. Years with no observed returns are 1998, 1999, 2002, 2003, and 2005 (ODFW 2009a). It is problematic to draw definitive conclusions from these data because the locations of sampling and water conditions at time of sampling are unknown. If survey coverage was incomplete, coho salmon may have been overlooked in many years. High flows may have occurred in some years, making accurate counts difficult or impossible.

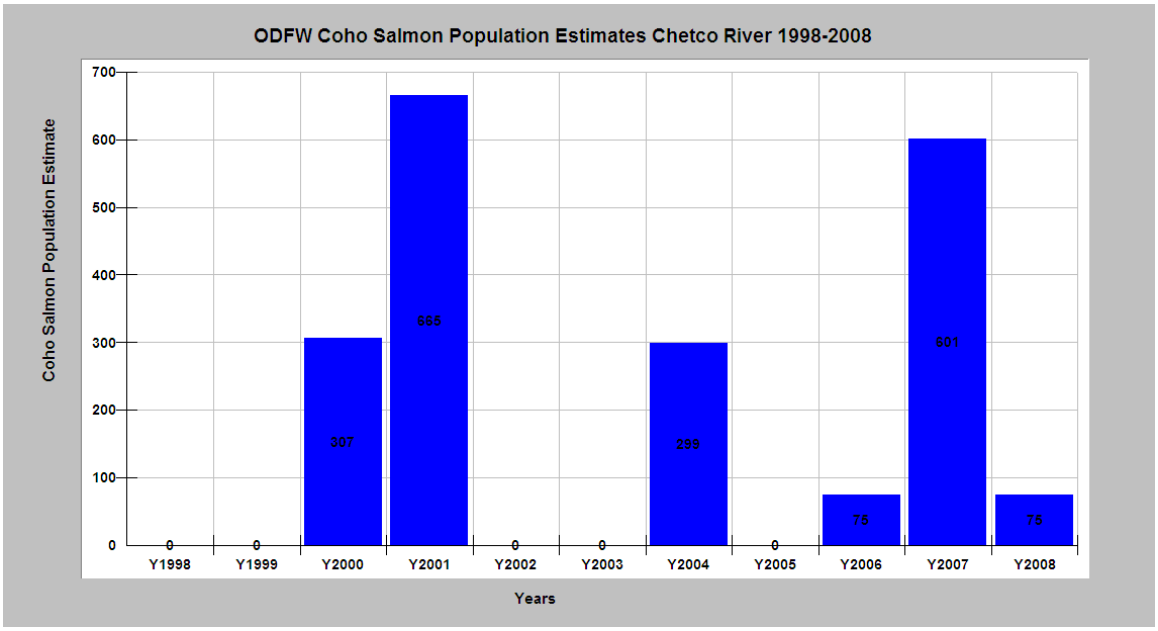

Figure 13-2. Chetco River basin-wide adult coho salmon return estimates. The data are for the years 1998 to 2008 (ODFW 2009a).

The more robust returns in 2001, 2004 and 2007 suggest that one year class is stronger than the other two. The lack of returns in 2003, after 307 coho spawned in the Chetco River in 2000, suggests that successful recruitment of juveniles to the adult life stage was problematic. With the exception of one year class, the overall population productivity for Chetco River coho salmon appears to be very low.

Extinction Risk

The Chetco River coho salmon population is not viable and at high risk of extinction, because the estimated average spawner abundance over the past three years has been less than the depensation threshold (Table ES-1 in Williams et al. 2008).

Role in SONCC Coho Salmon ESU Viability

As a functionally independent population, the Chetco River would have once served as a source of spawners for adjacent basins, such as the Winchuck River to the south and Pistol River to the north. As a core population, the Chetco River will be an important source of colonists to other recovering basins in the ESU.

13.4 Plans and Assessments

State of Oregon

http://www.Oregon.gov

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, ODFW (2008b) summarized the concerns for the Chetco River population as follows:

> Key concerns in the Chetco River were primarily loss of over-winter tributary and freshwater estuarine habitat complexity and floodplain connectivity for juveniles, especially in the lowlands which are naturally very limited in this system and have been impacted by past and current urban, rural residential, and forestry development and practices. Secondary concerns were related to a loss of large wood and habitat complexity, high water temperatures in tributaries for summer parr (excluding the mainstem, where rearing is not expected), reduced estuarine habitat for smolts, and a very low spawner abundance susceptible to genetic impacts by out-of-basin hatchery fish.

Oregon Plan for Salmon and Watersheds

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 a comprehensive plan that includes voluntary actions for all of the threats currently facing coho in these ESUs and involves all relevant state agencies. Reforms to fishery harvest and hatchery programs were implemented by ODFW in the late 1990's. 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 http://www.oregon.gov/OPSW/.

Southwest Oregon Salmon Restoration Initiative

The Southwest Oregon Salmon Restoration Initiative (Prevost et al. 1997) was created to help fulfill a memorandum of understanding between ODFW and the National Marine Fisheries Service (NMFS) to recover coho salmon. The initiative provides the framework for recovery in southwest Oregon and helped foster formation of watershed councils. Although the Chetco River has 72.8 miles of "high value" coho salmon habitat, there are no reaches or tributaries designated as "core areas" that are the highest priority for restoration in the SONCC.

Oregon Coastal Management Program (OCMP)

The OCMP has identified several areas of the Chetco River (mainstem Chetco River from Box Canyon Creek to estuary, North Fork Chetco River, and Bravo Creek) as 303(d) impaired water bodies under the Clean Water Act as a result of excessively high river temperatures. Due to this listing, a total maximum daily load (TMDL) must be prepared for these areas, in accordance with

40 CFR 130.6. The Oregon Department of Water Quality has initiated a TMDL for the Chetco River basin. The TMDL is in the initial scoping and data collection phase.

Cumulative Effects of Southwest Oregon Coastal Land Use on Salmon Habitat

Oregon State University (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 assessed basins along the Oregon coast extending from the Sixes River to the southern border during the period from 1986 to 1992 with the most extensive research conducted in Euchre Creek to the south of the Elk River.

South Coast Watersheds Council

http://oregonwatersheds.org/

Chetco River Watershed Assessment

The Chetco River Watershed Assessment (Maguire 2001f) identified reduced juvenile summer and over-wintering habitat as the greatest limiting factor for coho salmon, and linked degraded habitat conditions to sedimentation of channels, reduction of large wood jams, diking and draining of wetlands, and riparian removal on the lower mainstem Chetco River and its tributaries. The report offered solutions such as the potential for increased peak flows, reducing estuary eutrophication, and increasing water supply.

Chetco River Action Plan

The Chetco River Action Plan was written to address issues raised in the CRWA. Its intent is to define specific priority actions for restoration. Recommendations include educating residents regarding the need for riparian and water quality protection and water conservation. Recommended actions include increasing conifers in riparian zones, reconnecting wetlands in the lower Chetco River and estuary, and decreasing erosion potential related to roads. The document concludes Jack Creek and the North Fork Chetco have the greatest coho salmon restoration potential.

13.5 Stresses

Table 13-2. Severity of stresses affecting each life stage of coho salmon in the Chetco 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)[2]	Egg	Fry	Juvenile[1]	Smolt	Adult	Overall Stress Rank
1	Degraded Riparian Forest Conditions[1]	-	Very High	Very High[1]	Very High	Very High	Very High
2	Lack of Floodplain and Channel Structure[1]	High	High	Very High[1]	Very High	High	Very High
3	Altered Hydrologic Function[1]	High	High	Very High[1]	Medium	Medium	Very High
4	Impaired Water Quality[1]	Low	High	Very High[1]	High	Medium	Very High
5	Impaired Estuary/Mainstem Function[1]	-	Low	Very High[1]	High	High	Very High
6	Altered Sediment Supply	Low	Medium	Medium	Medium	Low	Medium
7	Barriers	-	Low	Low	Low	Low	Low
8	Adverse Hatchery-Related Effects	Low	Low	Low	Low	Low	Low
9	Adverse Fishery-Related Effects	-	-	-	-	Low	Low

[1]Key limiting factor(s) and limited life stage(s).
[2]Increased Disease/Predation/Competition is not considered a threat to this population.

Limiting Stresses, Life Stages, and Habitat

The juvenile life stage is most limited and quality winter rearing habitat, as well as summer rearing habitat, is lacking for the population. Juvenile summer rearing habitat is impaired by high water temperatures resulting from degraded riparian conditions and water withdrawals. Winter rearing habitat is severely lacking because of channel simplification, disconnection from the floodplain, degraded riparian conditions, poor large wood availability, and an estuary which has been altered and reduced in size due to development, channelization, and diking. Large wood has been removed and is not naturally replacing at the rates required to maintain key components of habitat complexity. Overall, these findings are consistent with those of the Oregon Expert Panel (ODFW 2008b) (Section 13.4), but the expert panel considered altered hydrologic function and impaired water quality to be only secondary, not primary, concerns.

Degraded Riparian Forest Conditions

Degraded riparian forest condition is the most significant stress affecting coho viability in the Chetco River basin. Old growth conifers historically lined the banks of the lower mainstem Chetco River and tributaries in most of the population area. These trees helped create high quality coho salmon rearing habitat by maintaining stable banks, creating undercuts beneath roots, contributing large wood to the channel, and providing shade to maintain cool stream

temperature. Canopy within the North Fork watershed is currently dominated by hardwood species. ODFW riparian surveys indicate poor riparian conditions on the North Fork Chetco with fewer than 75 conifers larger than 36 inches in diameter per thousand feet of stream length. The CRWA (USFS 1996a) used remote sensing to gauge the size of trees within 200 feet of streams and found few large conifers along reaches on USFS lands. The Oregon Department of Agriculture (2008) documented sudden oak death syndrome in the riparian zones of the North Fork Chetco River and Joe Hall Creek.

Lack of Floodplain and Channel Structure

The lower Chetco River channel has been disconnected from its estuary, floodplain, wetlands, and smaller tributaries. Tributary channels and floodplains have been simplified. Higher peak flows have increased bank erosion, caused loss of large woody structure, and scoured channels in many upper tributaries in the Chetco population area (USFS 1996a). Large wood surveys from ODFW and the USFS confirm very low levels in the North Fork, upper South Fork, Boulder Creek, and Mislatnah Creek.

Stream channels in the Chetco River tend to be wide and shallow, and pools lack both depth and complexity (Massingill 2001f). Good quality spawning gravel is present, but quantity is limited. Only large mainstem reaches have pools deeper than 3 feet. An insufficient abundance of deep pools in most lower and middle Chetco River channels limits juvenile rearing potential. For example, the South Fork Chetco River, including Coons Creek, have coho salmon present and are showing a cooling trend, but lack deep pools and large wood.

Altered Hydrologic Function

In late summer and early fall, water withdrawals that reduce flow in the lower Chetco River and tributaries are of concern. The lower Chetco River, North Fork Chetco, middle mainstem Chetco, and Jack Creek are over-allocated during low flow months (Massingill 2001f). In 1964, the State of Oregon Water Rights Division established a minimum flow requirement of 80 cubic feet per second (cfs) for the Chetco River. Total allocated water rights for out of stream use are 59 cfs (Maguire 2001f). Minimum flow levels were not met in 11 of the 25 years from 1970 to 1994, and the number of days per year below this level ranged from two to 77 days (USFS 1996a). . These reduced flows disrupt juvenile rearing habitat as well as migration of smolts. Base flows may also decrease following clear cutting because of the increase in water use by young trees growing in dense stands (Murphy 1995). Disconnection of the floodplain and channel, disrupts exchange of surface water and groundwater that helps maintain cool water temperatures needed for juvenile rearing of coho salmon (Chapter 3).

Two areas have been identified by ODFW as Streamflow Restoration Priority Areas: Jack(s) Creek and the Chetco River mainstem above the North Fork. These areas were determined to have both “need” (fisheries) and “optimism” (water resources) (Maguire 2001f).

Impaired Water Quality

Temperature is the most widespread water quality impairment in Chetco River. The river is warm coming out of the Kalmiopsis Wilderness because of sparse vegetation and riparian conditions resulting from granitic soil (Maguire 2001f). Historically, it was cooled by tributaries

flowing from forested watersheds in the middle and lower basin. Most tributaries and the lower mainstem Chetco River have warmed considerably in modern times and do not meet the ODEQ (2002a) temperature criterion of MWMT 64 °F. Tributaries no longer provide a significant buffer to mainstem temperatures and their function as cold water refugia for downstream migrating coho salmon juveniles and other salmonids is now impaired. Although tributaries still provide cool water refugia, the quantity and quality of the cold water refugia has decreased over time while temperatures gradually warm. Temperature data confirm that reaches of the mainstem are acutely stressful or lethal to salmonids (Figure 13-3), indicating that cooler water inputs from tributaries has become even more important over time. The water temperature in stream channels on U.S. Forest Service (USFS) lands has been improving. Emily Creek and the South Fork Chetco River have been gradually approaching suitable water temperatures for coho salmon (USFS 1996a). The middle North Fork Chetco River and its tributary Bosley Creek, on BLM lands, are currently suitable for coho salmon, but Bravo Creek and the lower North Fork reaches on private timberlands are too warm. There are also problems with high total phosphates, and occasional high pH, in the lower Chetco River (Maguire 2001f). Water quality in the estuary is poor due to low dissolved oxygen in the summer (Maguire 2001f).

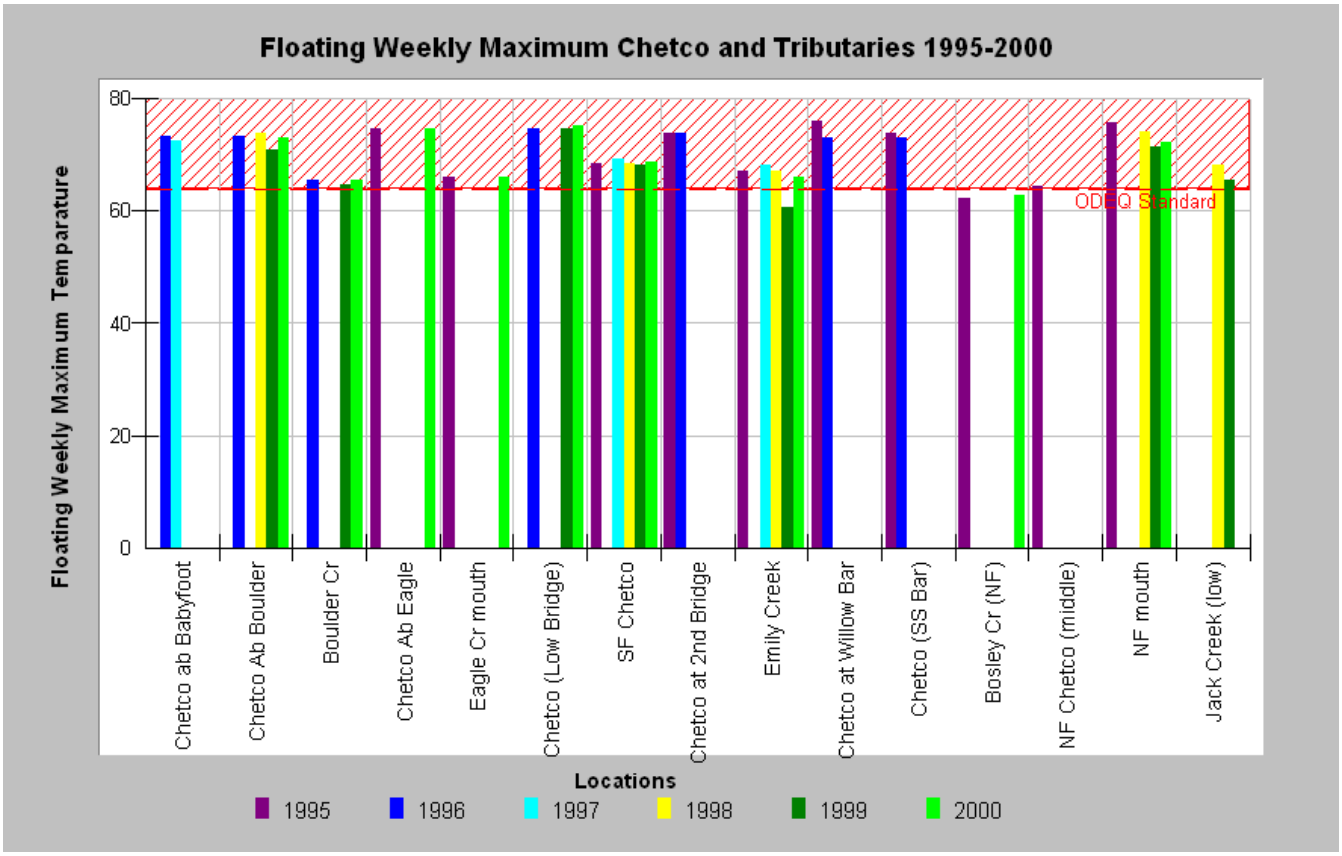

Figure 13-3. Maximum floating weekly maximum temperatures (MWMT). These data show that from 1995 to 2000, water temperature exceeded the 64 °F standard at most locations (Maguire 2001f).

Impaired Estuary/Mainstem Function

The Chetco River estuary was historically small, and much of what once was estuarine rearing habitat no longer serves this function for coho salmon (Massingill 2001f). There is little to no

remaining estuarine rearing habitat or refugia for smolts or adults. Upstream of the mouth, steep terrain adjacent to the mainstem limits the availability of tidal estuarine habitat. Formerly productive Tuttle Creek is disconnected as it now flows through several hundred feet of culverts underneath an RV Park. Reduced freshwater flows into the estuary contribute to and exacerbate stagnation and water quality problems. Lack of juvenile rearing habitat and impaired water quality in the estuary constitute an overall high stress for coho salmon.

Altered Sediment Supply

Altered sediment supply poses an overall medium stress to coho salmon in the Chetco River. Sediment contribution from landslides and erosion occurs naturally in the Chetco River basin; however, roads, timber harvest, and bank erosion following removal of riparian vegetation have elevated fine sediment input. Excess fine sediment directly impacts coho salmon egg viability and can reduce food for fry, juveniles and smolts. Poor pool frequency and depth throughout the Chetco River basin (Massingill 2001f) 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. Overall, coarse sediment supply in the Chetco River basin has declined since the 1970's (Wallick et al. 2009) due to improved management practices on public lands in the upper basin.

Barriers

One major tributary, Ferry Creek, is culverted for several hundred feet just upstream of its confluence which is likely a complete barrier. Road-stream crossings in the Lower, Middle and North Fork watersheds and their tributaries that could be barriers to coho salmon or other adult and juvenile salmonids have been inventoried and necessary restoration actions are planned (Maguire 2001f), although progress is unknown. The barrier at the confluence of Left Redwood Creek and the mainstem Chetco River, as well as those on the small tributaries to the south of Jacks Creek that empty directly to the ocean, are of greatest concern. The first barrier blocks access to most of the river, and the others occur upstream where high IP habitat is scarce.

Adverse Hatchery-Related Effects

The effects of hatchery fish on all life stages of coho salmon are described in Chapter 3. There are no operating hatcheries in the Chetco River population area. The ODFW Expert Panel expressed concern that out-of-basin hatchery-produced coho salmon may stray into the Chetco River and affect the genetic integrity of the wild population (ODFW 2008b). Hatchery-origin coho salmon may stray into the Chetco River, but hatchery-origin adults may stray into the population area; however, the proportion of adults that are of hatchery origin is unknown. Adverse hatchery-related effects pose a low risk to all life stages, because less than five percent of adults are presumed to be of hatchery origin and there are no hatcheries in the basin (Appendix B).

Adverse Fishery-Related Effects

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

13.6 Threats

Table 13-3. Severity of threats affecting each life stage of coho salmon in the Chetco 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	Channelization/Diking	Medium	High	High	High	High	High
2	Roads	Medium	High	High	High	High	High
3	Urban/Residential/Industrial	Low	High	High	High	High	High
4	Timber Harvest	Low	High	High	High	High	High
5	Mining/Gravel Extraction	Medium	High	High	Medium	Medium	Medium
6	Agricultural Practices	Low	Medium	Medium	Medium	Medium	Medium
7	Dams/Diversion	Low	Medium	Medium	Medium	Medium	Medium
8	High Intensity Fire	Low	Medium	Medium	Medium	Medium	Medium
9	Climate Change	Low	Low	Medium	Medium	Medium	Medium
10	Road-Stream Crossing Barriers	-	Low	Low	Low	Low	Low
11	Hatcheries	Low	Low	Low	Low	Low	Low
12	Invasive Non-Native/Alien Species	Low	Low	Low	Low	-	Low
13	Fishing and Collecting	-	-	-	-	Low	Low

Channelization/Diking

Nearly all of the tidal wetlands in the Chetco River have been channelized or diked and are no longer available to coho salmon. Development along the south side of the river likely eliminated limited tidal wetlands that provided off-channel habitat for coho salmon rearing and holding. Two marinas and a large jetty have been built in the estuary and most of the floodplain is developed. Many reaches of the lower Chetco River mainstem, its tributaries, and the estuary have high intrinsic potential coho salmon habitat (Williams et al. 2006); however, this portion of the river has been disconnected from the floodplain. The estuary was partially filled when levees were constructed to improve navigability into the ocean. The mouth of the river and the mainstem upstream are now channelized and diked. Tuttle Creek, which was formerly productive for coho salmon (Maguire 2001f), has been straightened and confined. The Chetco River channel above the North Fork has been confined in order to expand pastures for grazing. Streams are also forced into narrow channels due to confinement by roads throughout the

population area (USFS 1996a). This leads to reduced floodplain connectivity and function, increased current velocity, and makes reaches less suitable for coho rearing.

Roads

The highest road densities in the middle, lower, and North Fork Chetco River are on private lands. Maguire (2001f) used road crossing density to evaluate the risk of sediment impacts and found the highest density of road crossings in the Chetco coastal area and middle Chetco mainstem. There was a moderately high risk due to density of road crossings in Jack Creek, and the lower and upper Chetco mainstem. The North Fork and Eagle Creek both received moderate risk ratings. On USFS land, streams with the highest road densities are Mill, Emily, Eagle, Panther, West Coon and Quail Prairie creeks, South Fork Chetco River, and the south side of the Chetco River below Long Ridge (USFS 1996a). Another effect of roads is the potential for elevated peak flows. The lower Chetco River near the coast and middle mainstem is at the highest risk of damaging peak flows due to roads (Massingill 2001f). There is a moderate risk for elevated peak flows in Jacks Creek, the lower mainstem Chetco, and the North Fork Chetco.

Urban/Residential/Industrial Development

The number of rural landowners in the Chetco River basin has increased considerably since 1950. For example, in 1950 there were less than ten adjoining property owners near the mouth of the North Fork, and in 2001 there were 92 (Massingill 2001f). The highest intrinsic potential coho habitat is centered in the lower basin where most land is privately owned and land management is often intensive. Human population growth is concentrated around Brookings Harbor at the mouth of the Chetco River and upstream to USFS ownership at the mouth of the South Fork Chetco River. As rural populations grow, so does the demand for water, the risks of increases in peak flow, increases in sediment inputs, riparian vegetation removal and water contamination. Currently, municipal uses account for most of the water withdrawals from the Chetco River and its tributaries (Massingill 2001f).

Development continues to occur adjacent to the estuary, and fill material has reduced the size and function of the estuary. Marina development and other commercial activities in and near the estuary combine with urbanization to create a high amount of impervious area that can contribute to non-point source pollution. Paved roads, parking lots, rooftops, or other surfaces that do not absorb rainfall tend to send much more water to streams, elevating peak flows and contributing pollution to streams (Booth and Jackson 1997). Leakage or percolation from rural residential septic systems is a potential source of nutrient pollution.

Timber Harvest

Timber harvest in the Chetco River basin poses a threat to coho salmon due to short rotation clear cutting cycles in areas that overlap with high IP coho salmon habitat, or contribute water to IP habitat downstream. Landscape-scale imagery available from Google Earth shows widespread timber harvest and extensive road networks on private timber land in the western portion of the population area. More than 50 percent of the area in many small drainages along the Chetco River from Eagle Creek to the mouth has been harvested (USFS 1996a). Other parts of the population area have also experienced intense timber harvest, such as Basin creek which has had 60 percent of its area harvested recently. . These levels of timber harvest have been

found to disrupt channels and diminish Pacific salmon species diversity in other Oregon coastal basins (Reeves et al. 1993).

Mining/Gravel Extraction

Gold mining claims remain in the upper Chetco River basin (Zaitz 2010), which cover several miles of stream. Mining activity could potentially increase, including use of larger dredges and heavy equipment (Zaitz 2010). The largest active gravel mining site is in the lower Chetco River on the terrace just upstream of Jacks Creek, where the river is low gradient and the valley is unconfined.

Agricultural Practices

Grazing is the principal agricultural activity in the Chetco River basin. However, the largest agricultural impact to coho salmon is the confinement of the lower river channel and the resulting disconnection from its historic floodplain. The levees, dikes, and general encroachment of pasture and agricultural lands onto the floodplain have greatly reduced off channel rearing habitat availability.

Dams/Diversions

One major tributary to the estuary, Ferry Creek, is dammed just upstream of its confluence. There are no known diversions that block fish passage. Effects of water diversions other than passage issues are described under the 'Urban/Residential/Industrial Development' threat.

High Intensity Fire

Extensive portions of the Chetco River population area burned in the 23,500 acre Silver Fire of 1987. The Biscuit Fire of 2002 burned most of the upper Chetco River, including most of the Kalmiopsis Wilderness area (Azuma et al. 2004). However, 63 percent of the area burned in the Biscuit Fire was at low to very low intensity. In the North Fork Chetco, sudden oak death syndrome is killing tan oak and bay laurel trees (ODA 2008), which can elevate fire risk because dead trees are more flammable.

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 predicts a moderate increase over the next 50 years. Average temperature could increase by up to 1.5^{o}C in the summer and by 1^{o}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 will likely occur (Mote and Salathe 2010). Overall, the range and degree of variability in temperature and precipitation are likely to increase. The vulnerability of the estuary and coast to sea level rise is moderate to high in this coastal population. Rising sea level may impact the quality and extent of wetland rearing habitat.

Road-Stream Crossing Barriers

Coho salmon have access to most of the population area, although there are ten remaining barriers which have been identified as problematic for fish passage. One of the most significant barriers is the barrier at the confluence of the mainstem Chetco River and Redwood Creek, which blocks access to the majority of Redwood Creek. Five tide gates on small streams emptying directly to the ocean are problematic because they affect some of the little available IP habitat in this basin.

Hatcheries

Hatcheries pose a low threat to all life stages of coho salmon in the Chetco River population area. The rationale for these ratings is described under the "Adverse Hatchery-Related Effects" stress.

Invasive Non-Native/Alien Species

Sudden oak death (SOD) is a non-native pathogen which affects almost all native plants, trees, and shrubs. SOD infections often result in mortalities to some species of oaks and bay laurels. There are known outbreaks of SOD in Curry County and the Chetco River. SOD infections, especially SOD control efforts to limit outbreaks, result in affects to riparian function by removing trees from riparian areas.

Japanese knotweed (*Polygonum cuspidatum*) has spread into the Chetco River (ODA 2010) and efforts are underway to control its spread and distribution. This is a concern because Japanese knotweed is aggressive, fast growing, and out-competes native vegetation in riparian areas. Scotch broom and gorse are also locally common and similarly invasive. If these plants replace conifers or hardwoods in riparian zones, it substantially impacts coho salmon habitat.

Fishing and Collecting

The directed recreational fishery for hatchery coho salmon in Oregon likely encounters more coho salmon than the Chinook-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 recreational fishery. The exploitation rates associated with this freshwater fishery and all other fisheries managed by the State of Oregon were found to be low enough to avoid jeopardizing the existence of the ESU (NMFS 1999). The standard applied to make that determination was a jeopardy standard, not a species viability standard, because recovery objectives to achieve species viability had not been established for SONCC coho salmon at that time (NMFS 1999). NMFS has authorized future collection of coho salmon for research purposes in the Chetco River. NMFS has determined these collections are not likely to jeopardize the continued existence of the SONCC coho salmon ESU.

13.7 Recovery Strategy

The most important factor limiting recovery of coho salmon in the Chetco River is a deficiency in the amount of suitable rearing habitat for juveniles. The processes that create and maintain such habitat must be restored by increasing channel complexity, restoring flow, and reducing

stream temperatures. Channel complexity should be improved by restoring large wood in streams, restoring those processes that provide large wood to streams, constructing off-channel ponds or backwater habitat, restoring wetlands, moving levees, or limiting development and fill. Areas adjacent to the stream should be replanted with conifers to re-establish mature streamside forest as a source for large wood recruitment. Restoration of sufficient water may require changes in water use and allocation.

Habitat restoration and threat reduction in the Chetco River should be focused on those areas currently occupied by coho salmon, which would allow for immediate benefits to the population. Unoccupied areas must also be restored to provide enough habitat to achieve population viability and provide for conditions suitable to allow for re-colonization.

Table 13-4 on the following page lists the recovery actions for the Chetco River population.

Table 13-4. Recovery action implementation schedule for the Chetco River population.

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-CheR.1.1.1	Estuary	Yes	Improve connectivity of tidally-influenced habitat	Increase conifer riparian vegetation	USFS lands	3
SONCC-CheR.1.1.1.1	*Determine appropriate silvicultural prescription for benefits to coho salmon habitat*					
SONCC-CheR.1.1.1.2	*Thin, or release conifers, guided by prescription*					
SONCC-CheR.1.1.1.3	*Plant conifers, guided by prescription*					
SONCC-CheR.1.4.7	Estuary	Yes	Protect estuarine habitat	Improve regulatory mechanisms	Estuary	2
SONCC-CheR.1.4.7.1	*Limit development and filling of estuarine habitat through the development of regulatory mechanisms such as county or city ordinances*					
SONCC-CheR.1.4.7.2	*Maintain or strengthen current estuarine protection measures*					
SONCC-CheR.1.3.8	Estuary	Yes	Increase tidal exchange of water	Set back or remove dikes or levees	Estuary	3
SONCC-CheR.1.3.8.1	*Assess and prioritize levees for setback or removal.*					
SONCC-CheR.1.3.8.2	*Remove or setback levees, guided by assessment results*					
SONCC-CheR.1.2.9	Estuary	Yes	Improve estuarine habitat	Restore tidally influenced habitats	Estuary	3
SONCC-CheR.1.2.9.1	*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-CheR.1.2.9.2	*Restore tidally influenced habitats, guided by the plan*					
SONCC-CheR.1.2.10	Estuary	Yes	Improve estuarine habitat	Improve water quality	Estuary	3
SONCC-CheR.1.2.10.1	*Determine causal mechanisms for nutrient pollution, algae blooms, and anoxia in the estuary, starting with understanding circulation patterns in the estuary. Make recommendations for reducing algal blooms*					
SONCC-CheR.1.2.10.2	*Implement recommendations to improve water quality, guided by assessment results*					
SONCC-CheR.1.2.31	Estuary	Yes	Improve estuarine habitat	Assess estuary and tidal wetland habitat	Estuary	3
SONCC-CheR.1.2.31.1	*Identify parameters to assess condition of estuary and tidal wetland habitat*					
SONCC-CheR.1.2.31.2	*Identify parameters to assess condition of estuary and tidal wetland habitat*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-CheR.2.2.5	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	North Fork Chetco basin, alluvial terraces along the Lower Chetco, Jacks Creek, estuary.	3
SONCC-CheR.2.2.5.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-CheR.2.2.5.2	*Implement restoration projects that improve off channel habitats as guided by assessment results*					
SONCC-CheR.2.1.6	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	North Fork Chetco basin, alluvial terraces along the Lower Chetco, and Jacks Creek.	3
SONCC-CheR.2.1.6.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-CheR.2.1.6.2	*Place instream structures, guided by assessment results*					
SONCC-CheR.2.2.32	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	3
SONCC-CheR.2.2.32.1	*Develop program to educate and provide incentives for landowners to keep beavers on their lands*					
SONCC-CheR.2.2.32.2	*Implement beaver program (may include reintroduction)*					
SONCC-CheR.3.1.11	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Lower mainstem Chetco River, Jacks Creek	3
SONCC-CheR.3.1.11.1	*Determine instream flow needs for coho salmon, utilize existing USGS gauging station information*					
SONCC-CheR.3.1.11.2	*Perform a groundwater study to determine the volume of aquifer storage and the role of aquifers in streamflow*					
SONCC-CheR.3.1.11.3	*Provide incentives and education to landowners to reduce water consumption and reduce groundwater pumping and surface water diversion by utilizing conservation and storage.*					
SONCC-CheR.7.1.2	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Timberland	BR
SONCC-CheR.7.1.2.1	*Plant disease-resistant Port Orford cedars, guided by assessment results*					
SONCC-CheR.7.1.3	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Population wide	3
SONCC-CheR.7.1.3.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-CheR.7.1.3.2	*Develop watershed-specific guidance for managing riparian vegetation. Consider larger riparian buffers in coho occupied habitat and discourage development adjacent to the estuary*					
SONCC-CheR.7.1.4	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Privately held timberlands	2
SONCC-CheR.7.1.4.1	*Revise Oregon Forest Practice Act Rules in consideration of IMST (1999) and NMFS (1998) recommendations*					
SONCC-CheR.7.1.33	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	BLM lands	3
SONCC-CheR.7.1.33.1	*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-CheR.10.2.15	Water Quality	Yes	Reduce pollutants	Educate stakeholders	North Fork Chetco, Jacks Creek, lower Chetco, estuary	BR
SONCC-CheR.10.2.15.1	*Develop an educational program that teaches landowners and businesses about avoiding pollution from septic systems, backyard pesticides, fuels, and nutrients.*					
SONCC-CheR.10.2.16	Water Quality	Yes	Reduce pollutants	Set standard	Population wide	3
SONCC-CheR.10.2.16.1	*Develop TMDLs for 303(d) listed water bodies*					
SONCC-CheR.16.1.17	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-CheR.16.1.17.1 *SONCC-CheR.16.1.17.2*	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters* *Identify fishing impacts expected to be consistent with recovery*					
SONCC-CheR.16.1.18	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-CheR.16.1.18.1 *SONCC-CheR.16.1.18.2*	*Determine actual fishing impacts* *If actual fishing impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-CheR.16.2.19	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-CheR.16.2.19.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-CheR.16.2.19.2	*Identify scientific collection impacts expected to be consistent with recovery*					
SONCC-CheR.16.2.20	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-CheR.16.2.20.1	*Determine actual impacts of scientific collection*					
SONCC-CheR.16.2.20.2	*If actual scientific collection impacts exceed levels consistent with recovery, modify collection so that impacts are consistent with recovery*					
SONCC-CheR.27.1.21	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate abundance	Population wide	3
SONCC-CheR.27.1.21.1	*Perform annual spawning surveys*					
SONCC-CheR.27.1.22	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Develop survival estimates	Site to be determined	3
SONCC-CheR.27.1.22.1	*Install and annually operate a life cycle monitoring (LCM) station*					
SONCC-CheR.27.1.23	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Track life history diversity	Population wide	3
SONCC-CheR.27.1.23.1	*Describe annual variation in migration timing, age structure, habitat occupied, and behavior*					
SONCC-CheR.27.1.24	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Track indicators related to the stress 'Fishing and Collecting'	Population wide	2
SONCC-CheR.27.1.24.1	*Annually estimate the commercial and recreational fisheries bycatch and mortality rate for wild SONCC coho salmon.*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-CheR.27.2.25	Monitor	No	Track habitat condition	Track habitat indicators related to spawning, rearing, and migration	Population wide	3
SONCC-CheR.27.2.25.1	*Measure indicators for spawning and rearing habitat. Conduct a comprehensive survey*					
SONCC-CheR.27.2.25.2	*Measure indicators for spawning and rearing habitat once every 10 years, sub-sampling 10% of the original habitat surveyed*					
SONCC-CheR.27.2.26	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Lack of Floodplain and Channel Structure'	All IP habitat	3
SONCC-CheR.27.2.26.1	*Measure the indicators, pool depth, pool frequency, D50, and LWD*					
SONCC-CheR.27.2.27	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Degraded Riparian Forest Condition'	All IP habitat	3
SONCC-CheR.27.2.27.1	*Measure the indicators, canopy cover, canopy type, and riparian condition*					
SONCC-CheR.27.2.28	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Water Quality'	All IP habitat	3
SONCC-CheR.27.2.28.1	*Measure the indicators, pH, D.O., temperature, and aquatic insects*					
SONCC-CheR.27.2.29	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Hydrologic Function'	All IP habitat	3
SONCC-CheR.27.2.29.1	*Annually measure the hydrograph and identify instream flow needs*					
SONCC-CheR.27.2.30	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Estuarine Function'	All IP habitat	3
SONCC-CheR.27.2.30.1	*Identify habitat condition of the estuary*					
SONCC-CheR.27.2.34	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Altered Sediment Supply'	All IP habitat	3
SONCC-CheR.27.2.34.1	*Measure the indicators, % sand, % fines, V Star, silt/sand surface, turbidity, embeddedness*					
SONCC-CheR.27.2.35	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Estuarine Function'	Estuary	3
SONCC-CheR.27.2.35.1	*Identify habitat condition of the estuary*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID		*Step Description*				
SONCC-CheR.27.1.38	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Refine methods for setting population types and targets	Population wide	3
SONCC-CheR.27.1.38.1		*Develop supplemental or alternate means to set population types and targets*				
SONCC-CheR.27.1.38.2		*If appropriate, modify population types and targets using revised methodology*				
SONCC-CheR.27.1.39	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Measure VSP parameters of coho salmon in remote areas		3
SONCC-CheR.27.1.39.1		*Develop techniques to estimate abundance, productivity, spatial structure, and diversity in remote areas.*				
SONCC-CheR.27.2.40	Monitor	No	Track habitat condition	Determine best indicators of estuarine condition	Estuary	3
SONCC-CheR.27.2.40.1		*Determine best indicators of estuarine condition*				
SONCC-CheR.5.1.12	Passage	No	Improve access	Remove barriers	Barriers identified in profile	3
SONCC-CheR.5.1.12.1		*Evaluate and prioritize barriers for removal*				
SONCC-CheR.5.1.12.2		*Remove barriers*				
SONCC-CheR.5.1.37	Passage	No	Improve access	Remove barriers	BLM lands	3
SONCC-CheR.5.1.37.1		*Evaluate and prioritize barriers for removal*				
SONCC-CheR.5.1.37.2		*Remove barriers*				
SONCC-CheR.7.1.36	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Private lands in Jacks Creek, Emily Creek, South Fork Chetco River	3
SONCC-CheR.7.1.36.1		*Determine appropriate silvicultural prescription for benefits to coho salmon habitat*				
SONCC-CheR.7.1.36.2		*Thin, or release conifers, guided by prescription*				
SONCC-CheR.7.1.36.3		*Plant conifers, guided by prescription*				
SONCC-CheR.8.1.13	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	BR
SONCC-CheR.8.1.13.1		*Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective*				
SONCC-CheR.8.1.13.2		*Decommission roads, guided by assessment*				
SONCC-CheR.8.1.13.3		*Upgrade roads, guided by assessment*				
SONCC-CheR.8.1.13.4		*Maintain roads, guided by assessment*				