7. Elk River Population

Northern Coastal Stratum

Core, Functionally Independent Population

High Extinction Risk

Population likely below depensation threshold

2,400 Spawners Required for ESU Viability

93 mi^2 watershed (78% Federal ownership)

63 IP-km (39 IP-mi) (23% High)

Dominant Land Uses are Agriculture and Recreation

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

Key Limiting Threats are 'Agricultural Practices' and 'Channelization/Diking'

Highest Priority Recovery Actions

• Develop total maximum daily loads (TMDLs) for water bodies listed under Clean Water Act Section 303(d) • Increase large woody debris (LWD), boulders, or other instream structure • Increase instream flows	• Improve timber harvest practices by revising Oregon Forest Practices Act • Improve regulatory mechanisms regarding agricultural practices • Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows

7.1 History of Habitat and Land Use

Historically, the lower Elk River provided the most important habitat for coho salmon in the population area. Large wood jams spanning the lower Elk River channel would dislodge and relocate with winter high flows. Impacts to the Elk River basin include timber harvest (and associated road-building) in the lower basin and extensive placer and hydraulic mining in the upper basin (Maguire 2001a). The legacy of mining in the Elk River basin may be substantial because hydraulic mining used water cannons to blast away alluvial deposits that caused potentially long lasting impacts on channel structure. Over time, settlement and associated agriculture encroached on the lower Elk River floodplain which confined the channel and reduced wetlands. These human settlements greatly reduced or eliminated wood jams and beaver that had previously helped form coho salmon rearing habitat. Basin-wide disturbances occurred from 1950 to 1990 and were associated with expansion of the road network and industrial timber harvest on public and private lands (U.S. Forest Service [USFS] 1998a). Extensive road networks were developed to support timber harvest, and these roads and timber harvesting practices greatly damaged the landscape surrounding the Elk River and impacted the water quality and habitat in the river and its tributaries. Between 1954 and 1989, over 300 million board feet of timber were removed from the Elk River population area and the cumulative effects to streams were substantial, particularly following large storm events (USFS 1998a). Between 1952 and 1986, road and harvest-related landslides within the basin delivered 2.2 times more fine sediment volume than naturally-occurring landslides (USFS 1998a). Currently, the Elk River is recognized as a Key Watershed under the Northwest Forest Plan, (USDA and USDI 1994) and much of the USFS land is managed as Late Successional Reserve or as part of the Copper Salmon Wilderness. Private timberlands are limited in the population area. In the last two decades, cranberry farming has expanded into lower tributary watersheds, where on and off-stream storage reservoirs have been built. Cranberry farming has contributed to the loss of function in three low gradient tributaries that were mostly high IP coho salmon habitat. Residential development has also increased in the lower basin.

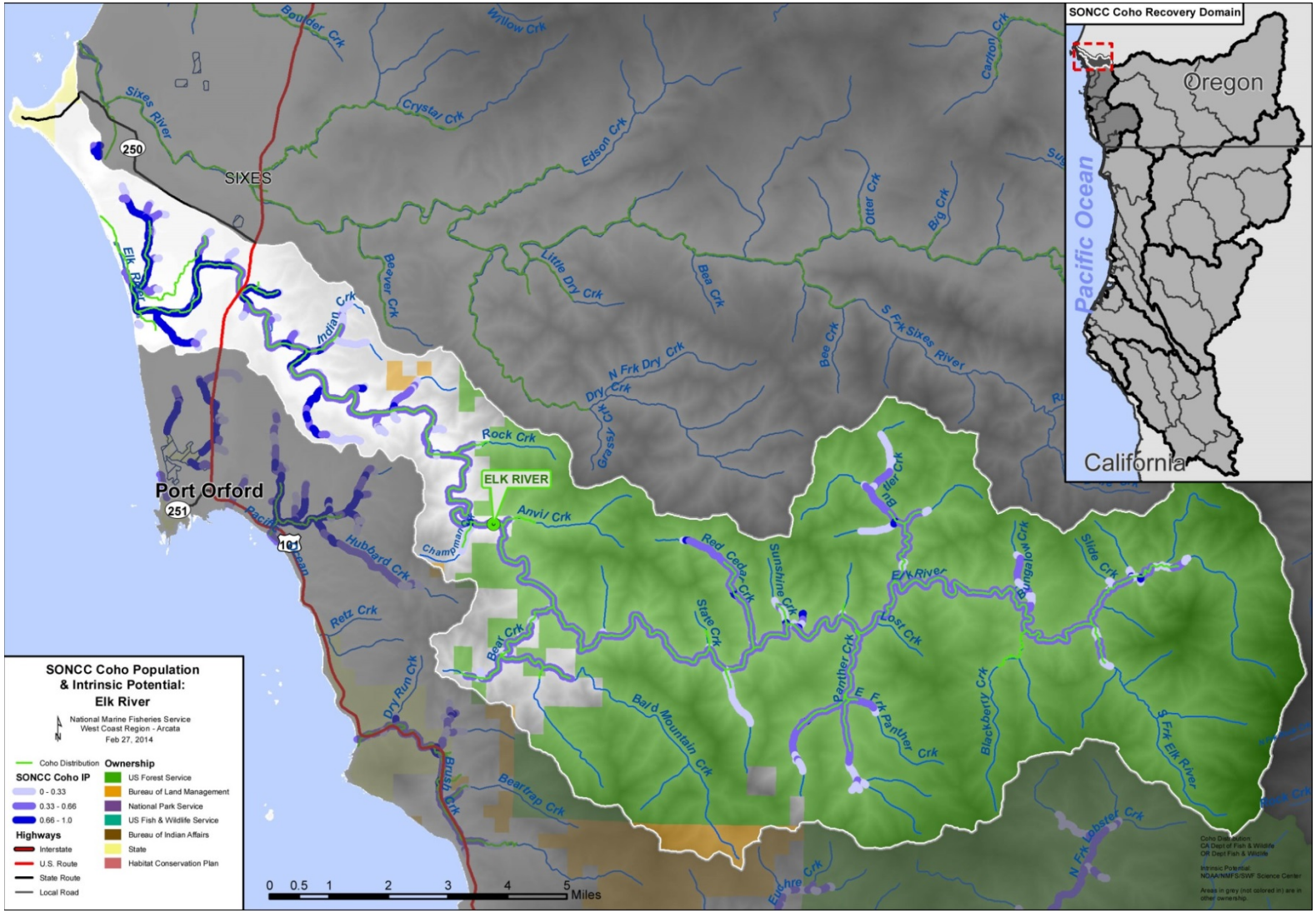

Figure 7-1. The geographic boundaries of the Elk River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2013a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

7.2 Historic Fish Distribution and Abundance

The Elk River basin has 63 total Intrinsic Potential-kilometers (IP-km) of coho salmon habitat (Williams et al. 2008). Approximately 7.7 km of IP habitat is currently inaccessible due to a dam. The coho salmon habitat with highest IP is concentrated in the lower Elk River, including all tributaries of the alluvial coastal plain downstream of Rock Creek (Williams et al. 2008) (Figure 7-1). Short, low gradient stream reaches in upper tributaries, such as the North Fork Elk River, Red Cedar Creek, Panther Creek and Butler Creek also have optimal IP habitat.

Historically, coho salmon were more abundant in the Elk River basin than they are today. Contemporary distribution of coho salmon is much reduced from the period of early Anglo-American settlement beginning in the 1850s. This reduction may be due to habitat modification in the lower reaches, including diking and channelization of the mainstem, which eliminated summer and winter rearing habitat (Maguire 2001a). Smaller tributaries, such as one near the mouth of Elk River and upstream of Highway 101, are now disconnected or dammed for agricultural water supply. In 1927, the gillnet catch from the Elk River was dominated by 13,334 pounds of coho salmon (USFS 1998a). Tributaries with the highest IP are shown in Table 7-1.

Table 7-1. Tributaries with high IP reaches (IP > 0.66) (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Lower Elk River and Estuary	Panther Creek	Sunshine Creek
Indian Creek	Red Cedar Creek	Butler Creek
Bagley Creek	Swamp Creek	

7.3 Status of Elk River Coho Salmon

Spatial Structure and Diversity

Oregon Department of Fish and Wildlife (ODFW) has conducted adult coho salmon carcass and redd counts (ODFW 2008a) and juvenile snorkel surveys (ODFW 2005a) in the mainstem Elk River and its tributaries. The South Coast Watershed Council (SCWC) conducted smolt trap surveys in 2012 in Swamp Creek and Cedar Creek (SCSC 2012). There are far more surveys with no sightings than those where coho salmon were found. Adult coho salmon were found in Anvil, Indian, Butler, and Red Cedar creeks as well as the mainstem Elk River between Sunshine Creek and Red Cedar Creek. Juvenile coho salmon were found in Panther, Red Cedar, Swamp, Cedar, and Blackberry creeks as well as the middle mainstem Elk River. USFS (1998a) identified Red Cedar, the North Fork Elk, Panther Creek, and Anvil Creeks as those most important for coho salmon production, as they appeared to account for most coho salmon production in the basin. The very low number of adult fish observed by ODFW and low density of juveniles in summer surveys indicates a very small population which would likely have restricted genetic diversity.

Population Size and Productivity

In 1997, adult coho salmon populations for the entire Elk River population area ranged between 100 and 200 (USFS 1998a). Estimated returns were zero in many years between 1998 and 2007, and at most 501 in 1998 (ODFW 2009a) (Table 7-2). Large differences in effort between years and incomplete survey coverage could account for observed differences in estimates. In addition, high flows may have occurred in some years, which could affect the ability to carry out sampling consistently or effectively.

Table 7-2. Estimates of annual spawning escapement of coho salmon for the Elk River (ODFW 2009a).

Year	Population Estimate	Year	Population Estimate	Year	Population Estimate
1998	501	2002	104	2006	0
1999	Not estimated	2003	187	2007	230
2000	0	2004	0	2008	Not estimated
2001	Not estimated	2005	0		

Extinction Risk

The Elk River population is at high risk of extinction because NMFS estimates 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.

In addition, the areas where juvenile coho salmon currently rear are concentrated in the low gradient reaches of steeper upper basin tributaries, recognized by Frissell (1992) as alluviated canyons. These areas are prone to alteration by floods and populations dependent on them are vulnerable to periodic disturbance and habitat alterations. Therefore, even the low numbers of coho salmon observed in some years are at high risk of losing their habitat.

Role in SONCC Coho Salmon ESU Viability

The Elk River population is considered to be a core, Functionally Independent population within the Northern Coastal diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams et al. 2006). To contribute to stratum and ESU viability, the Elk River core population needs to have at least 2,400 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. Besides its role in achieving demographic goals and objectives for recovery, as a core population the Elk River population may serve as a

source of spawner strays for nearby coastal populations. At present, the capacity of the Elk River coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from nearby rivers may enhance recovery of the Elk River population.

7.4 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 Elk River population are as follows:

> Key concerns were primarily loss of over-winter tributary and freshwater estuarine habitat complexity and floodplain connectivity for juveniles, especially in the lowlands which are naturally limited in this system and have been impacted by past and current agricultural practices. Secondary concerns were primarily related to high water temperatures in tributaries for summer parr (excluding the mainstem, where rearing is not expected) and loss of tributary habitat for juveniles and adults due to road crossings (especially in Bagley and Blackberry Creeks).

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 a comprehensive plan that 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.

Cumulative Effects of Southwest Oregon Coastal Land Use on Salmon Habitat

Oregon State University's Oak Creek Labs conducted a study funded by ODFW and the Oregon Department of Forestry 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.

Oregon Clean Water Act 303(d) Impaired Water Body List

The mainstem Elk River and estuary, Bald Mountain Creek and Butler Creek are recognized as water quality impaired on the Oregon Clean Water Act 303(d) impaired water body list due to temperature problems and habitat modification. No TMDL has been approved.

U.S. Forest Service

Elk River Watershed Analysis (USFS 1998a)

The Elk River watershed analysis was developed to implement the Northwest Forest Plan and provides the watershed context for fishery protection, restoration, and enhancement efforts. The following is a summary of the most relevant findings: (1) Excessive sediment from natural and management activities has decreased pool depth; (2) Reduction of pool depth decreases available habitat and fish production and provides a competitive advantage to steelhead over other salmonids; (3) High road densities change hillslope hydrology, which contributes to elevated peak flows that damage streams; and (4) Over-winter survival for juvenile salmonids may be decreased due to low habitat complexity (i.e., no slow velocity marginal habitats behind large wood jams or old growth riparian trees).

Sufficiency Assessment: Forest Service and Bureau of Land Management Programs in Support of SONCC Coho Salmon Recovery (USFS and BLM 2011)

The USFS has adopted a Watershed Condition Framework assessment and planning approach (USFS and BLM 2011). The Watershed Condition Framework (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands. The WCF provides the Forest Service with an outcome-based performance measure for documenting improvement to watershed condition at forest, regional, and national scales. As part of the WCF, Upper Elk River was identified as a high priority 6th field sub-watershed in the Rogue-Siskiyou National Forest (USFS and BLM 2011).

South Coast Watershed Council

Elk River Watershed Assessment (Maguire 2001a)

The Elk River watershed assessment includes a compilation, summary, and synthesis of existing data and information pertaining to watershed conditions in the Elk River basin. Some findings relevant to coho salmon recovery include issues with water temperature, highly altered wetlands, weak riparian cover (especially in the lower sections), sediment sources (present and potential), and noxious weed invasions. The assessment describes variation in run timing of coho salmon in the Elk River basin, with “early” coho salmon entering streams beginning in about mid-November and spawning soon after, while “late” coho salmon delay spawning until as late as March or April.

Elk River Action Plan (Massingill 2001a)

The Elk River action plan is a companion to Maguire (2001a) and defines specific action items for restoration of the Elk River basin.

7.5 Stresses

Table 7-3. Severity of stresses affecting each life stage of coho salmon in the Elk 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]	High	High	Very High[1]	Very High	Very High	Very High
2	Impaired Water Quality[1]		High	Very High[1]	High	Low	High
3	Degraded Riparian Forest Conditions	-	High	High	High	Medium	High
4	Impaired Estuary/Mainstem Function	-	Low	Medium	High	Low	Medium
5	Altered Hydrologic Function	Low	Low	High	High	High	High
6	Altered Sediment Supply	Medium	Medium	Medium	Low	Medium	Medium
7	Barriers	-	Medium	Medium	Low	Medium	Medium
8	Adverse Hatchery-Related Effects	Low	Low	Low	Low	Low	Low
9	Increased Disease/Predation/Competition	Low	Low	Low	Low	Low	Low
10	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Low	Low

[1]Key limiting stresses and limited life stage.

Key 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. Lack of floodplain and channel structure and impaired water quality are the two most limiting stresses. Juvenile summer rearing habitat is impaired by high temperatures resulting from degraded riparian conditions and water withdrawals. Winter rearing habitat has been reduced by channelization, diking, and filling of wetlands. Timber removal has decreased the source of large wood, and most historically available habitat in the estuary has been altered by development, channelization, sedimentation, and diking. Overall, these findings are consistent with those of the Oregon Expert Panel (ODFW 2008b) (Section 7.4), but the expert panel considered water temperature to be only a secondary, not primary, concern.

The IP habitat in the Elk River basin is concentrated in the low gradient reaches of the basin near the ocean. No thermal refugia have been noted. Off-channel juvenile rearing habitat with suitable temperature is vital to coho salmon recovery in this river. Habitat currently occupied by coho salmon is at a premium and should be prioritized for protection.

Lack of Floodplain and Channel Structure

Lack of floodplain and channel structure is the greatest constraint to coho salmon production in the Elk River. The lower Elk River channel is disconnected from its floodplain, wetlands, and tributaries (Figure 7-2). This has significantly reduced what was once optimal habitat for coho salmon spawning, egg incubation, and rearing. The ODFW (2008b) Expert Panel found that loss of floodplain connectivity and access to off-channel habitat was a major limiting factor in this population. This stress applies to both freshwater and tidally-influenced freshwater areas. Tributary channels are also altered by agricultural activities, as evidenced in aerial photos (Figure 7-2). One entire fork of Swamp Creek is no longer discernible on aerial photos and has been completely filled in. Large woody debris was historically important and available in the lower Elk River but today there is little large wood (ODFW 2008b).

Figure 7-2. Aerial image from Google Earth of the Lower Elk River above and below Highway 101 (yellow line is highway). Rectangular beige shapes are cranberry bogs. Filled river meanders, cutoff wetlands and streams, and an irrigation pond on a tributary (right) are highlighted with red arrows.

Impaired Water Quality

Water temperature in the mainstem Elk River, Bald Mountain, Panther and Butler creeks does not meet the Oregon Department of Environmental Quality (ODEQ) maximum average weekly temperature (temperature) standard of 64 ºF. Water temperatures are suitable during the time of adult returns and when eggs are in the gravel. Data from the South Coast Watershed Council's monitoring program from 1991 to 2000 indicate that the warmest 7-day maximum recorded in the Elk River basin was 74.1 °F on the mainstem of the Elk River below Camp Creek. The water temperature at Bagley Creek is 3 to 4 °F warmer than that observed upstream at the National Forest boundary (Maguire 2001a). Butler, Bald Mountain, and Panther creeks were warm and ranged from 66 °F to 68 °F (USFS 1998a). Swamp Creek, a tributary to the estuary, also had impaired water temperature conditions of 69.7 °F (USFS 1998a). Fecal coliform levels exceeded standards in 8 out of 27 samples often during high flows, indicating moderately impaired conditions (Maguire 2001a). Phosphate levels exceeded the water quality standards 4 out of 28 samples (14.3 percent) during high flow events. All of these data (Maguire 2001a, USFS 1998a) are at least ten years old and so should not be considered a definitive description of current conditions. Effects of pesticides and herbicides on salmon are harmful (Ewing 1999), but there are no pesticide studies in the Elk River, nor any regional data available (Riley, S., pers. comm. 2009).

Degraded Riparian Forest Conditions

ODFW (2008b) noted problems with high water temperatures due to riparian shade loss and competition from non-native shrubs. Elk River riparian zones were once dominated by large conifers, but today are dominated by hardwoods and invasive non-native species including gorse and Himalayan blackberry (USFS 1998a, Maguire 2001a). In steeper channels of headwater streams, riparian trees may be removed by rapidly moving landslides known as debris torrents that move down channels (USFS 1998a).

Impaired Estuary/Mainstem Function

The main issues for coho salmon in the estuary are insufficient holding habitat for smolts and the barriers described below. Based on aerial photos, most of the land adjacent to the Elk River estuary has been converted to agricultural land, with associated channelization and diking that has disconnected small tributaries. A small amount of off-channel habitat remains near the mouth.

Altered Hydrologic Function

Diversion dams block water movement and restrict flows in a few lower river tributaries. Flow to the estuary from tributaries is completely disconnected. Wells for domestic and agricultural water supply in the lower Elk River and its tributaries have the potential to reduce surface water availability, which could substantially diminish coho salmon habitat in the smaller streams. Water diversions or surface water supply reductions both can directly reduce the amount of habitat available to coho salmon by drying up smaller streams and can increase water temperatures, making habitat unsuitable for coho salmon. The Elk River Watershed Assessment (Maguire 2001a) found that the minimum Oregon Water Rights Division instream-flow right of 45 cubic feet per second in the mainstem Elk River is usually met at the USGS gage at the Elk

River Hatchery. However, almost all of the water diversion is below the hatchery and no measurements are taken downstream or in tributaries with high IP. Therefore, compliance with the instream flow downstream of the hatchery has not been established. The significant number of cranberry bogs (Figure 7-2) alters hydrologic function by converting some tributaries to ponds and diverting many others. A golf course has been proposed on a terrace above Elk River. The proposal includes use of irrigation water from a tributary of lower Elk River. Increased peak flows in the watershed (USFS 1998a) can negatively affect redd stability and over-winter survival of fry and juveniles.

Altered Sediment Supply

Altered sediment supply poses an overall medium stress to coho salmon in the Elk River. Sediment contribution from landslides and erosion occurs naturally in the Elk River basin; however, roads, timber harvest, and bank erosion following removal of riparian vegetation have elevated fine sediment input. High sediment yield is of particular concern in those areas of the basin with decomposing diorite-type soil, such as at Bald Mountain Creek and Purple Mountain Creek (Maguire 2001a). 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 Elk River basin (Maguire 2001a) 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.

Barriers

The most important barriers in the Elk River are three agricultural dams that block migration of coho salmon and contribute to excessively high water temperature. Two of the dams disrupt Swamp Creek, a tributary to the estuary. The Curry County Soil and Water Conservation District recently improved fish passage at these barriers by installing baffled culverts. They documented coho salmon smolts above the first dam, but fully unimpeded passage has not been confirmed (Swanson, M., pers. comm. 2013).

The third dam affects the small unnamed creek immediately upstream of Highway 101. In addition, diking and filling of river and estuarine tributaries constitute a great impediment to fish movement that is addressed as part of the channelization and diking stress. A few culverts are in need of modification to improve fish passage, as described in the “road-stream crossing barriers” threat description.

Adverse Hatchery Effects

The Elk River Hatchery releases approximately 295,000 Chinook salmon juveniles into Elk River each September and an additional 10,000 yearling Chinook in April (ODFW 2008c). The risk of competition between wild coho salmon and hatchery-produced steelhead and Chinook salmon is minimized by rearing fish to a sufficient size that smoltification occurs quickly and the stocked fish quickly leave the river for the ocean (ODFW 2008c). Due to temperature impairment below the hatchery, juvenile coho salmon rear mostly upstream of the hatchery. Due to these factors, the potential for competition between hatchery-released Chinook salmon and wild coho salmon is expected to be reduced. Adverse hatchery-related effects pose a medium

risk to all life stages of coho salmon in the Elk River because of the ongoing in-basin stocking with Chinook salmon (Appendix B).

Disease/Predation/Competition

Water temperatures that are too high could elevate disease risk, although there are no recognized fish disease problems in the basin. Elk River Hatchery proactively manages disease risk and minimizes the risk of exposure of coho salmon to hatchery-related disease (ODFW 2008c).

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 low stress to juveniles, smolts, and adults.

7.6 Threats

Table 7-4. Severity of threats affecting each life stage of coho salmon in the Elk 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	Agricultural Practices[1]	High	Very High	Very High[1]	Very High	Very High	Very High
3	Channelization/Diking[1]	High	High	High[1]	Medium	Medium	High
2	Dams/Diversions	Low	Medium	High	High	Medium	High
4	Road/Stream Crossing Barriers	-	Low	High	Medium	High	High
5	Roads	Low	Medium	Medium	Medium	Medium	Medium
6	Timber Harvest	Medium	Medium	Medium	Medium	Low	Medium
7	Invasive/Non-Native Alien Species	-	Medium	Medium	Medium	Medium	Medium
8	Climate Change	-	-	Medium	Medium	Medium	Medium
9	High Severity Fire	Low	Low	Low	Low	Low	Low
10	Hatcheries	Low	Low	Low	Low	Low	Low
11	Mining/Gravel Extraction	Low	Low	Low	Low	Low	Low
12	Urban/Residential/Industrial Dev.	Low	Low	Low	Low	Low	Low
13	Fishing and Collecting	-	-	Low	Low	Low	Low

[1]Key limiting threats and limited life stage.

Key Limiting Threats

The two key limiting threats, those which most affect recovery of the population by influencing stresses, are agricultural practices and channelization/diking.

Agricultural Practices

Agricultural practices are the top threat for coho salmon because their impacts are concentrated in the lower basin, where the highest IP habitat exists and where all fish from the upper basin must pass. Agricultural impacts include the loss and filling of wetlands, water diversion, riparian alteration, polluted stormwater runoff, and blocked access to formerly productive tributaries. Areas of bare soil on terraces adjacent to the lower river and estuary, and newly cleared riparian forests, which are apparent in recent aerial photo images, suggest that agricultural activities may be expanding. The ODFW (2008b) expert panel found agricultural activities to be the causal mechanism for a number of factors limiting Elk River coho salmon production. Removal of riparian trees, particularly conifers, associated with agricultural activities decreases shade and promotes increased water temperature. Cattle grazing can degrade bank structure, initiate erosion, and lead to increases in nutrients and pollutants. Non-point source pollution from cranberry cultivation has not been assessed, but the South Coast Watershed Council is working with growers to consider value-added organic options.

Channelization and Diking

The ODFW (2008b) expert panel found that habitat simplification, resulting from straightening, channelizing, revetting, filling, and/or stream channel dredging, was the most limiting stress upon coho salmon in the Elk River. One entire fork of Swamp Creek has been filled. Much of the lower Elk River channel has been diked since the major floods of 1955 and 1964 (USFS 1998a). Channel confinement causes bed load mobility that disrupts redds which results in high stress to eggs. Fry and juveniles have difficulty over-wintering in confined channels because of elevated water velocities and a lack of off-channel refugia. The Lower Elk River lacks large wood jams that formerly provided shelter from winter high flows and complex summer rearing habitat. Streamside roads in the basin may also confine the channel, creating higher velocities.

Dams/Diversions

There are two main effects of diversions on coho salmon: passage impairment and reduced water in the river. The most problematic diversions are those to cranberry bogs and the small unnamed creek just upstream of Highway 101. These and other diversions facilitate movement of water away from juvenile rearing habitat. The USGS stream flow gage is upstream of the Elk River hatchery and flow data for the lower river are not available. This reach may be at risk from over-diversion, but there are insufficient data to evaluate.

Road-Stream Crossing Barriers

Road crossings on Bagley and Blackberry Creeks are high priority barriers (ODFW 2008b). Additional barriers are listed in Table 7-5.

Table 7-5. List of prioritized road-stream crossing barriers in the range of Elk River coho salmon.

Priority	Stream Name	Road Name	County	Miles of upstream habitat
High	Bagley Creek	N/A	Curry	N/A
High	Blackberry Creek	N/A	Curry	1.25
N/A	Chapman Creek	At intersection with Elk River	Curry	N/A

Roads

Some areas have road densities exceeding levels known to increase risk of fine sediment yield and altered hydrology. There are far more un-surfaced roads than paved roads in the Elk River basin, which can increase surface erosion. Road densities are highest in the lower Elk River, Panther Creek and Bald Mountain Creek watersheds. The number of road failures and landslides caused by roads is far greater on roads constructed before 1980 than more recently built roads (USFS 1998a). In 2009, the USFS designated the Copper Salmon Wilderness. Most of the USFS lands north of the mainstem Elk River were included. The USFS designated approximately 60 miles of road within this area to be decommissioned, thus reducing the future threat of roads.

Timber Harvest

Timber harvest poses a medium threat in the Elk River basin because of high rates of timber harvest on private lands. Private timberlands are located in the lower Elk River, in tributaries such as Indian and Bagley creeks, as well as in-holdings in the Bald Mountain and Panther Creek drainages. Harvest practices on private lands have been shown to increase movement of fine sediment to the Elk River, where the percentage of fine sediment from landslides delivered to streams was higher where trees had been harvested from riparian areas (USFS 1998a). High rates of timber harvest and high road densities in the lower Elk River are a concern because the tributary streams found there are important for coho salmon recovery.

Invasive Non-Native Species

Gorse, Himalayan blackberry, and scotch broom pose serious problems for agricultural land in the lower river. These species have colonized riparian zones and are inhibiting regeneration of native hardwoods and conifers that provide shade and channel stability and allow for long-term large wood recruitment. Japanese knotweed (*Polygonum cuspidatum*) has spread into areas near Port Orford and may be present in the Elk River (Oregon Department of Agriculture 2010). 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, coho salmon habitat will be substantially impacted.

Climate Change

Air temperatures during July are expected to increase by 0.0 – 0.5 °C at the coast and 1.5 to 2.0 °C in the eastern portion of the basin. January temperature rise is expected to be similar with

an increase of 0.5 to 1.0 °C at the coast and 1.0 to 1.5 °C in the interior portion of the basin. The latter trend could reduce snow pack in higher elevations, diminishing this source of cold water for coho salmon juvenile rearing. Sea level rise could expand the estuary and the footprint of tidal wetlands, which could potentially benefit coho salmon.

High Severity Fire

The large amount of land owned by the USFS and managed as Wilderness and Late Successional Reserves means that the Elk River basin has more old growth coniferous forest and maturing stands than any other southwest Oregon coastal basin. Stands of this type have a low risk of stand-replacing fires, particularly in a coastal basin.

Hatcheries

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

Mining/Gravel Extraction

There are 534 historic gold mining claims in the Elk River basin (Bredensteiner et al. 2001), and eight are active. There is currently no industrial scale gravel extraction. Minor amounts of aggregate are extracted for local use.

Urban/Residential/Industrial Development

There is some rural residential development in the lower Elk River. Residential development is concentrated in the lower basin, where the highest value coho salmon habitat occurs. Rural residential development can cause a variety of negative effects upon coho salmon and their habitats. These potential effects include, but are not limited to: increased road densities, increased densities of impervious surfaces, channel modification, reductions in riparian vegetation, reductions in riparian function, increased pollution and runoff, and reductions in in-stream water availability.

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 low threat to juveniles, smolts, and adults.

7.7 Recovery Strategy

Deficiencies in the amount of suitable, juvenile rearing habitat are the most important factors limiting Elk River coho salmon recovery. The processes that create and maintain such habitat must be restored by increasing channel complexity and restoring flow. Channel complexity should be improved by constructing off-channel ponds or backwater habitat, restoring wetlands, and limiting development and fill. To increase instream structure, LWD should be added to stable channels to provide structure until natural sources of LWD (mature coniferous forests) are

re-established next to the stream. Areas adjacent to the stream should be replanted to re-establish mature streamside forest as a source for LWD recruitment.

The most immediate need for habitat restoration and threat reduction in the Elk River are in those areas currently occupied by coho salmon, which are identified in this profile. Unoccupied areas must also be restored to provide enough habitats to allow for coho salmon recovery. Those areas with high IP habitat such as the Lower Elk River, Bagley Creek, Panther Creek, and Sunshine Creek are optimum candidates for recovery actions. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 7-6 on the following page lists the recovery actions for the Elk River population.

Table 7-6. Recovery action implementation schedule for the Elk River population. Recovery actions for monitoring and research are listed in the tables at the end of Chapter 5.

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-ElkR.12.1.41	Agricultural Practices	Yes	Improve agricultural practices	Improve regulatory mechanisms	Population wide	1
SONCC-ElkR.12.1.41.1	*Determine the best way to revise the Agricultural Water Quality Management Act (AWQMAP) so that it does not limit recovery of SONCC coho salmon and recommend appropriate revisions*					
SONCC-ElkR.12.1.41.2	*Ensure basin rules are specific and linked to implementing AWQMAP recommendations, including developing specific standards for riparian buffers*					
SONCC-ElkR.12.1.41.3	*Ensure that AWQMA plans address both impaired areas and proactive prevention of water quality impairment*					
SONCC-ElkR.12.1.41.4	*Adopt interim buffers equal to the buffer standards NMFS is recommending in Washington state until the state establishes its own buffers*					
SONCC-ElkR.12.1.41.5	*Change the complaint-based compliance monitoring process to a focused compliance program*					
SONCC-ElkR.2.8.4	Floodplain and Channel Structure	Yes	Improve timber harvest practices	Improve regulatory mechanisms	Private timberlands that include: tributaries of the alluvial coastal plain downstream of North Fork Elk River, Rock, Indian, Bagley, Red Cedar, Panther, and Butler creeks	1
SONCC-ElkR.2.8.4.1	*Determine how to revise Oregon Forest Practice Rules so that they do not limit recovery of SONCC coho salmon and make appropriate revisions*					
SONCC-ElkR.2.8.4.2	*Adopt rules for fish-bearing streams sufficient to protect both water quality and fish habitat*					
SONCC-ElkR.2.8.4.3	*Adopt rules to increase protection of non-fish-bearing streams that address practices that adversely impact water quality and fish habitat*					
SONCC-ElkR.2.8.4.4	*Ensure management measures for landslide prone areas include protection of water quality and fisheries habitat*					
SONCC-ElkR.2.8.4.5	*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-ElkR.2.7.3	Floodplain and Channel Structure	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Elk River, west of Indian Creek, between County Highway 207 and Elk River Road, and areas where coho would benefit immediately	2a
SONCC-ElkR.2.7.3.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-ElkR.2.7.3.2	*Develop grazing management plans to improve water quality and coho salmon habitat*					
SONCC-ElkR.2.7.3.3	*Plant vegetation to stabilize stream bank*					
SONCC-ElkR.2.7.3.4	*Fence livestock out of riparian zones*					
SONCC-ElkR.2.7.3.5	*Remove instream livestock watering sources*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.2.1.6	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	All tributaries of the alluvial coastal plain downstream of Rock Creek, as well as Indian Cree, Bagley, Sunshine creeks, North Fork Elk River, Red Cedar, Panther, and Butler creeks	2a
SONCC-ElkR.2.1.6.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-ElkR.2.1.6.2	*Place instream structures, guided by assessment results*					
SONCC-ElkR.2.1.51	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2b
SONCC-ElkR.2.1.51.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-ElkR.2.1.51.2	*Place instream structures, guided by assessment results*					
SONCC-ElkR.2.2.5	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Private timberlands that include: Mainstem Elk River and tributaries of the alluvial coastal plain downstream of North Fork Elk River, Rock, Indian, Bagley, Red Cedar, Panther, and Butler creeks	2a
SONCC-ElkR.2.2.5.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-ElkR.2.2.5.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-ElkR.2.2.53	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Population wide	2b
SONCC-ElkR.2.2.53.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-ElkR.2.2.53.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-ElkR.10.2.15	Water Quality	Yes	Reduce pollutants	Set standard	Population wide	2a
SONCC-ElkR.10.2.15.1	*Develop TMDLs for water bodies listed under Clean Water Act Section 303(d)*					
SONCC-ElkR.10.1.37	Water Quality	Yes	Reduce water temperature, increase dissolved oxygen	Increase instream flows	All streams with ODFW water rights for fish	2a
SONCC-ElkR.10.1.37.1	*Secure adequate instream flows to fulfill ODFW water rights for fish*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.2.2.49	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-ElkR.2.2.49.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-ElkR.2.2.49.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-ElkR.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-ElkR.2.2.52.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-ElkR.2.2.52.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-ElkR.2.7.1	Floodplain and Channel Structure	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Federal forest lands	2b
SONCC-ElkR.2.7.1.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-ElkR.2.7.1.2	*Plant conifers, guided by the plan*					
SONCC-ElkR.2.1.38	Floodplain and Channel Structure	Yes	Increase channel complexity	Improve grazing practices	Private lands population wide	2b
SONCC-ElkR.2.1.38.1	*Assess grazing contribution to sediment delivery, pollutants, and impaired riparian conditions*					
SONCC-ElkR.2.1.38.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-ElkR.2.1.38.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-ElkR.2.2.29	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	2b
SONCC-ElkR.2.2.29.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for landowners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-ElkR.2.2.29.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-ElkR.2.2.29.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-ElkR.10.2.36	Water Quality	Yes	Reduce pollutants	Increase regulatory oversight	Population wide	2b
SONCC-ElkR.10.2.36.1	*Increase application of Low Impact Development (LID) techniques through education and incentives*					
SONCC-ElkR.10.2.36.2	*Incorporate LID in Clean Water Act permits for projects that result in stormwater discharge*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.10.2.40	Water Quality	Yes	Reduce pollutants	Increase regulatory oversight	Population wide	2b
SONCC-ElkR.10.2.40.1	*Strengthen city and county ordinances to minimize new impervious surfaces and require treatment to current standards*					
SONCC-ElkR.10.2.40.2	*Strengthen city and county ordinances to require treatment to current standards when existing impervious surfaces are expanded, reconditioned, reconstructed or replaced*					
SONCC-ElkR.10.2.40.3	*Develop local regulatory mechanisms that reduce amount of total impervious area through incentives*					
SONCC-ElkR.26.1.48	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2b
SONCC-ElkR.26.1.48.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-ElkR.2.2.45	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Improve regulatory mechanisms	Population wide	2b
SONCC-ElkR.2.2.45.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					
SONCC-ElkR.2.4.8	Floodplain and Channel Structure	Yes	Improve estuarine habitat	Restore tidally influenced habitats	Estuary	3b
SONCC-ElkR.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-ElkR.2.4.8.2	*Restore tidally influenced habitats, guided by the plan*					
SONCC-ElkR.10.4.13	Water Quality	Yes	Improve flow timing or volume	Educate stakeholders	Lower Elk River and tributaries downstream of confluence of Rock Creek	3b
SONCC-ElkR.10.4.13.1	*Provide incentives and education to landowners to reduce water consumption and reduce groundwater pumping and surface water diversion by utilizing conservation and storage*					
SONCC-ElkR.10.4.12	Water Quality	Yes	Improve flow timing or volume	Increase instream flows	Lower Elk River and tributaries downstream of confluence of Rock Creek	3b
SONCC-ElkR.10.4.12.1	*Determine instream flow needs for coho salmon, utilize existing USGS gauging station information*					
SONCC-ElkR.10.4.12.2	*Perform a groundwater study to determine the volume of aquifer storage and the role of aquifers in streamflow*					
SONCC-ElkR.10.4.50	Water Quality	Yes	Improve flow timing or volume	Increase instream flows	Population wide	3d
SONCC-ElkR.10.4.50.1	*Determine instream flow needs for coho salmon, utilize existing USGS gauging station information*					
SONCC-ElkR.10.4.50.2	*Perform a groundwater study to determine the volume of aquifer storage and the role of aquifers in streamflow*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.2.7.2	Floodplain and Channel Structure	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Private lands subject to development and Panther, Red Cedar, and Blackberry creeks, middle mainstem Elk River	3b
SONCC-ElkR.2.7.2.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-ElkR.2.7.2.2	*Develop watershed-specific guidance for managing riparian vegetation. Consider larger riparian buffers in coho occupied habitat*					
SONCC-ElkR.2.7.30	Floodplain and Channel Structure	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	BLM lands	3b
SONCC-ElkR.2.7.30.1	*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-ElkR.2.2.28	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Assess estuary and tidal wetland habitat	Estuary	3b
SONCC-ElkR.2.2.28.1	*Identify parameters to assess condition of estuary and tidal wetland habitat*					
SONCC-ElkR.2.2.28.2	*Complete a full assessment of the estuary using identified parameters*					
SONCC-ElkR.2.2.28.3	*Determine amount of estuary and tidal wetland habitat needed for population recovery and develop a plan for restoration*					
SONCC-ElkR.5.1.11	Passage	No	Improve access	Remove barriers	Swamp Creek, unnamed tributary above Highway 101, Bagely Creek, Chapman Creek, Blackberry Creek, and other streams downstream of confluence of Rock Creek and the mainstem Elk River.	3b
SONCC-ElkR.5.1.11.1	*Evaluate and prioritize barriers for removal*					
SONCC-ElkR.5.1.11.2	*Remove barriers, based on evaluation*					
SONCC-ElkR.5.1.54	Passage	No	Improve access	Remove barriers	Population wide	3d
SONCC-ElkR.5.1.54.1	*Evaluate and prioritize barriers for removal*					
SONCC-ElkR.5.1.54.2	*Remove barriers, based on evaluation*					
SONCC-ElkR.7.1.39	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase regulatory oversight	All coho salmon bearing streams	3b
SONCC-ElkR.7.1.39.1	*Strengthen city and county ordinances to limit development within the 100 year channel migration zone*					
SONCC-ElkR.7.1.39.2	*Strengthen city and county ordinances to limit development within the 50 year flood elevation*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.8.1.9	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All tributaries of the alluvial coastal plain downstream of Rock, Indian, and Bagley creeks. Priority is the Butler Creek watershed.	3b
SONCC-ElkR.8.1.9.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-ElkR.8.1.9.2	*Decommission roads, guided by assessment*					
SONCC-ElkR.8.1.9.3	*Upgrade roads, guided by assessment*					
SONCC-ElkR.8.1.9.4	*Maintain roads, guided by assessment*					
SONCC-ElkR.8.1.55	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	3d
SONCC-ElkR.8.1.55.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-ElkR.8.1.55.2	*Decommission roads, guided by assessment*					
SONCC-ElkR.8.1.55.3	*Upgrade roads, guided by assessment*					
SONCC-ElkR.8.1.55.4	*Maintain roads, guided by assessment*					
SONCC-ElkR.10.2.14	Water Quality	Yes	Reduce pollutants	Educate stakeholders	Lower Elk River and tributaries downstream of confluence of Rock Creek	3d
SONCC-ElkR.10.2.14.1	*Develop an educational program that promotes Salmon Safe methods for agricultural operations and Integrated Pest Management for rural residents*					
SONCC-ElkR.10.2.35	Water Quality	Yes	Reduce pollutants	Reduce pesticides	Population wide	3d
SONCC-ElkR.10.2.35.1	*Develop a pesticide management plan*					
SONCC-ElkR.10.2.35.2	*Implement pesticide management plan and technical assistance program*					
SONCC-ElkR.16.1.16	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-ElkR.16.1.16.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-ElkR.16.1.16.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-ElkR.16.1.17	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-ElkR.16.1.17.1	*Determine actual fishing impacts*					
SONCC-ElkR.16.1.17.2	*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*					
SONCC-ElkR.16.2.18	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-ElkR.16.2.18.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-ElkR.16.2.18.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-ElkR.16.2.19	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-ElkR.16.2.19.1	*Determine actual impacts of scientific collection*					
SONCC-ElkR.16.2.19.2	*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-ElkR.1.4.7	Estuary	No	Protect estuarine habitat	Improve regulatory mechanisms	Estuary	3d
SONCC-ElkR.1.4.7.1	*Limit development and filling of estuarine habitat through the development of regulatory mechanisms such as county or city ordinances*					
SONCC-ElkR.1.4.7.2	*Maintain or strengthen current estuarine protection measures*					
SONCC-ElkR.10.7.47	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-ElkR.10.7.47.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-ElkR.10.7.47.2	*Supply marine-derived nutrients to streams guided by the plan*					

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