32. Upper Rogue River Population

Interior Rogue Stratum

Core, Functionally Independent Population

Moderate Extinction Risk

Population likely above depensation threshold

13,800 Spawners Required for ESU Viability

2,422 mi^2 watershed (52% Federal ownership)

689 IP-km (428 mi) (56% High)

Dominant Land Uses are Agriculture and Urban/Residential/Commercial Development

Key Limiting Stresses are 'Altered Hydrologic Function' and 'Impaired Water Quality'

Key Limiting Threats are 'Agricultural Practices' and 'Urban/Residential/Industrial Development'

Highest Priority Recovery Actions

• Improve timber harvest practices by revising Oregon Forest Practices Act • Improve agricultural practices • Improve suction dredging practices	• Increase regulatory oversight to reduce pollutants • Increase instream flows • Increase large woody debris (LWD), boulders, or other instream structure

32.1 History of Habitat and Land Use

From 1780 to 1840, trappers swept Oregon coastal rivers, including the Rogue River basin, reducing the robust beaver population to remnant levels (Oregon Department of Fish and Wildlife (ODFW) 2005b). Beaver ponds provide excellent rearing habitat for coho salmon, and thus beaver trapping was likely the first negative effect of European settlers on coho salmon. In the mid- to late 1800s, proliferation of gold mining in the Rogue Valley further decreased coho salmon rearing, spawning, and migratory habitat. After the 1850s, settlers began reclaiming and development of the flat, alluvial valley bottoms and wetlands, and increased agricultural production. Many Rogue River streams were straightened and disconnected from their floodplains, wetlands and meanders were filled, flows were diverted and riparian shade was reduced. Due to habitat alteration and flow depletion, summer air temperatures (which often exceed 100° F) in the Upper Rogue River sub-basin are now more likely to cause higher stream temperatures than in the past, thereby reducing the quality and quantity of summer rearing habitat, and decreasing juvenile coho salmon survival.

The Upper Rogue River headwaters, primarily managed by the U.S. Forest Service (USFS), are located along the crest of the Cascade Range. Public and private lands in the Upper Rogue River sub-basin were extensively logged after World War II, when there were few restrictions on harvesting near streams or using stream beds to skid logs. Channel damage from the 1964 flood was widespread in areas downstream of timber harvest activity (Thompson and Fortune 1970, USFS 1997a).

The USFS adopted more conservation-based management in 1994 when the Record of Decision for the Northwest Forest Plan was signed, but most National Forest lands in the sub-basin are above the current range of coho salmon. The USFS manages an appreciable amount of coho salmon habitat within Elk Creek and Little Butte Creek watersheds. Lands managed by the BLM are extensive in the watersheds of Evans, Trail, Big and Little Butte, and upper Bear creeks but alternate with private land in a checker board pattern. The BLM manages substantial lands in Elk Creek where ownership is fairly contiguous. Urban development is extensive in Lower Bear Creek and the Upper Rogue Valley, where most land is privately owned. In addition, there has been substantial residential development in many parts of the sub-basin, accompanied by surface water and groundwater extraction.

The completion of Lost Creek Dam (later renamed William L. Jess Dam) in 1977 created Lost Creek Reservoir, altering the natural hydrograph of the mainstem Rogue River, and the associated Cole Rivers Hatchery mitigation program annually produces 200,000 coho salmon smolts. The notching of the Elk Creek Dam on Elk Creek, an important tributary that joins the Rogue River five miles downstream of Lost Creek Reservoir, in 2008 provided coho salmon with unrestricted access to that watershed after nearly 20 years of trapping and hauling coho salmon upstream (USACE 2014). Other recent major fish passage improvements include the removal of three diversion dams on the mainstem Rogue River: Savage Rapids Dam in 2009 in the Middle Rogue sub-basin (U.S. Bureau of Reclamation 2009a) and Gold Hill Dam in 2008 (Oregon Water Watch 2008) and Gold Ray Dam in 2010 (Freeman 2010) in the Upper Rogue sub-basin.

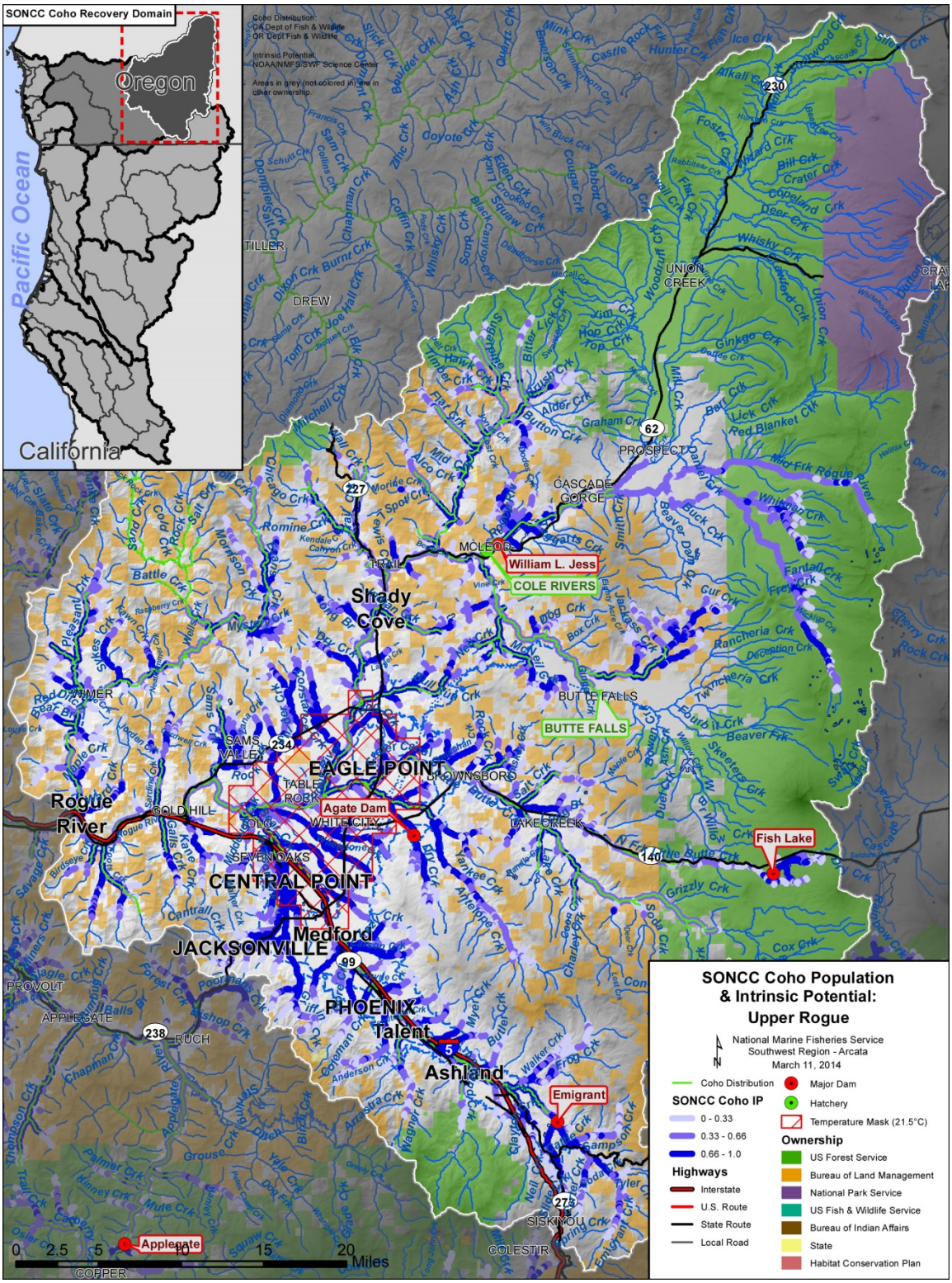

Figure 32-1. The geographic boundaries of the Upper Rogue River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2013a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Rogue River diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

32.2 Historic Fish Distribution and Abundance

The 1977 construction of William L. Jess Dam (Figure 32-2) at river mile (RM) 157 in the Upper Rogue River sub-basin reduced mainstem coho salmon distribution by only 12 miles (ODFW 2005c) because geologic barriers near Prospect above the dam naturally prevented anadromous fish migration to the uppermost reaches of the mainstem Rogue River (USFS 1998d); however, some additional habitat in the South and Middle forks of the Rogue River is also blocked by the dam (ODFW 2013c). Major tributaries below the dam include Evans, Trail, Elk, Bear, Big Butte, and Little Butte creeks; however, some high coho salmon IP habitat is blocked by dams within these watersheds. Dams impounding Emigrant Reservoir in the Bear Creek watershed, Agate and Fish Lake Reservoirs in the Little Butte Creek watershed, and Willow Lake Reservoir on Big Butte Creek are the most significant barriers.

A cannery operated at the mouth of the Rogue River beginning in 1876. Records from the cannery were used to estimate an annual run size of approximately 114,000 adult coho salmon in the late 1800s (Meengs and Lackey 2005). There is no way to know how many of these fish were returning to the sub-basin, rather than elsewhere in the 5,600 square mile Rogue River basin. The sub-basin contains 39 percent of the basin-wide IP kilometers of habitat (Williams et al. 2008), suggesting possible returns of 45,000 fish during the time of cannery operation, if fish were produced in proportion to IP kilometers.

Figure 32-2. William L. Jess Dam. The dam blocks anadromous fish access upstream, but provides a perennially cold mainstem Rogue River flows below the dam (at center left). Aerial photo from June 2005.

32.3 Status of Upper Rogue River Coho Salmon

Spatial Structure and Diversity

Coho salmon juvenile surveys performed in the Upper Rogue River sub-basin (ODFW 2005a) confirmed presence and varying levels of abundance in Little Butte, Big Butte, Evans, Trail, Elk, and Antelope creeks (Figure 32-3). Most high density rearing occurs in the upper watersheds and often immediately below public land that supplies cool water. Potential coho salmon habitat periodically lacks sufficient flow (Rogue Basin Coordinating Council (RBCC) 2006), and Trail Creek seasonally has no flow (Nawa 1999).

Densities of juvenile coho salmon throughout the Upper Rogue River population vary by location (Figure 32-3). Most of the juvenile coho salmon observed recently were in the headwater areas of Little and Big Butte creeks, Elk Creek, Trail Creek, and Evans Creek. Historically, Bear Creek had more than 25 miles of estimated high IP habitat (Figure 32-1); however, no juvenile coho salmon were observed during summer sampling (Figure 32-3), likely due to high water temperatures and habitat degradation in this highly urbanized watershed. Coho salmon juveniles died in Bear Creek during an herbicide-related fish kill on May 6, 1996 (Ewing 1999), indicating some juveniles are present in this watershed at least during times of year with lower temperatures. Juvenile coho salmon were documented in Larson Creek (VanDyke 2006a) and Military Slough (VanDyke 2006b), both in the Bear Creek watershed, during sampling with hoop traps from November 2005 to March 2006. No juvenile coho salmon were observed during sampling on Sand Creek during that same period (VanDyke 2006c).

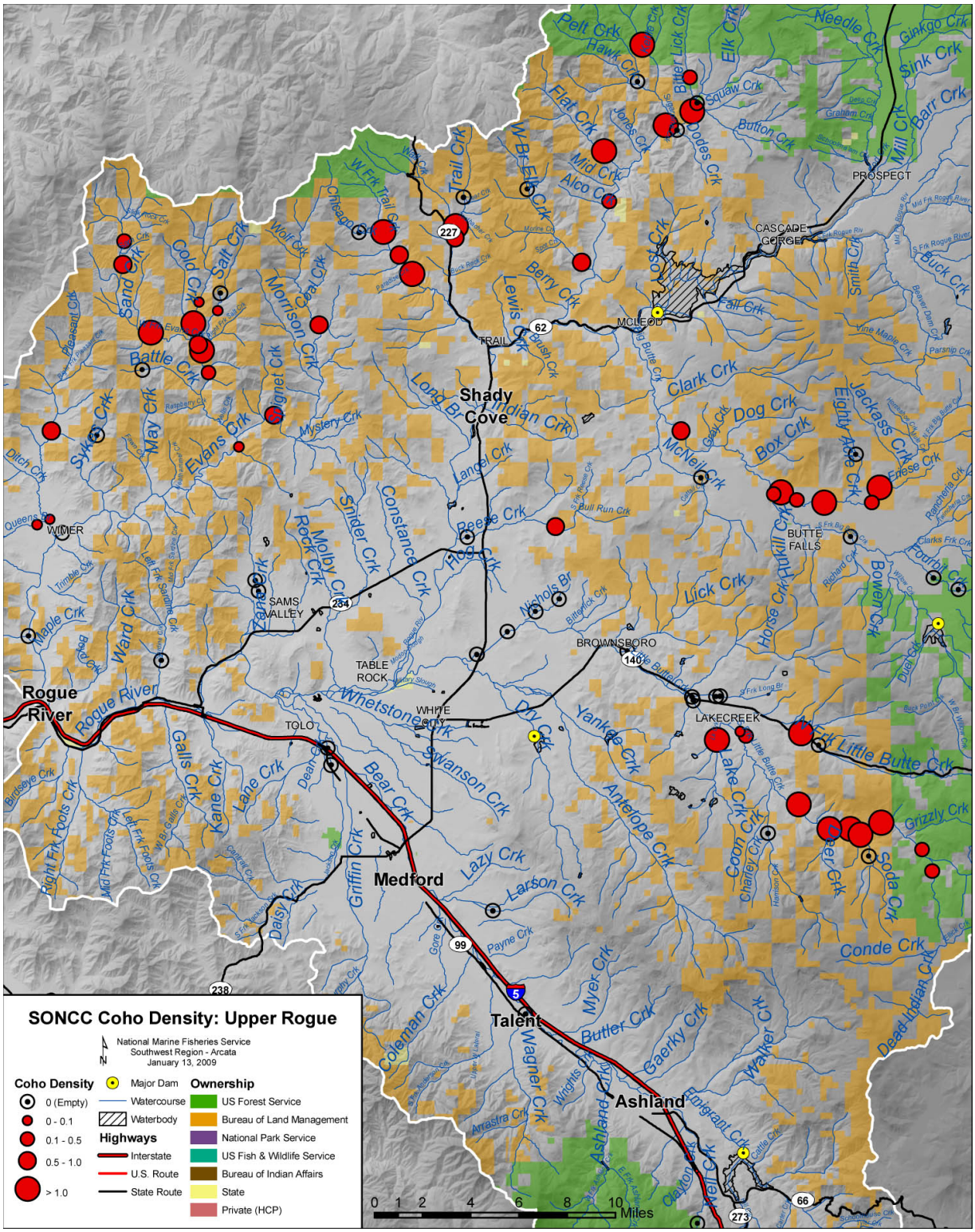

Figure 32-3. Upper Rogue River juvenile coho salmon survey results from 1998 to 2004. Map shows density of fish per square meter. The highest densities were located in upper watershed areas, and coho salmon were absent in lower reaches of all tributaries and at all stations in Bear Creek ODFW (2005a).

During the 2004 to 2008 run years, on average about 17 percent of surveyed sites were occupied by wild adult coho salmon with an estimated average of 6 spawners per mile in the Upper Rogue sub-basin (hatchery or wild origin unstated) (Lewis et al. 2009).

Williams et al. (2008) expressed concern about potential loss of genetic diversity of Rogue River coho salmon due to very low returns from 1966 to 1990 and the high contribution of hatchery coho salmon to the overall number of returning adults. Overall, Williams et al. (2008) rated the threat of hatchery fish on population diversity as moderate, because although many hatchery fish were observed in surveys of adult coho salmon, few were observed on the spawning grounds.

Population Size and Productivity

ODFW used spawning surveys to estimate the abundance of wild adult coho salmon from 2002 to 2008 in the Upper Rogue River (Figure 32-4). Budget restraints have eliminated surveys since 2009. The lack of data makes it difficult to track the strength of year classes. From 2002 to 2004, estimates of wild adult coho salmon were above the depensation threshold of 805, but from 2006 to 2008 estimates of wild adult coho salmon returns were low (Figure 32-4). However, interpretation of these data is problematic because the number of miles surveyed in each of the first three years (average 19 miles) was considerably greater than in the second three years (average 8 years; ODFW 2011).

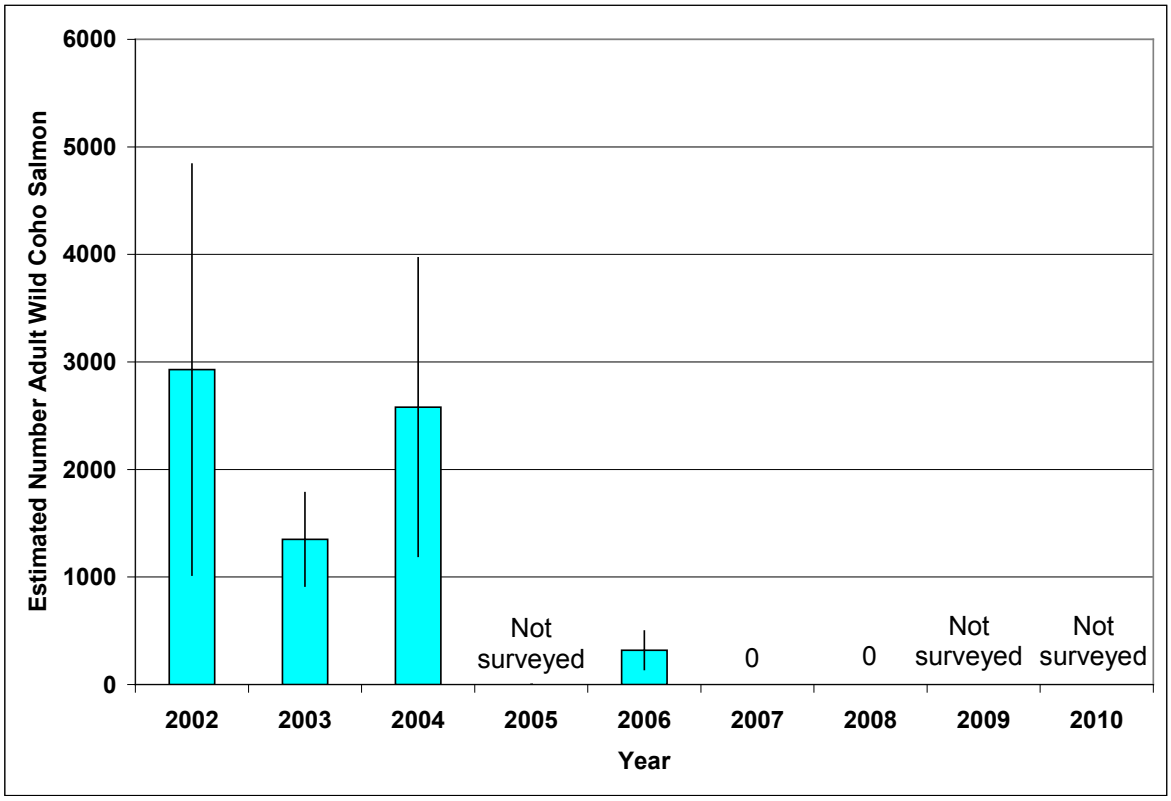

Figure 32-4. Estimated number of wild adult coho salmon in the Upper Rogue River, from ODFW spawning surveys. Error bars indicate the 95% confidence interval. Data from ODFW (2011b).

ODFW also monitored returning adult coho salmon at Gold Ray Dam until it was removed in 2010. This data set presents a rare opportunity to evaluate long-term trends within the Upper Rogue River coho salmon population (Figure 32-5). Between 1942 and the early 1980s, the number of adult coho salmon returns suggested a downward trend. While the average number of adult coho salmon returning (including jacks) to the entire Rogue River from 1942 to 1950 was 3936 adults, populations averaged only 750 adults between 1951 and 1979 (ODFW 2009b). For 15 out of 16 years from 1964 to 1979 fewer than 500 adults returned to the Rogue River (ODFW 2009b). Returns reached their lowest level during the 1976 drought, when only 44 coho salmon were counted at Gold Ray Dam. Hatchery coho salmon began returning to the Upper Rogue River in the late 1970s following the initiation of the hatchery mitigation program associated with the construction of Lost Creek Dam (later renamed William L. Jess Dam). The number of wild and hatchery coho salmon adults peaked in 2000 and 2002, respectively. Thereafter, a declining trend in both wild and hatchery coho salmon escapement has been observed (Figure 32-5). In 2007, approximately 4,500 wild coho salmon returned to Gold Ray Dam. Coho salmon returns declined in the Rogue River basin in 2008, and remained low in 2009 (Oregon State University 2009, ODFW 2009b). In 2008 and 2009, total adult coho salmon returns to Gold Ray Dam including both hatchery and wild fish were about 2,500 per year. If we assume the current returns of adult coho salmon contain the approximate proportion of hatchery fish as observed from 1996 to 2007, then 60 percent of these fish, or about 1,500 spawners, were wild fish.

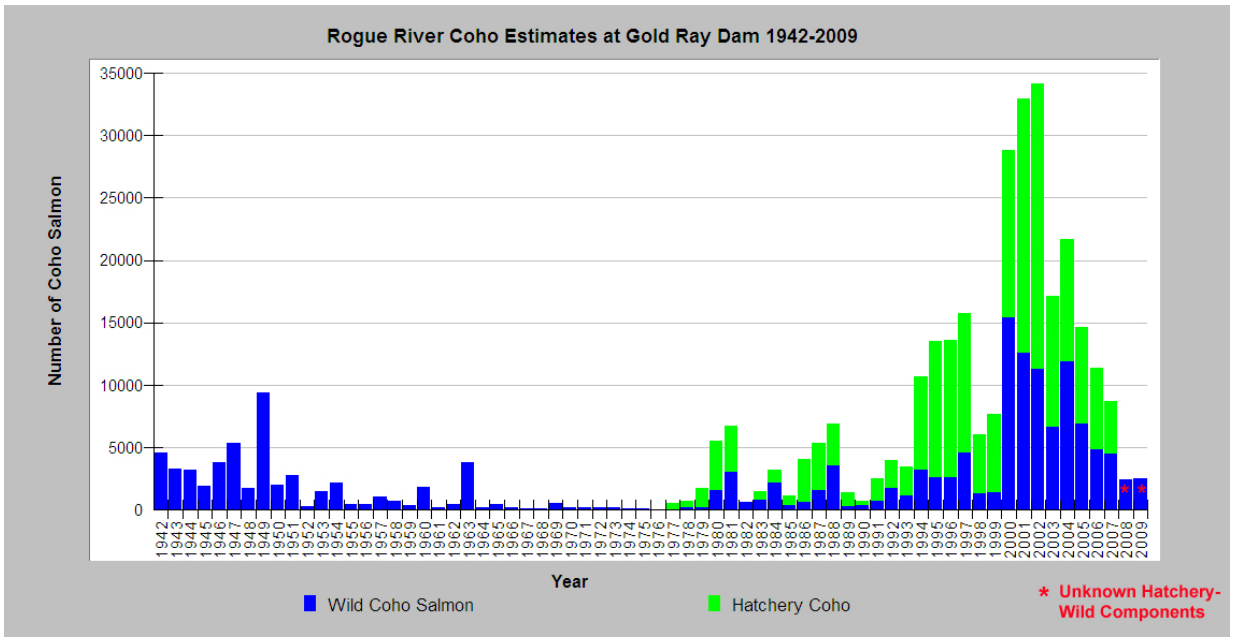

Figure 32-5. Coho salmon returns at Gold Ray Dam, including jacks (ODFW 2010a and 2010b). Hatchery fish are not distinguished from wild fish in 2008 and 2009 because estimates are preliminary.

The trend in adult abundance over the last four generations (1998-20010) has been negative, but less than a 10 percent decline (Figure 32-6).

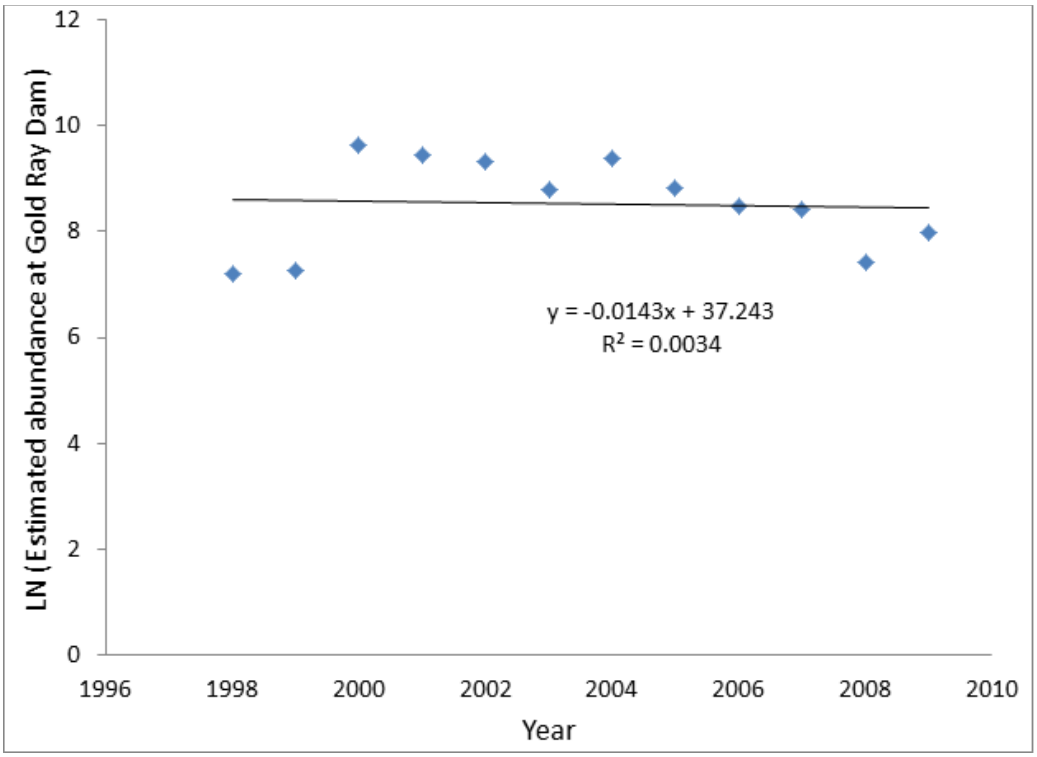

Figure 32-6. Rate of decline of estimated population abundance at Gold Ray Dam. (Data source: ODFW 2010a and 2010b).

Extinction Risk

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

Role in SONCC Coho Salmon ESU Viability

The Upper Rogue River population is a core, Functionally Independent population within the Interior Rogue River 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 Upper Rogue River core population needs to have at least 13,800 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 Upper Rogue population would serve as a source of spawner strays for other Rogue River populations.

32.4 Plans and Assessments

U.S. Forest Service, Rogue River-Siskiyou National Forest and U.S. Bureau of Land Management (Medford District)

Sufficiency Assessment: Forest Service and Bureau of Land Management Programs in Support of SONCC Coho Salmon Recovery (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, Sugarpine Creek, a tributary of Elk Creek, was identified as a high priority 6th field sub-watershed in the Rogue-Siskiyou National Forest (USFS and BLM 2011).

U.S. Bureau of Reclamation

Rogue River Basin Project Coho Salmon Instream Flow Assessment

The U.S. Bureau of Reclamation modeled stream flow needs of SONCC coho salmon in two drainages in southern Oregon in order to assess the effects of the U.S. Bureau of Reclamation's Rogue River Basin Project on the species (Sutton et al. 2007). The Rogue River Basin Project (RRBP) is a series of reservoirs and diversions designed to provide water to 35,000 acres of irrigated cropland in Oregon (U.S. Bureau of Reclamation 2009b). For the most part water is diverted and stored during the winter, then delivered for irrigation in the summer. Sutton et al. (2007) was relied upon when analyzing and describing the future effects of the RRBP on SONCC coho salmon and other listed species (U.S. Bureau of Reclamation 2009b). On April 12, 2012, NMFS completed a biological opinion finding continued operation of the RRBP is likely to adversely affect SONCC coho salmon and their critical habitat, but is not likely to jeopardize the continued existence of SONCC coho salmon or result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon. The greatest effects of the project are on juveniles from flow management.

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 perceived limiting factors and threats to recovery. Based on the input of panel members, ODFW (2008b) summarized the concerns for the Upper Rogue River as follows:

Key concerns were related to loss of over-winter tributary habitat complexity, floodplain connectivity, and access and oversummer water temperatures and habitat access. Over-winter tributary habitat and floodplain connectivity, especially in the lowlands, has been impacted by past and current agricultural, urban, rural residential, and forestry development and practices and an interruption in the transport and presence of large wood. Access to habitat has been limited by road crossings. Summer habitat is limiting because high water temperatures have resulted from land management actions in the riparian zone and straightening of channels and water management actions for agricultural purposes. Water withdrawals and diversions and road crossings have also limited the amount of, and access to, summer habitat and thermal refuge.

Secondary concerns spanned a number of life history stages and locations. Unscreened diversions and non-criteria screens at diversions affect fry, summer parr, and out-migrating smolts. Summer juvenile habitat has been impacted by a loss of tributary habitat complexity, especially in the lowlands, caused by past and current agricultural, urban, rural residential, and forestry development and practices and an interruption in the transport and presence of large wood. Non-native vegetation is a secondary factor contributing to higher water temperatures affecting summer parr by limiting native riparian vegetation. Runoff from urban and agricultural areas impacts summer parr through poor water quality and the presence of toxins. Access to spawning habitat by returning adults is limited by road crossings and diversion structures. Spawners are affected by both a lack of gravel due to alteration of large wood processes (i.e., some tributaries have bedrock) and sedimentation of existing gravel. Finally, reduced estuarine habitat for smolts due to past and current forestry practices and rural residential development is another impact.

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

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

ODFW Coastal Salmonid Inventory Project

ODFW has monitored coho salmon in the Upper Rogue River as part of their Coastal Salmonid Inventory Project. From 1998 to 2004, ODFW conducted dives in the Upper Rogue River sub-basin to detect juvenile coho salmon (ODFW 2005a) (Figure 32-3). ODFW also estimated the abundance of adult coho salmon in the Upper Rogue River from 2002 to 2004 and from 2006 to 2008.

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 NMFS (Northwest Region) to recover coho salmon. The initiative provides the framework for recovery in southwest Oregon and helped foster formation of watershed councils. Prevost et al. (1997) designated upper South Fork Little Butte Creek, West Fork Trail Creek, Sugarpine Creek (Elk Creek), West Branch Elk Creek, and West Fork Evans Creek as "core areas" in the Upper Rogue River watershed that are defined as 'reaches or watersheds that are judged to be of critical importance to the maintenance of salmon populations that inhabit those basins.'

Water Requirements of Rogue River Fish and Wildlife

ODFW fisheries biologists (Thompson and Fortune 1970) conducted widespread surveys of the Rogue River basin to assess water flow and its effect on fish habitat and carrying capacity for salmonids. The study was designed to inform the Oregon Water Resources Board so that a "beneficial water use program" could be developed. The document contains comprehensive flow tables for all major coho-salmon-producing tributaries in the Rogue River basin, including recommended minimum flows. Thompson and Fortune (1970) also provides a summary of the Rogue River basin fish community, including the Upper Rogue River. The report identified flow depletion as a major cause of stress, disease, and predation to Pacific salmonids.

Upper Rogue River Total Maximum Daily Load Reports

A large-scale Rogue River TMDL (ODEQ 2008) covers all perennial and intermittent streams, rivers, and lakes within the Rogue River basin in Oregon with the exception of those areas where TMDLs have previously been developed: Bear Creek Watershed, Applegate Sub-basin, Lobster Creek Watershed, and Sucker Creek Watershed.

Bear Creek Watershed TMDL

The Bear Creek Watershed TMDL (ODEQ 2007) addresses the listed parameters of temperature, bacteria (fecal coliform and *E. coli*) and sedimentation. The TMDL includes shade targets for the Bear Creek watershed and a water quality management plan.

Rogue River Watershed Health Factors Assessment

The Rogue Basin Coordination Council (RBCC 2006) produced the Rogue River Watershed Health Factors Assessment on behalf of the watershed councils within the basin. The assessment rates aquatic health and watershed conditions, including wildfire risk. Key problems in different Rogue River watersheds are described and potential solutions proposed.

Bear Creek Habitat and Temperature Study 1990-1991

Dambacher et al. (1992) investigated the temperature and habitat in Bear Creek and its tributaries during the summers of 1990 and 1991, and made recommendations for rehabilitation of the watershed. Temperatures in lower Bear Creek and in tributaries approached and exceeded, respectively, 80 °F. Temperature in Bear Creek increased downstream, was strongly influenced

by solar input, and reached a maximum in late July. High water temperature was found to be the greatest factor limiting production of salmonids. Redside shiners were found in Bear Creek, and the authors were concerned that they were outcompeting and displacing salmonids.

Upper Rogue Watershed Association

Upper Rogue Watershed Assessment

The assessment (URWA 2006) describes various aspects of the Upper Rogue River sub-basin, including hydrology, water quality, fish populations, fish habitat, riparian conditions, and wetland conditions. The assessment also identifies the issues and restoration opportunities within each of five sub-watersheds of the Upper Rogue watershed.

Bear Creek Watershed Council (BCWC)

Ashland Watershed Management & Action Plan (BCWC 2007)

The watershed management and action plan (BCWC 2007) considers the Ashland Creek and Neil Creek drainages in the Bear Creek watershed, and includes an assessment of hydrology and water use, riparian and wetlands, sediment sources, channel modifications, water quality, and fish and aquatic wildlife. A number of projects are suggested to restore habitat, manage stormwater, address fish passage barriers, and inform and educate the public. The plan focuses on voluntary activities on private and municipal land.

32.5 Stresses

Table 32-1. Severity of stresses affecting each life stage of coho salmon in the Upper Rogue River. Stress rank categories, assessment methods, and data used to assess stresses are described in Appendix B.

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

[1]Key limiting stresses and limited life stage.

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. Juvenile summer rearing habitat is impaired by deficient floodplain and channel structure, high water temperature resulting from degraded riparian conditions, and altered hydrologic function from water withdrawals. Furthermore, the degraded nature of the riparian forests inhibits future input of large wood and cannot provide bank stability that assists in a stable and complex channel. Finally, barriers throughout the basin limit access to rearing habitat. These findings are consistent with those of the Oregon Expert Panel (ODFW 2008b) (Section 32.4).

Altered Hydrologic Function

The Rogue River Basin Project (RRBP) is a series of reservoirs and other facilities used to collect, impound, and divert water from tributaries to the Rogue River for delivery to irrigated cropland (U.S. Bureau of Reclamation 2009b). The RRBP adversely affects coho salmon in the Bear Creek and Little Butte Creek watersheds of the Upper Rogue River sub-basin. Forty-seven percent of the high-IP habitat in the Upper Rogue River sub-basin is located in these watersheds. Another major source of hydrologic alteration affecting the Upper Rogue River coho salmon population is flow depletion due to groundwater extraction. Many types of groundwater uses do

not require a water right, including stock watering, lawn or noncommercial garden watering of up to 0.5 acres, and domestic use of up to 15,000 gallons per day (Bureau of Land Management [BLM] 1998c). Data are lacking regarding groundwater use, its interaction with surface flow, and potential impacts to coho salmon (ODEQ 2008). However, due to the presumed large number of wells, groundwater pumping is likely contributing to inadequate stream flows and reduced groundwater inflow to many streams in the Upper Rogue River sub-basin. Streams sometimes lose flow entirely (Thompson and Fortune 1970). The overall stress rating for Upper Rogue River coho salmon from this factor is very high.

Impaired Water Quality

Thirty-three percent of the 137 sampled reaches in the Upper Rogue River sub-basin met water quality standards (Southwest Oregon Resource Conservation and Development Council (SO RC&D) 2003). The most pervasive problem affecting coho salmon is water temperature. Very few reaches in the Upper Rogue River Sub-basin meet ODEQ (2008) water standards compatible with coho salmon recovery. Few locations other than the tailwater of William L. Jess Dam contain both cold water temperatures (<64.4 °F) and pools deep enough to harbor coho salmon (>3 feet). The urbanized Bear Creek watershed is listed as temperature impaired (ODEQ 2007), with summer water temperatures in lower Bear Creek and its tributaries approaching 80 °F in 1990 and 1991 (Dambacher et al. 1992). However, in August 2007, detailed surveys detected 13 coldwater springs, seeps, and tributaries in the Bear Creek watershed (Sutton 2007), suggesting that there are some localized areas with temperatures suitable for summer rearing. Most potential thermal refugia were located in the upper half of Bear Creek watershed, with the majority being tributary inflows originating in the southwest portion of Bear Creek watershed.

Flow depletion reduces water volume and slows water velocity, thus promoting warming, stagnation, and depressed dissolved oxygen (D.O.) (Thompson and Fortune 1970). Nawa (1999) documented loss of coho salmon juveniles in Trail Creek due to flow depletion and low D.O. Little Butte Creek is similar to Trail Creek and has both low flow and D.O. problems. Growth of free-floating and attached algae may indicate nutrient enrichment, and algal photosynthetic activity may cause daily fluctuations in pH and D.O. (ODEQ 2007). The Larson and Lazy Creek watersheds are considered impaired due to high pH. It is unlikely that high fecal coliform bacterial levels in the Upper Rogue would directly harm coho salmon; however, the coliform levels might indicate livestock access to creeks or leaking septic systems.

Degraded Riparian Forest Conditions

Riparian zones on the mainstem and in tributaries exhibit impacts from 150 years of land use leading to a very high level of stress rating for coho salmon. In forested reaches conifers have been removed (ODEQ 2007, 2008) and early seral species like alder and willows are dominant in the Upper Rogue River. ODFW found low numbers of large conifers in Upper Rogue River riparian surveys, with almost all reaches having fewer than 75 conifers over 36” in diameter per 1,000 feet of stream surveyed. Streams surveyed include Evans, Little Butte, Big Butte, Elk and Trail creeks.

On valley floors where there may have previously been cottonwood gallery forests, marshes, and beaver ponds, the straightening of channels and draining of wetlands has altered the most

productive coho salmon habitat (ODEQ 2008). The resulting disruption of surface and groundwater connections has led to stream warming (ODEQ 2008). Downcutting due to channel confinement is widespread in the Rogue River basin. Regional studies (Spence et al. 1996) found that downcutting may change near-stream soil moisture, which can inhibit recovery of riparian forest species. The most degraded streams in the Upper Rogue are channelized urban streams that are nearly devoid of riparian vegetation.

Lack of Floodplain and Channel Structure

The straightening and simplification of streams has reduced the amount of slow, cool edgewater habitats where coho salmon fry and juveniles thrive (ODEQ 2008). Beaver have been greatly reduced along with the pools they create (ODFW 2005b). Although there are patches of functional coho salmon habitat, juvenile surveys indicate that many lower elevation Upper Rogue tributary channels are too altered to support them (Figure 32-7). Channelization of the Upper Rogue River has disconnected it from much of its floodplain, reducing the physical processes that form coho salmon rearing and spawning habitat. These processes include side channel formation, accumulation of large wood jams, formation of slower water velocities, formation of pools, and lower shear stress. Extensive ODFW habitat surveys of Evans, Elk, Trail, Little and Big Butte creeks indicated poor wood levels (< 1 key piece per 100m), except in headwaters at a few locations, usually on or below USFS and BLM lands. All these factors lead to a high stress ranking for Upper Rogue River coho salmon.

Figure 32-7. The Upper Rogue River running through Shady Cove. This 2005 aerial photo shows channelization, lack of a functional riparian vegetation, and potential risk of non-point source pollution.

Altered Sediment Supply

Sediment contribution from landslides and erosion occurs naturally in the Upper Rogue 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. The majority of stream reaches measured for surface fine sediment in Upper Rogue River habitat surveys rated poor (>17 percent surface fines), with only Little Butte above the confluence with Antelope Creek rated as very good (<12 percent surface fines). Lower Evans Creek has particular problems with sand-sized sediment pollution because its watershed has extensive areas of decomposed granite (BLM 1995b). Other than a short reach of Big Butte Creek, most other tributaries with low levels of fine sediment are steeper, confined channels often on BLM or USFS lands. Poor pool frequency and depth throughout the Upper Rogue River basin (URWA 2006) 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 high level of stress caused by barriers to migration in the Upper Rogue River sub-basin is a result of high numbers of road stream crossings (i.e., shown in Bredensteiner et al. 2003 maps), small temporary agricultural dams (Prevost et al. 1997), large diversion dams, and seasonal complete loss of stream flow in tributaries such as Trail Creek (RBCC 2006, Nawa 1999).

William L. Jess Dam was constructed in 1977 at river mile 157 in the Upper Rogue basin and blocks passage into the Rogue River headwaters. NMFS believes recovery of the Upper Rogue population of SONCC coho salmon can occur without access to habitat above this dam. Several dams in the Middle and Upper Rogue Sub-basin have been evaluated for removal or fish passage improvement (Mosser and Graham 2004). The top three dams (Savage Rapids, Gold Ray, and Gold Hill Irrigation dams) have all been removed. Five of the top ten dams targeted are on Evans Creek, including Feilder (RM 3.0) and Wimer (RM 9.0) which impede passage to nearly the entire Evans Creek watershed.

Impaired Estuary/Mainstem Function

The Rogue River estuary is highly altered and retains little of its historic function. Studies of other rivers in the region have shown that some portion of coho salmon fry and juveniles migrate out of their stream of origin in search of viable habitat patches, and these fish opportunistically use estuarine and slough habitats (Koski 2009, Miller and Sadro 2003). The lack of rearing habitat in the estuary limits the productive potential of the entire Rogue River basin and impaired estuary/mainstem function is rated as an overall very high stress for coho salmon. A discussion of the causes of reduced estuarine function can be found in the Lower Rogue River population profile.

Adverse Hatchery Related Effects

Cole Rivers Hatchery is located in the Upper Rogue River sub-basin, and produces approximately 200,000 coho salmon smolts annually in addition to millions of hatchery spring Chinook, winter steelhead, and summer steelhead (ODFW 2008d). Adult coho salmon were counted at Gold Ray Dam until its removal in 2010. From 1977, when hatchery production started, to 2007 (last year for which hatchery proportion was available), the proportion of hatchery adults that passed Gold Ray Dam nearly always exceeded 50 percent. However, these data are not a good indicator of the proportion of spawning adults of hatchery origin in the population. Fish that passed Gold Ray Dam were on their way to Cole Rivers Hatchery. Up until 2008, a trap was maintained at Elk Creek, about 5 miles below Cole Rivers Hatchery. This trap was an ideal location to estimate stray rates, because it was at the terminal end of the current anadromous distribution of coho salmon in the Rogue River basin. From 1995 to 2008, on average 10 percent of adult coho salmon trapped at Elk Creek were of hatchery origin. Adverse hatchery-related effects pose a medium threat to all life stages because greater than or equal to 5 percent and less than or equal to 10 percent of observed adults are of hatchery origin and there is a hatchery in the basin (Appendix B).

Increased Disease/Competition/Predation

Thompson and Fortune (1970) found that salmonids in the Rogue River basin, including the Upper Rogue River, had higher incidences of the fish diseases *furunculosis* and *columnaris* in reaches that were warm due to flow depletion. They also noted that warm water conditions favored introduced species in the mainstem Rogue River. Warm water and low flows are still pervasive in the Upper Rogue River sub-basin; therefore, problems related to disease, competition and predation likely persist for coho salmon. These warm water conditions favor introduced fish species such as Umpqua pikeminnow and centrarchids which are prevalent throughout the population. Competition with and predation on coho salmon is likely more prevalent now than historically. Port Orford Cedar root-rot is a disease which is negatively impacting this important riparian species region-wide (Frissell 1992).

Adverse Fishery- and Collection-Related Effects

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

32.6 Threats

Table 32-2. Severity of threats affecting each life stage of coho salmon in the Upper Rogue River. Threat rank categories, assessment methods, and data used to assess threats are described in Appendix B.

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

Agricultural Practices

Although the extent of agriculture in the Upper Rogue River sub-basin is not large, these lands substantially overlap high IP (>0.66) coho salmon habitat. Much of the water withdrawals causing insufficient flow are used for agriculture. Other agricultural impacts include grazing, wetland filling, channelization and diking, riparian removal, channel simplification, and chemical application. Significant grazing occurs on private lands and by permit on Federally administered lands. Grazing may change soil infiltration rates and can cause deleterious channel

changes (Spence et al. 1996). Riparian vegetation alteration occurs with grazing as well. Herbicide use has resulted in fish kills in the Rogue River basin, including juvenile coho salmon in Bear Creek in 1996 (Ewing 1999). Risk to coho salmon resulting from agriculture chemical use has been identified as a concern throughout the Pacific Northwest (Laetz et al. 2009), and it is likely that pesticides known to harm salmonids (NMFS 2008) are used in the region.

Roads

Upper Rogue River sub-basin road density associated with timber harvest, residential and urban development, and major highway systems are high (Bredensteiner et al. 2003). For example, the lower Big Butte watershed (BLM 1999b) has approximately 4.6 miles of road per square mile of watershed (mi. /sq. mi.). The Bear Creek watershed in the Upper Rogue likely has similar values. NMFS (1995) recommended a road density limit of 2 mi./sq. mi. to protect anadromous salmonids in interior Columbia River basins to limit sediment and damaging cumulative watershed effects. Streamside roads, known to yield chronic fine sediment and elevate the probability of landslides, are common in Upper Rogue watersheds with timber harvest activities (BLM and USFS 1997, BLM 1999b) (Figure 32-9).

Urban/Residential/Industrial Development

The city of Medford and surrounding areas have grown substantially over the last several decades and future projections suggest that Rogue Valley urban and rural development will continue to increase. Maps of impervious areas (Homer et al. 2004) indicate extensive urbanization occurred in the Upper Rogue River sub-basin. For example, total impervious area (TIA) in the lower Bear Creek watershed is greater than 10 percent, a level which studies in other river systems found caused increased peak flows, decreased base flows, simplified channel conditions, increased non-point source storm water pollution, and resulted in loss of aquatic system function (Booth and Jackson 1997). An acute regional example of this phenomenon is that toxic storm water runoff is leading to high pre-spawn mortality of adult coho salmon in tributaries to Washington's Puget Sound (Booth et al. 2006). Urbanization and commercial development are expected to continue in the Interstate 5 corridor along Bear Creek.

Streams, such as Big Butte Creek and Little Butte Creek, supply water for urban areas and agriculture (RBCC 2006), and new residents add to growing water demand. Rural residential development also uses water and presents potential for pollution from septic systems (SO RC&D 2003). The threat to coho salmon from urban/residential and industrial development in the Upper Rogue River is very high.

Figure 32-8. Jackson Creek with channel altered by agricultural and urban land uses. Bear Creek is at right along the I-5 corridor in the city of Medford. Photo from 2005.

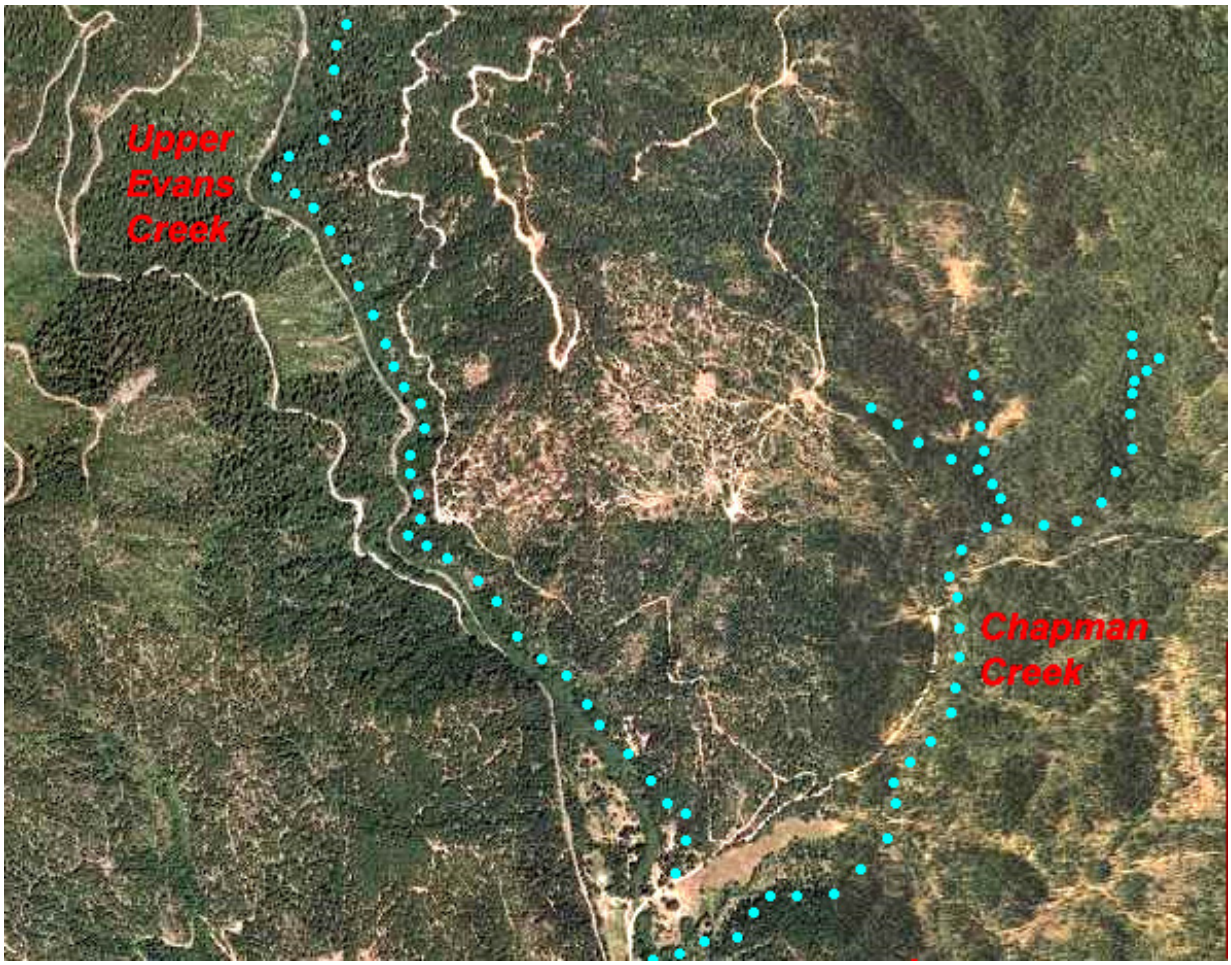

Figure 32-9. Upper Evans Creek and tributary Chapman Creek shown with dots. Timber management roads are immediately next to the channel and there is an extensive network of skid trails that can alter watershed hydrology and sediment yield. Stream courses are based on the USGS (1989) topographic map. June 2005.

Timber Harvest

Studies in coastal basins of Oregon found that when timber harvest exceeds approximately 25 percent of a watershed (Reeves et al. 1993) in 30 years (Reeves, G., pers. comm. 2003), aquatic habitat becomes degraded and simplified and Pacific salmon species diversity diminished. The extent of early- to mid-seral-stage forests on private land in the Upper Rogue River sub-basin (BLM 1999b) indicates that harvest rates on those lands were typically greater than this threshold. Aerial photos show that harvest rotations on private lands may be as short as 30 to 50 years, with very early seral stand conditions and high road densities near stream areas. Studies in other areas of the region have shown that timber harvest in unstable headwater areas increases sediment yield substantially (PWA 1998), depleting the supply of large wood delivered to streams during natural landsliding (May and Greswell 2003). In addition, the Independent Multidisciplinary Science Team (IMST 1999) concluded that the Oregon Forest Practice Rules for riparian protection, large wood management, sedimentation, and fish passage are not adequate to recover depressed stocks of wild salmonids. The primary timber harvest areas

within this population are Evans Creek, Trail Creek, Elk Creek, and some parts of Little Butte Creek.

Dams/Diversions

The high number of dams and diversion systems in the Upper Rogue River sub-basin resulted in a high threat score. Agricultural diversions on major low gradient tributaries can impede upstream adult passage or strand downstream-migrating juveniles, if fish screens are not in place. Major diversions by the City of Medford and large agricultural districts are particularly problematic with regard to reduced stream flows (RBCC 2006).

Channelization/Diking

Channelization and confinement of mainstem and tributary reaches of the Upper Rogue River is common and shown in Figure 32-9 and Figure 32-8. Disconnecting high IP coho salmon streams from their floodplains and constricting their channels into straight, narrow stream courses greatly diminishes their summer and winter habitat carrying capacity (BLM 1997). These activities also tend to reduce surface-groundwater connections that help maintain cool stream temperatures (ODEQ 2008).

Climate Change

The current climate is generally warm and modeled regional average temperature shows a large increase over the next 50 years (see Appendix B for the climate change stress assessment methods). Average temperature could increase by over 2.8 ^{o}C in the summer and 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 may change (Mote and Salathe 2010). Juvenile and smolt rearing and migratory habitat are most at risk from climate change. Rising sea level may reduce the quality and extent of wetland rearing habitat. Adult Upper Rogue River coho salmon will likely be negatively affected by ocean acidification and changes in ocean conditions and prey availability (see Independent Science Advisory Board 2007, Feely et al. 2008, Portner and Knust 2007).

Mining/Gravel Extraction

Large scale gravel operations along the Upper Rogue River have resulted in the river abandoning its channel and forming a new one, and degrading formerly productive coho salmon rearing areas. Off channel ponds formed by pits excavated in the floodplain can capture juvenile coho salmon, coho salmon smolts, and adult coho salmon during high flow. Gravel extraction reduces overall habitat complexity and reduces the quality and quantity of available pool habitat. Given the sensitivity of the channel to disturbance (i.e., due to the current lack of floodplain and channel structure, and low levels of instream wood), and the use of the gravel extraction reach by coho salmon juveniles for summer rearing, gravel extraction is a significant threat to rearing juveniles. However, gravel mining has not occurred within stream channels for many years and no proposals to do so are known.

Invasive Non-Native/Alien Species

Thompson and Fortune (1970) noted that warm water favored introduced species in the mainstem Rogue River, with largemouth bass, black crappie, bluegill, pumpkin seed, and brown bullhead present at fishable levels in the mainstem near Shady Cove prior to dam construction. In the Gold Ray Dam pool, carp were previously abundant (Thompson and Fortune 1970), but this dam has now been removed. In the nearby Middle Rogue, BLM (1999b) noted that private farm ponds related to agriculture and rural residential development have been stocked with introduced warm water species such as largemouth bass and sunfish. Umpqua pikeminnow, introduced in the Rogue River, have become established and likely represent the greatest threat to coho salmon of all the non-native species present. The threat of non-native fish species predominately occurs in the mainstem Rogue River. The risk of non-native fish species to the recovery of Upper Rogue River coho salmon is medium.

Hatcheries

Cole Rivers Hatchery releases 200,000 smolts annually, in addition to millions of hatchery spring-run Chinook salmon, winter-run steelhead, and summer-run steelhead (ODFW 2008d). Consequently, Upper Rogue River coho salmon are exposed to risks posed by hatcheries. The greatest hatchery-related concerns for this population are spawning between hatchery coho salmon and wild coho salmon in the wild, and predation by and competition with hatchery fish. The management goal for this population is to have less than 10 percent of the spawning coho salmon be hatchery-origin (ODFW 2008d). There is some uncertainty on whether this goal is being attained because randomized sampling of spawning sites has been sporadic. Available information suggests that the incidence of hatchery fish spawning in the wild is likely in the range of 5 to 15 percent.

Road-Stream Crossing Barriers

Road densities in portions of the Upper Rogue River sub-basin are very high and stream side roads are common. Culverts may block upstream migration for adults or passage for juveniles during low flow periods. Watersheds with particularly high road densities, road stream crossings, and associated barriers are Bear Creek, Evans Creek and lower Little Butte Creek. Stream crossings have been, and continue to be, improved on federal lands in the sub-basin.

High Severity Fire

Fire risk is acknowledged as a regional concern (RBCC 2006, BLM 1998b). Early seral stage forests, which are common in the Upper Rogue River sub-basin, lead to dry site conditions and increased fire risk (SO RC&D 2003). There have been recent occurrences where fire occurred within/along coho salmon occupied stream segments within the Upper Rogue (i.e., Timbered Rock Fire in Elk Creek watershed 2002). Overall, high severity fire is a medium threat to Upper Rogue River coho salmon.

Fishing and Collecting

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

32.7 Recovery Strategy

The most immediate need for habitat restoration and threat reduction in the Upper Rogue River is in those areas currently occupied by coho salmon in the headwaters of Evans, Trail, Elk, Big Butte, and Little Butte Creeks. Unoccupied areas must also be restored to provide enough habitat for coho salmon to achieve recovery.

The degraded conditions of the Upper Rogue River habitat, combined with the depressed coho salmon population size and distribution, increases the risk of extinction of this inland coho salmon population, which is critical to recovery of the Interior Rogue River diversity stratum. The greatest factor limiting recovery of coho salmon in the Upper Rogue River is the lack of suitable rearing habitat for juveniles. The processes that create and maintain such habitat must be restored by restoring flow, increasing habitat complexity within the channel, restoring off-channel rearing areas, and reducing threats to instream habitat. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 32-3 on the following page lists the recovery actions for the Upper Rogue River population.

Table 32-3. Recovery action implementation schedule for the Upper Rogue River population. Recovery actions for monitoring and research are listed in tables at the end of Chapter 5.

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.12.1.50	Agricultural Practices	Yes	Improve agricultural practices	Improve regulatory mechanisms	Population wide	1
SONCC-URR.12.1.50.1	*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-URR.12.1.50.2	*Ensure basin rules are specific and linked to implementing AWQMAP recommendations, including developing specific standards for riparian buffers*					
SONCC-URR.12.1.50.3	*Ensure that AWQMA plans address both impaired areas and proactive prevention of water quality impairment*					
SONCC-URR.12.1.50.4	*Adopt interim buffers equal to the buffer standards NMFS is recommending in Washington state until the state establishes its own buffers*					
SONCC-URR.12.1.50.5	*Develop a process in the AWQMA Program that tracks and evaluates implementation*					
SONCC-URR.12.1.50.6	*Change the complaint-based compliance monitoring process to a focused compliance program*					
SONCC-URR.10.5.14	Water Quality	No	Improve timber harvest practices	Improve regulatory mechanisms	Privately held timberlands	1
SONCC-URR.10.5.14.1	*Determine how to revise Oregon Forest Practice Rules so that they do not limit recovery of SONCC coho salmon and make appropriate revisions*					
SONCC-URR.10.5.14.2	*Adopt rules for fish-bearing streams sufficient to protect both water quality and fish habitat*					
SONCC-URR.10.5.14.3	*Adopt rules to increase protection of non-fish-bearing streams that address practices that adversely impact water quality and fish habitat*					
SONCC-URR.10.5.14.4	*Ensure management measures for landslide prone areas include protection of water quality and fisheries habitat*					
SONCC-URR.10.5.14.5	*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-URR.3.1.7	Hydrology	Yes	Improve flow timing or volume	Educate stakeholders	Population wide	2c
SONCC-URR.3.1.7.1	*Develop an educational program about water conservation programs and instream leasing programs*					
SONCC-URR.3.1.4	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2c
SONCC-URR.3.1.4.1	*Quantify groundwater withdrawal and determine maximum amount available for use without significantly reducing instream flows*					
SONCC-URR.3.1.5	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2c
SONCC-URR.3.1.5.1	*Quantify groundwater withdrawal and ensure urban/residential/industrial development does not limit recovery of SONCC coho salmon*					
SONCC-URR.3.1.6	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2c
SONCC-URR.3.1.6.1	*Establish a comprehensive groundwater permit process*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.22.3.47	Urban, Residential, Industrial Development	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Increase regulatory oversight	All coho salmon bearing streams	2c
SONCC-URR.22.3.47.1	*Strengthen city and county ordinances to limit development within the 100 year channel migration zone*					
SONCC-URR.22.3.47.2	*Strengthen city and county ordinances to limit development within the 50 year flood elevation*					
SONCC-URR.2.1.11	Floodplain and Channel Structure	Yes	Increase channel complexity	Improve suction dredging practices	All streams where coho salmon would benefit immediately	2c
SONCC-URR.2.1.11.1	*Develop suction dredging regulations that minimize or prevent impacts to coho salmon. Consider special closed areas, closed seasons, and restrictions on methods and operations*					
SONCC-URR.2.1.70	Floodplain and Channel Structure	Yes	Increase channel complexity	Improve suction dredging practices	Population wide	2d
SONCC-URR.2.1.70.1	*Develop suction dredging regulations that minimize or prevent impacts to coho salmon. Consider special closed areas, closed seasons, and restrictions on methods and operations*					
SONCC-URR.2.1.49	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2c
SONCC-URR.2.1.49.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-URR.2.1.49.2	*Place instream structures, guided by assessment results*					
SONCC-URR.2.1.71	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2d
SONCC-URR.2.1.71.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-URR.2.1.71.2	*Place instream structures, guided by assessment results*					
SONCC-URR.2.2.9	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	All streams where coho salmon would benefit immediately	2c
SONCC-URR.2.2.9.1	*Assess habitat to determine where potential exists for floodplain reconnection. Prioritize sites and determine best means for reconnection at each site using tools such as hydrologic analysis*					
SONCC-URR.2.2.9.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.2.2.73	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Population wide	2d
SONCC-URR.2.2.73.1	*Assess habitat to determine where potential exists for floodplain reconnection. Prioritize sites and determine best means for reconnection at each site using tools such as hydrologic analysis*					
SONCC-URR.2.2.73.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-URR.2.2.10	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	All streams where coho salmon would benefit immediately	2c
SONCC-URR.2.2.10.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for land owners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-URR.2.2.10.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-URR.2.2.10.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-URR.2.2.72	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	2d
SONCC-URR.2.2.72.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for land owners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-URR.2.2.72.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-URR.2.2.72.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-URR.3.1.44	Hydrology	No	Improve flow timing or volume	Increase instream flows	All streams with ODFW water rights for fish and all streams where coho salmon would benefit immediately	2c
SONCC-URR.3.1.44.1	*Secure adequate instream flows to fulfill ODFW water rights for fish*					
SONCC-URR.3.1.65	Hydrology	No	Improve flow timing or volume	Increase instream flows	All streams where coho salmon would benefit immediately	2c
SONCC-URR.3.1.65.1	*Identify and cease unauthorized water diversions*					
SONCC-URR.3.1.67	Hydrology	No	Improve flow timing or volume	Increase instream flows	All streams where coho salmon would benefit immediately	2c
SONCC-URR.3.1.67.1	*Identify diversions in tributaries that have subsurface or low flow barrier conditions during the summer*					
SONCC-URR.3.1.67.2	*Reduce diversions using a combination of incentives and enforcement measures*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.3.1.74	Hydrology	No	Improve flow timing or volume	Increase instream flows	Population wide	2d
SONCC-URR.3.1.74.1	*Identify and cease unauthorized water diversions*					
SONCC-URR.3.1.75	Hydrology	No	Improve flow timing or volume	Increase instream flows	Population wide	2d
SONCC-URR.3.1.75.1	*Identify diversions in tributaries that have subsurface or low flow barrier conditions during the summer*					
SONCC-URR.3.1.75.2	*Reduce diversions using a combination of incentives and enforcement measures*					
SONCC-URR.26.1.66	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2c
SONCC-URR.26.1.66.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-URR.10.2.43	Water Quality	No	Reduce pollutants	Increase regulatory oversight	Population wide	2c
SONCC-URR.10.2.43.1	*Increase application of Low Impact Development (LID) techniques through education and incentives*					
SONCC-URR.10.2.43.2	*Incorporate LID in Clean Water Act permits for projects that result in stormwater discharge*					
SONCC-URR.10.2.48	Water Quality	No	Reduce pollutants	Increase regulatory oversight	Population wide	2c
SONCC-URR.10.2.48.1	*Strengthen city and county ordinances to minimize new impervious surfaces and require treatment to current standards*					
SONCC-URR.10.2.48.2	*Strengthen city and county ordinances to require treatment to current standards when existing impervious surfaces are expanded, reconditioned, reconstructed or replaced*					
SONCC-URR.10.2.48.3	*Develop local regulatory mechanisms that limits development and reduces amount of total impervious area through incentives*					
SONCC-URR.10.1.12	Water Quality	No	Reduce water temperature, increase dissolved oxygen	Improve long-range planning	Population wide	2c
SONCC-URR.10.1.12.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-URR.10.1.12.2	*Develop watershed-specific guidance for managing riparian vegetation. Consider larger riparian buffers in coho occupied habitat*					
SONCC-URR.10.1.13	Water Quality	No	Reduce water temperature, increase dissolved oxygen	Increase conifer riparian vegetation	Federal forest lands	2c
SONCC-URR.10.1.13.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-URR.10.1.13.3	*Plant conifers, guided by the plan*					
SONCC-URR.2.2.61	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Improve regulatory mechanisms	Population wide	2d
SONCC-URR.2.2.61.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.5.1.20	Passage	No	Improve access	Remove barriers	All streams where coho salmon would benefit immediately	3c
SONCC-URR.5.1.20.1	*Assess and prioritize barriers using the ODFW fish passage barrier database*					
SONCC-URR.5.1.20.2	*Remove barriers, based on evaluation*					
SONCC-URR.5.1.76	Passage	No	Improve access	Remove barriers	Population wide	3d
SONCC-URR.5.1.76.1	*Assess and prioritize barriers using the ODFW fish passage barrier database*					
SONCC-URR.5.1.76.2	*Remove barriers, based on evaluation*					
SONCC-URR.10.5.37	Water Quality	No	Improve timber harvest practices	Improve timber harvest practices	BLM lands	3c
SONCC-URR.10.5.37.1	*Manage timber harvest (and associated activities) on Federal lands in accordance with the Aquatic Conservation Strategy of the NWFP, or with the updated ACS guidance contained in newly revised Resource Management Plans or Land and Resource Management Plans, in order to achieve riparian and stream channel improvements for coho salmon.*					
SONCC-URR.7.1.45	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Private lands where coho salmon would benefit immediately	3c
SONCC-URR.7.1.45.1	*Assess grazing contribution to sediment delivery, pollutants, and impaired riparian conditions*					
SONCC-URR.7.1.45.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-URR.7.1.45.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-URR.7.1.77	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Population wide	3d
SONCC-URR.7.1.77.1	*Assess grazing contribution to sediment delivery, pollutants, and impaired riparian conditions*					
SONCC-URR.7.1.77.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-URR.7.1.77.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-URR.8.1.2	Sediment	No	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	3c
SONCC-URR.8.1.2.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.8.1.1	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All basins with road densities greater than 3 miles/square mile	3c
SONCC-URR.8.1.1.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-URR.8.1.1.2	*Decommission roads, guided by assessment*					
SONCC-URR.8.1.1.3	*Upgrade roads, guided by assessment*					
SONCC-URR.8.1.1.4	*Maintain roads, guided by assessment*					
SONCC-URR.10.2.42	Water Quality	No	Reduce pollutants	Reduce pesticides	All streams where coho salmon would benefit immediately	3c
SONCC-URR.10.2.42.1	*Develop a pesticide management plan*					
SONCC-URR.10.2.42.2	*Implement pesticide management plan and technical assistance program*					
SONCC-URR.10.2.68	Water Quality	No	Reduce pollutants	Reduce pesticides	Population wide	3d
SONCC-URR.10.2.68.1	*Develop a pesticide management plan*					
SONCC-URR.10.2.68.2	*Implement pesticide management plan and technical assistance program*					
SONCC-URR.10.7.64	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3c
SONCC-URR.10.7.64.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-URR.10.7.64.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-URR.10.7.69	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-URR.10.7.69.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-URR.10.7.69.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-URR.3.1.8	Hydrology	Yes	Improve flow timing or volume	Manage flow	William L. Jess Dam	3d
SONCC-URR.3.1.8.1	*Review dam management practices to ensure operations benefit the survival of all life stages of coho salmon*					
SONCC-URR.3.1.8.2	*Modify dam management, if needed*					
SONCC-URR.1.2.39	Estuary	No	Improve estuarine habitat	Improve estuary condition	Rogue River Estuary	3d
SONCC-URR.1.2.39.1	*Implement recovery actions for Lower Rogue River population that address the target "Estuary"*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.7.1.46	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Federal lands	3d
SONCC-URR.7.1.46.1	*Monitor effects of livestock grazing on coho salmon habitat and adjust or discontinue grazing if effects of livestock grazing on salmon habitat are limiting coho recovery*					
SONCC-URR.16.1.21	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-URR.16.1.21.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-URR.16.1.21.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-URR.16.1.22	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-URR.16.1.22.1	*Determine actual fishing impacts*					
SONCC-URR.16.1.22.2	*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-URR.16.2.23	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-URR.16.2.23.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-URR.16.2.23.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-URR.16.2.24	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-URR.16.2.24.1	*Determine actual impacts of scientific collection*					
SONCC-URR.16.2.24.2	*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*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-URR.10.2.15	Water Quality	No	Reduce pollutants	Educate stakeholders	Population wide	3d
SONCC-URR.10.2.15.1	*Develop an educational program that promotes Salmon Safe methods for agricultural operations and Integrated Pest Management for rural residents*					
SONCC-URR.14.2.19	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of warm-water, non-native fish species	Population wide	3d
SONCC-URR.14.2.19.1	*Determine presence and absence of warm water, non-native fish species and develop a plan for eradication or control*					
SONCC-URR.14.2.19.2	*Eradicate or suppress invasive fish species, guided by the plan*					
SONCC-URR.10.7.63	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-URR.10.7.63.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-URR.10.7.63.2	*Supply marine-derived nutrients to streams guided by the plan*					