38. Lower Trinity River Population

Interior Trinity River Stratum

Core Population

High Extinction Risk

Population likely below depensation threshold

3,600 Spawners Required for ESU Viability

746 mi^2 watershed (91% Federal ownership)

112 IP-km (63 IP-mi) (1% High)

Dominant Land Uses are Forestry and Agriculture

Key Limiting Stresses are 'Lack of Floodplain and Channel Structure' and 'Altered Hydrologic Function'

Key Limiting Threats are 'Channelization/Diking' and 'Hatcheries'

Highest Priority Recovery Actions

• Prioritize and provide incentives for use of CA Water Code Section 1707 • Streamline process for water leasing under CA Water Code Section 1707 for instream purposes • Establish a comprehensive groundwater permit process	• Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows • Implement a hatchery and genetic management plan • Remove, set back, or reconfigure levees and dikes

38.1 History of Habitat and Land Use

Prior to 1944, the Lower Trinity River was occupied by Native Americans and turn-of-the century miners (U.S. Forest Service (USFS) 2000d). Their use of these lands probably had relatively minor impacts. Forest Service road construction and timber harvest did not begin until the 1950s (USFS 2000e). Land use activities in the Lower Trinity River watershed today include mining, timber harvesting, agriculture, road construction, recreation and a limited degree of residential development (U.S. Environmental Protection Agency [USEPA] 2001). The construction of Trinity and Lewiston dams in the early 1960s and water diversion to the Sacramento Valley has had major impacts on the flow and function of the Trinity River (USEPA 2001, USFS 2000e). Effects to coho salmon habitat in the Lower Trinity River include degradation of spawning and rearing habitat, lack of deep pools, sedimentation, channelization and channel confinement, and high water temperatures. Some streams with moderate intrinsic potential (IP) value are relatively intact with regards to their historic condition and a few have federally designated Wilderness protection.

Fish habitat, especially anadromous fish habitat, was greatly degraded in the 1964 flood, which affected the Lower Trinity River and most anadromous habitat in northern California (USFS 2000e). Substantial habitat recovery has occurred since the 1964 flood, but wild anadromous fish populations and salmon habitat have generally not recovered in the Klamath basin (USFS 2000e). Fire has also been a source of catastrophic disturbance. Several high severity fires have burned through the lower Trinity River since fire suppression activities on USFS land began in the mid-1900s.

For instance, the 1999 Megram Fire burned 125,000 acres and the Big Bar Complex burned close to 80,000 acres (53 percent) of the New River watershed in August 1999. Both impacted the riparian communities of some streams and accelerated the delivery of sediment to several streams in the Lower Trinity River drainage (USFS 2000e).

Timber harvest practices and developments on floodplains within the Trinity River watershed have also contributed significantly to habitat degradation (U.S. Department of the Interior 1981). A total of 28 percent of the Lower Trinity was harvested between 1940 and 1990 (USEPA 2001) as a result of large-scale timber harvesting occurring on private land (especially Willow Creek and Sharber Creek) (USFS 2003b). Clearcutting promoted increased sediment loading; removal of streamside vegetation increased water temperatures; and log jams at the mouths of tributaries (USDOI 1981). In addition, timber harvest within the sub-basin has necessitated the construction of hundreds of miles of unpaved timber management roads (USDOI 1981). Road networks in the Lower Trinity and many other areas of the Pacific Northwest are the most significant source of anthropogenic sediment input to anadromous fish habitats, often exceeding all other combined sources from forest activities (USFS 2003b). Roads have led to decreased hydrologic function and increased sediment loading. The resulting increased yield of sediment in the mainstem Trinity River and its tributaries has reduced the biological productivity and fish carrying capacity of the river (USDOI 1981).

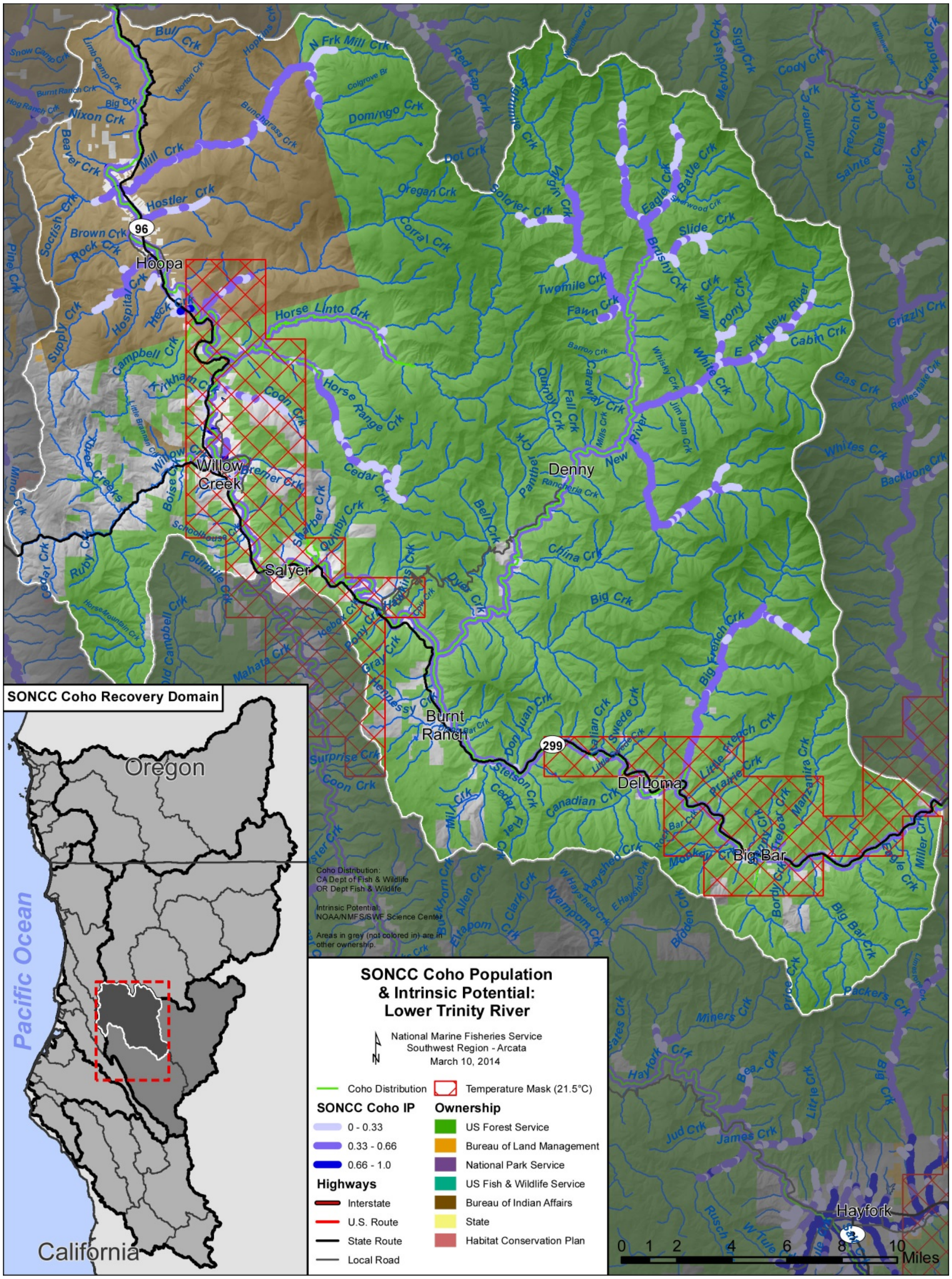

Figure 38-1. The geographic boundaries of the Lower Trinity River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), a temperature mask (indicating areas that are inherently too warm for rearing coho salmon), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Trinity River diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

Much of the mainstem Trinity River and virtually all tributaries have been subjected to hydraulic mining activities (U.S. Fish and Wildlife Service [USFWS] and Hoopa Valley Tribe [HVT] 1999, USEPA 2001). Hydraulic mining destabilized streambanks, changed the channel structure, and caused large amounts of sediment to be washed into tributary streams. However, the form and function of the streams in areas where hydraulic mining has occurred seem to have persisted despite this disturbance (USFWS and HVT 1999, USEPA 2001).

It is likely that many watersheds within the Burnt Ranch and New River hydrologic subarea (HSA) are properly functioning with regard to aquatic habitat and watershed conditions. These streams have a large portion of their watersheds in the Trinity Alps Wilderness and remain in a relatively undisturbed state. Most of these streams remain accessible to coho salmon. Although these streams currently support small populations of anadromous steelhead and some coho salmon, they may not have historically supported robust populations of coho salmon because of their high gradient.

38.2 Historic Fish Distribution and Abundance

There is little information on the historic abundance of coho salmon in the lower Trinity River. USFWS and California Department of Fish and Game (CDFG) (1956) noted that "Silver [coho] salmon enter most lower Trinity River tributaries to spawn." Similarly, Moffet and Smith (1950) stated that "silver [coho] salmon enter the lower Trinity River to spawn" and reported that coho salmon were usually observed in the Hoopa Valley by October. In 1969 and 1970, CDFG estimated the coho salmon run size for the Trinity River to be 3,222 and 5,245, respectively (Smith 1975, Rogers 1973). Since 1978, coho salmon escapement estimates above Willow Creek has ranged from 558 to 32,373 (USFWS and HVT 1999). These returns have largely been comprised of hatchery fish since Trinity River Hatchery (TRH) was built. An estimated 90 percent of coho salmon spawning between Willow Creek and Lewiston Dam are of hatchery origin (USFWS and HVT 1999). The estimated escapement of naturally produced coho salmon adults and jacks upstream of the Willow Creek weir from 1997 to 2010 ranged from 539 to 9,055, with an average of 2,028. Unknown is the proportion of these coho salmon that spawn in the lower Trinity River, as many are likely migrating to the Upper Trinity River. Spawning surveys by the USFS in the mid to late 1990s have found scattered use of tributaries in the Lower Trinity by coho salmon with between 0 and 100 spawners found during any given year in the few surveyed streams (USFS 2003b).

TRH first began releasing coho salmon in 1960. Although substantial efforts were made to trap and haul coho salmon above the dam during the construction of Trinity Dam, adult returns fell to essentially zero during the 1962-63 run (zero females, seven males, nine jacks). Transfer of coho salmon eggs from outside of the Trinity basin often occurred, which imported coho salmon that were likely not as well adapted to the Trinity basin's habitat conditions as were the original stocks. The TRH facility originally used Trinity River fish for broodstock, though coho salmon from Eel River (1965), Cascade River (1966, 1967, and 1969), Alsea River (1970), and Noyo River (1970) have also been reared and released at the hatchery as well as elsewhere in the Trinity River basin (NMFS 2003). Actual production averaged 496,813 from 1987 to 1991, decreased to 385,369 from 1992 to 1996, then increased again to 527,715 fish from 1997 to 2002. During the period 1991–2001, an average of 3,814 adult coho salmon were trapped and 562 females were spawned at TRH (NMFS 2003).

Given that several tributary streams in Lower Trinity River provide spawning habitat, it can be inferred that coho salmon were historically widely distributed throughout the Lower Trinity River sub-basin. Historically, it was probably rare for coho salmon to spawn in the mainstem Lower Trinity River. The steep nature of the surrounding terrain likely limited the amount of high quality habitat available to coho salmon and the majority of IP habitat is of moderate value (0.33- 0.66). There exist only a few scattered kilometers of high IP habitat (>0.66). The relatively steep nature of the area and the consequent lack of high IP habitat (<2 percent high IP) suggest this population never supported large runs of coho salmon but may have supported a moderately-sized population that was spread throughout most major tributaries (e.g., Big French Cr., New River, Willow Cr., Horse Linto Cr., Tish Tang Cr., Mill Cr., and Cedar Cr.)

38.3 Status of Lower Trinity River Coho Salmon

Spatial Structure and Diversity

Good spawning habitat exists in a few tributaries in the Lower Trinity. The Burnt Ranch and New River HSAs have some of the best known spawning habitat in the population area. Tributaries known to support coho salmon spawning and/or rearing include Mill Creek, Horse Linto Creek, Tish Tang Creek, and Sharber-Peckham Creek. The presence of juvenile coho salmon has also been confirmed within relatively recent years in Manzanita Creek, Big French Creek, East Fork New River, Cedar, Supply, Campbell, and Hostler creeks, as well as in Willow Creek as far upstream as the Boise Creek confluence (Boberg 2008, Everest 2008). Sharber-Peckham Creek likely supports the highest number of spawning coho salmon (USFS 2001; Boberg 2008). The Six Rivers National Forest indicated that populations in the lower portions of Mill and Horse Linto creeks are extremely low, particularly in Horse Linto Creek since 1995 (USFS 2001). The USFS (2000f) reported that coho salmon are rarely found in the New River although this is one of the largest watersheds with the potential for coho salmon production based on the availability of IP habitat in the sub-basin. Based on this current distribution of coho salmon in the Lower Trinity, most of the historic habitat of the Lower Trinity River remains accessible to coho salmon, though many of the streams are unoccupied, or sporadically occupied.

Although not well documented, there appears to be some diversity of life history strategies in the Lower Trinity River. Data on run timing and outmigration indicate that there is some variation in the life history characteristics of the population. Coho salmon enter the Trinity River between September and November and spawning in the river continues into December (CDFG 2009b). Also, both young-of-the-year and yearling coho salmon are captured at downstream migrant traps located in the Trinity River near Willow Creek (Pinnix et al. 2007). Redistribution of age 0+ coho occurs over a large time period between March and September as does outmigration of age 1+ (Pinnix et al. 2007).

Hatchery influences on the genetic diversity of the population are substantial in the Lower Trinity River sub-basin. Each year, TRH releases approximately 500,000 coho salmon smolts. Currently, coho salmon returns to the Trinity River are dominated by hatchery fish (USFWS and HVT 1999). From 1997 to 2005, over 85 percent of adults returning to the Trinity River (as estimated at Willow Creek) were of hatchery origin (CDFG 2009b). Trinity River hatchery coho salmon stray into many of the tributaries on the Six Rivers National Forest, such as Horse Linto Creek (Cyr 2008). Straying of hatchery fish into tributaries of the Trinity River presents a particular threat to the diversity viability parameter, as hatchery fish may reduce the reproductive success of the overall population (Mclean et al. 2003) through outbreeding depression (Reisenbichler and Rubin 1999). In 1985, Jong and Mills (1992) found that 35.8 percent of adult coho salmon returning to the South Fork Trinity River were of hatchery origin. In other years, few or no hatchery coho salmon were trapped on the South Fork Trinity River (Jong and Mills 1992). We assume that in years of high adult returns of hatchery coho salmon (>10,000), the proportion of hatchery coho salmon adult returns to tributaries in the Lower Trinity River is similar to that found in the South Fork, or greater, because hatchery coho salmon are migrating to Trinity River Hatchery through the Lower Trinity River.

Table 38-1. Estimated run sizes of adult and jack coho salmon based on observations at Willow Creek weir (CDFW 2013c). Hatchery-origin fish were identified by a right maxillary clip.

Year	Number Unmarked	Number Marked	% Hatchery	% Natural
1997	651	7,284	92%	8%
1998	1,132	11,348	90%	10%
1999	586	4,959	89%	11%
2000	539	14,993	97%	3%
2001	3,373	28,768	90%	10%
2002	596	15,420	96%	4%
2003	4,093	24,059	86%	14%
2004	9,055	29,827	77%	23%
2005	2,740	28,679	92%	8%
2006	1,624	18,454	92%	8%
2007	1,199	4,551	79%	21%
2008	1,312	8,671	87%	13%
2009	642	5,753	90%	10%
2010	861	7,085	89%	11%

Population Size and Productivity

Williams et al. (2008) determined at least 112 spawners are needed each year in the Lower Trinity River to avoid problems associated with low spawner density such as the failure to find mates leading to a reduced probability of fertilization, and the failure to saturate predator populations (Liermann and Hilborn 2001, Williams et al. 2008). Williams et al. (2008) also determined that there should be a spawner density of at least 35 coho salmon per IP-km of habitat in the Lower Trinity River sub-basin, resulting in a total of 3,900 individuals to meet the low risk spawner threshold.

Limited presence/absence and spawning survey data are available from the U.S. Forest Service. Based on spawner surveys by the USFS run sizes in Sharber Creek between 1996 and 2001 ranged from 0 fish in 1999 to almost 150 fish in 2001 (USFS 2003b). The average run size during this time was 56 fish (and 27 redds). No coho salmon were found during spawning surveys in Willow Creek between 1991-2000 although juveniles have been found during outmigrating trapping (USFS 2003b). Surveys of coho salmon in streams with IP on USFS land suggest that coho salmon have declined since the 1990s and are only occasionally seen at extremely low abundance levels (Collins 2012). However, no live coho salmon were observed in

2011 and there were only a couple of potential redds observed in 2011 (Collins 2012). Captures of yearling coho salmon in the Trinity River during outmigrant trapping have been consistent, but numbers are generally low (CDFG 2009b).

Coho salmon on the Hoopa Valley Indian Reservation (HVIR) are rare and seemingly missing cohorts based on monitoring conducted by the Hoopa Valley Tribe HVT (Table 38-2, Figure 38-2 and Figure 38-3). From 2005 to 2010, the total expanded net catch for the HVIR ranged from 744 to 2 coho salmon (Figure 38-2 and Figure 38-3). Because so few were captured in these years, population estimates were not possible (HVT 2012). However, dividing the yearly total Chinook salmon expanded net catch by the yearly Chinook salmon population estimates provides an approximation, albeit rough, of the percentage of the Chinook salmon population that was captured in the downstream migrant traps. From 2005 to 2010, the expanded Chinook salmon catch accounted for 8 to 19 percent of the estimated Chinook salmon population (HVT 2012). Assuming this same proportion of the coho salmon population was captured in the downstream migrant traps (expanded catch) yields an approximation of the population of coho salmon juveniles on streams on the HVIR. From 2005 to 2010, roughly 9,036 to 14 coho salmon were present in the seven streams monitored by HVT (Table 38-3) using this method. NMFS acknowledges there are limitations to using this population proxy, including, but not limited to, potentially unequal capture probabilities of juvenile coho salmon and Chinook salmon. However, the calculations do provide an understanding of the magnitude of what could be expected of coho salmon juvenile population estimates on the HVIR, if estimates were available.

The expanded catch of coho salmon, as well as the population approximations, show marked declines after 2005. This leads NMFS to conclude that since 2005, there have been no more than a couple spawning pairs of coho salmon in all of the tributaries on the HVIR combined, assuming that none of the juveniles captured in HVIR tributaries were rearing in non-natal streams. If these few fish were actually non-natal rearing SONCC coho salmon juveniles, which is equally probable, then no adult coho salmon would have spawned in HVIR streams since 2005.

Table 38-2. Present (X) and missing (blank) coho salmon brood years in anadromous HVIR streams in the action area, 2005-2010 (HVT 2012). Pine Creek is a tributary to the Klamath River.

	Hostler	Mill	Pine	Soctish	Supply	Tish Tang
2005						
2006	X		X	X	X	X
2007	X			X	X	
2008	X			X		X
2009	X				X	
2010		X	X	X	X	X

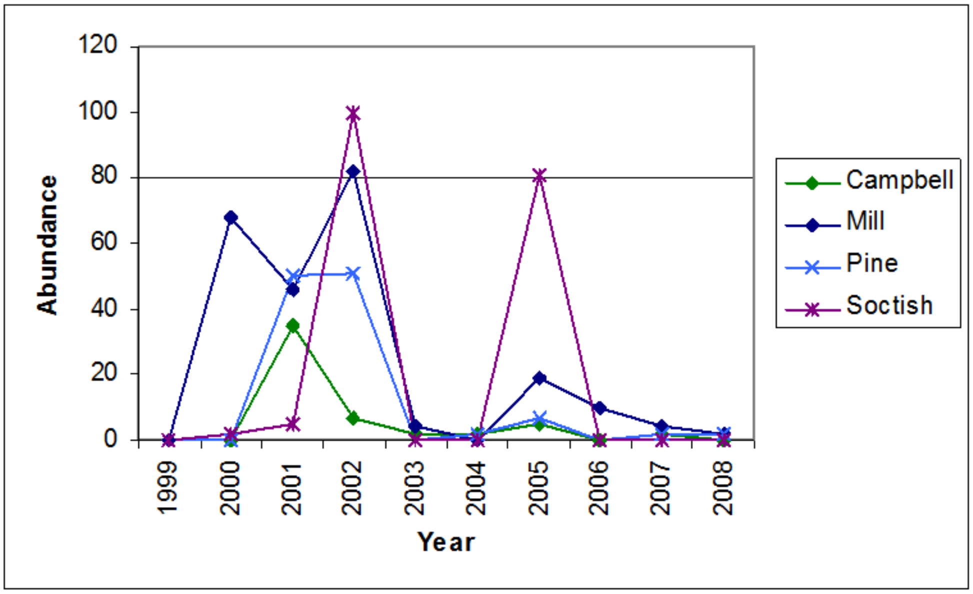

Figure 38-2. Juvenile coho salmon trapped in Campbell, Mill, Pine, and Soctish Creeks from 1999-2008 (HVT 2012).

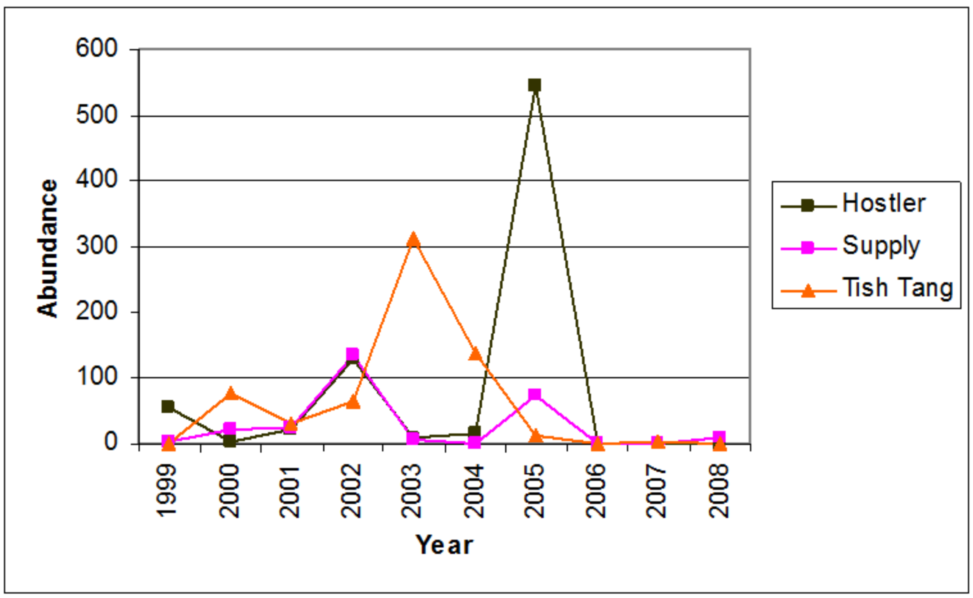

Figure 38-3. Juvenile coho salmon trapped in Hostler, Supply, and Tish Tang Creeks from 1999-2008 (HVT 2012).

Table 38-3. Number coho salmon captured, and population estimation, for seven streams on the HVIR (Campbell, Hostler, Mill, Pine, Soctish, Supply, and Tish Tang creeks) (HVT 2012).

Year	Expanded coho salmon catch	Coho salmon population approximation
2005	744	9,036
2006	10	81
2007	9	93
2008	12	121
2009	7	36
2010	2	14

In years such as 2001 and 2004 that were exceptionally strong brood years for coho salmon throughout northern California, with smolt-to-adult returns (SAR) for TRH hatchery coho salmon exceeding 6 percent and population estimates over 25,000 (CDFG 2008c), tributaries of the HVIR likely hosted numerous strays of both hatchery and wild origin. Strays in the early 2000s could have accounted for a significant proportion of the juvenile coho salmon production on the HVIR. Undoubtedly, a factor in the decline in coho salmon abundance on the HVIR is low marine survival, as evidenced by SAR rates on the order of 1 percent since 2005 for TRH coho salmon (CDFG unpublished data). Given the low number of coho salmon in the HVIR tributaries, a 1 percent SAR appears to have yielded numbers of coho salmon in the tributaries so small that they are likely not viable or self-sustaining. The inability of the coho salmon population on the HVIR to remain viable during years of low marine survival leads NMFS to believe that tributaries of the HVIR currently do not support a population of self-sustaining coho salmon and likely rely on strays to periodically produce juvenile coho salmon.

The limited data available from the USFS and the HVT for the Lower Trinity River population suggests that much of the IP habitat in the Lower Trinity River is currently unoccupied or only sporadically occupied. Brood year cohorts may be missing and the adult coho salmon population is likely less than the depensation threshold of 112 adults. The population growth rate in Lower Trinity River sub-basin has not been quantified. Recent data indicate that the amount of recruits produced per female spawner in the Trinity River is substantially less than two, meaning the population is failing to replace itself (Table 39-3). The population growth rate for the Lower Trinity River is likely to be negative, and the population relies on the heavy influence of hatchery fish to maintain current abundance levels.

Extinction Risk

The Lower Trinity 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.

Role of Population in SONCC Coho Salmon ESU Viability

The Lower Trinity River population is a core, Potentially Independent population within the Interior Trinity River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, but strongly influenced by immigration from other populations such that they did not exhibit independent dynamics (Williams et al. 2006). To contribute to stratum and ESU viability, the Lower Trinity River core population should have at least 3,600 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 Lower Trinity River population may serve as a source of spawner strays for nearby coastal populations. At present, the capacity of the Lower Trinity River coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from other populations in the Klamath River basin may enhance recovery of the Lower Trinity River population.

38.4 Plans and Assessments

Hoopa Valley Tribal Fisheries and Hoopa Valley Environmental Program

http://www.hoopa-nsn.gov

Monitoring activities include fish tagging, weir operations, juvenile outmigrant trapping, screw trap monitoring, creel census, and net harvest monitoring. Much of the data gathered through these monitoring activities is used to estimate future anadromous runs in order to determine allocation between the ocean fishery, Tribal fisheries, and the sports fishery. Along with the monitoring and reporting, Hoopa Tribal Fisheries takes several measures to ensure optimal spawning habitat and rearing grounds in the seven major tributaries located within the Hoopa Reservation. Through habitat typing, channel morphology characterization, and sediment loading analysis, Tribal Fisheries is able to assess local stream habitat and address shortcomings through restoration activities.

Hoopa Tribal Environmental Protection Agency offers a multitude of services to the Hoopa Valley Tribe in environmental protection, public outreach and education, air quality monitoring, water quality planning, solid waste management, hazardous waste protection, and environmental compliance. www.hoopa-nsn.gov.

Yurok Tribal Fisheries Program and Yurok Tribal Environmental Program

http://www.yuroktribe.org/departments/fisheries/
http://www.yuroktribe.org/departments/ytep/

The Yurok Tribe has several reports and assessments available for the Trinity River basin on salmon populations, salmon habitat, and water quality. The Yurok Tribe is an active participant in the Trinity River Restoration Program, performing fisheries research, salmon population monitoring such as redd and carcass surveys and habitat restoration. The Yurok Tribe also monitors and reports on water quality in the Trinity River.

U.S. Forest Service- Shasta-Trinity and Six Rivers National Forests

http://www.fs.fed.us/r5/shastatrinity/

The U.S. Forest Service (USFS) has a variety reports and assessments available for the Trinity Basin. USFS has programs benefitting salmon and steelhead habitat in the Trinity River basin. USFS maintains an active road decommissioning and sediment abatement program that aims to minimize fine sediment delivery to streams. Fuels reductions programs implemented by the USFS are activities that help reduce the risk of catastrophic forest fires and subsequent erosion. The USFS is an active participant in the Trinity River Restoration Program and performs salmon and steelhead monitoring, restoration, and habitat assessments.

State of California

Recovery Strategy for California Coho Salmon
http://www.dfg.ca.gov/fish/Resources/Coho/SAL_CohoRecoveryRpt.asp

The specific restorative recommendations developed by the Coho Recovery Team and CDFG for the Upper Trinity River have been considered and incorporated into the table of population-specific recovery actions.

North Coast Regional Water Quality Control Board (NCRWQCB)

www.waterboards.ca.gov/northcoast

The NCRWQCB has identified the Trinity River as impaired under Clean Water Act (CWA) 303(d) due to elevated sedimentation. The NCRWQCB is required to develop the measures which will result in implementation of the TMDLs in accordance with the requirements of 40 CFR 130.6. The North Coast Basin Plan identifies both numeric and narrative water quality objectives for the Trinity River.

Five Counties Salmonid Conservation Program

http://www.5counties.org/

The Five Counties Salmonid Conservation Program (5C) has reports and plans available on sediment reduction, barriers to migration and fish habitat in the Trinity River basin. The 5C promotes improved understanding and support for road-related conservation and restoration efforts by providing roads, salmon, and water quality workshops, fish passage engineering training, and planning and policy meetings for County and other agency staff. Among other goals, the 5C seeks to:

- Improve County policies and road maintenance practices with a strong emphasis on training.
- Identify potential restoration opportunities through inventories of fish passage barriers and potential sediment sources on County maintained roads.
- Increase the amount of salmonid habitat by replacing stream crossings that are barriers to migration with structures that provide for passage.
- Improve water quality by treating identified sources of road related sediment.

38.5 Stresses

Table 38-4. Severity of stresses affecting each life stage of coho salmon in the Lower Trinity 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	Adverse Hatchery-Related Effects	Very High	Very High	Very High	Very High	Very High	Very High
2	Lack of Floodplain and Channel Structure[1]	Medium	Very High	Very High[1]	Medium	Medium	Very High
3	Altered Hydrologic Function[1]	Medium	Medium	High[1]	High	High	High
4	Altered Sediment Supply	High	High	High	Medium	Medium	High
5	Impaired Water Quality	Low	Low	High	Low	Medium	Medium
6	Degraded Riparian Forest Conditions	-	Medium	Medium	Low	Medium	Medium
7	Barriers	-	Low	Medium	Medium	Medium	Medium
8	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Medium	Low
9	Increased Disease/Predation/Competition	Low	Low	Medium	Medium	Low	Medium
10	Impaired Estuary/Mainstem Function	-	Low	Medium	Medium	Low	Medium

[1]Key limiting stresses and limited life stage

Key Limiting Stresses, Life Stages, and Habitat

Several factors limit the viability of the Lower Trinity population. The most dominant of these factors stem from negative impacts of the altered hydrologic function and altered floodplain and channel structure. The juvenile life stage is the most limited and quality summer and winter rearing habitat is lacking for the population. Overall, the capacity of the Lower Trinity to support juveniles and other life stages of coho salmon has been reduced by these impacts. In order to improve the viability of this population it will be imperative to address the issues related to the hatchery and to improve habitat conditions for juveniles and adults. Addressing other stresses and threats and improving habitat for all life stages and life history strategies will also be an important component of recovery.

Lack of floodplain and channel structure impacts also have a major impact on the productivity of this population. Rearing opportunities and capacity are low due to disconnection of the floodplain, a lack of LWD inputs, poor riparian conditions, and sediment accretion. Low-lying areas of streams such as Supply, Mill, and Willow Creek have been channelized, diked, and disconnected from the floodplain. There exists very little off-channel habitat that can be used for rearing and refugia. Many tributaries in low-gradient areas of the Lower Trinity experience similar habitat characteristics due to development of the floodplain, sedimentation and changes in flow. The mainstem river also lacks side channel, backwater, and wetland habitat where juvenile coho salmon could find habitat in the winter. A lack of floodplain and channel structure impacts winter rearing because high flow events can displace juveniles from streams and there exists very little low-velocity rearing habitat. Lack of complex habitat also impacts summer rearing due to the loss of predatory refugia, low-flow refugia, and foraging habitat.

Given the number of diversions and the potential amount of water withdrawn from the mainstem Trinity River and its tributaries, a lack of hydrologic function could also be potentially limiting coho salmon production in the Lower Trinity population. Many tributaries likely experience unnatural seasonal low flow conditions that prohibit their use during the summer. Thermal refugia on the mainstem may also be impacted by reduced flows through a reduction in the extent, duration, or quality of refugia areas. Given the importance of tributary rearing habitat and thermal refugia on the mainstem a loss of hydrologic function could have a major impact on juvenile coho.

Lack of Floodplain and Channel Structure

The lack of floodplain and channel structure presents a moderate to high stress across life stages. Data on instream large woody debris (LWD) is limited, but it is assumed to be low given the extent of timber harvest in the areas and current lack of late seral riparian forest (e.g., Willow Creek and Sharber Creek; USFS 2003b). Lack of LWD has resulted in loss of pool habitat and a reduction in overall habitat and hydraulic complexity in coho salmon streams (CDFG 2002). Sediment loading in many streams has led to the filling of pools, disconnection from the floodplain, and the overall loss of stream complexity. Diking and channelization in many streams has reduced habitat complexity, connectivity with the floodplain, and increased water velocity, leading to lower survival of the egg, fry, and juvenile life stages. Historic floodplains in the area have been disconnected from tributary streams and converted to agricultural, grazing, or residential lands. This has further limited a relatively scarce yet important habitat type that is used for rearing of coho salmon fry and juveniles. Examples of floodplains that have been diked and simplified are the lower portions of Supply and Mill creeks on the Hoopa Valley Tribe Reservation. Complex floodplain habitats are crucial for overwintering survival and growth of juvenile coho salmon.

Altered Hydrologic Function

Altered hydrologic function is a medium to high stress for all life stages. There were 381 diversions listed in CDFG’s Fish Passage Assessment Database (CalFish 2009), and this does not included unpermitted or illegal diversions or groundwater use. The towns of Willow Creek and Hoopa both get drinking water from the Lower Trinity River sub-basin through city water systems. Denny and Burnt Ranch also get water from tributaries in the Lower Trinity. Even when a stream is not fish bearing (e.g., McDonald Creek in Burnt Ranch) it will create vitally important thermal refugia for coho salmon where the creek meets the Trinity River. By reducing the summer stream flow in streams like McDonald Creek that are not fish bearing, water diversion can still have an impact on juvenile rearing by decreasing the size of thermal refugia within the mainstem Trinity River. Other smaller domestic wells also utilize ground water, but the cumulative impact from these various residential uses on surface flows is not well documented. Overall diversions likely impact flow in many tributaries, especially during summer and early fall low flow periods. Sharber Creek, an important stream for coho salmon production in the Lower Trinity, has limited flow during the summer and can go dry in some areas. In addition to water diversion for human uses, the hydrologic regime in the Lower Trinity has been affected by the road system and fire regime. Many streams in the Lower Trinity population unit are impacted by illegal diversions and water use for marijuana cultivation, which is a growing and substantial impact to streamflow in the area. Roads affect subsurface water flow, concentrate flow, and divert or reroute water from paths it would otherwise take (Gucinski et al. 2001, USFS 2003b). The high density of roads mean that many streams experience changes in their hydrology as a result of roads. Less frequent fire in tributary watersheds has reduced or eliminated peak flow responses to the removal of duff, understory vegetation, and overstory vegetation by fire.

Adverse Hatchery-Related Effects

There are no hatcheries in the Lower Trinity River population area, but Trinity River Hatchery is upstream on the Trinity River. Trinity River Hatchery currently releases 4.3 million juvenile and yearling Chinook salmon, 500,000 yearling coho salmon, and 800,000 yearling steelhead. Hatchery-origin coho salmon make up most of the spawning run to the Trinity River each year. On average, only three percent of in-river spawners were not reared in a hatchery (USFWS and HVT 1999). Between 1997 and 2002, hatchery fish constituted between 85 percent and 97 percent of the fish (adults plus jacks) returning to the Willow Creek weir in the Lower Trinity River (CDFG 2009b). Spawning surveys in 1998-99 found a high proportion of hatchery strays (60-100 percent) in all Lower Trinity streams where coho salmon where found (Dutra and Thomas 1999). Adverse hatchery-related effects pose a very high risk to all life stages, because more than thirty percent of adults are of hatchery origin (Appendix B) and there is significant potential for ecological interactions.

Altered Sediment Supply

Water quality of the Trinity River is listed as impaired for sediment throughout its length by California State Water Resources Control Board under Section 303 (d) of the Federal Clean Water Act. Increased sediment loading is thought to have filled pools, widened channels, and simplified stream habitat used for rearing and altered sediment supply presents a moderate to high stress for coho salmon in this population. In many reaches, aggradation has reduced surface stream flows, limiting tributary and habitat access to migrating juveniles. In the Willow Creek and Hoopa HSAs, sediment loading is especially high and likely limits the potential for spawning and rearing in these areas. Campbell and Willow Creek have experienced intensive land management and suffer from high sediment loading. Campbell Creek, Supply Creek, and Willow Creek have been noted as having extremely high rates of sedimentation and are highly impaired due to sediment/turbidity. Supply Creek was also recently impacted by large fine sediment input in winter of 2009. Mill and Tish Tang Creek are also considered impaired due to sedimentation as a result of timber harvest and road-building and experience high rates of sedimentation (USEPA 2001). The majority of sediment in the Lower Trinity originates from roads and landslides (USEPA 2001).

Impaired Water Quality

Impaired water quality poses a moderate stress to the Lower Trinity population. In some smaller tributary streams, water temperatures can increase to levels stressful for rearing coho salmon in the summer months (>16 °C). Water temperature in the mainstem often reaches >20^{o} C. Mainstem and tributary migratory habitat is impaired by high summer temperatures and thermal barriers. Releases from Lewiston Dam to support North Coast Regional Water Quality Control Board (NCRWQCB) and ROD temperature criteria have substantially improved conditions (USFWS and HVT 1999). However, criteria for the Lower Trinity River do not prohibit temperature increases after July 9 (or June 15 in Dry and Critically Dry Water Years). Temperature readings at Hoopa often exceed the thermal tolerance of coho salmon starting in June and extending into September (USFS 2003b). Juveniles often rely on thermal refugia during the summer in areas of the mainstem where water quality is poor. Localized areas of non-point source pollution likely exist (e.g., runoff from roads, parking lots, and agricultural lands). Recent large algae blooms in the Lower Trinity River are likely associated with high levels of nutrients in runoff from various agricultural operations, particularly near the town of Willow Creek.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions pose a low to moderate stresses across all life stages. Evaluations of streamside canopy cover range from fair to very good throughout the watershed based on existing survey data. The Willow Creek HSA appears to have fair riparian conditions, while the Burnt Ranch and New River HSAs have very good riparian conditions. The Hoopa HSA was not rated for streamside canopy cover. Many of the riparian areas in the Lower Trinity have been disturbed through timber harvesting, natural storm events, landslides, and wildfires. Changes in timber management have helped foster recovery of riparian zones, although hardwoods now dominate canopy cover where it was once conifer dominated. While LWD recruitment potential may be reduced, the shade component along tributary streams has been re-established through encroachment of alders and other riparian vegetation. While riparian canopy closure conditions have substantially recovered, forest openings and degraded riparian forest remain along most tributaries, particularly along Willow Creek. The mainstem Trinity generally does not have extensive shade-producing riparian cover because the width of the channel reduces closure.

Barriers

Barriers pose a moderate stress to coho salmon in the Lower Trinity River and are especially detrimental to juveniles, smolts, and adults. The extent of impact from barriers is largely unknown due to the number of private diversions in the Lower Trinity, however the impact could be large. There are no large dams in the Lower Trinity River drainage, except on McDonald Creek, where the town of Burnt Ranch gets its water. The dam is upstream of where coho salmon can migrate. There are 25 road-stream crossing structures that are total barriers to juvenile and adult salmonid migration in the Lower Trinity River population area and a total of 33 unscreened diversions (CalFish 2009). More of the remaining 30 diversions on private land may also be unscreened. Two barriers are a high priority for removal and two are a moderate priority (CalFish 2009). The location of most road crossings and diversions suggests that most of the watershed remains accessible to coho salmon and these barriers are not substantially restricting the availability of habitat. One exception is the barrier on Sharber Creek which is blocking access to approximately 2 miles of high quality rearing and spawning habitat on one of the last remaining productive streams. Low water barriers and thermal barriers (e.g., mainstem reaches) may seasonally limit coho salmon rearing and migratory habitat. Permanent natural barriers also prevent access to potential spawning and rearing habitat (e.g., Campbell Creek, Sharber Creek, and Hawkins Creek).

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.

Increased Disease/Predation/Competition

Disease is a medium to low stress across all life history stages in the Lower Trinity River. Coho salmon smolts may be exposed to diseases like Ceratomyxosis during their downstream migration in the Trinity and Klamath River. The rates of infection for these smolts are likely somewhat low given that disease rates in the Trinity are generally low and the zones with the highest rates of infection in the Klamath are upstream of the Trinity confluence (Bartholomew 2008). By the time adult coho salmon from the Trinity River enter the Lower Klamath River (late fall to early winter), *Ceratonova shasta* (Ceratomyxosis) and *Flavobacterium columnare* (Columnaris) are probably not a significant issue. Releases of Chinook salmon from Trinity River Hatchery may result in competition for limited rearing space and food in thermal refugia during the summer months.

Impaired Estuary/Mainstem Function

All salmon and steelhead that originate from the Lower Trinity River migrate to and from the ocean through the mainstem Lower Trinity, Lower Klamath River, and the Klamath River estuary. The Klamath River estuary may play an important role in providing foraging and refuge opportunities for juvenile coho salmon from the Lower Trinity River. This type of non-natal rearing may be especially important because a lack of summer and winter rearing habitat in the Lower Trinity may force juveniles to move downstream and rear in the estuary. The degraded conditions that exist throughout the Trinity basin may mean that the estuary plays a very important role by providing the opportunity for growth and refugia prior to entering the ocean. The estuary, although relatively intact, suffers from poor water quality, elevated sedimentation and accretion, loss of habitat, and disconnection from tributary streams and the floodplain. Mainstem conditions contribute to this stress because of the issues with water quality, sedimentation and accretion, and degraded habitat in mainstem reaches of the Lower Klamath River. Juveniles, smolts, and adults transitioning through mainstem habitat are stressed by the degraded conditions in these migratory habitats and suffer from the lost opportunity for increased growth, and consequently have a lower survival rate. The loss and degradation of estuarine and mainstem habitat is considered a low to medium stress for the population, with the most affected life stages being juveniles and smolts.

38.6 Threats

Table 38-5. Severity of threats affecting each life stage of coho salmon in the Lower Trinity 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	Hatcheries[1]	Very High	Very High	Very High[1]	Very High	Very High	Very High
2	Channelization/Diking[1]	Low	Very High	Very High[1]	High	Medium	Very High
3	Climate Change	Low	Medium	Very High	High	High	High
4	Roads	High	High	High	Medium	Medium	High
5	Dams/Diversions	Low	High	High	Medium	Medium	High
6	High Severity Fire	Medium	Medium	Medium	Medium	Medium	Medium
7	Agricultural Practices	Medium	Medium	Medium	Medium	Medium	Medium
8	Timber Harvest	Medium	Medium	Medium	Medium	Low	Medium
9	Urban/Residential/Industrial Dev.	Low	Medium	Medium	Medium	Low	Medium
10	Fishing and Collecting	-	-	Low	Low	Medium	Low
11	Road-Stream Crossing Barriers	Low	Low	Medium	Low	Low	Low
12	Mining/Gravel Extraction	Low	Low	Medium	Low	Low	Low
13	Invasive Non-Native/Alien Spices	Low	Low	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 hatcheries and channelization/diking.

Hatcheries

Hatcheries pose a very high threat to all life stages of coho salmon in the Lower Trinity River sub-basin. The rationale for these ratings is described under the "Adverse Hatchery-Related Effects" stress.

Channelization/Diking

Channelization and diking poses a low to very high threat to coho salmon. Although channelization and diking is not widespread in the population area, localized restrictions where roads parallel streams reduce floodplain connectivity and function. These areas are important for coho salmon rearing and growth. This reduces the amount of spawning and rearing habitat available to coho salmon by reducing habitat complexity and increasing water velocity, particularly during the winter months. For example, lower reaches of tributaries such as Supply and Mill Creeks in the Hoopa HSA have been straightened and diked, reducing the complexity and natural meandering tendency that produces complex habitat, diversity in foraging opportunities, and high quality rearing habitat. In cases where streams have been straightened and confined, swift currents and lack of habitat are expected to reduce survival of rearing juveniles, fry, and cause a reduction in egg-to-fry survival.

Climate Change

Climate change poses a high threat to this population. The impacts of climate change in this region will have the greatest impact on juveniles, smolts, and adults. The current climate is generally warm and modeled regional average temperature shows a large increase over the next 50 years (see Appendix B for modeling methods). Average temperature could increase by up to 3 °C in the summer and by 1 °C in the winter. Predictions indicate annual precipitation will have little change in the next century. However, snowpack in upper elevations of the Trinity River basin will decrease with changes in temperature (California Natural Resources Agency 2009). Climate change is expected to reduce the amount of snowpack in the Trinity Alps (Mote et al. 2005; Regonda et al. 2005; Mote 2006) and shift streamflow timing (i.e. peak streamflow) by 20–40 days earlier in many streams during the 21st century (Stewart et al. 2005). NMFS expects that climate change will cause the amount of coldwater thermal refugia habitat and the amount of available rearing area to decline over time. The increase in water temperatures is expected to reduce growth or cause negative growth of juvenile coho salmon in the summer months by elevating metabolism beyond daily ration (McCarthy et al. 2009). The vulnerability of the downstream Klamath estuary to sea level rise is low to moderate, and therefore does not pose a significant threat to estuarine rearing habitat downstream. Overall, the range and degree of variability in temperature and precipitation is likely to increase in all populations. Also, with all populations in the ESU, adults will be negatively impacted 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).

Roads

Roads are a moderate to high threat for this population. About one third of the area with high potential to support juveniles occurs in areas with high or very high road densities. Data indicate road density is very high (>3 mi/sq. mi) in the Hoopa and Willow Creek HSAs where small tributary streams with high or medium IP stream reaches are accessible to coho salmon. Given the sedimentation problems observed in the watershed, unpaved roads contribute to landslide potential and chronic sedimentation. Approximately 45 percent of sedimentation in the Lower Trinity originates from roads, especially road-related landslides (USEPA 2001). Highway 299 significantly affects Willow Creek, as it runs along much of the creek's mainstem. At the landscape scale, correlative evidence suggests that roads are likely to influence the frequency, timing, and magnitude of disturbance to aquatic habitats (Gucinski et al. 2001). Roads can act as barriers to migration, lead to water temperature changes, and alter flow regimes (Gucinski et al. 2001). The Road Hazard Potential indicator used by the USFS represents the potential for altered hydrologic regime (changes in runoff response) and stream diversions associated with roads (USFS 2003b). USFS (2003) ranked the area from the New River to the South Fork Trinity River as having a high road hazard potential. The area from the South Fork Trinity River Trinity to Tish Tang a Tang Creek was given a moderate hazard rating. Given the large tracts of

U.S. Forest Service land in the watershed and the current trends toward decreasing timber harvest and increasing road decommissioning and storm-proofing on public land, the number of new roads and impacts from legacy roads is likely to decrease in the future. Road building for access to marijuana cultivation sites is common in many areas of the SONCC coho salmon recovery domain. Many of these roads are likely unpermitted and contribute excessive amounts of fine sediment to coho salmon streams.

Dams/Diversions

Dams and diversions are a low to high threat across life history stages. Numerous wells and diversions varying from single domestic spring boxes to community water systems occur throughout the watershed. The impact of these diversions is dependent on the amount and location of the withdrawal. The reduction in surface and subsurface flow in tributaries can reduce the amount of cool water refugia at their confluence with the Trinity River and impacts can increase during dry water years. The towns of Willow Creek, Burnt Ranch, Hawkins Bar and Hoopa obtain water from streams in the Lower Trinity River. The Campbell Creek diversion supplies much of the west-side Hoopa Valley. Additionally, there are vineyards and small farms that utilize water in the Lower Trinity River sub-basin, but their effect on stream flows has not been studied. Tributary accretions in the Lower Trinity River sub-basin, combined with relatively unconfined floodplain and valley characteristics, probably ameliorate some of the impacts of the Central Valley Project, such as lack of flushing flows, reduced winter habitat quantity and quality, and loss of large woody debris recruitment.

Marijuana cultivation has become abundant in many areas of the SONCC coho salmon recovery domain. Although the number of plants grown each year is unknown, the water diversion required to support these plants is placing a high demand on a limited supply of water (Bauer 2013a). Most diversions for marijuana cultivation occur at headwater springs and streams, thereby removing the coldest, cleanest water at the most stressful time of the year for coho salmon (Bauer 2013b). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per growing season (HGA 2010).

High Severity Fire

High severity fire poses a moderate threat to the population due to current level of fire risk and the predicted future increase in fire risk that is expected as a result of climate change. Fires such as the Megram Fire in 1999 and the complex of fires in 2008 have swept through regions of the Lower Trinity River in the recent past. Fuel loads, climate, and vegetative characteristics in the sub-basin have resulted in a high to extreme fire risk (USFS 2003b). Human-related causes are the predominant type of fire starts within the area especially within the Trinity River corridor. Lightning fire starts, although relatively infrequent when compared to human related starts, are a significant cause of wildfires along the upper slopes and ridges of the watersheds (USFS 2003b). Present and future challenges to fire and fuels management include significant areas of private lands which may prohibit fire use and prescribed fire; prevention of unnatural fire starts; limited access due to topography or intermixed ownership; and vegetation mortality and fuel accumulation in the area affected by the Megram Fire (USFS 2003b).

Agricultural Practices

There are several agricultural operations in the Lower Trinity River sub-basin, consisting of several small farms, vineyards and small cattle grazing operations. Agriculture is a medium threat to coho salmon in the Lower Trinity River watershed given the current and expected level of agriculture in the area. However, in the area of Willow Creek, where much of the agriculture occurs, localized impacts of reduction in thermal refugia areas and excessive nutrient loads could cause substantial impacts. These impacts may increase in the future as the demand for high quality fruits and vegetables in the area grows. Recent algae blooms in the Lower Trinity River are thought to be associated with agricultural practices near the town of Willow Creek. Also of concern is marijuana cultivation and the associated water, and fertilizer and pesticide use.

Timber Harvest

Timber harvest poses a medium threat to the Lower Trinity River population. Much of the area is in public ownership (USFS) and has a substantial portion of federally-designated wilderness. Current and future timber harvesting on Forest Service land is small in scale and is conducted under strict guidelines designed to protect aquatic resources. Based on data from CalFire (2009) a total of 12,287 acres within the Upper and Lower Trinity and Lower Klamath River sub-basins have THPs that could potentially be harvested in the future (0.5 percent of total watershed area). The Hoopa Valley Tribe owns 15 percent of the Lower Trinity population area. Timber harvest is ongoing on these lands, and the extent of its environmental impacts are unknown but presumed to be low given Tribal timber management practices. One of the greatest impacts of all timber harvest in the Lower Trinity is the input of sediment. Timber harvest makes up approximately 5 percent of all sedimentation in the Lower Trinity (USEPA 2001).

Urban/Residential/Industrial Development

Rural population growth will continue to present a low to moderate threat to coho salmon in the Lower Trinity River. Human population in the Lower Trinity River drainage is tempered by the large amount of publicly-owned land as well as the steep surrounding terrain. The principal communities near the Lower Trinity River are Willow Creek, Hoopa, and Burnt Ranch. There are also a few smaller towns, like Del Loma and Big Flat, which may increase in population during this time. Areas likely to experience the greatest impacts from development include Willow Creek and mainstem river near major population areas. The demand for water in the drainage is expected to increase in the future. Development generally results in floodplain disconnection, removal of vegetation, increased sediment generation and delivery and introduction of exotic species. Subdivision of existing parcels will exacerbate this threat. Increased diversions associated with the population growth were addressed under Dams/Diversions above.

Fishing and Collecting

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

Road-stream Crossing Barriers

There are 25 road-stream crossing structures that are total barriers to juvenile and adult salmonid migration in the Lower Trinity River watershed (CalFish 2009). However, the majority of these barriers, including low priority barriers listed in the table below, are on streams inaccessible to coho salmon. There may be additional road-stream crossing barriers on private or Tribal land; however, their status and impacts are unknown at this time. The location of most known road crossings and diversions suggests that most of the watershed remains accessible to coho salmon and these barriers are not substantially restricting the availability of habitat. One exception to this is the barrier on private land on Sharber Creek, which blocks or reduces access to approximately 2 miles of high quality rearing and spawning habitat upstream.

Table 38-6. List of road-stream crossing barriers in IP habitat in the Lower Trinity River basin (CalFish 2009).

Priority	Stream Name	Road Name	County	Barrier Status*
High	Sharber Creek	Fountain Ranch Rd	Trinity	Total
Low	Hawkins Creek	Hawkins Bar Rd	Trinity	Total
Low	Hawkins Creek	Flame Tree Rd	Trinity	Total
Low	Boise Creek	Hwy 299	Trinity	Total
Low	Bell Creek- New River	Denny Rd	Trinity	Total
Low	Panther Creek #1-New River	Denny Rd	Trinity	Total
Low	Quinby Creek- New River	Denny Rd	Trinity	Total
Low	Hospital Creek	Hwy 96	Trinity	Total
Medium	Campbell Creek	Hwy 96	Trinity	Partial

Mining/Gravel Extraction

A number of gravel mining operations occur on private land and on Tribal land in the Lower Trinity River. A total of nine sites are mined on an annual, rotational or intermittent basis. NMFS issued a Biological Opinion on these operations in 2009 (NMFS 2009b) and a new consultation will likely be completed in 2015 after the permits expire. Suction dredge gold mining was common in the Trinity River until it was stopped by a court order in 2009. The California Department of Fish and Wildlife is currently prohibited by statute from issuing suction dredge permits. (Fish & G. Code, § 5653.1, subd. (b), making it unlawful to use any vacuum or suction dredge equipment in any river, stream, or lake in California (see http://www.dfg.ca.gov/suctiondredge)). This prohibition will remain in effect until CDFW completes a court-ordered environmental review of its permitting program and institutes any changes that are necessary to its former suction dredge permit regulations. Gravel and dredge mining primarily affect juvenile coho and their habitat and given the extent of mining in the area this is considered a moderate threat to this life stage but a low threat overall.

Invasive Non-Native/Alien Species

This threat is currently considered to be low for the population but has the potential to increase in the future if New Zealand mud snails or other exotic species cause trophic shifts. Brown trout, although in substantial numbers in the Upper Trinity River, do not inhabit the lower Trinity River in substantial numbers.

38.7 Recovery Strategy

Naturally-produced coho salmon in the Lower Trinity River are depressed in abundance relative to their historical numbers. An important consideration for recovery of the Lower Trinity River population is how naturally-produced coho salmon interact with the 500,000 coho salmon smolts released annually in the Trinity River, or the 11 million hatchery salmonids that are released into the Klamath Basin. Minimizing these interactions and the stresses that naturally-produced coho salmon experience from residing in a river system with millions of hatchery fish should be a high priority for coho salmon recovery. Protecting and enhancing thermal refugia and streams that are relatively intact and support coho salmon (e.g., Horse Linto and Sharber-Peckham creeks) should be the primary focus of recovery efforts. Protection and restoration of spawning and rearing habitat in potential coho salmon habitat (e.g., Mill Creek, Willow Creek) is also important over the long-term to ensure adequate spatial distribution and productivity. Creeks with the potential for floodplain connectivity include Supply, Mill, Tish Tang a Tang and Willow creeks. Recovery of the Lower Trinity River population of coho salmon will not be possible without significant restoration efforts to reconnect and expand the floodplain habitat in these and other creeks. Activities that reduce sediment delivery, improve water quantity and quality, and promote increased floodplain and channel structure should be the highest priority because these are the primary stresses for the population. Set back or removal of levees and dikes as well as instream habitat projects aimed at increasing floodplain size and connectivity need to be priorities. Sharber/Peckham Creek is considered the most productive coho salmon stream in the Lower Trinity River population (Collins 2012). Removal of the fish passage barrier on Sharber Creek is also a high priority for recovery given the area's importance to coho salmon production in the Lower Trinity.

Vital habitat in the Lower Trinity includes areas that provide thermal refugia for juveniles in the summer, areas of current production, and areas with relatively intact habitat features such as clean spawning gravel, functional floodplain and channel structure, and established riparian forest. Coldwater discharges from tributaries are a key component of the thermal regime of the mainstem of the Trinity River. Localized coldwater refugia are often found where tributary flows enter the Trinity River. Some streams such as Coon, Bremmer, China, Soctish, McDonald, and Kirkham creeks do not provide much anadromous habitat, but they are generally well-shaded and provide high quality thermal refugia and cool clean water for the Trinity River. Juvenile and adult salmonids hold in the Trinity River near the confluence of these tributaries or, when accessible, in the lower reaches of the tributaries during mid- to late summer. The stressful stream temperatures in July, August, and September within the mainstem underscore the importance of maintaining these cool water tributaries for these species. Horse Linto Creek provides an excellent refugia area for juvenile and adult coho salmon (Strange, J., pers. comm. 2008). Horse Linto Creek has cool, clean water that originates in the Trinity Alps Wilderness, moderating the high temperature of the Trinity River in the summer months at the confluence of the two waterways. At times, hundreds of juvenile salmonids congregate in this area. Other potential refugia areas are given in Table 38-7, although there are numerous unnamed seeps and smaller tributaries, all of which are important to survival of coho salmon in the summer months.

Table 38-7. Potential temperature refugia in the Lower Trinity River basin.

Watershed	Stream Name	Ownership
Hoopa	Horse Linto Creek	Public
Hoopa	Mill Creek	Tribal
Hoopa	Supply Creek	Tribal
Hoopa	Soctish Creek	Tribal
Hoopa	Coon Creek	Private
Hoopa	Tish Tang a Tang Creek	Tribal
Hoopa	Hostler Creek	Tribal
Burnt Ranch	Sharber Creek	Private
Willow Creek	Willow Creek	Private

Many watersheds within the Burnt Ranch and New River watersheds are likely properly functioning with regard to aquatic habitat and watershed conditions. These streams have a large portion of their watersheds in the Trinity Alps Wilderness and remain in a relatively undisturbed state. Given the low abundances of the population, all these areas in Table 38-7 are considered vital habitat for the population and should be prioritized for recovery. Horse Linto Creek is a designated Tier-1 Key watershed by the Northwest Forest Plan, meaning the creek is intended to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids (USDA and USDI 1994).

An unnamed tributary (known to U.S. Forest Service biologists as Sharber-Peckham Creek) has one of the strongest populations of coho salmon in the Lower Trinity River (Cyr 2008, Boberg 2008). Between the area spanning the Hoopa Tribe reservation and the North Fork Trinity River, Sharber-Peckham Creek is the single greatest producer of coho salmon in the Lower Trinity River (Boberg 2008). The Sharber-Peckham Creek area is spring-fed, has side channel and overwintering habitat, and is low gradient (Cyr 2008, Boberg 2008). The coho salmon here are found mainly in an unnamed tributary that emanates from springs between Sharber and Quinby creeks near the Forest Service boundary (Cyr 2008, Boberg 2008). This unnamed tributary is perennial and during winter, part of Sharber Creek is diverted into this unnamed tributary (Cyr 2008, Boberg 2008). This diversion is part of an old mining activity. The rearing habitat is split between Forest Service and private property (Cyr 2008, Boberg 2008). The spawning habitat is on private property. Coho are probably using Sharber Creek, but it is overgrown with brush, is difficult to survey, and likely doesn't have the spring support for rearing as does Sharber-Peckham Creek (Cyr 2008, Boberg 2008).

In order to recover the Lower Trinity River coho salmon population, special attention should be given to important tributaries discussed above. Creeks with the potential for floodplain connectivity include Supply, Mill, Tish Tang a Tang and Willow creeks. Recovery of the Lower Trinity River population of coho salmon will not be possible without significant restoration efforts to reconnect and expand the floodplain habitat in these and other creeks that are currently confined by diked and channelized reaches. A focus on habitat complexity and connecting off channel ponds, backwaters, and large woody debris should be an essential part of restoring these streams. Several crossing barriers in the population unit should also upgraded in order to maximize habitat area available to coho salmon. Many road systems throughout the population unit need to go through decommissioning or upgrading to limit sedimentation. Consumptive water use within the population unit should be quantified and monitored. Measures should be employed to reduce water consumption by farms, residences, and municipalities. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 38-8 on the following page lists the recovery actions for the Lower Trinity River population.

Table 38-8. Recovery action implementation schedule for the Lower Trinity 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-LTR.3.1.38	Hydrology	Yes	Improve flow timing or volume	Secure and maintain sufficient instream flows	Bull, Limb Camp, Soctish, Lower Mill, Hostler, Lower Tish Tang, Lower Cedar, Campbell Ridge, Hospital, Supply, Horse Range, Summit, E.F. Willow, Ruby, Bunchgrass, Mill (Burnt Ranch HSA), Trinity Village, Hawkins, Quinby, and Sharber creeks	2a
SONCC-LTR.3.1.38.1	*Identify and cease unauthorized water diversions*					
SONCC-LTR.3.1.58	Hydrology	Yes	Improve flow timing or volume	Secure and maintain sufficient instream flows	Population wide	2b
SONCC-LTR.3.1.58.1	*Identify and cease unauthorized water diversions*					
SONCC-LTR.2.1.11	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	New River and Tish Tang a Tang, Hostler, Willow, Mill, Horse Linto, Sharber, Supply, Cedar, and Campbell creeks, and all streams where coho salmon would benefit immediately	2a
SONCC-LTR.2.1.11.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-LTR.2.1.11.2	*Place instream structures, guided by assessment results*					
SONCC-LTR.2.1.53	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2b
SONCC-LTR.2.1.53.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-LTR.2.1.53.2	*Place instream structures, guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LTR.2.2.7	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	New River and Tish Tang a Tang, Hostler, Willow, Mill, Horse Linto, Sharber, Supply, Cedar, and Campbell creeks, and all streams where coho salmon would benefit immediately	2a
SONCC-LTR.2.2.7.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-LTR.2.2.7.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-LTR.2.2.8	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	New River and Tish Tang a Tang, Hostler, Willow, Mill, Horse Linto, Sharber, Supply, Cedar, and Campbell creeks, and all streams where coho salmon would benefit immediately	2a
SONCC-LTR.2.2.8.1	*Assess habitat to determine where potential exists to re-connect existing off-channel ponds, wetlands, and side channels. Map existing features so that connection can be maintained*					
SONCC-LTR.2.2.8.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-LTR.2.2.55	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-LTR.2.2.55.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-LTR.2.2.55.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-LTR.2.2.56	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-LTR.2.2.56.1	*Assess habitat to determine where potential exists to re-connect existing off-channel ponds, wetlands, and side channels. Map existing features so that connection can be maintained*					
SONCC-LTR.2.2.56.2	*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-LTR.2.2.12	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	New River and Tish Tang a Tang, Hostler, Willow, Mill, Sharber, Supply, and Campbell creeks, and all streams where coho salmon would benefit immediately	2a
SONCC-LTR.2.2.12.1	*Assess feasibility and develop a plan to remove or set back levees and dikes that includes restoring the natural channel form and floodplain connectivity once the levees and dikes have been removed or set back*					
SONCC-LTR.2.2.12.2	*Remove or set back levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					
SONCC-LTR.2.2.54	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	Population wide	2b
SONCC-LTR.2.2.54.1	*Assess feasibility and develop a plan to remove or set back levees and dikes that includes restoring the natural channel form and floodplain connectivity once the levees and dikes have been removed or set back*					
SONCC-LTR.2.2.54.2	*Remove or set back levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					
SONCC-LTR.17.2.37	Hatcheries	Yes	Reduce adverse hatchery impacts	Identify and reduce impacts of hatchery on SONCC coho salmon	Trinity River Hatchery	2a
SONCC-LTR.17.2.37.1	*Develop and implement Hatchery and Genetic Management Plan*					
SONCC-LTR.5.1.31	Passage	No	Improve access	Remove barrier	Hostler Creek	2a
SONCC-LTR.5.1.31.1	*Remove barrier from old water supply system*					
SONCC-LTR.5.1.36	Passage	No	Improve access	Remove Sharber-Peckham culvert	Sharber-Peckham Creek	2a
SONCC-LTR.5.1.36.1	*Remove culvert on Sharber-Peckham creek*					
SONCC-LTR.1.2.33	Estuary	No	Improve estuarine habitat	Improve estuary condition	Klamath River Estuary	2a
SONCC-LTR.1.2.33.1	*Implement recovery actions for Lower Klamath River population that address the target "Estuary", including the creation/restoration of off-channel rearing habitat throughout the lower Klamath River*					
SONCC-LTR.3.1.4	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-LTR.3.1.4.1	*Work with partners to streamline the process needed for the dedication of water to fish and wildlife resources under CA Water Code section 1707*					
SONCC-LTR.3.1.4.2	*Implement water dedications to increase instream flows using the streamlined process*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LTR.3.1.5	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-LTR.3.1.5.1	*Establish a categorical exemption under CEQA for water leasing to increase instream flows*					
SONCC-LTR.3.1.6	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-LTR.3.1.6.1	*Establish a comprehensive groundwater permit process*					
SONCC-LTR.3.1.28	Hydrology	Yes	Improve flow timing or volume	Improve water management techniques	Population wide	2b
SONCC-LTR.3.1.28.1	*Develop plan to manage stream flows and water temperature during periods of drought*					
SONCC-LTR.3.1.28.2	*Manage stream flows, guided by the plan*					
SONCC-LTR.3.1.29	Hydrology	Yes	Improve flow timing or volume	Improve water management techniques	Population wide	2b
SONCC-LTR.3.1.29.1	*Develop plan to protect coho salmon from effects of climate change*					
SONCC-LTR.3.1.29.2	*Implement plan based on findings*					
SONCC-LTR.5.1.32	Passage	No	Improve access	Remove barriers	All streams where coho salmon would benefit immediately	2b
SONCC-LTR.5.1.32.1	*Evaluate and prioritize barriers for removal*					
SONCC-LTR.5.1.32.2	*Remove barriers, guided by the assessment*					
SONCC-LTR.5.1.59	Passage	No	Improve access	Remove barriers	Population wide	2d
SONCC-LTR.5.1.59.1	*Evaluate and prioritize barriers for removal*					
SONCC-LTR.5.1.59.2	*Remove barriers, guided by the assessment*					
SONCC-LTR.3.1.51	Hydrology	No	Improve flow timing or volume	Provide adequate instream flow for coho salmon	Population wide	2b
SONCC-LTR.3.1.51.1	*Conduct study to determine instream flow needs of coho salmon at all life stages.*					
SONCC-LTR.3.1.51.2	*If coho salmon instream flow needs are not being met, develop plan to provide adequate flows. Plan may include water conservation incentives for landowners and re-assessment of water allocation.*					
SONCC-LTR.3.1.51.3	*Implement coho salmon instream flow needs plan.*					
SONCC-LTR.26.1.50	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2b
SONCC-LTR.26.1.50.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LTR.14.2.14	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of invasive species	Population wide	2b
SONCC-LTR.14.2.14.1	*Adopt fishing regulations and educational programs that encourage and allow for the take of an unlimited number of brown trout*					
SONCC-LTR.14.2.14.2	*Euthanize all brown trout captured at CDFW weirs*					
SONCC-LTR.8.1.13	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Bull, Limb Camp, Soctish, Lower Mill, Hostler, Lower Tish Tang, Lower Cedar, Campbell Ridge, Hospital, Supply, Horse Range, Summit, E.F. Willow, Ruby, Bunchgrass, Mill (Burnt Ranch HSA), Trinity Village, Hawkins, Quinby, and Sharber creeks	2c
SONCC-LTR.8.1.13.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-LTR.8.1.13.2	*Decommission roads, guided by assessment*					
SONCC-LTR.8.1.13.3	*Upgrade roads, guided by assessment*					
SONCC-LTR.8.1.13.4	*Maintain roads, guided by assessment*					
SONCC-LTR.8.1.60	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	2d
SONCC-LTR.8.1.60.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-LTR.8.1.60.2	*Decommission roads, guided by assessment*					
SONCC-LTR.8.1.60.3	*Upgrade roads, guided by assessment*					
SONCC-LTR.8.1.60.4	*Maintain roads, guided by assessment*					
SONCC-LTR.3.1.2	Hydrology	Yes	Improve flow timing or volume	Educate stakeholders	Hoopa, Willow Creek, Burnt Ranch, New River HSAs (particularly Willow, Sharber, Mill, and Supply creeks)	3a
SONCC-LTR.3.1.2.1	*Perform studies to determine if consumptive water use in specific areas is reducing the amount of rearing habitat or limiting the availability of cold water refugia*					
SONCC-LTR.3.1.2.2	*Develop an educational program about water conservation programs and instream leasing programs*					
SONCC-LTR.3.1.39	Hydrology	Yes	Improve flow timing or volume	Determine effects of marijuana cultivation	Population wide	3b
SONCC-LTR.3.1.39.1	*Assess cumulative effects (e.g., flow, water quality) of marijuana cultivation*					
SONCC-LTR.3.1.39.2	*If needed, develop plan to reduce effects of marijuana cultivation*					
SONCC-LTR.3.1.39.3	*Implement plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-LTR.2.2.9	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	New River and Tish Tang a Tang, Hostler, Willow, Mill, Horse Linto, Sharber, Supply, Cedar, and Campbell creeks, and all streams where coho salmon would benefit immediately	3c
SONCC-LTR.2.2.9.1	*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-LTR.2.2.9.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-LTR.2.2.9.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-LTR.2.2.57	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	3d
SONCC-LTR.2.2.57.1	*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-LTR.2.2.57.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-LTR.2.2.57.3	*Reintroduce or relocate beaver if appropriate, guided by the plan*					
SONCC-LTR.10.7.49	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3c
SONCC-LTR.10.7.49.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-LTR.10.7.49.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-LTR.10.7.52	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-LTR.10.7.52.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-LTR.10.7.52.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-LTR.2.2.10	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Improve regulatory mechanisms	Population wide	3d
SONCC-LTR.2.2.10.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					
SONCC-LTR.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-LTR.16.1.16.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-LTR.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-LTR.16.1.47	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	Tribal lands	3d
SONCC-LTR.16.1.47.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-LTR.16.1.47.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-LTR.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-LTR.16.1.17.1	*Determine actual fishing impacts*					
SONCC-LTR.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-LTR.16.1.48	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Reduce fishing impacts to levels that do not limit recovery	Tribal lands	3d
SONCC-LTR.16.1.48.1	*Determine actual fishing impacts*					
SONCC-LTR.16.1.48.2	*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-LTR.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-LTR.16.2.18.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-LTR.16.2.18.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-LTR.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-LTR.16.2.19.1	*Determine actual impacts of scientific collection*					
SONCC-LTR.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-LTR.10.2.30	Water Quality	No	Reduce pollutants	Educate stakeholders	Population wide	3d
SONCC-LTR.10.2.30.1	*Develop and implement an educational program that promotes Salmon Safe methods for agricultural operations and Integrated Pest Management for rural residents*					

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