39. Upper Trinity River Population

Interior Trinity River Diversity Stratum

Core Population

Moderate Extinction Risk

Population likely above depensation threshold

5,800 Spawners Required for ESU Viability

1,183 mi^2 watershed (69% Federal ownership)

365 IP-km (227 IP-mi) (0% High)

Dominant Land Uses are Recreation and Timber Harvest

Key Limiting Stresses are 'Altered Hydrologic Function' and 'Adverse Hatchery Related Effects'

Key Limiting Threats are 'Dams/Diversions' and 'Hatcheries'

Highest Priority Recovery Actions

• Prioritize and provide incentives for use of CA Water Code Section 1707 • Establish a comprehensive groundwater permit process for instream purposes • Increase instream flows	• Identify and cease illegal water diversions • Provide artificial passage for fish at Lewiston and Trinity Dams • Streamline process for water leasing under CA Water Code Section 1707 for instream purposes

39.1 History of Habitat and Land Use

Land use activities in the Trinity include mining, timber harvesting, road construction, recreation and a limited degree of residential development in certain locations (U.S. Environmental Protection Agency (USEPA) 2001). The construction of Trinity and Lewiston dams in the early 1960s had and continues to have a major impact on the flow, function and use of the Trinity River (USEPA 2001). The dams block access to 109 miles of habitat. Problems facing the Upper Trinity River coho salmon population include degradation of spawning and rearing habitat, sparse spawning gravel recruitment, lack of deep pools, stressful late summer water temperatures, water diversions, channelization and confinement, irregular timing of flows, fragmentation of populations, genetic and ecological interactions with hatchery salmonids, migration barriers, water quality problems, and unscreened diversions.

Historically, the upper Trinity River functioned as a dynamic river reach that effectively created and maintained quality spawning and rearing habitat for anadromous fish. In 1957, construction began on the Trinity River Division (TRD) of U.S. Bureau of Reclamation's Central Valley Project (CVP), which transfers water from the Trinity River portion of the Klamath Basin to the Sacramento Basin. The division consists of a series of dams, lakes, power plants, a tunnel, and other related facilities. Lewiston Dam, part of the CVP, was constructed in 1963 near Lewiston, California, and is now the upper limit of anadromous fish migration on the Trinity River. At times, 90 percent of the Trinity River flow was diverted to the Sacramento Basin, contributing to the decline of Chinook salmon, coho salmon, and steelhead.

These water withdrawals, which extracted a large portion of Trinity River water, also caused severe degradation of fish habitat of the Trinity River (US Fish and Wildlife Service (USFWS) and Hoopa Valley Tribe (HVT) 1999). Located at the base of Lewiston Dam, Trinity River Hatchery (TRH) began production of salmon and steelhead in 1958 to mitigate for the loss of 109 miles of anadromous fish habitat upstream of the dam (USFWS and HVT 1999).

Out of concern for declines in anadromous fish populations, Congress enacted the Trinity River Fish and Wildlife Restoration Act (P.L. 98-541) in 1984. This Act directed the Secretary of the Interior to take actions necessary to restore the fisheries resources of the Trinity River Basin. The Central Valley Project Improvement Act (CVPIA) of 1992 (P.L. 102-575, Title 34) legislated alterations in the operation of the CVP for the improvement of fish and wildlife habitat and resources.

In December 2000, Interior Secretary Bruce Babbitt signed the Record of Decision for the Trinity River Mainstem Fishery Restoration Environmental Impact Statement and Environmental Impact Report (EIS/EIR) (hereafter referred to as the ROD; USDOI 2000, USFWS et al. 2000). The ROD adopted the preferred alternative, a suite of actions that included a variable annual flow regime, mechanical channel rehabilitation, sediment management, watershed restoration, and adaptive management. The U.S. Bureau of Reclamation has been and continues to implement the flows described in the Trinity ROD.

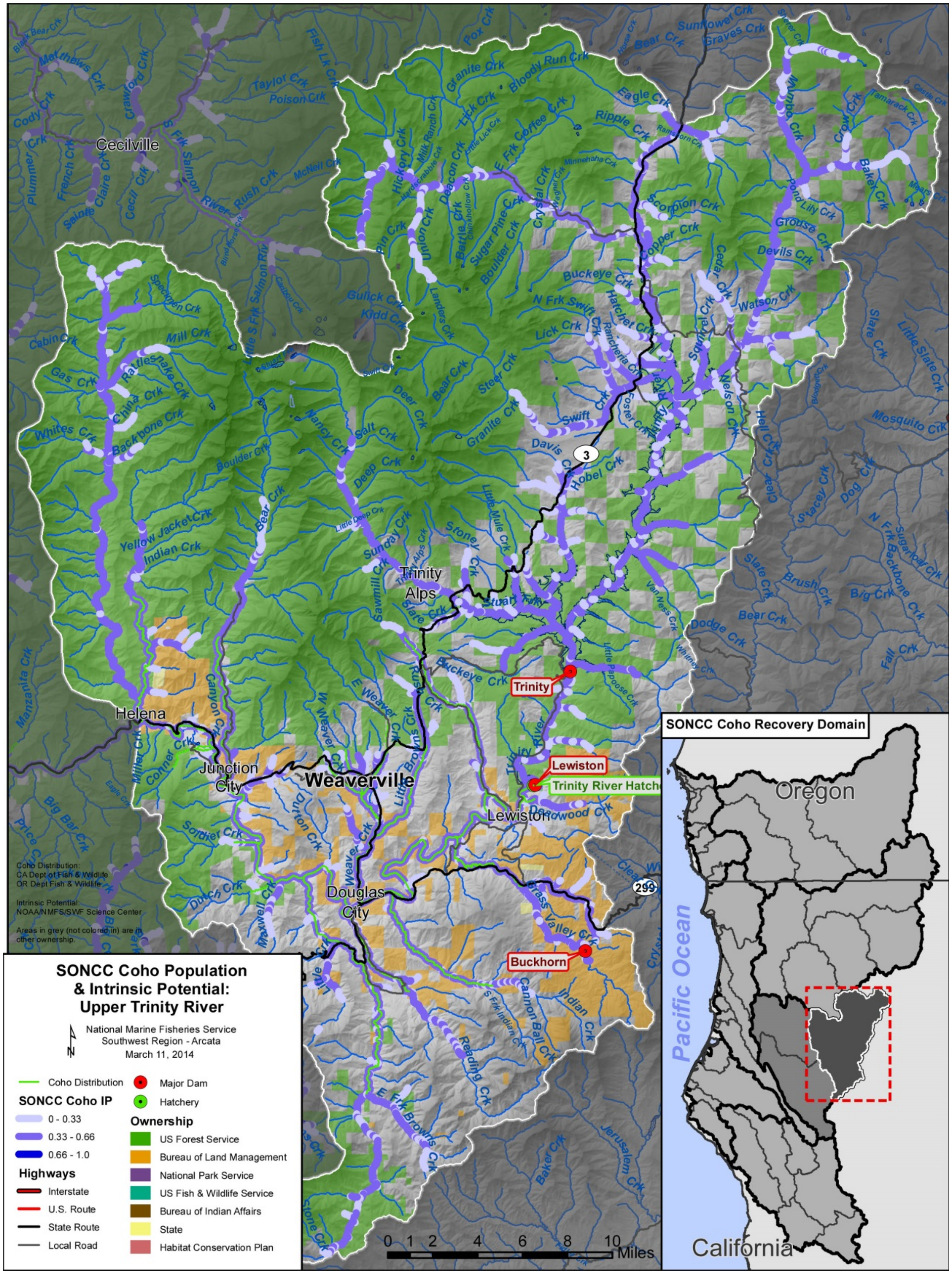

Figure 39-1. The geographic boundaries of the Upper Trinity River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Trinity River diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

The minimal static flow levels released after the completion of Lewiston Dam in 1964 until the early 2000s were insufficient to maintain the alluvial nature of the upper river and, as a consequence, much of the river channel between Lewiston and the North Fork Trinity River confluence became confined within a narrow channel bordered by a dense riparian corridor. Timber harvest practices, road construction, and floodplain development within the Trinity River watershed have also contributed significantly to habitat degradation (USFWS and HVT 1999). Clearcutting has promoted increased sediment loading; removal of streamside vegetation has increased water temperatures; and logjams at the mouths of tributary streams have blocked access for fish spawning and rearing (USFWS and HVT 1999). Timber harvest within the sub-basin has necessitated the construction of hundreds of miles of unpaved timber management roads and skid trails (USFWS and HVT 1999). 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 (USFWS and HVT 1999). Much of the mainstem Trinity River and virtually all its tributaries have been subjected to hydraulic mining activities (USFWS and HVT 1999; USEPA 2001).

Many tributaries downstream of Lewiston Dam presently or historically contained salmonid habitat, particularly in the lower gradient reaches. These tributaries, such as Rush, Reading, Brown’s and Canyon creeks have been subjected to some form of habitat modification, including historic hydraulic mining, current water diversions, road construction and timber harvesting (USEPA 2001). De la Fuente et al. (2000) and USEPA (2001) determined that Weaver and Rush creeks are impaired based on an analysis of the stream and watershed condition indicators. The water quality and channel conditions in Weaver and Rush creeks were rated as functioning at risk and the watershed hazard condition was high (USEPA 2001). The same assessment determined that Brown’s Creek was in a moderate condition (De la Fuente et al. 2000, USEPA 2001). In other words, physical and biological conditions suggest that aquatic and riparian systems’ abilities to support dependent species and retain beneficial uses of water are at risk.

Numerous studies have identified and evaluated sediment sources and delivery from Grass Valley Creek, which is considered to be the primary producer of sand-size sediment to the mainstem Trinity River (USEPA 2001). As a result, the Trinity River Restoration Program (TRRP) supported the development of an extensive erosion control program. Based on a survey initiated by Pacific Watershed Associates (PWA 2000, USEPA 2001) in 1992, stream channel conditions in Grass Valley Creek appeared to be improving (pools were more common, larger and deeper; substrate was more coarse; and channel complexity increased). Because Grass Valley Creek is a transport-dominated system (PWA 2000, USEPA 2001), most of the sediment is transported to the mainstem Trinity River, aside from what is trapped in the sediment retention basins. Even though sediment production has decreased, the creek continues to discharge sand-size sediment in quantities that are affecting the mainstem (USEPA 2001).

The North Fork Trinity, East Fork North Fork Trinity and Stuart Fork Trinity rivers and Coffee Creek watersheds are presently considered “properly functioning” with regard to aquatic habitat and watershed conditions (De la Fuente et al. 2000, USEPA 2001). These streams have a large portion of their watersheds in the Trinity Alps Wilderness and remain in a relatively undisturbed state. Of these, the North Fork Trinity and East Fork North Fork Trinity rivers remain accessible to coho salmon; Lewiston and Trinity dams are complete fish passage barriers. However, the accessible streams are higher gradient rivers that currently support populations of anadromous steelhead and minimal coho salmon production (Everest 2008), and may not have historically supported robust populations of coho salmon.

39.2 Historic Fish Distribution and Abundance

Approximately 5,000 wild adult coho salmon migrated past the town of Lewiston annually prior to the construction of the Trinity River Division (CDFG and USFWS 1956; USFWS and HVT 1999). Accurate estimates of coho salmon production below Lewiston prior to dam construction are not readily available. Although limited high quality coho salmon habitat exists throughout the Upper Trinity River recovery area (e.g., Weaver Creek), the IP model shows the greatest amount of high IP (IP > 0.66) habitat is upstream of Trinity Dam. Coho salmon are thought to have inhabited many of the smaller creeks and tributaries to the Trinity River in the area upstream of where Trinity Dam now lies (USFWS and HVT 1999). In the late 1940s and early 1950s, juvenile coho salmon were rescued from an irrigation diversion near Ramshorn Creek, which enters the Trinity River approximately 42 miles upstream from Lewiston (CDFG and USFWS 1956, USFWS and HVT 1999). 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. Salmon spawner surveys in 1995 indicate substantial usage in many of the tributaries from the North Fork upstream to Deadwood Creek. Surveys in the 1980s (USFS 1988) revealed coho salmon in some tributaries. The USFS (2000d) reported that coho salmon are rarely found in the New River.

From this information, NMFS infers that coho salmon once were well distributed throughout the Upper Trinity River sub-basin with the highest concentrations in lower gradient tributaries. Table 39-1 lists those tributaries with high IP values. The tributary below Lewiston Dam with the most incidences of high IP reaches is Weaver Creek and its tributaries (Figure 39-1). The close proximity of Deadwood and Rush creeks to Trinity River Hatchery has led to a high degree of straying by hatchery steelhead into these streams (Yurok Tribe, unpublished data). If coho also stray at high rates into these streams, this will limit the effectiveness of recovery efforts.

Table 39-1. Tributaries with high IP reaches (IP > 0.66) (Williams et al. 2006). Access to most of the streams in the Upper Trinity River subarea is blocked by Lewiston Dam.

Subarea[1]	Stream Name	Subarea[1]	Stream Name
Upper Trinity River	Hobel Creek	**Douglas City**	Deadwood Creek
	Mule Creek		Rush Creek
	Stewart Fork Trinity River		Browns Creek
	Trinity River		Little Browns Creek
	East Fork Trinity River		Indian Creek
Weaver Creek	Weaver Creek and tributaries		Grass Valley Creek
Helena	Trinity River		Little Grass Valley Creek

[1]Subarea refers to hydrologic subarea (HSA) in the CALWATER classification system.

39.3 Status of Upper Trinity River Coho Salmon

Spatial Structure and Diversity

Coho salmon are found in only a fraction of their historic habitat areas in the upper Trinity River sub-basin, due mainly to loss of habitat resulting from the erection of Lewiston and Trinity dams. Thirty-six percent of the historic IP-km has been lost (Williams et al. 2008). The presence of coho salmon has been confirmed in a variety of streams in the Upper Trinity River sub-basin such as Grass Valley Creek, Sidney Gulch, Deadwood Creek, Rush Creek, Weaver Creek, East Weaver Creek, West Weaver Creek, Little Browns Creek, Sidney Gulch, Dutch Creek, Indian Creek, Canadian Creek, Soldier Creek, Canyon Creek, North Fork Trinity River, East Fork North Fork Trinity River, Manzanita Creek, Big French Creek, New River and East Fork New River (Hill 2008, Everest 2008). Coho salmon also likely occur in Reading and Browns creeks. However, most of these streams do not have a substantial amount of high IP (IP > 0.66) when compared to the Trinity River upstream of Lewiston Dam. In the mainstem Trinity River, rearing juvenile coho salmon occur in highest densities within the first 12 km downstream of Lewiston Dam (CDFG 2008c). None were found downstream of river kilometer 163 (CDFG 2008c), which is approximately 5 km upstream of Steel Bridge. CDFG (2008c) documented the majority of observations of juvenile coho salmon were at water temperatures of 48.2 to 53 °F. The highest water temperature observed for a juvenile coho salmon was 60.8 °F. Within the mainstem Trinity River, the distribution of coho salmon can likely be explained, at least in part, by water temperature.

Hatchery influences are substantial in the Upper Trinity River sub-basin. Each year, Trinity River Hatchery releases approximately 500,000 coho salmon smolts, 800,000 steelhead, and 4.3 million Chinook salmon. Currently, hatchery fish dominate coho salmon returns to the Trinity River (USFWS and HVT 1999). From 2003 to 2005, over 75 percent of adults returning to the Trinity River, as estimated at Willow Creek, were of hatchery origin (Table 39-2). A population of native fish is at least at moderate risk of extinction if the fraction of naturally spawning hatchery fish exceeds five percent (Williams et al. 2008). Hatchery fish may negatively affect wild fish or mixed populations of wild and hatchery fish through genetic interactions (Reisenbichler and Rubin 1999; Mclean et al. 2003; Araki et al. 2007). Straying of hatchery fish into tributaries of the Trinity presents a particular threat to the population's diversity, as the hatchery fish may reduce the reproductive success of the overall population (Mclean et al. 2003).

Although not well documented, there appears to be some diversity of life history strategies in the Upper 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 January (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). Dispersing of age 0+ coho occurs over several months between March and September as does outmigration of age 1+ (CDFG 2009b). Outmigration of subyearling coho may be an expression of a life history type that rears in non-natal streams prior to emigrating to the ocean. Some of the dispersion of subyearling coho salmon is likely due to competition for rearing habitat and resources.

Population Size and Productivity

NMFS made adjustments to the low risk spawner threshold number proposed by Williams et al. (2008) for the Upper Trinity River population unit. The amount of available IP habitat was determined to be 365 IP-km and a spawner density of 20 fish/IP-km. This resulted in a low risk extinction threshold of 5,800 adult coho salmon spawners.

Population estimates for individual tributaries are not available. Limited presence/absence data are available from the U.S. Forest Service's Weaverville Office. Given land use changes and activities such as timber harvest and mining, coho salmon abundance in smaller tributaries like Weaver and Reading creeks is probably much less than it was historically. Although there may be robust numbers of spawners occasionally in some years, the overall number of naturally produced coho salmon in the Upper Trinity River watershed is low compared to historic conditions, and hatchery fish dominate the run (Table 39-2). In some years, it appears that naturally produced spawners returned to the Trinity River in sufficient numbers to meet the low risk extinction threshold specified above. However, a small proportion of the coho salmon that are judged to be of natural origin are non-clipped hatchery fish (generally less than 1%).

Table 39-2. 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 mark (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%

Table 39-3 shows the number of spawners, and the estimated number of recruits, in the Upper Trinity River. Counts occur at Willow Creek, but most of the fish are thought to spawn in the Upper Trinity River. These data indicate that the amount of recruits produced per female spawner in the Upper Trinity River is substantially less than two, meaning the population is failing to replace itself. Chilcote et al. (2010) found that the recruits produced per coho salmon spawner decreases as the mean proportion of hatchery fish in the spawning population increases, a finding similar to that of Buhle et al. (2009). This is particularly important given that a high percentage (~80 percent) of coho salmon spawners in the upper Trinity River is of hatchery origin. The population growth rate for the Upper Trinity is therefore negative, and the population relies on the heavy influence of hatchery fish to maintain current abundance levels. Due to the low natural population abundance and a negative population growth rate, the Upper Trinity River population does not meet the minimum standards of a viable salmonid population.

Table 39-3. Estimated number of adult recruits per female spawner in the Upper Trinity River. Adult return data from CDFG (2013c).

Run Year	Marked and Unmarked natural adult female spawners (S)	*Estimated adult unmarked recruits (R) (year+3)	R/S	LN (R/S)
1997	529	390	0.74	-0.31
1998	2,933	3,424	1.17	0.15
1999	839	538	0.64	-0.44
2000	3,164	4,389	1.39	0.33
2001	8,666	10,021	1.16	0.15
2002	3,356	2,903	0.86	-0.15
2003	7,235	1,736	0.24	-1.43
2004	11,356	1,261	0.11	-2.20
2005	5,630	1,361	0.24	-1.42
2006	4,964	573	0.12	-2.16
2007	1,222	1,010	0.83	-0.19
2008	1,709			
2009	1,084			
2010	1,286			

*Harvest by the Yurok and Hoopa tribes as well as incidental mortality in ocean Chinook salmon fisheries added into recruits.

Extinction Risk

The Upper Trinity River population is at moderate 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 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 Trinity River population is a core, Functionally Independent population within the Interior Trinity 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 Trinity River core population should have at least 5,800 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 Trinity population may serve as a source of spawner strays for nearby populations.

39.4 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.

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 the Clean Water Act (CWA) Section 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.

Trinity River Restoration Program (TRRP)

The Trinity River Restoration Program focuses substantial resources on restoration of the upper Trinity River, particularly the mainstem Trinity River between Lewiston Dam and the North Fork Trinity River. The TRRP also has an active watershed program that performs restoration work in tributaries. A variety of plans and assessments are available from www.trrp.net.

39.5 Stresses

Table 39-4. Severity of stresses affecting each life stage of coho salmon in the Upper 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[1]	Very High	Very High	Very[1] High	Very High	Very High	Very High
2	Altered Hydrologic Function[1]	Low	Very High	Very[1] High	High	Medium	Very High
3	Barriers	Low	High	High	High	Very High	Very High
4	Lack of Floodplain and Channel Structure	Medium	High	High	Low	High	High
5	Increased Disease/Predation/Competition	Low	High	High	Medium	Low	High
6	Impaired Water Quality	Low	Medium	High	Low	Medium	Medium
7	Impaired Estuary/Mainstem Function	Low	Low	Medium	Medium	Medium	Medium
8	Degraded Riparian Forest Conditions	Low	Medium	Medium	Medium	Low	Medium
9	Altered Sediment Supply	Medium	Medium	Medium	Low	Medium	Medium
10	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Medium	Low

[1]Key limiting stresses and limited life stage.

Key Limiting Stresses, Life Stages, and Habitat

Several factors limit the viability of the Upper Trinity population. The most dominant of these factors stem from the effects of the large-scale dams, reservoirs, and diversion on hydrologic function. The juvenile life stage is the most limited and quality summer and winter rearing habitat is lacking for the population. In addition, the negative impacts of Trinity River Hatchery, altered floodplain and channel structure, and the lack of habitat access upstream of Lewiston Dam create substantial stresses to the Upper Trinity River coho salmon population. Heating of water in Lewiston Reservoir during the summer months contributes to limiting the amount of habitat available to rearing juvenile coho salmon in the mainstem Trinity River.

Trinity River Hatchery plays a role in limiting the productivity (recruits produced per spawner) of the Upper Trinity River population through negative genetic and ecological interactions. Competition with hatchery fish released from Trinity River Hatchery limits rearing and spawning capacity in the Upper Trinity River. Competition of hatchery fish with naturally produced fish almost always has the potential to displace wild fish from portions of their habitat (Flagg et al. 2000). Both intra- and inter-specific redd superimposition on the spawning grounds can substantially affect salmon reproductive success (Essington et al. 2000) and the spawning areas downstream of Lewiston Dam are likely near carrying capacity. Another negative effect of the

Trinity River Hatchery is predation on wild coho salmon fry by hatchery-reared salmonids (Naman 2008). Cumulatively and in concert with other habitat-related stresses, adverse hatchery-related impacts are a key stress for the population.

Altered hydrologic function has a major impact on the productivity of this population. Rearing opportunities and capacity are low due to a reduced and dampened flow regime. Loss of flow variability and reduced rearing habitat during the fall and winter months as a result of water storage and regulation is expected to reduce the ability of the habitat in the Upper Trinity River to support winter rearing of juvenile coho salmon. Water withdrawals from important tributaries like Weaver and Rush creeks reduce baseflows in the summer and fall months, contributing to low flows and high water temperatures. Variability of the natural flow regime is inherently critical to ecosystem function and native biodiversity (Poff et al. 1997, Puckridge et al. 1998, Bunn and Arthington 2002, Beechie et al. 2006). In the summer, flow regimes and the lack of LWD and off-channel habitat leads to poor hydrologic function, disconnection and diminishment of thermal refugia and off-channel habitat, and poor water quality in tributaries and the mainstem during dry years. Floodplain disconnection and poor riparian function as a result of reduced flow and variability is being addressed through restoration efforts but will continue to be a limiting factor for the population.

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 for this population.

Adverse Hatchery-Related Effects

The Trinity River Hatchery was built to mitigate for the impacts of the dams on the population, but the negative consequences of genetic and ecological interactions under current management goals is likely to be suppressing the productivity of the population (e.g., Chilcote et al. 2010). The 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). Most of these fish likely migrate upstream and interact with naturally-produced coho salmon in the Upper Trinity River.

Recent studies have shown that steelhead released from TRH suppress wild salmon populations via predation (Naman 2008). Currently, spawners of natural origin are making very little genetic contribution, and the amount of natural influence in the hatchery population is extremely low (median proportion of natural influence = 0.045). It is important to note that TRH protects the Upper Trinity River coho salmon population from catastrophic losses, and could take on a very important role in the protection and recovery of this population. Available data indicate that substantial straying of TRH fish occurs into tributaries and mainstem habitat throughout the Upper Trinity (Yurok Tribal Fisheries Program unpublished data), negatively affecting the genetic and life history diversity of the population via outbreeding depression and competition.

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 Hydrologic Function

Hydrologic function is a high stress for coho salmon in the Upper Trinity River. Roughly half of the mainstem Trinity River flow is diverted to the Sacramento River Valley and remaining flows and variability are reduced downstream of the Trinity dam. Fry, juvenile, and smolt life stages are all negatively affected by changes in flow. Available fry and juvenile rearing habitat is reduced during certain times of the year, particularly winter months, by reduced flow volumes. Habitat complexity and food supply are likely limited by reduced flow variability. The reduction of scouring flows in the mainstem has contributed to habitat simplification. In the mainstem Trinity River, regulated flows from Lewiston Dam create static flow releases of 300 CFS for the fall and winter months. Arthington et al. (2004) stated that simplistic, static, environmental flow rules are misguided and will ultimately contribute to further degradation of river ecosystems. Flow variability is an important component of river ecosystems which can promote the overall health and vitality of both rivers and the aquatic organisms that inhabit them (Poff et al. 1997, Puckridge et al. 1998, Bunn and Arthington 2002, Arthington et al. 2004). Variable flows trigger longitudinal dispersal of migratory aquatic organisms and other large events allow access to otherwise disconnected floodplain habitats (Bunn and Arthington 2002), which can increase the growth and survival of juvenile salmon (Jeffres et al. 2008). Lack of flow variability in the mainstem Trinity River in the winter months is likely limiting the growth and survival of rearing coho salmon. In some streams such as Weaver and Rush creeks where water is utilized for residential purposes, summer and fall baseflows are likely impacted from the water withdrawals.

Seaward migration of juveniles is often triggered by the incremental increases in flow (Tripp and McCart 1983, Annear et al. 2002). Elevated flows occur only once during the year and there is little flow variability to trigger or aid in fish migration in the upper reaches of the Trinity River until tributary accretion begins to add flow variability. The current physical and hydrologic conditions in the Upper Trinity River reach likely impair adult migration. Upstream migration is often triggered by flow variability in the fall; however in the Upper Trinity River flows are stable throughout the summer and fall (Groot and Margolis 1991). Winter flows are particularly low in the mainstem Trinity River and overwintering habitat for juvenile coho salmon is limited. Channel and floodplain-forming flows are absent from the system, leaving simplified rearing habitat. Additional impacts on water quality likely result from flow alteration.

Barriers

The stress table shows that barriers cause a high stress across all life stages except the egg life stage. Lewiston and Trinity dam block a majority of the high IP habitat in the sub-basin. The loss of this habitat has led to a restricted spatial structure and the reliance on a limiting amount of spawning and rearing habitat downstream. The lack of available spawning and rearing habitat downstream of Lewiston Dam is a limiting stress for the population and limits the productivity of the population. Additionally, many road-related barriers preclude access to potential coho salmon habitat. The California Fish Passage Assessment Database (CalFish 2009) lists 17 sites on county roads where barriers exist in the Upper Trinity sub-basin. Additional barriers on private land may also exist. In certain instances, these road-related barriers block access to stream reaches where the potential for coho salmon habitat and refugia exists. At least seven total barriers block habitat on the North Fork Trinity, Canyon Creek, Browns Creek, Reading Creek, Weaver Creek, and Middle Weaver Creek (CalFish 2009). Other high priority total barriers exist on tributaries with the potential for providing coho salmon habitat. In addition, four partial barriers exist within the range of coho salmon on Weaver Creek, Browns Creek, and Canyon Creek. Thermal barriers are also a potential stress for the population. Because thermal refugia appear to be decreasing due to climate change and other factors, migratory habitat in some tributaries may be limited and thermal barriers may prevent movement between habitats.

Lack of Floodplain and Channel Structure

Floodplain and channel structure is a high stress for the population and particularly affects fry, juveniles, and adults. Poor floodplain and channel structure is attributed to changes in the hydrology of the sub-basin. Changes in sediment supply, storage, and transport, in combination with altered mainstem flow following construction of the TRD, altered the channel geomorphology. Riffle-pool sequences associated with point bars were replaced with monotypic runs after dam construction, which reduced the quantity, quality, and diversity of aquatic habitats. Important habitat types affected by the change in floodplain and channel structure include pools that provide cover from predators and refugia for juveniles and adults; gravel riffles for spawning; open gravel/cobble bars that create shallow, low-velocity zones important for emerging fry; and slack water habitats for rearing juveniles (USFWS and HVT 1999). The Trinity River does not approach a pre-dam channel geomorphology until the confluence with the North Fork (USFWS and HVT 1999). Mainstem reaches are generally disconnected from floodplain habitat and many tributaries experience simplified instream structure and habitat diversity. Pool depths and frequencies are thought to be poor to fair throughout the population area, but data are limited. Data on instream LWD are also limited; however, given the timber harvesting that has occurred in the watershed and the changes in riparian vegetation characteristics, LWD is likely limiting the development of complex stream habitat throughout much of the population area.

There is a direct link between the filling of pools and thermal impacts on water quality. The deepest pools prior to the TRD, were as much as 7 degrees Fahrenheit cooler than the shallow pools and provided important thermal refugia for juveniles (Moffett and Smith 1950). The change in channel geomorphology has eliminated much of the temperature stratification in pools, particularly in the summer and early fall months. In addition, changes in channel structure and substrate quality have reduced benthic macroinvertebrate production. Production of benthic macroinvertebrates takes place on the submerged portions of a streambed (Frederiksen, Kamine, and Associates 1980). Substrate quality and particle size within the streambed can greatly influence the production of benthic macroinvertebrates. Boles (1980) documented an increase in productivity, biomass, and diversity of benthic organisms following the “flushing” of granitic sand from a riffle in the Junction City reach of the Trinity River. However, the EIS noted that based on investigations of macroinvertebrate production in the Trinity compared with other basins, benthic food production does not appear to be a major factor in limiting fish production in the mainstem Trinity at the current time (USFWS and HVT 1999, App. B-13)

Increased Disease/Predation/Competition

Approximately 30 percent of hatchery yearling smolts perished within or did not migrate further than 10 km from the TRH (Beeman et al. 2009). Disease and predation are possible explanations for this smolt mortality (Beeman et al. 2009), as are tagging and handling and naivety of hatchery coho salmon. Coho salmon smolts may be exposed to diseases like Ceratomyxosis once they reach the Klamath River. Since the zones with the highest rates of infection in the Klamath Basin are in the Klamath River upstream of the Trinity and Klamath rivers confluence (Bartholomew 2008), the level of stress for Trinity smolts is likely lower than for the populations located further upstream in the Klamath Basin. Bacterial kidney disease infection rates at Trinity River Hatchery may be substantial.

Competition and predation by non-native brown trout and hatchery-released salmon and steelhead are also a source of stress and mortality for coho salmon fry, juvenile, and smolts. Coho salmon eggs are consumed by juvenile hatchery steelhead and returning adult hatchery steelhead (Naman 2008). Naman (2008) also found that residualized steelhead can consume large quantities of coho salmon fry.

Impaired Water Quality

Water quality in the Upper Trinity is primarily impacted on a localized basis by fine sediment loading and temperature impairments. No coho salmon were found downstream of river kilometer 163 (CDFG 2008c), which is approximately 5 km upstream of Steel Bridge. CDFG (2008c) documented the majority of observations of juvenile coho salmon were at water temperatures of 48.2 to 53 °F. The highest water temperature observed for a juvenile coho salmon was 60.8 °F. It is likely that within the mainstem Trinity River, the distribution of coho salmon can be explained, at least in part, by water temperature. Although mainstem water temperatures during the summer months in the Upper Trinity River are generally cool downstream to roughly Douglas City, temperatures can be problematic during years when storage in Trinity Reservoir is low, tributary runoff is low, or air temperatures are high for long durations. Violations of NCRWQCB temperature criteria in the mainstem Trinity River occur often enough to warrant concern. Downstream of Douglas City, daily average mainstem water temperatures during the summer months are higher than the published range for juvenile coho salmon rearing. In some smaller tributary streams, water temperatures can increase to levels stressful for rearing coho salmon in the summer months. Juvenile coho are unlikely to have a sufficient amount of thermal refugia during the summer due to competition and the effects of climate change. Stress from water quality ranges from low to high across life history stages.

Impaired Estuary/Mainstem Function

All salmon and steelhead that originate from the Upper Trinity River migrate to and from the ocean through the mainstem Trinity, the mainstem Klamath River and the Klamath River estuary. The Klamath River estuary plays an important role in providing holding habitat and foraging and refuge opportunities for outmigrating juvenile coho salmon from the Upper Trinity River, especially since there is a significant number of subyearling coho salmon that leave the Upper Trinity and presumably rear downstream in non-natal habitat. Although the estuary is short and small compared to the large size of the watershed, it does provide the opportunity for juvenile and smolt growth and refugia prior to entering the ocean. The estuary, although relatively intact, suffers from poor water quality, elevated sedimentation and accretion, loss of wetland habitat, and disconnection from tributary streams and the floodplain. Levees along the Lower Klamath and development on the floodplain have led to the loss and degradation of habitat in the estuary. Mainstem conditions contribute to this stress because of the issues with water quality, sedimentation and accretion, and degraded habitat in the Lower Trinity and the Lower Klamath River. Juveniles, smolts, and adults transitioning through mainstem habitat are stressed by the poor water quality, degraded habitat, and increased rates of disease in these migratory habitats.

Degraded Riparian Forest Conditions

Riparian forest conditions present medium to low stresses across all life history stages. Where data exist, the assessment of streamside canopy cover ranges from fair to very good throughout the watershed. The Weaver and Helena areas appear to have fair riparian conditions, while portions of the Helena and Upper Trinity areas have very good riparian conditions. The dynamics of the Trinity River riparian forest have changed dramatically as a result of flow regulation. Whereas natural flow regimes would historically have naturally produced diverse riparian forests with the ability to provide large wood and in-stream structure for coho salmon, the current flow regime favors simplified riparian forests with little habitat diversity. In addition, the removal of riparian canopy cover in some tributaries has resulted in increased solar radiation on the stream, and consequent elevated water temperatures.

Altered Sediment Supply

Altered sediment supply presents Low to Medium stress across all life history stages. The mainstem has an oversupply of sediments because of hydraulic mining, dredging, timber harvest, and road building. Specifically, the substrates that coho salmon require for particular life stages are limited. Below Lewiston Dam, the already coarse channel bed coarsened even more without significant channel down-cutting (USFWS and HVT 1999). Larger particles that were commonly transported during pre-dam floods were no longer mobilized, such that only finer gravels and sands were transported downstream (USFWS and HVT 1999). This caused the riverbed to become armored, which inhibited redd construction. Despite flow re-regulation to produce a scaled-down natural hydrograph, anthropogenic boundary controls have severely altered processes associated with geomorphic self-sustainability and instream habitat availability (Brown and Pasternack 2008). Inadequate spawning gravel has likely led to density dependent reductions in salmon populations and effects to the wild genome that have progressed through time (Ligon et al. 1995). Spawning gravel augmentation under the TRRP takes place below TRH and at the cableway site near Lewiston. This augmentation has helped supplement some of the loss of spawning gravels in the mainstem river and will likely continue to do so in the future.

Fine sediment input was high in the Upper Trinity River and consequently the Trinity River watershed in Trinity County was listed as sediment impaired in California's 1995 CWA Section 303(d) list, adopted by the State of California North Coast Regional Water Quality Control Board (NCRWQCB). Excessive fine sediment in tributaries and the mainstem have limited coho salmon habitat by infiltrating spawning gravel and increasing egg and alevin mortality, depositing on exposed cobble bars and impacting coho salmon fry and over-wintering rearing habitat, and filling pools and off-channel habitat and limiting juvenile summer rearing habitat (Graham Matthews and Associates (GMA) 2001). Downstream of the first tributaries, salmon egg survival to emergence appears to drop and is lowest below Grass Valley Creek (Poker Bar site), likely due to increased tributary derived fine sediment (GMA 2001). Permeability levels in several other tributaries are low as well. Studies have found that permeability levels in several of the tributaries can be quite low (98cm/hr. in Reading Creek; 258 cm/hr. in Indian Creek; 363 cm/hr. in Rush Creek; 521 cm/hr. in Canyon Creek) and could be indicative of low survival rates of salmonids (GMA 2001). The majority of fine sediment in the Trinity River originates from roads, timber harvest, and natural sediment loading from landslides and erosion (USEPA 2001).

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.

39.6 Threats

Table 39-5. Severity of threats affecting each life stage of coho salmon in the Upper 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	Dams/Diversions[1]	Medium	High	Very High[1]	High	Very High	Very High
3	Road-Stream Crossing Barriers	Low	High	High	Low	High	High
4	Climate Change	Medium	Medium	Very High	High	Medium	High
5	Invasive Non-Native Alien Species	Medium	High	High	Medium	Low	Medium
6	High Severity Fire	Medium	Medium	Medium	Medium	Medium	Medium
7	Roads	High	High	High	Medium	Medium	High
8	Agricultural Practices	Low	Medium	Medium	Medium	Medium	Medium
9	Channelization/Diking	Low	Low	Medium	Medium	Medium	Medium
10	Urban/Residential/Industrial Dev.	Low	Low	Medium	Medium	Low	Medium
12	Timber Harvest	Medium	Medium	Medium	Medium	Low	Medium
11	Fishing and Collecting	-	-	Low	Low	Medium	Low
13	Mining/Gravel Extraction	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 dams/diversions.

Hatcheries

Hatcheries pose a very high threat to all life stages of coho salmon in the Upper Trinity sub-basin. The rationale for these ratings is described under the Adverse Hatchery-Related Effects stress. Approval and implementation of a hatchery and genetic management plan at TRH will be a critical step to reduce the effect of the genetic and ecological interactions between hatchery salmonids and coho salmon in the Upper Trinity River population. Increasing the proportion of natural influence, as well as reducing ecological effects from hatchery salmonids on coho salmon, are both important components of hatchery reform which should be addressed in an HGMP or similar regulatory process.

Dams/Diversions

Dams and diversions are a significant threat across all life history stages. Lewiston and Trinity dams block access to the vast majority of high quality coho salmon habitat. Using the IP model, Lewiston Dam blocks access to 46 percent of the habitat in the Upper Trinity River population. The Trinity River downstream from Lewiston now must mimic and take on the functional role of the mainstem lost beneath the reservoirs and the smaller tributary streams, now cut off by the dams. The Trinity River below Lewiston Dam now has to provide for year-round rearing for fry and juvenile coho salmon, as well as suitable habitat for adult salmonid holding, spawning, and egg incubation and spawning. Based on the limited spawning and rearing conditions downstream of the dams this threat will likely continue to have a negative effect on all life stages of the population in the future.

Based on an average inflow to Trinity Reservoir, the U.S. Bureau of Reclamation diverts approximately 57 percent of Trinity River flows to the Central Valley Project (CVP). Remaining flows downstream of the diversion are managed according to water-year type under the Trinity River Record of Decision (USDOI 2000). The continuing impacts of diversion and storage are numerous and include reduced water quality during dry years, altered hydrologic function, and reduced rearing habitat availability and access. As mentioned above, loss of flow variability in the winter months resulting from static flows from Lewiston Dam is likely to result in reduced growth and survival of juvenile coho salmon.

Numerous small-scale wells and diversions for domestic uses, stock watering, and small agricultural operations occur throughout the watershed and reduce stream flows during critical low-flow periods in the late summer and fall. The Fish Passage Assessment Database lists 154 diversions in the upper Trinity River population, many of which are unscreened (CalFish 2009). 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).

A ten-foot defunct concrete diversion dam on Garden Gulch prevents access to high quality low gradient habitat. East Weaver Creek supplies the town of Weaverville with its water. The town's municipal diversion dam creates a barrier to salmon migration and to gravel movement in the creek, which degrades habitat below the dam in addition to blocking fish passage. Developments, like the housing development along Rush Creek, as well as the town of Weaverville (Weaver Creek), draw water from important tributaries used by coho salmon. Water use along these and other small creeks during the summer and fall months likely reduces baseflow in some areas, which reduces the amount of habitat available and contributes to elevated water temperatures.

Road-Stream Crossing Barriers

Although much work has been done to remove barriers in the watershed, road-stream crossing barriers remain that prevent access to several stream reaches. Numerous road-stream crossing barriers exist in the Upper Trinity River population unit. These present a high threat to several life stages of coho salmon because they inhibit fish passage and cause erosion-related effects in downstream reaches. The Fish Passage Assessment database lists 112 road stream crossing barriers in the Upper Trinity River. There are 30 road stream crossing structures that are total barriers to migration in the Upper Trinity River watershed and 25 partial barriers. Two-road stream crossing barriers have been prioritized for removal and 21 prioritized for assessment (CalFish 2009). Important road-stream crossing barriers within the range of the Upper Trinity population are listed below (Table 39-6). Impacts may result when juveniles are unable to pass these culverts during summer low flows and access to potential rearing habitat is restricted. No information exists on the occurrence of road-related barriers on private lands.

Table 39-6. List of road-stream crossing barriers.

Priority*	Stream Name	Road Name	County	Barrier Status*
High	Conner Creek	Conner Creek Rd	Trinity	Total
High	Oregon Gulch	Sky Ranch Rd	Trinity	Total
High	Middle Weaver Creek	Easter Ave	Trinity	Total
High	Weaver Creek	Highway 299	Trinity	Partial
High	Sidney Gulch	Highway 299	Trinity	Partial
High	Sidney Gulch	Weaver Bally Drive	Trinity	Partial
High	Sidney Gulch	Weaver Bally Loop Road	Trinity	Total
High	Ash Hollow	Highway 299	Trinity	Total
High	Five Cent Gulch	Highway 299	Trinity	Partial
High	Ten Cent Gulch	Highway 299	Trinity	Partial
High	Ten Cent Gulch	Highway 3	Trinity	Partial
Medium	Unnamed Tributary	Goose Ranch Rd	Trinity	Total
Low	McKinney Gulch	Conner Creek Rd	Trinity	Total
Low	Trinity House Gulch	Browns Mountain Rd	Trinity	Total
*From Taylor (2002 and USFS, Weaverville office)				

Climate Change

The Trinity River is a snowmelt-based river system. This has important implications in terms of climate change because snow pack has been decreasing in the western U.S. (Knowles and Cayan 2004; Mote 2006), and is expected to continue to decrease in the future as a result of the warming trend (Zhu et al. 2005, Vicuna et al. 2007), despite increases in precipitation (Hamlet et al. 2005). This may limit summer base flows in small tributary streams, increase stream temperatures, and cause earlier onsets of peak runoff. Mainstem Trinity River flows could also decrease if the hydrologic yield of Trinity Reservoir decreases over time, which could limit habitat availability for rearing juvenile salmonids. Summertime heating of Lewiston Reservoir poses a substantial threat both to Trinity Reservoir storage flexibility and to water temperatures in the Trinity River, impacting most life stages, but juveniles in particular.

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 warmer than the past and modeled regional average temperature predicts 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. Changes in flow and air temperature will influence water quality in the Trinity River. During drought years, temperatures will likely rise above levels that are stressful for coho salmon.

Annual precipitation is predicted to change little over the next century. Snowpack in upper elevations of the Trinity River basin will decrease with changes in temperature and precipitation (California Natural Resources Agency 2009). The vulnerability of the Klamath estuary to sea level rise is low to moderate and therefore does not pose a significant threat to estuarine rearing habitat downstream. Juvenile and smolt rearing and migratory habitat are most at risk to climate change. Increasing temperatures and changes in the amount and timing of precipitation and snowmelt will impact water quality and hydrologic function in the summer and winter. 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).

Invasive Non-Native/Alien Species

Competition and predation from brown trout, a non-native species, poses a substantial threat to coho salmon (Glova and Field-Dodgson 1995) in the Upper Trinity. Brown trout eat other fish species, and compete with them at all life stages for food, rearing habitat and spawning habitat (Waters 1983; Dewald and Wilzbach 1992; Wang and White 1994; McHugh and Budy 2006). Coho are absent where brown trout were present, and preferred habitats were left unoccupied by coho salmon (CDFG 2009b). Data from weirs operated by CDFG indicate several hundred brown trout pass through the Junction City area annually. Brown trout are abundant enough in the Trinity River to make up a substantial proportion of observations by biologists collecting juvenile salmonid habitat utilization data (Martin, A., pers. comm. 2009).

High Severity Fire

Fires have swept through regions of the Upper Trinity River in the recent past. The altered vegetation characteristics throughout the watershed present a moderate threat for future high severity fires, which could alter sedimentation processes as well as riparian vegetation characteristics. Fire risks will continue to increase in the future as conditions become drier and hotter as a result of climate change. Higher temperatures, reduced snowpack, and earlier spring snowmelt all contribute to the frequency, intensity, and extent of fires. Elevated fire frequency and intensity will continue to degrade spawning and rearing habitat through sedimentation and loss of riparian vegetation. Areas prone to fire risk are spread throughout the Trinity Basin.

Roads

Roads are a moderate to high threat across most life history stages. Data indicate road density varies from Very High to Low across the watershed. Most of the habitat with the greatest potential to support coho salmon in this area occurs in areas with road densities greater than 2.5

miles/sq. mile, and much of that habitat is in areas with greater than 3 miles/sq. mile. Given the sedimentation problems seen in the watershed, roads should be considered for removal or upgrade to reduce sediment delivery. Of particular importance are the many roads in the Weaverville and Douglas City areas, where small tributary streams containing reaches with high or medium IP value are accessible to coho salmon. Road building for access to marijuana cultivation sites is common in many areas of the SONCC coho salmon recovery domain. It is likely that many of these roads are unpermitted and contribute excessive amounts of fine sediment to coho salmon streams.

In total, 636 high and high/moderate priority sites have been identified for treatment on Trinity Country Roads including 149 high priority road-stream crossing sites (Trinity County 2000). In addition, Two County roads, Trinity Dam Boulevard and East Side Road, account for 57.8 percent of the total (708,583 yd^3) stream crossing related volume of potential sediment delivery. This potential volume is the result of roads built on highly erodible decomposed granitic soils. Numerous studies have identified and evaluated decomposed granite sediment sources and delivery from Grass Valley Creek. This creek has been determined to be the largest source of decomposed granite sediment in the reach. Portions of Trinity Dam Boulevard, Lewiston Turnpike, Old Lewiston and other roads in the Lewiston area cross through decomposed granite soils and act as sediment sources. Some sites have already been treated and the County and its partners will continue to target road-related sediment issues to reduce sediment inputs into the river.

Agricultural Practices

Limited agricultural activities exist in the upper Trinity River sub-basin. There are small-scale agricultural operations, such as small farms, vineyards and cattle grazing operations. Agriculture is a minor factor affecting coho salmon in this population and is therefore considered a low threat. One associated impact of agricultural practices that is addressed under the threat of dams and diversions (see above) is the diversion of water.

Channelization/Diking

Channelization and diking was ranked a low to medium threat in the threats table. Although channelization and diking is not widespread throughout the watershed, localized restrictions occur if roads run parallel to streams where they reduce floodplain connectivity and function. In addition, growth of the riparian berms in the upper Trinity River has been found to limit habitat availability. Other localized instances of channelization near tributary confluences should be identified and evaluated for potential restoration to improve floodplain function and provide off-channel habitat.

Urban/Residential/Industrial Development

Rural population growth will continue to present a moderate threat to coho salmon in the Upper Trinity River. The population of Trinity County increased 9.9 percent from 2000 to 2006 according to the U.S. Census Bureau (U.S. Census Bureau 2008), equating to an annual increase of 1.7 percent. The five principal communities in the area (Trinity Center, Weaverville, Lewiston, Douglas City, and Junction City) are home to approximately half of the people in Trinity County. In the future, demand for water for public use is expected to increase as more people move to the area. Towns will divert more surface flow from streams and waterways in order to provide the public with clean water near towns, and the number of rural residential groundwater wells will likely increase as well. However, the extent of that demand is likely limited due to the relatively small number of people expected to occupy the area. Such growth also results in removal of vegetation, increased sediment generation and delivery and introduction of exotic species. Subdivision of existing parcels will exacerbate this threat.

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.

Timber Harvest

Timber harvest poses a medium threat to the Upper Trinity River population. Much of the population area is in public ownership (U.S. Forest Service and Bureau of Land Management), including a substantial portion of federally-designated Wilderness. Under current management practices and the financial, administrative and legal restrictions on timber harvest on public land, the USFS and BLM are unlikely to implement large timber sales in the next ten years. Additionally, timber practices are governed by the rigorous protective measures for water quality that are required for actions on public lands under the Northwest Forest Plan Aquatic Conservation Strategy and Standards and Guidelines. Timber harvest in the Upper Trinity has been on the decline over the past 50 years (GMA 2001).

Almost all recently harvested land in the Trinity watershed is privately owned and the extent of its environmental impacts are unknown (USEPA 2001). Approximately 15 percent of the Trinity Basin is under private industrial timber management (USEPA 2001). Based on data from CalFire (2009) on approved private land timber harvest plans (THPs) in the Trinity River, the majority of timber harvest occurs as large timber sales on industrial timberlands. Most timber harvest on private land will occur in the Douglas City, Weaver Creek, and Upper Trinity HSAs of the Trinity River. Based on the extent and restrictions on future timber harvest it is considered a medium threat to the Upper Trinity population.

Mining/Gravel Extraction

Gravel extraction and mining is a low threat for the population. Very little in-stream gravel mining occurs in the Upper Trinity River. The bedrock underlying the Trinity River supports natural pool and riffle formation and maintenance, providing a buffer against detrimental effects of mining on coho salmon habitat (Wolff, L, pers. comm. 2009). Suction dredge mining for gold probably presents a low threat to coho salmon because of the small number and scale of these operations, and the current moratorium on suction dredge mining. NMFS expects the effects of this activity to remain the same or decrease in the future.

39.7 Recovery Strategy

Naturally-produced coho salmon in the Upper Trinity River are depressed in abundance and have a restricted distribution. Recovery activities in the watershed should promote increased spatial distribution as well as increased productivity and abundance. Curtailing the effects of hatchery fish on this population is of utmost importance. Returns of hatchery fish are several times greater than historical runs and several times greater than the low risk threshold presented by Williams et al. (2008). Activities that increase streamflows, reduce summertime stream temperatures, increase fish distribution through barrier removal, promote increased floodplain and channel structure and improve long-term prospects for LWD recruitment, should be a priority in the watershed. Specific goals for each stress are listed below and in the table of recovery actions that follows. These goals identify activities that are expected to reduce the stresses currently affecting the Upper Trinity River coho salmon population.

The presence of coho salmon has been confirmed in a variety of streams in the Upper Trinity River Sub-basin such as Grass Valley Creek, Sidney Gulch, Deadwood Creek, Rush Creek, Weaver Creek, East Weaver Creek, West Weaver Creek, Little Browns Creek, Sidney Gulch, Dutch Creek, Soldier Creek, Canyon Creek, North Fork Trinity River, East Fork North Fork Trinity River, Manzanita Creek, Big French Creek, New River and East Fork New River (Hill 2008; Everest 2008). Coho salmon are also likely to be found in Reading and Browns creeks. The following actions are essential for the coho salmon population in the Upper Trinity River coho salmon population to recover to the extent necessary for recovery of the SONCC coho salmon ESU. Streams considered a high priority of recovery actions include those streams listed in Table 39-1.

Several steps will be necessary to recover the Upper Trinity population of coho salmon. The hatchery reforms discussed above, including a Hatchery and Genetic Management Plan, need to be implemented to align hatchery production with recovery standards for hatcheries. Road stream crossing barriers discussed above should be addressed and ameliorated. Areas that contain high road densities, particularly with areas of decomposed granite should be targeted for road decommissioning. A new, more variable and dynamic flow regime to replace static 300 cfs baseflows, which occur from October to May in the mainstem Trinity River, is critical for rearing coho salmon. Adequate protections for the cold water pool in Trinity Reservoir and a strategy to compensate for thermal heating in Lewiston Reservoir are necessary to buffer coho salmon production in the mainstem Trinity River from drought and climate change. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 39-7 on the following page lists the recovery actions for the Upper Trinity River population.

Table 39-7. Recovery action implementation schedule for the Upper 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-UTR.3.1.18	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-UTR.3.1.18.1	*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-UTR.3.1.18.2	*Implement water dedications to increase instream flows using the streamlined process*					
SONCC-UTR.3.1.19	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-UTR.3.1.19.1	*Establish a categorical exemption under CEQA for water leasing to increase instream flows*					
SONCC-UTR.3.1.20	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-UTR.3.1.20.1	*Establish a comprehensive groundwater permit process*					
SONCC-UTR.3.1.21	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Population wide	2c
SONCC-UTR.3.1.21.1	*Assess basin wide water diversion projects and prioritize areas in need of increased flows. Develop a plan to obtain adequate flows for riparian resources*					
SONCC-UTR.3.1.21.2	*Reduce diversions, guided by the plan*					
SONCC-UTR.3.1.36	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Mainstem above Douglas City, Grass Valley, Indian, Hayfork, Reading, Weaver, East Fork Weaver creeks, and all streams where coho salmon would benefit immediately	2c
SONCC-UTR.3.1.36.1	*Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow*					
SONCC-UTR.3.1.36.2	*Monitor forbearance compliance and flow*					
SONCC-UTR.3.1.37	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Weaver and East Weaver creeks	2c
SONCC-UTR.3.1.37.1	*Pump water from mainstem Trinity River for Weaverville municipal water supply during periods of low flow*					
SONCC-UTR.3.1.65	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Population wide	2d
SONCC-UTR.3.1.65.1	*Establish a forbearance program, using water storage tanks to decrease diversion during periods of low flow*					
SONCC-UTR.3.1.65.2	*Monitor forbearance compliance and flow*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.3.1.44	Hydrology	Yes	Improve flow timing or volume	Secure and maintain sufficient instream flows	North Fork Trinity River and Canyon, Browns, Reading, Weaver, Middle Weaver Creeks, Grass Valley, Indian, Hayfork, Reading, Weaver, East Fork Weaver Creek, and all streams where coho salmon would benefit immediately	2c
SONCC-UTR.3.1.44.1	*Identify and cease unauthorized water diversions*					
SONCC-UTR.3.1.67	Hydrology	Yes	Improve flow timing or volume	Secure and maintain sufficient instream flows	Population wide	2d
SONCC-UTR.3.1.67.1	*Identify and cease unauthorized water diversions*					
SONCC-UTR.17.2.1	Hatcheries	Yes	Reduce adverse hatchery impacts	Identify and reduce impacts of hatchery on SONCC coho salmon	Trinity River Hatchery	2c
SONCC-UTR.17.2.1.1	*Develop and implement a Hatchery and Genetic Management Plan*					
SONCC-UTR.17.2.1.2	*Increase proportion of natural influence by reducing production of coho salmon smolts, adopt naturally-produced (unmarked) broodstock targets, trap and cull excess hatchery broodstock, and encourage a terminal recreational fishery to help decrease the number of hatchery fish on the spawning grounds*					
SONCC-UTR.17.2.1.3	*Monitor genetic diversity by collecting tissue samples from all fish returning to the hatchery*					
SONCC-UTR.17.2.1.4	*Reduce genetic impacts of hatchery on wild fish by adopting a 1:1 mating protocol*					
SONCC-UTR.17.2.1.5	*Reduce steelhead ecological interactions by reducing hatchery steelhead production*					
SONCC-UTR.17.2.1.6	*Provide geographic segregation of spawning to runs of Chinook salmon, coho salmon, and steelhead by operating weirs or other systems aimed at limiting redd superimposition*					
SONCC-UTR.5.1.35	Passage	No	Improve access	Provide artificial passage	Lewiston and Trinity Dams	2c
SONCC-UTR.5.1.35.1	*Study feasibility of fish passage at Lewiston and Trinity dams*					
SONCC-UTR.5.1.35.2	*Provide passage for all life stages, guided by plan*					
SONCC-UTR.1.2.41	Estuary	No	Improve estuarine habitat	Improve estuary condition	Klamath River Estuary	2c
SONCC-UTR.1.2.41.1	*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-UTR.3.1.59	Hydrology	No	Improve flow timing or volume	Provide adequate instream flow for coho salmon	Population wide	2c
SONCC-UTR.3.1.59.1	*Conduct study to determine instream flow needs of coho salmon at all life stages.*					
SONCC-UTR.3.1.59.2	*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-UTR.3.1.59.3	*Implement coho salmon instream flow needs plan.*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.2.1.9	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	Mainstem above Douglas City, Grass Valley, Indian, Hayfork, Reading, Weaver, East Fork Weaver Creek, and all streams where coho salmon would benefit immediately	2c
SONCC-UTR.2.1.9.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-UTR.2.1.9.2	*Place instream structures, guided by assessment results*					
SONCC-UTR.2.1.62	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2d
SONCC-UTR.2.1.62.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-UTR.2.1.62.2	*Place instream structures, guided by assessment results*					
SONCC-UTR.26.1.58	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2c
SONCC-UTR.26.1.58.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-UTR.2.2.7	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Mainstem, Grass Valley, Indian, Hayfork, Reading, Weaver, East Fork Weaver Creek, and all streams where coho salmon would benefit immediately	2c
SONCC-UTR.2.2.7.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-UTR.2.2.7.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-UTR.2.2.63	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Population wide	2d
SONCC-UTR.2.2.63.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-UTR.2.2.63.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-UTR.14.2.22	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of brown trout	Population wide	2c
SONCC-UTR.14.2.22.1	*Adopt fishing regulations and educational programs that encourage and allow for the take of an unlimited number of brown trout*					
SONCC-UTR.14.2.22.2	*Euthanize all brown trout captured at CDFW weirs*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.10.1.14	Water Quality	No	Reduce water temperature, increase dissolved oxygen	Increase flow	Weaver, Reading, Grass Valley, and Indian creeks, and all streams where coho salmon would benefit immediately	2c
SONCC-UTR.10.1.14.1	*Develop a plan to address water quality and quantity*					
SONCC-UTR.10.1.14.2	*Implement plan to address water quality and quantity*					
SONCC-UTR.10.1.60	Water Quality	No	Reduce water temperature, increase dissolved oxygen	Increase flow	Population wide	2d
SONCC-UTR.10.1.60.1	*Develop a plan to address water quality and quantity*					
SONCC-UTR.10.1.60.2	*Implement plan to address water quality and quantity*					
SONCC-UTR.3.1.45	Hydrology	Yes	Improve flow timing or volume	Determine effects of marijuana cultivation	Population wide	3c
SONCC-UTR.3.1.45.1	*Assess cumulative effects (e.g., flow, water quality) of marijuana cultivation*					
SONCC-UTR.3.1.45.2	*If needed, develop plan to reduce effects of marijuana cultivation*					
SONCC-UTR.3.1.45.3	*Implement plan*					
SONCC-UTR.3.1.17	Hydrology	Yes	Improve flow timing or volume	Educate stakeholders	Coldwater mainstem tributaries, Grass Valley, Indian, Reading, Weaver, East Fork Weaver Creek	3c
SONCC-UTR.3.1.17.1	*Develop an educational program about water conservation programs and instream leasing programs*					
SONCC-UTR.3.1.38	Hydrology	Yes	Improve flow timing or volume	Improve water management techniques	All streams where coho salmon would benefit immediately	3c
SONCC-UTR.3.1.38.1	*Develop a plan to manage stream flows and water temperature during periods of drought, protecting coho salmon from effects of climate change*					
SONCC-UTR.3.1.38.2	*Implement plan based on findings*					
SONCC-UTR.3.1.66	Hydrology	Yes	Improve flow timing or volume	Improve water management techniques	Population wide	3d
SONCC-UTR.3.1.66.1	*Develop a plan to manage stream flows and water temperature during periods of drought, protecting coho salmon from effects of climate change*					
SONCC-UTR.3.1.66.2	*Implement plan based on findings*					
SONCC-UTR.3.1.16	Hydrology	Yes	Improve flow timing or volume	Manage flows	Population wide	3c
SONCC-UTR.3.1.16.1	*Assess how climate change and likely reduced snowpack might influence water availability*					
SONCC-UTR.3.1.16.3	*Update Trinity River allocations, if needed, based on assessments of ROD flows*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.5.1.11	Passage	No	Improve access	Reduce sediment barriers	Tributary confluences where coho salmon would benefit immediately	3c
SONCC-UTR.5.1.11.1	*Inventory and prioritize barriers formed by alluvial deposits*					
SONCC-UTR.5.1.11.2	*Remove alluvial deposits, construct low flow channels, or reduce stream gradient to provide fish passage at all life stages*					
SONCC-UTR.5.1.69	Passage	No	Improve access	Reduce sediment barriers	Population wide	3d
SONCC-UTR.5.1.69.1	*Inventory and prioritize barriers formed by alluvial deposits*					
SONCC-UTR.5.1.69.2	*Remove alluvial deposits, construct low flow channels, or reduce stream gradient to provide fish passage at all life stages*					
SONCC-UTR.5.1.10	Passage	No	Improve access	Remove barriers	North Fork Trinity and Canyon, Browns, Reading, Weaver, Middle Weaver Creeks, and all streams where coho salmon would benefit immediately	3c
SONCC-UTR.5.1.10.1	*Assess highest priority road-stream and diversion related barriers. Develop a plan for removal*					
SONCC-UTR.5.1.10.2	*Remove barriers, guided by the plan*					
SONCC-UTR.5.1.68	Passage	No	Improve access	Remove barriers	Population wide	3d
SONCC-UTR.5.1.68.1	*Assess highest priority road-stream and diversion related barriers. Develop a plan for removal*					
SONCC-UTR.5.1.68.2	*Remove barriers, guided by the plan*					
SONCC-UTR.2.2.8	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Increase beaver abundance	Grass Valley, Indian, Hayfork, Reading, Weaver, East Fork Weaver Creek, and all streams where coho salmon would benefit immediately	3c
SONCC-UTR.2.2.8.1	*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-UTR.2.2.8.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-UTR.2.2.64	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	3d
SONCC-UTR.2.2.64.1	*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-UTR.2.2.64.2	*Implement education and technical assistance programs for landowners, guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.10.1.13	Water Quality	No	Reduce water temperature, increase dissolved oxygen	Reduce warm water inputs	Lewiston Dam on mainstem Trinity	3c
SONCC-UTR.10.1.13.1	*Study and evaluate methods to reduce thermal heating in Lewiston Reservoir*					
SONCC-UTR.10.1.13.2	*Implement plan to reduce thermal heating based on findings*					
SONCC-UTR.10.7.57	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3c
SONCC-UTR.10.7.57.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-UTR.10.7.57.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-UTR.10.7.61	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-UTR.10.7.61.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-UTR.10.7.61.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-UTR.16.1.23	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-UTR.16.1.23.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-UTR.16.1.23.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-UTR.16.1.55	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-UTR.16.1.55.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-UTR.16.1.55.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-UTR.16.1.24	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-UTR.16.1.24.1	*Determine actual fishing impacts*					
SONCC-UTR.16.1.24.2	*If actual fishing impacts limit attainment of population-specific viability criteria, modify management so that fishing does not limit attainment of population-specific viability criteria*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-UTR.16.1.56	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-UTR.16.1.56.1	*Determine actual fishing impacts*					
SONCC-UTR.16.1.56.2	*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-UTR.16.2.25	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-UTR.16.2.25.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-UTR.16.2.25.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-UTR.16.2.26	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-UTR.16.2.26.1	*Determine actual impacts of scientific collection*					
SONCC-UTR.16.2.26.2	*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-UTR.2.2.43	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Improve regulatory mechanisms	Population wide	3d
SONCC-UTR.2.2.43.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					