

North-Central Coastal Diversity Stratum

This stratum includes populations that spawn in watersheds of small to moderate size along the coast between Cape Mendocino and the Albion River (inclusive). Watersheds along this coast, including the larger basins, exhibit a more comprehensive “coastal” character than those to the south, and lack extensive areas that experience warmer, drier conditions.

The populations that have been selected for the recovery scenarios are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Essential populations are listed by alphabetical order within the diversity stratum, followed by the Rapid Assessment of the Supporting populations:

- Big River,
- Noyo River
- North-Central Coast Diversity Stratum Rapid Assessment
 - Albion River
 - Ten Mile River

CC Chinook North-Central Coastal Diversity Stratum, Populations, Historical Status, Population’s Role in Recovery, Current IP-km, and Spawner Density and Abundance Targets for Delisting. The Diversity Stratum recovery targets are only comprised of the essential populations because these are the populations that are expected to be viable (See Vol. 1 Chapter 5).

Diversity Stratum	CC Chinook salmon Populations	Historical Population Status	Population’s Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North-Central Coastal	Albion River	D	Supporting	17.6	6-12	104-209
	Big River	I	Essential	104.3	30.6	3,200
	Noyo River	I	Essential	62.2	35.3	2,200
	Ten Mile River	I	Supporting	67.2	6-12	401-804
Diversity Stratum Recovery Target						5400



CC Chinook salmon North-Central Coastal Diversity Stratum Populations selected for the recovery scenario.

Big River Population

CC Chinook Salmon Fall-Run

- Role within ESU: Functionally Independent Population
- Diversity Stratum: North Central Coastal
- Spawner Abundance Target: 3,200 adults
- Current Intrinsic Potential: 104.3 IP-km

For information regarding NC steelhead and CCC coho salmon for this watershed, please see the NC steelhead volume of this recovery plan and the CCC coho salmon recovery plan (<http://www.westcoast.fisheries.noaa.gov/>).

Chinook Salmon Abundance and Distribution

In their 1965 analysis of Big River, the California Department of Fish and Game (CDFG) estimated gave estimates for Chinook salmon (CDFG, 1965). Spence *et al.* 2008 estimates a population abundance of 3,200 spawners, and approximately 31 Chinook salmon per-IP-km is required to provide a low risk of extinction in the Big River watershed. The most recent counts from carcass surveys, estimate a total of 26 adult Chinook salmon spawning in Big River (D. Wright, personal communication 2010). Spence *et al.* (2008) report the status of Chinook salmon in coastal watersheds in Mendocino County, which includes Big River, as highly uncertain, and may reflect the fact that early logging had a tremendous impact on populations due to splash damming and log drives down mainstem reaches that Chinook salmon utilize.

Juvenile salmonid distribution has been documented by private timber companies and resource agencies throughout the watershed in the recent past. Various survey methods have been used since the 1980s to assess juvenile salmonid distribution. Chinook salmon have only been reported sporadically, with limited information on current distribution or abundance (Downie *et al.*, 2006). Downie *et al.* (2008) report stocking of Big River and its tributaries with salmonids for over 100 years. Juvenile steelhead were reportedly stocked in James Creek in 1904; and CDFW attempted to establish a Chinook salmon run in the 1940s and 1950s due to a depleted CCC coho salmon population.

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians utilized the Big River fishery resources. Native Americans also used fire in coastal areas to clear land for tribal activities. Starting in 1852, timber harvest began in the lower Big River area with a mill in the town now known as Mendocino. From the beginning of this timber harvesting in the 1850s to

about 1940, logs were either driven down stream channels with the use of splash dams or where taken out with the use of railroad cars. In the 1940s, truck transport of logs began with the use of tractor yarding and the construction of roads, skid trails and log landings (GMA, 2001). By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing in the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems. The majority of the watershed has been harvested more than once, 79 percent of the acres have been harvested twice, 34 percent harvest three times, and eight percent seeing activities four times (Downie *et al.*, 2006).

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Of the 1,242 miles of roads in this basin, 64 percent were built prior to 1979, 32 percent are rock surface, and less than five percent are paved highways or county roads (Downie *et al.*, 2006). Although newer roads tend to generate less surface erosion, USEPA (2001) reports that aerial photo analysis shows that in the last decade roads account for 16 percent of the road surface erosion in the watershed, whereas older roads (1921-1936) accounting for only one percent of the surface erosion for that period. The sheer number of roads in the watershed today is believed to be the reason for the increased sediment production that currently exists.

Current Resources and Land Management

Due to the remote location and large public ownership of the Big River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners within the watershed, with Mendocino Redwood Company (MRC) owning 29.4 percent (34,114 acres), Strategic Timber Trust owning 15.4 percent (17,850 acres), and Hawthorne Timber Company owning eight percent (9,700 acres) of the watershed. Jackson State Forest accounts for 19.6 percent (22,714 acres) of the watershed and a new state park, Big River State Park (7,342 acres) and the majority of the remaining property is owned by 31 property owners (GMA, 2001).

Private timberland management varies from maximum sustainable yield on MRC lands to Hawthorne Timberland Management's goal of sustained production over time. Jackson Demonstration State Forest management is primarily demonstrating forest management practices, recreation, and environmental conservation.

Salmonid Viability and Watershed Conditions

The following indicators are rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile and adult salmonids. Gravel quality for the

egg lifestage rate as Poor for this watershed. Indicators for watershed processes that are rated Poor through the CAP process include watershed road densities and riparian road densities.

All viability attributes for Chinook salmon are rated Poor due to the extremely low abundance of this population.

Recovery strategies will typically focus on ameliorating Poor habitat indicators although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Big River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Habitat Complexity: Large Wood and Shelter

Data from the Coastal Watershed Planning Assessment (Downie *et al.*, 2006) show that one of 58 streams meet target values for shelter. Past splash damming and timber harvest activities have reduced large woody debris loading instream reaches across this watershed. Forest canopy has begun to recover with most stream reaches in the watershed approaching or meeting target values, however, current riparian conditions are unlikely to deliver woody debris to provide high quality habitat in the near future. Poor habitat complexity and low LWD volume are expected to limit salmonid rearing and migration by reducing cover and velocity refuge required during freshwater residency.

Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater Ratios

The majority of stream reaches sampled in Big River do not meet target conditions for pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. In the Big River watershed, only 21 percent of the streams sampled met the target for primary pool frequency, and no stream reaches met the target for pool/riffle ratio. Streams within this basin have low large woody debris loading, which affects pool frequency and increases the amount of flat water, or glide type habitat. Current pool/riffle habitat conditions limit rearing space, velocity refuge, and food availability for juvenile salmonids.

Other Conditions

Although substrate condition is rated as a Fair condition for the egg lifestage, there is conflicting information regarding the current condition of instream habitat with respect to fine sediment. Downie *et al.* (2006), report that less than 50 percent of the pools sampled in the basin have good embeddedness ratings (low fine sediment in spawning gravel). GMA (2001) suggests that the presence of fine sediment in spawning gravels is currently not limiting fish production in the Big River basin. We rated this stress Medium to indicate that the basin is likely in a state of recovery, yet given the number of roads, and slides in the basin there is much work to be implemented to reduce erosion in the watershed. The estuary is also reported to be in the early stages of recovery from past logging practices (Downie *et al.* 2006) and was rated to be in Fair condition.

The Viability condition has an overall Poor rating. At very low densities, adult spawners have difficulty finding mates and increased predation rates can occur. Low population abundance can further reduce population productivity and increase extinction risk (Spence *et al.* 2008).

Threats

The following discussion focuses on those threats that rate as High or Very High (see Big River CAP Results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is more frequent flood and mass wasting events, which will be especially significant in this area due to the steep terrain, high road densities and unstable geology.

Roads and Railroads

Road density throughout the Big River watershed was identified as a High rating threat that, unless abated, will continue to limit fish production in the basin. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (GMA, 2001). Road-related slides and surface erosion account for 30 percent of the sediment budget delivered to stream channels, 49 percent of the sediment is from natural processes, and timber harvest activities contribute the remaining 20 percent. GMA (2001) found the recent (1989-1999) spike in road construction has increased sediment yields from surface erosion, while road-related mass wasting and harvest-related surface erosion have decreased.

Severe Weather Patterns

Future impacts of severe weather patterns pose a High threat to watershed processes. The impacts of climate change in this region will have the greatest impact on overall watershed

process that may affect all lifestages by reducing habitat conditions such as pool frequency and increasing fine sediment in spawning areas. Overall, the range and degree of temperature and precipitation variability is likely to increase across all watersheds in California. Dry weather patterns that affect migration of adults could reduce abundance for individual year classes impacted by these conditions.

Other Threats

Timber harvest and the threat of fire are Medium threats to watershed processes within Big River. Improved forest practices and the implementation of the Mendocino Redwood Company's HCP were the basis for rating timber harvest as a Medium future threat in this watershed. The Mendocino Redwood Company is the largest industrial timberland owner in the watershed. With reduced fire frequency over the last few decades, understory fuel loads have likely increased and have increased the threat of large fires that could increase soil destabilization and future erosion. However, because of the current fire suppression capability available, this threat rates as a Medium future threat. Although channelization from past splash damming continues to affect instream habitat, it has not been conducted for decades and is not a future threat.

Limiting Stresses, Lifestages, and Habitats

All lifestages are limited by the lack of channel complexity instream reaches throughout the basin. Poor channel complexity alters pool/riffle ratios, reduces cover and pool volume, and reduces velocity refuge. In addition, the egg lifestage is likely limited by elevated fine sediment that reduces survival to emergence in many spawning areas of Big River.

General Recovery Strategy

Habitat Complexity: Large Wood and Shelter

Restoration actions should focus on improving large woody debris (LWD) frequency across the Big River watershed, including the estuary reach of this basin. Riparian areas are in the process of recovery with stands of smaller diameter conifers that currently buffer stream areas. Adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity and begin to recruit LWD naturally to channels. LWD will improve instream habitat attributes, such as pool and riffle frequency and habitat complexity, as well as improve over wintering habitat for salmonids. These areas will provide important refuge from high flow events and for increased growth and survival for juveniles during the summer. Increasing the LWD frequency is also expected to improve sediment routing by sorting gravels and improving habitat quality in spawning areas.

The estuary has been identified as an important refugia area for rearing and smolt lifestages of salmonids (Downie *et al.* 2006), therefore we recommend assessing the potential for improving complexity within this important habitat area.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest will improve a number of key attributes for salmonids in Big River. Slides and surface erosion resulting from road failures and timber harvest currently account for approximately 50 percent of the sediment budget in the watershed. The inland subbasins tend to have steeper slopes and a higher number and volume of slides than coastal and middle areas of the watershed. Reducing management-related sediment delivery to stream channels is expected to improve juvenile rearing habitat conditions by improving gravel quality, egg survival, benthic macro-invertebrate production, and pool volume.

Improve Population Abundance for Chinook Salmon

Chinook salmon population abundance is extremely low, with the possibility of population extinction in the watershed. In order to improve abundance in this basin, the potential for a conservation hatchery program in the near future needs investigation. Adult monitoring should be conducted to determine the potential for using natural origin broodstock for such a program. If Chinook salmon are extinct in Big River, fishery managers should investigate whether Chinook salmon from other North-Central Coastal populations may be available and appropriate for use in rebuilding a population in this watershed. If it is determined that sufficient numbers of Chinook salmon are not available within the North-Central Coastal stratum, then efforts to determine the potential use of other populations within the ESU need to be explored.

Literature Cited

Department of Water Resources (DWR). 1965. North Coast Area Investigation, Bulletin No. 136, Appendix C Fish and Wildlife. By Department of Fish and game water Projects Branch Contract Services Section, April 1965.

Downie, S., B. DeWaard, E. Dudik, D. McGuire, and R. Rutland. 2006. Big River Basin Assessment Report. North Coast Watershed Assessment Program. California resources Agency, and California Environmental Protection Agency, Sacramento, California.

Graham Matthews & Associates (GMA). 2001. Sediment source analysis for the Big River Watershed, Mendocino County, California. Weaverville, California.

Wright, D., Biologist. Campbell Timber Company. 2010 and 2011. Personal Communication. Fort Bragg, California.

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-km (>6 Key Pieces/100 meters)	Fair
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% average staging pool frequency)	51% to 74% of streams/ IP-Km (>20% average staging pool frequency)	75% to 89% of streams/ IP-Km (>20% average staging pool frequency)	>90% of streams/ IP-Km (>20% average staging pool frequency)	19% streams/ 45% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	37% streams/ 48% IP-km (>40% Pools; >20% Riffles)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100 of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	> 75% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawners per IP-Km	1-20 Spawners per IP-Km	20-40 Spawners per IP-Km (e.g., Low Risk Extinction Criteria)		<1 spawners per IP-km	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	59% streams/ 51 % IP-km (>50% stream average scores of 1 & 2)	Fair

3	Pre Smolt	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	19% streams/ 45% IP-km (>40% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	37% streams/ 48% IP-km (>40% Pools; >20% Riffles)	Poor
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	7% streams/ 1% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 75	Fair
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 42	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	40% Class 5 & 6 across IP-km	Fair

			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	59% streams/ 51 % IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined		
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-km maintains severity score of 3 or lower	Very Good
		Size	Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	7% streams/ 1% IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35		
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions	Very Good

			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	100 of IP-km	Very Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	59% streams/ 51 % IP-km (>50% stream average scores of 1 & 2)	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)			
6	Watershed Processes	Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.075% of Watershed in Impervious Surfaces	Very Good

		Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	<10% of Watershed in Agriculture	Very Good
		Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	14% of Watershed in Timber Harvest	Very Good
		Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	<1% of watershed >1 unit/20 acres	Very Good
		Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
		Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	2.4 Miles/Square Mile	Good
		Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	>1 Miles/Square Mile	Poor

Big River CAP Threat Results

Threats Across Targets		Adults	Eggs	Pre Smolt	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	5	6	
1	Agriculture						
2	Channel Modification	Low	Low	Low	Low	Medium	Low
3	Disease, Predation and Competition						
4	Hatcheries and Aquaculture	Medium					Low
5	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low
6	Fishing and Collecting	Medium					Low
7	Livestock Farming and Ranching						
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Medium	Medium
9	Mining						
10	Recreational Areas and Activities	Low	Low				Low
11	Residential and Commercial Development		Low	Low	Low	Low	Low
12	Roads and Railroads	Low	Medium	Medium	Medium	High	Medium
13	Severe Weather Patterns	Medium	Medium	Low	Low	High	Medium
14	Water Diversion and Impoundments	Low	Low	Low	Low	Low	Low
Threat Status for Targets and Project		Medium	Medium	Medium	Medium	High	Medium

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
BR-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	CDFW, MMWD, SPAWN	50.00	50.00				100	Existing program (e.g. SPAWN) could be expanded at minimal cost. Estimate additional monitoring costs at \$10K/year.
BR-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	3	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, State Parks						TBD	Costs depend on level of technical assistance required and types of projects proposed. Many salmon recovery efforts and management programs are currently ongoing. It is possible that there could be additional salmon restoration costs identified based on recovery needs of the species; however, at this time we do not have sufficient information to estimate those potential costs or identify the actions under which they might fall.
BR-CCCh-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited						TBD	Initiate projects should target stream reaches with high IP-km values, however, consideration should be also given to mainstem Big River, particularly mainstem reaches above the estuary.
BR-CCCh-2.1.1.4	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, and use streamway concept where appropriate.	2	25	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited						TBD	TBD, cost based on amount of habitat. Cost estimate for floodplain connectivity estimated at a rate of \$41,000/acre.
BR-CCCh-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
BR-CCCh-5.1.1.1	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	20	CalTrans, NMFS, CDFW						TBD	Cost could be partially accounted for in fish/habitat monitoring. A total of 4 impassable barriers are currently known.
BR-CCCh-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										
BR-CCCh-6.1.1.1	Action Step	Habitat Complexity	Identify historic salmonid habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	California Coastal Conservancy, CDFW, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks	57.50	57.50				115	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority. Cost for fish/habitat monitoring is estimated at \$114,861/project.
BR-CCCh-6.1.1.2	Action Step	Habitat Complexity	Fund a watershed coordinator.	2	10	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, RCD, RWQCB, State Parks, Trout Unlimited	300.00	300.00				600	Currently, Big River is managed by five or six larger landowners - including State, private, and non-profit. A coordinator is likely necessary to focus actions and resources in key areas and to apply for grants that will span multiple landowners.
BR-CCCh-6.1.1.3	Action Step	Habitat Complexity	Install properly sized large woody debris to meet targets specified in recovery plan.	1	20	California Coastal Conservancy, CDFW, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, UC Extension	232.50	232.50	232.50	232.50		930	Cost based on treating 36 miles (assume 50% High IP) at a rate of \$25,825/mile. Costs may vary significantly due to access, varying paucity of large wood between sub-watersheds, and installation techniques. Much of Big River has been habitat typed and thus the stream reaches lacking wood can be readily identified. Permitting should be streamlined because of programmatic biological opinions for these types of actions. Many key areas in Big River have been targeted for LWD enhancement through the MRC HCP and on JDSF and total costs may be significantly less than projected.

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks						0	Costs will vary with site specific conditions (such as access and availability of materials). However, significant cost saving could result if projects are implemented when other land management action are planned. Action is considered In-Kind
BR-CCCh-6.1.1.5	Action Step	Habitat Complexity	Encourage the development and implementation of large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	2	20	CalFire, CDFW, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks						0	Cost are likely part of other action steps.
BR-CCCh-6.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
BR-CCCh-6.1.2.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20	Campbell Timberland Management, CDFW, NMFS, NOAA RC, Private Landowners						TBD	Cost should be accounted for in increase LWD frequency and primary pools.
BR-CCCh-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-7.1.1	Recovery Action	Riparian	Improve canopy cover										

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	20	CDFW, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy						TBD	Cost cannot be estimated because overall amount of landowner participation is unknown (particularly for conservation easements).
BR-CCCh-7.1.1.2	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs to the North and South Forks Big River, mainstem Big River, and Daugherty Creek.	2	20	CalFire, Private Landowners						0	Action is considered In-Kind
BR-CCCh-7.1.1.3	Action Step	Riparian	Develop riparian improvement projects along James Creek to increase canopy levels.	2	20	CDFW, Jackson Demonstration State Forest, NOAA RC, Trout Unlimited	416.50	416.50	416.50	416.50		1,666	Recommendation from CDFW coastal watershed report. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of \$20,719/acre.
BR-CCCh-7.1.1.4	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	20	CDFW, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy						0	Action is considered In-Kind
BR-CCCh-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-8.1.1	Recovery Action	Sediment	Improve instream gravel quality and distribution for macro-invertebrate productivity (food)										

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-8.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	1	5	CalFire, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USEPA						TBD	This sediment reduction plan could be part of a larger road and sediment reduction plan. This plan should tier off recommendations in the Big River TMDL.
BR-CCCh-8.1.1.2	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments. Focus efforts in the South Daugherty and Chamberlain Creek subbasins.	2	5	CDFW, NOAA RC, Private Landowners, Trout Unlimited						TBD	A sediment assessment will identify high priority slides and landings.
BR-CCCh-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks						TBD	This infrastructure is likely present in much of the Big River subwatersheds. Additional sites may be installed as part of the timber harvest plan process and the cost for construction will likely be absorbed on a harvest plan by harvest plan basis. Ongoing maintenance will likely occur as part of yearly evaluation prior to the winter period. Maintenance costs are estimated at \$50,000/yr. Most of these costs are not anticipated to be additional costs to landowners but should be viewed as expenses incurred for maintenance of existing infrastructure.
BR-CCCh-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
BR-CCCh-10.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient. Focus on tributaries in the Middle and Inland subbasins that do not meet canopy target of 70 percent. Use CDFW habitat typing data/reports to determine tributaries that do not meet canopy target.	2	10	CDFW, Mendocino Redwood Company, Private Landowners, RCD, Trout Unlimited							Cost accounted for in RIPARIAN.
BR-CCCh-10.1.1.2	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and increased riparian buffers (CDFG 2004).	3	100	Campbell Timberland Management, CDFW, NOAA RC, Trout Unlimited						0	Action is considered In-Kind
BR-CCCh-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity										

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-11.1.1.1	Action Step	Viability	Measure or estimate the condition of key habitat attributes across the watershed. Prioritize tributaries that have been habitat typed in the past.	2	5	CalFire, California Department of Mines and Geology, CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Consultants, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension							Cost accounted for in the Monitoring Chapter.
BR-CCCh-11.1.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFW habitat assessment protocols) to ensure ESU-wide consistency.	3	60	CalFire, California Department of Mines and Geology, CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Consultants, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension						TBD	Most of the watershed has been habitat typed according to CDFW stream protocols. New habitat assessment methods may result in additional (but unknown) costs for Big River. Cost accounted for in the Monitoring Chapter.

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-11.1.1.3	Action Step	Viability	Monitor population status for response to recovery actions.	2	100	CalFire, California Department of Mines and Geology, CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Consultants, Private Landowners, RPFs, RWQCB, SWRCB, UC Extension							Cost accounted for in the Monitoring Chapter.
BR-CCCh-11.1.1.4	Action Step	Viability	Conduct monitoring activities to determine the abundance of adult and smolt salmonids in Big River.	2	12	CDFW, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, State Parks							Cost accounted for in the Monitoring Chapter.
BR-CCCh-11.1.1.5	Action Step	Viability	Determine the appropriate agencies and technical staff to evaluate the potential for Chinook conservation hatchery program on Big River.	2	10	CDFW, NMFS						0	Action is considered In-Kind
BR-CCCh-11.1.1.6	Action Step	Viability	Convene a technical committee that produces a decision document on the potential for using a conservation hatchery program to increase Chinook salmon abundance.	2	2	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NMFS, NOAA SWFSC, Private Consultants	50.00					50	Rough estimate for committee costs and report preparation.
BR-CCCh-19.1	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
BR-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
BR-CCCh-19.1.1.1	Action Step	Logging	Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations.	3	20	NMFS, State						0	Action is considered In-Kind
BR-CCCh-19.1.1.2	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	1	20	NMFS, State						0	Action is considered In-Kind
BR-CCCh-19.1.1.3	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	NMFS, State						0	Action is considered In-Kind

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	20	NMFS, State						0	Action is considered In-Kind
BR-CCCh-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
BR-CCCh-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	305.00	305.00				610	This plan should leverage the Big River TMDL. If most of the TMDL recommendations are adopted the total cost of this plan would likely be significantly less than that estimated here. Cost for road inventory is estimated at \$957/mile (assume 50% of road network).
BR-CCCh-23.1.1.2	Action Step	Roads/Railroads	Continue efforts such as road improvements, and decommissioning to reduce sediment delivery to Big River and its tributaries. CDFW stream surveys indicated Kidwell Gulch, Two Log Creek, and Saurkraut Creek have road sediment inventory and control as a top tier tributary improvement recommendation.	3	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks						TBD	Cost likely accounted for in other action steps.
BR-CCCh-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	19.00	19.00				38	Cost based on decommissioning 3.1 miles of riparian road network at a rate of \$12,000/mile. If upgraded, cost would be \$65,534.

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.	3	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks						0	Action is considered In-Kind
BR-CCCh-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	100	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks						0	Action is considered In-Kind
BR-CCCh-23.1.1.6	Action Step	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	15.50	15.50				31	Cost based on sediment assessment for 5% of road network at a rate of \$1,430/mile.

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-23.1.1.7	Action Step	Roads/Railroads	Use NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	2	20	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks						0	Action is considered In-Kind
BR-CCCh-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
BR-CCCh-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
BR-CCCh-24.1.1.1	Action Step	Severe Weather Patterns	During Drought years CDFW, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting that could impact salmonids. These agencies should use existing regulations or other mechanisms to minimize water use during the summer months.	2	20	CDFW, CDFW Law Enforcement, Mendocino County, NMFS OLE, NOAA RC, Private Landowners, SWRCB						0	Action is considered In-Kind
BR-CCCh-24.1.1.2	Action Step	Severe Weather Patterns	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions in the summer and fall months. Focus stream gaging efforts on the South Fork Big River.	2	5	CDFW, NMFS, SWRCB	66.00					66	Initial efforts should be focused in upper South Fork Big River where numerous small landowners are believed to divert from Big River for domestic purposes. Cost for stream flow modeling estimated at \$65,084/project
BR-CCCh-24.1.1.3	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	2	10	CDFW, NMFS, SWRCB						TBD	Cost accounted for in other recovery actions.
BR-CCCh-24.1.1.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for salmonids, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	2	60	CDFW, NMFS, Private Landowners, SWRCB						TBD	Stream flow modeling will determine critical low flow levels. Conservation programs are contingent upon water users participation and feasibility of water conservation practices.
BR-CCCh-24.1.1.5	Action Step	Severe Weather Patterns	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).	2	50	CDFW, NMFS, Private Landowners						0	Action is considered In-Kind
BR-CCCh-24.2	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species' continued existence										
BR-CCCh-24.2.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
BR-CCCh-24.2.1.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	20	CDFW, NMFS, Private Landowners						TBD	Cost based on amount of high-risk shallow-seeded landslide areas needed to be protected. Cost to protect vary depending on methods applied.
BR-CCCh-25.1	Objective	Water Diversion/ Impoundment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
BR-CCCh-25.1.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										

Big River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
BR-CCCh-25.1.1.1	Action Step	Water Diversion/ Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	1	10	NOAA RC, Private Landowners, RCD, SWRCB						TBD	Focus on Landowners in the South Fork Big River subbasin.
BR-CCCh-25.1.1.2	Action Step	Water Diversion/ Impoundment	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential salmonid streams (CDFG 2004).	2	5	CDFW, NMFS, Private Landowners, SWRCB	66.00					66	Cost based on stream flow/precipitation monitoring at a rate of \$65,084/project.
BR-CCCh-25.2	Objective	Water Diversion/ Impoundment	Address the inadequacy of existing regulatory mechanisms										
BR-CCCh-25.2.1	Recovery Action	Water Diversion/ Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
BR-CCCh-25.2.1.1	Action Step	Water Diversion/ Impoundment	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFW, CDFW Law Enforcement, NMFS OLE, Private Landowners, SWRCB						TBD	TBD, cost based on amount of base flow needed to protect species. Water acquisition and/or leasing are potential outcomes for ensuring summer base flows and will be contingent upon market value, availability, and willingness of water user.
BR-CCCh-25.2.1.2	Action Step	Water Diversion/ Impoundment	Improve coordination between agencies and others to address the season of water diversions, off-stream reservoirs, and bypass flows to better protect salmonids and their habitats (CDFG 2004).	2	10	CDFW, NMFS, Private Landowners, SWRCB, USFWS						0	Cost of additional coordination is expected to be minimal. Action is considered In-Kind
BR-CCCh-25.2.1.3	Action Step	Water Diversion/ Impoundment	Require compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	60	NMFS, NMFS OLE, Private Landowners, SWRCB						TBD	Further analysis is needed to determine cost to landowners to comply with guidelines for new diversions.
BR-CCCh-25.2.1.4	Action Step	Water Diversion/ Impoundment	Assess and map water diversions (CDFG 2004).	2	2	CDFW, NMFS, SWRCB	20.00					20	Rough cost estimate for Big River watershed only. This exercise should include Riparian and Appropriative diversions. The majority of the estimated cost would result from attempting to identify unreported Riparian diversions.
BR-CCCh-25.2.1.5	Action Step	Water Diversion/ Impoundment	Request that SWRCB review and/or modify water use based on the needs of salmonids and authorized diverters (CDFG 2004).	2	10	SWRCB						0	Additional analysis needed. Action is considered In-Kind
BR-CCCh-25.2.1.6	Action Step	Water Diversion/ Impoundment	Require streamflow gauging devices to determine the current streamflow condition.	2	10	NMFS, SWRCB, USGS	150.00	150.00				300	Cost based on 30k per year for two stations. This information could provide baseline information that would be useful in evaluating changes to baseflow over time.
BR-CCCh-25.2.1.7	Action Step	Water Diversion/ Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	10	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
BR-CCCh-25.2.1.8	Action Step	Water Diversion/ Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	10	CDFW, NMFS, SWRCB						0	Action is considered In-Kind
BR-CCCh-25.2.1.9	Action Step	Water Diversion/ Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).□	2	10	CDFW, NMFS, SWRCB						0	Action is considered In-Kind

Noyo River Population

CC Chinook Salmon Fall-Run

- Role within ESU: Functionally Independent Population
- Diversity Stratum: North-Central Coastal
- Spawner Abundance Target: 2,200 adults
- Current Intrinsic Potential: 62.2 IP-km

For information regarding NC steelhead and CCC coho salmon for this watershed, please see the NC steelhead volume of this recovery plan and the CCC coho salmon recovery plan (<http://www.westcoast.fisheries.noaa.gov/>).

Chinook Salmon Abundance and Distribution

Chinook salmon have only been reported sporadically in the Noyo River watershed, with CDFW spawning surveys documenting only a few adults in the basin. Gallagher *et al.* (2010) reported a mean escapement of four adult Chinook salmon with an estimated population range of 2-157 spawners. Spence *et al.* (2008) reports the status of Chinook salmon in coastal watersheds in Mendocino County, which includes the Noyo River, as highly uncertain, and may reflect the fact that early logging had a tremendous impact on mainstem reaches that Chinook salmon utilize. Based on Spence *et al.* (2008), 62 km of potential habitat results in a Chinook salmon population target of 2,200 spawners for the Noyo River watershed.

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, Pomo Indians likely utilized the fishery resources of the Noyo River. Native Americans also used fire in coastal areas to clear land for tribal activities. In 1853, timber harvest began in the Noyo River area with the first water-powered mill in the lower Noyo River. Harvesting of old growth timber continued in the Noyo River watershed until the early part of the 20th century (EPA, 1999). In 1940, tractors were used throughout the basin to yard fallen timber, and roads, skid trails and log landings were constructed to ease transport of the logs to sawmills. By the 1960s, some harvesting of second growth timber had begun, with poor timber harvesting practices continuing into the 1980s, although the Forest Practice Act (1973) has progressively improved road and yarding systems.

Roads and railroads associated with timber harvesting have been in the watershed since the 1800s, and in the 1940s railroads were converted to truck roads. Railroad operations began in 1886 in the Noyo River watershed, with railroad tracks operating east from Fort Bragg to the Little North Fork. Railway service was completed from Fort Bragg to Willits in 1911, including

the construction of an extensive set of trestles that cross the Noyo River. Spur tracks were developed to increase logging opportunities in the North and South Fork Noyo subbasins and were later converted into truck roads (GMA, 1999). This railroad line remains in use today as the Skunk Railroad, a popular tourist attraction in Mendocino County.

Current Resources and Land Management

Due to the remote location and large public ownership of the Noyo River watershed, a small number of programs and management plans guide land use activities within the basin. Private timber management companies are the largest landowners in the watershed, with Mendocino Redwood Company (MRC) owning the majority of the upper watershed, and Hawthorne Timber Company owning much of the lower Noyo River along the mainstem. Jackson State Forest accounts for 19 percent of the watershed which located in the South Fork subbasin.

Private timberland management varies from maximum sustainable yield on MRC lands to Hawthorne Timberland's management goal of sustained production over time. Jackson Demonstration State Forest management is primarily for demonstrating forest management practices, recreation, and environmental conservation.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, shelter rating, primary pools, pool/riffle ratio for juvenile rearing, smolts and adult lifestages of salmonids. Stream temperature was also rated as Poor for juvenile summer rearing. Indicators for watershed processes that were rated as Poor through the CAP process included watershed road densities, and riparian road densities. Due to the extremely low numbers of Chinook salmon in this basin, all viability attributes were rated Poor.

Recovery strategies will typically focus on ameliorating these habitat indicators, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. Indicators that rated as Fair through the CAP process, but are considered important within specific areas of the watershed include gravel quality for eggs, baseflow conditions for summer rearing and the estuary.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Noyo River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Conditions

Habitat Complexity: Large Wood and Shelter

The best available data, including CDFW habitat typing surveys, indicate that no streams within the Noyo River watershed currently meet target values for shelter. Past timber harvest activities and LWD removal programs in the 1970s through the early 1990s have reduce large woody debris loading across stream reaches in this watershed. Forest canopy has begun to recover, with most stream reaches in the watershed approaching or meeting target values; however, riparian trees that make up the riparian corridor are not of sufficient size and age to deliver woody debris that will provide shelter in the near future. Unsuitable habitat complexity and large woody debris volume are expected to limit salmonids during rearing and migration lifestages by reducing pool frequency and volume, cover habitat, and velocity refuge areas required during freshwater residency.

Water Quality: Temperature

Stream temperatures in the mainstem Noyo River are unsuitable for salmonid rearing. Albin (2006) reports suitable stream temperatures in the coastal area tributaries, yet most of the streams, including the mainstem and interior, do not maintain suitable water temperatures for rearing salmonids during the summer months. The South Fork Noyo River and its tributaries currently have suitable stream temperatures. Stream temperatures are reported to less suitable for salmonids in the upper mainstem Noyo River, North Fork Noyo River, Hayworth Creek, North Fork Hayworth Creek, Olds Creek, Redwood Creek and Burbeck Creek, despite suitable canopy in these tributaries (Albin, 2006).

Overall, stream temperature conditions for this population is rated overall as Fair due to moderately and unsuitable stream temperatures that occur across the middle and inland portion of the basin. Although canopy targets are being met in many of the stream reaches surveyed, stream temperature monitoring suggests that the level of regenerated riparian buffers is not yet adequate to fully protect stream temperatures from solar warming and warmer inland air temperatures.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Sediment transport load in the Noyo River watershed was identified as a stress to overall watershed process. The USEPA TMDL and other studies (GMA 1999) have identified sediment delivery from roads a limiting factor for salmonids. Although the egg lifestage was not rated as Poor for impaired gravel quality, the Fair rating it received suggests gravel quality was not suitable in many reaches of the watershed.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization have an overall rating of Good with respect to overall watershed process. Disturbance in the form of timber harvest and roads across the basin, which act to alter sediment transport through the basin, have been and continue to cause landscape disturbance in the Noyo River watershed.

Other Conditions

Although substrate conditions were rated as a Fair for the egg lifestage, information suggests that many reaches within this basin do not meet target values for fine sediment in spawning gravels. We rated this condition as Fair to indicate that the basin is likely in a state of recovery, yet given the number of roads in the basin there is much work to be implemented to reduce fine sediment delivery to stream channels in the watershed.

The majority of streams sampled in the Noyo River watershed do not meet target conditions for percent of stream reach with pools and the ratio of pools to riffles. Stream reaches with greater than 40 percent pools and 20 percent riffles are considered suitable for salmonid rearing, migration and feeding. Many of the stream reaches, including the mainstem Noyo River, have a high percentage of flat water habitat types, which are not as suitable for salmonid rearing as pool habitat. Poor large woody debris loading across the basin affects pool frequency, and results in increased levels of flat water, or glide-type habitat. Current pool/riffle habitat conditions are expected to limit space for juvenile salmonids, and reduce the carrying capacity during the summer period.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Noyo River CAP results). Recovery strategies will likely focus on ameliorating High rating threats; however, some strategies may address Medium and Low threats when the strategy is essential to recovery efforts. The figures and tables that display data used in this analysis are provided in Noyo River CAP results.

Population and Habitat Threats

Roads and Railroads

Road density throughout the Noyo River watershed was identified as the Highest rating threat, and unless abated will continue to limit fish production in the basin. Although sediment quality is not rated as Poor in the basin currently, roads continue to be the largest source of anthropogenic sediment delivery in the basin (EPA 1999). Road densities are high both across

the basin and within riparian areas (7.0 miles per square mile, and 7.4 miles per square mile, respectively).

Graham Matthews & Associates (GMA, 1999) found an increase over time in road construction, which has increased sediment yield from surface erosion. Of the 838 miles of roads in the basin, approximately 83 percent are seasonal dirt roads (GMA 1999). GMA (1999) states that improved management practices since 1974 have decreased road-related mass wasting and harvest surface erosion. However, significant new road construction has increased sediment yields through increased road surface erosion, despite improved road management practices (GMA, 1999). According to EPA (1999), aggressive actions are required to reduce sediment delivery from roads to meet the TMDL allocation for road related sediment, which is the greatest source of management related sediment delivery in the Noyo River watershed. Estimated road-related sediment production for the Noyo River watershed is 183 tons/square mile/year, which is estimated to be an 8 fold increase over 1942 rates.

Logging and Wood Harvesting

Timber has been harvested in the watershed for over 150 years. Improved harvest methods and regulations have reduced the overall impact of this threat in recent decades. However, although the rate of harvest in this basin has slowed in the last decade, this threat will continue to exist in the future. For all salmonid lifestages except adults, and overall watershed processes, the threat of timber harvesting activities is rated as a Medium threat. Improved logging methods, such as tree yarding that reduces ground disturbance and reduced harvesting within riparian zones, could keep this threat from returning as a large contributor to habitat stress in the future.

Limiting Stresses, Lifestages, and Habitats

Based on the type and extent of stresses and threats affecting the population, as well as the limiting factors influencing productivity, the juvenile lifestage appears to be the most limited. Poor channel complexity can alter pool/riffle ratios, reduce instream cover volume, and reduce velocity refuge for salmonids. In addition, the egg lifestage is moderately limited by elevated fine sediment that reduces egg survival to emergence in many spawning areas of the Noyo River and its tributaries. Stream water temperatures occurring in the interior areas of the basin are not suitable and are likely limiting growth and survival of salmonids.

Low adult abundance of Chinook salmon that return to this system sporadically likely limits the viability of this population. Genetic samples taken from juvenile Chinook salmon in the Noyo River from 2000-2003 show substantially lower mean number of allelic richness which correlates

with a lower effective population size as compared to other Chinook salmon ESU populations (Bjorkstedt *et al.* 2005).

General Recovery Strategy

Improve Habitat Complexity

Restoration actions should improve large woody debris (LWD) frequency across the Noyo River watershed. Riparian areas are in the process of recovery, with stands of smaller diameter conifers that currently buffer stream areas. Strategically adding LWD will provide much needed complexity to stream channels until riparian areas reach maturity, at which time they can begin to recruit LWD naturally to channels. Increasing LWD volumes will improve instream habitat attributes such as pool and riffle frequency and habitat complexity. LWD will improve over wintering and summer survival of salmonids. The recovery strategy to improve overall productivity is to increase the extent, access, and quality of rearing areas and space (pools) throughout the basin. These areas will provide important refuge from high flow events and opportunity for increased growth and survival of juveniles during winter and summer. Increasing the LWD frequency is also expected to improve sediment sorting thereby improving spawning habitat. .

Improve Stream Temperatures

The approach to improving riparian conditions in the basin will need to focus on preventing further riparian vegetation loss and on rehabilitating riparian areas that are currently in poor condition. In addition, there may be opportunity to conduct riparian improvements on specific reaches that may be contributing to stream warming along interior stream reaches.

Improve Habitat and Substrate Quality

Reducing sediment delivery from roads and timber harvest is likely to improve a number of key habitat attributes for salmonids in the Noyo River. Road-related sediment delivery has increased in the recent past and must be reduced. Upgrading or decommissioning roads throughout the basin will lower erosion rates and improve sediment quality, which will in turn improve egg survival and benthic macro-invertebrate production for juvenile feeding, and reduce pool filling for improved juvenile rearing conditions.

Improve Population Abundance of Chinook Salmon

Chinook salmon population abundance is extremely low within the Noyo River, with the possibility of population extinction in the watershed. To improve abundance of the wild population in this basin, Federal and state biologists should investigate developing a

conservation hatchery program or other augmentation program in the near future. Adult Chinook salmon monitoring should be conducted to determine the potential for using natural origin broodstock in such a program. If Chinook salmon are extinct in the Noyo River, agencies need to determine if Chinook salmon from other North-Central Coastal populations are available and appropriate for use in rebuilding an independent population. If it is determined that sufficient numbers of Chinook salmon are not available in the North-Central Coastal Diversity stratum, the potential use of broodstock from other populations within the Chinook salmon ESU should be investigated.

Investigate and Address Impairment to Noyo Estuary

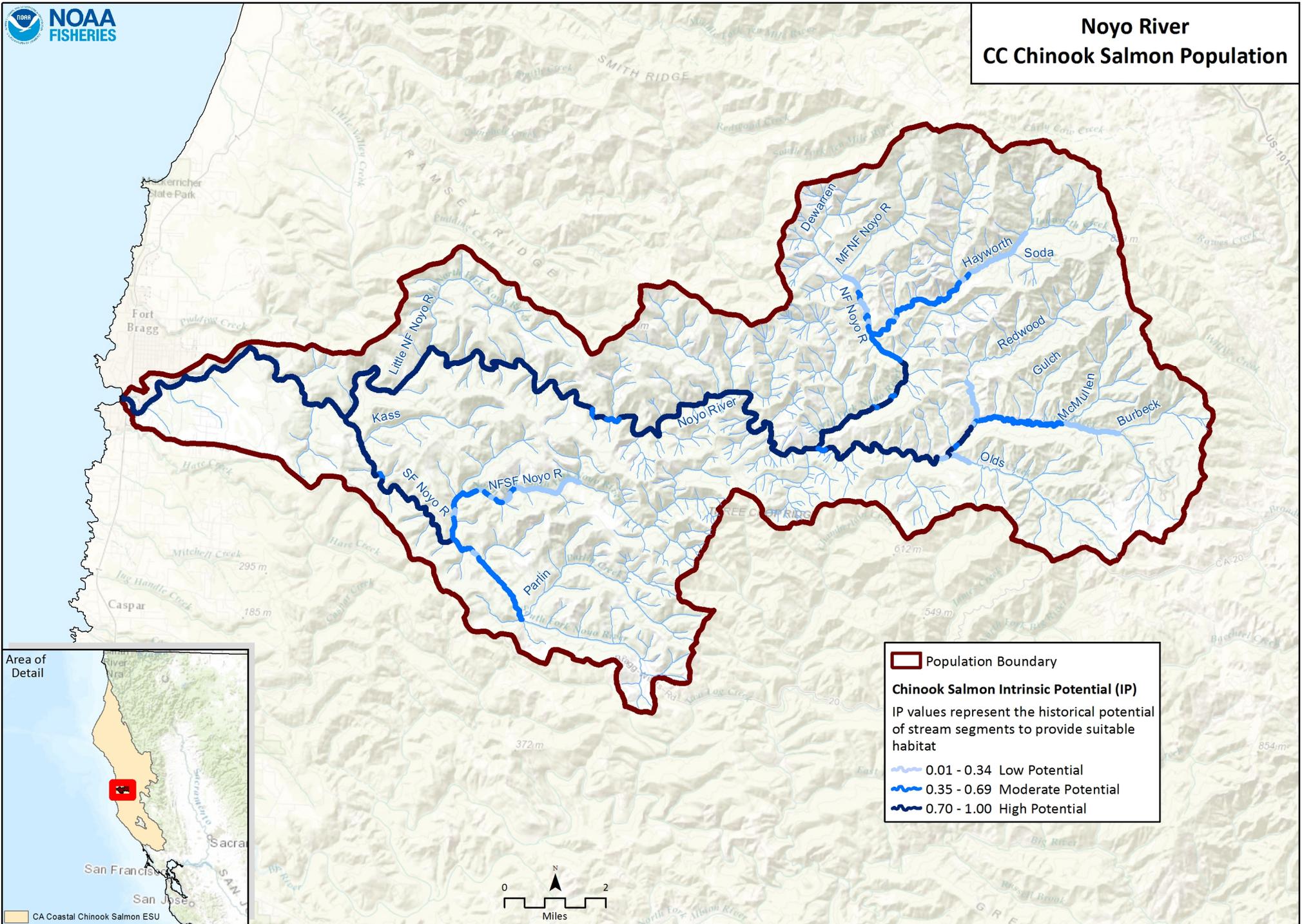
Estuaries are complex ecosystems where ocean and freshwater interface and are sources of significant biological productivity. Restoring limiting factors in the estuary will benefit steelhead production in the entire watershed and steelhead viability in the Lost Coast Diversity Stratum. Restoration actions should address habitat availability and suitability. However, the current function of Noyo estuary for providing suitable juvenile rearing conditions is unknown. Due to the importance of estuaries for juvenile rearing (Kjelson *et al.* 1982), a thorough evaluation of the habitat potential of the estuary to provide necessary attributes for salmonid survival should occur.

Literature Cited

- Albin D., and P. Law. 2006. Assessment of Environmental Effects on Salmonids, with Emphasis on Habitat Restoration for Coho Salmon, in the Mendocino Coast Hydrologic Unit. California Department of Fish and Game Central Coast Region, Fort Bragg California, April 2006. 66 pp.
- Bjorkstedt E.P., B.C. Spence, J. C. Garza, D. G. Hankin, W. E. Jones, J. J. Smith, and R. Macedo. 2005. An Analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the North-Central California Coast Recovery Domain. NOAA Technical memorandum NMFS, NOAA-TM-NMFS-SWFSC-382. Southwest Fisheries Science Center, Santa Cruz, California.
- EPA, Environmental Protection Agency. 1999. Noyo River total maximum daily load for sediment. U.S. Environmental Protection Agency Region IX, December 1999.
- Gallagher, S. P. 2000. Results of the winter 2000 steelhead (*Oncorhynchus mykiss*) spawning survey on the Noyo River, California, with comparison to some historic habitat

- information. California State Department of Fish and Game, Steelhead Research and Monitoring program, Fort Bragg, California, 1 December 2000. 28 pp.
- Gallagher S. P., and D. W. Wright. 2008. A regional approach to monitoring salmonid abundance trends: A pilot project for the application of the California Coastal Salmonid Monitoring Plan in coastal Mendocino County Year III. California Department of Fish and Game, Coastal Watershed Planning and Assessment Program, 1487 Sandy Prairie Court, Suite A, Fortuna, California 95540. 74 pp.
- Gallagher S. P., P. B. Adams, D. W. Wright, and B. W. Collins. 2010. Performance of spawner survey techniques at low abundance levels. *North American Journal of Fisheries Management* 30:1086-1097.
- GMA, Graham Matthews & Associates. 1999. Sediment Source Analysis and preliminary sediment budget for the Noyo River. Report to Tetra Tech, Inc. Fairfax, Virginia.
- Kjelson, M.J., P.F. Raquel, and F.W. Fisher. 1982. Life history of fall-run juvenile chinook salmon, *Oncorhynchus tshawytscha*, in the Sacramento—San Joaquin estuary, California. Pages 393—411 in V. S. Kennedy, ed., *Estuarine comparisons*. Academic Press, New York.
- Spence B. C., E. P. Bjorkstedt, J.C. Garza, J.J. Smith, D.G. Hankin. D. Fuller, W.E Jones, R. Macedo, T. H. Jones, E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast Recovery Domain. NOAA Technical memorandum NMFS, NOAA-TM-NMFS-SWFSC-423. Southwest Fisheries Science Center, Santa Cruz, California.

Noyo River CC Chinook Salmon Population



Noyo River CAP Viability Results

#	Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Measurement	Current Rating
1	Adults	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	<50% of streams/ IP-Km (>6 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>6 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>6 Key Pieces/100 meters)	>90% of streams/ IP-Km (>6 Key Pieces/100 meters)	<50% of streams/ IP-km (>6 Key Pieces/100 meters)	Poor
			Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	<50% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	50% to 74% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	75% to 90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	>90% of streams/ IP-Km (>1.3 Key Pieces/100 meters)	<50% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Poor
			Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>20% average staging pool frequency)	51% to 74% of streams/ IP-Km (>20% average staging pool frequency)	75% to 89% of streams/ IP-Km (>20% average staging pool frequency)	>90% of streams/ IP-Km (>20% average staging pool frequency)	50% of streams/ IP-km (>20% average staging pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	<50% of streams/ IP-km (>40% Pools; >20% Riffles)	Poor
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score <35	Very Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	47% Class 5 & 6 across IP-km	Fair

			Sediment	Quantity & Distribution of Spawning Gravels	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	75% of IP-km to 90% of IP-km	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Good
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Density	<1 spawners per IP-Km	1-20 Spawners per IP-Km	20-40 Spawners per IP-Km (e.g., Low Risk Extinction Criteria)		<1 spawners per IP-km	Poor
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor
2	Eggs	Condition	Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Redd Scour	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 51-75	Fair
			Sediment	Gravel Quality (Bulk)	>17% (0.85mm) and >30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	12-14% (0.85mm) and <30% (6.4mm)	<12% (0.85mm) and <30% (6.4mm)	15-17% (0.85mm) and <30% (6.4mm)	Fair
			Sediment	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	37% streams/ 59% IP-km (>50% stream average scores of 1 & 2)	Fair

3	Pre Smolt	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>40% average primary pool frequency)	51% to 74% of streams/ IP-Km (>40% average primary pool frequency)	75% to 89% of streams/ IP-Km (>40% average primary pool frequency)	>90% of streams/ IP-Km (>40% average primary pool frequency)	11% streams/ 64 % IP-km (>40% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>40% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>40% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>40% Pools; >20% Riffles)	>90% of streams/ IP-Km (>40% Pools; >20% Riffles)	63% streams 90% IP-km (>40% Pools; >20% Riffles)	Good
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-Km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP-km	Very Good
			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Riparian Vegetation	Tree Diameter (North of SF Bay)	≤39% Class 5 & 6 across IP-km	40 - 54% Class 5 & 6 across IP-km	55 - 69% Class 5 & 6 across IP-km	>69% Class 5 & 6 across IP-km	47% Class 5 & 6 across IP-km	Fair

			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	37% streams/ 59% IP-km (>50% stream average scores of 1 & 2)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined		
			Water Quality	Temperature (MWMT)	<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	>90% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	75 to 89% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
		Size	Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	<50% of Historical Range	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired but functioning	Fair
			Habitat Complexity	Shelter Rating	<50% of streams/ IP-Km (>80 stream average)	50% to 74% of streams/ IP-Km (>80 stream average)	75% to 90% of streams/ IP-Km (>80 stream average)	>90% of streams/ IP-Km (>80 stream average)	<50% of streams/ IP-km (>80 stream average)	Poor
			Hydrology	Flow Conditions (Instantaneous Condition)	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35		
			Hydrology	Number, Condition and/or Magnitude of Diversions	>5 Diversions/10 IP km	1.1 - 5 Diversions/10 IP km	0.01 - 1 Diversions/10 IP km	0 Diversions	0 Diversions/10 IP-km	Very Good

			Hydrology	Passage Flows	NMFS Flow Protocol: Risk Factor Score >75	NMFS Flow Protocol: Risk Factor Score 51-75	NMFS Flow Protocol: Risk Factor Score 35-50	NMFS Flow Protocol: Risk Factor Score <35	NMFS Flow Protocol: Risk Factor Score 35-50	Good
			Passage/Migration	Passage at Mouth or Confluence	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Passage/Migration	Physical Barriers	<50% of IP-Km or <16 IP-Km accessible*	50% of IP-Km to 74% of IP-km	75% of IP-Km to 90% of IP-km	>90% of IP-km	>90% of IP-km	Very Good
			Sediment (Food Productivity)	Gravel Quality (Embeddedness)	<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)	50% to 74% of streams/ IP-Km (>50% stream average scores of 1 & 2)	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	>90% of streams/ IP-Km (>50% stream average scores of 1 & 2)	37% streams/ 59% IP-km (>50% stream average scores of 1 & 2)	Fair
			Smoltification	Temperature	<50% IP-Km (>6 and <14 C)	50-74% IP-Km (>6 and <14 C)	75-90% IP-Km (>6 and <14 C)	>90% IP-Km (>6 and <14 C)	50-74% IP-km (>6 and <14 C)	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	50-80% Response Reach Connectivity	Fair
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	Sublethal or Chronic	Fair
			Water Quality	Turbidity	<50% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-Km maintains severity score of 3 or lower	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower	>90% of streams/ IP-Km maintains severity score of 3 or lower	50% to 74% of streams/ IP-km maintains severity score of 3 or lower	Fair
6	Watershed Processes	Size	Viability	Abundance	Smolt abundance which produces high risk spawner density per Spence (2008)	Smolt abundance which produces moderate risk spawner density per Spence (2008)	Smolt abundance to produce low risk spawner density per Spence (2008)			
		Landscape Context	Hydrology	Impervious Surfaces	>10% of Watershed in Impervious Surfaces	7-10% of Watershed in Impervious Surfaces	3-6% of Watershed in Impervious Surfaces	<3% of Watershed in Impervious Surfaces	0.251% of Watershed in Impervious Surfaces	Very Good

		Landscape Patterns	Agriculture	>30% of Watershed in Agriculture	20-30% of Watershed in Agriculture	10-19% of Watershed in Agriculture	<10% of Watershed in Agriculture	0.018% of Watershed in Agriculture	Very Good
		Landscape Patterns	Timber Harvest	>35% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	25-15% of Watershed in Timber Harvest	<15% of Watershed in Timber Harvest	26-35% of Watershed in Timber Harvest	Fair
		Landscape Patterns	Urbanization	>20% of watershed >1 unit/20 acres	12-20% of watershed >1 unit/20 acres	8-11% of watershed >1 unit/20 acres	<8% of watershed >1 unit/20 acres	2% of Watershed >1 unit/20 acres	Very Good
		Riparian Vegetation	Species Composition	<25% Intact Historical Species Composition	25-50% Intact Historical Species Composition	51-74% Intact Historical Species Composition	>75% Intact Historical Species Composition	25-50% Intact Historical Species Composition	Fair
		Sediment Transport	Road Density	>3 Miles/Square Mile	2.5 to 3 Miles/Square Mile	1.6 to 2.4 Miles/Square Mile	<1.6 Miles/Square Mile	7.2 Miles/Square Mile	Poor
		Sediment Transport	Streamside Road Density (100 m)	>1 Miles/Square Mile	0.5 to 1 Miles/Square Mile	0.1 to 0.4 Miles/Square Mile	<0.1 Miles/Square Mile	2.3 Miles/Square Mile	Poor

Noyo River CAP Viability Results

Threats Across Targets		Adults	Eggs	Pre Smolt	Smolts	Watershed Processes	Overall Threat Rank
Project-specific-threats		1	2	3	5	6	
1	Agriculture			Low			Low
2	Channel Modification	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition						
4	Hatcheries and Aquaculture						
5	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low
6	Fishing and Collecting	Medium					Low
7	Livestock Farming and Ranching						
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	Medium
9	Mining						
10	Recreational Areas and Activities					Low	Low
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Low	Medium	Medium	Low	High	Medium
13	Severe Weather Patterns	Medium	Medium	Medium	Low		Medium
14	Water Diversion and Impoundments	Low		Low	Low		Low
Threat Status for Targets and Project		Medium	Medium	Medium	Low	Medium	Medium

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
NR-CCCh-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for Noyo River estuary.	3	5	California Coastal Conservancy, CDFW, County of Mendocino, NMFS	20.00					20	
NR-CCCh-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
NR-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Delineate unconfined reaches possessing or having potential for winter rearing habitat restoration.	2	3	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners	10.00					10	Rough estimate for consultant to use existing data and conduct some ground truthing.
NR-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners						0	Action is considered In-Kind
NR-CCCh-2.1.1.3	Action Step	Floodplain Connectivity	Focus off-channel restoration actions in the lower mainstem Noyo River and areas and areas with high IP-km values (> 0.7).	2	10	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	94.00	94.00				188	Cost based on treating 5 miles, with 1 project/mile in high IP, at a rate of \$37,607/mile.
NR-CCCh-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-3.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	60	CalFire, Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners						TBD	Cost difficult to determine based on landowner participation. Estimate for off-channel storage is \$5,000/station.
NR-CCCh-3.1.1.2	Action Step	Hydrology	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	1	60	Campbell Timberland Management, CDFW, Jackson Demonstration State Forest, Private Landowners, SWRCB						0	Need to work with private and large industrial timberland owners to develop water storage for summer needs. Action is considered In-Kind
NR-CCCh-3.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	20	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners						TBD	Cost for incentives will vary depending on fair market value and landowner participation.
NR-CCCh-3.1.1.4	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the City of Fort Bragg and private landowners in the upper watershed to reduce diversion during the low flow summer period.	3	20	City of Fort Bragg, County of Mendocino, NMFS, SWRCB						0	Action is considered In-Kind
NR-CCCh-3.2	Objective	Hydrology	Address the inadequacy of existing regulatory mechanisms										
NR-CCCh-3.2.1	Recovery Action	Hydrology	Improve flow conditions										
NR-CCCh-3.2.1.1	Action Step	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	5	CDFW, NMFS, SWRCB	65.00					65	Cost for hydrologic model estimated at \$65,084/project.
NR-CCCh-3.2.1.2	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	3	5	CDFW, NMFS, NMFS OLE, SWRCB						0	The cost of this strategy is difficult to estimate at this time. Investigation will likely include CDFW/NMFS biologists and enforcement officers, as well as SWRCB. Action is considered In-Kind
NR-CCCh-3.2.1.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of salmonids. Encourage SWRCB deny additional water diversions from the Noyo River watershed.	3	10	CDFW, NMFS, RWQCB, SWRCB						0	Resources to promote this strategy will likely be addressed by NMFS/CDFW/RWQCB staff. Difficult to estimate the amount of time required by water rights staff at these agencies at this time. Action is considered In-Kind

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-3.2.1.4	Action Step	Hydrology	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of salmonids and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004). □	3	60	Campbell Timberland Management, CDFW, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners						0	Action is considered In-Kind
NR-CCCh-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
NR-CCCh-5.1.1.1	Action Step	Passage	Assess and restore passage at barriers associated with the California Western Railroad.	2	10	Cal Western Railroad, CDFW, Mendocino Redwood Company	362.00	362.00				724	Cost based on treating 1 barrier at a rate of \$723,858/unit.
NR-CCCh-5.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	10	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners						0	Action is considered In-Kind
NR-CCCh-5.1.1.3	Action Step	Passage	Restore passage in high priority areas of the Noyo River Watershed as identified in existing fish passage databases.	2	10	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners						TBD	
NR-CCCh-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-6.1.1.1	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historic salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth.	3	50	Cal Western Railroad, CalFire, California Coastal Conservancy, California Department of Mines and Geology, Campbell Timberland Management, CDFW, City of Fort Bragg, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USACE						0	Action is considered In-Kind
NR-CCCh-6.1.1.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	60	Cal Western Railroad, CalFire, California Coastal Conservancy, California Department of Mines and Geology, Campbell Timberland Management, CDFW, City of Fort Bragg, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USACE						0	There will be no cost when leaving remaining instream structures in place. Action is considered In-Kind

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-6.1.1.3	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information, where germane, from MRC Noyo Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFW stream habitat data to help determine reaches for LWD placement. High IP areas of the South Fork Noyo, Little North Fork Noyo and Redwood Creek are priorities for restoration of LWD.	1	10	Cal Western Railroad, CalFire, California Coastal Conservancy, Campbell Timberland Management, CDFW, City of Fort Bragg, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, NOAA RC, Pacific States Marine Fisheries Commission, Private Landowners, RWQCB, Trout Unlimited	65.00	65.00				130	Projects such as this are directly aimed at improving long-term survival for all freshwater life stages of salmonids. Cost is based on treating 5 miles, assuming 50% of high IP, at a rate of \$26,000/mile. If ELJ are used, total cost would be \$505,600.
NR-CCCh-6.1.1.4	Action Step	Habitat Complexity	Work with the railroad (California Western Railroad) to stop removal of LWD from the Noyo River.	1	10	Cal Western Railroad, CDFW, NMFS, NOAA RC						0	Cost of educating the railroad regarding the importance of large woody debris and their CDFW 1600 program is expected to be part of conducting business. Action is considered In-Kind
NR-CCCh-6.1.1.5	Action Step	Habitat Complexity	Develop and implement LWD projects in the Noyo River watershed using guidance from Albin (2006), Noyo River Watershed Enhancement Plan, or other credible watershed assessments.	2	10	Cal Western Railroad, CDFW, NMFS, NOAA RC						0	Cost accounted for in install or enhance existing LWD, boulders or other instream features.
NR-CCCh-6.1.1.6	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	60	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners						0	Action is considered In-Kind
NR-CCCh-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-7.1.1	Recovery Action	Riparian	Improve canopy cover										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-7.1.1.1	Action Step	Riparian	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners							Costs will vary depending on methods implemented and extent of rehabilitation.
NR-CCCh-7.1.2	Recovery Action	Riparian	Improve tree diameter										
NR-CCCh-7.1.2.1	Action Step	Riparian	Conserve and manage forestlands for older forest stages.	2	60	CalFire, California Coastal Conservancy, Campbell Timberland Management, CDFW, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners						0	As most of the land is used for forest management, most of this cost will be absorbed as part of on going forestry practices. Additional cost may be incurred across the areas of the watershed where industrial land management actions occur. Action is considered In-Kind
NR-CCCh-7.1.2.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian no harvest buffers.	2	60	CalFire, California Coastal Conservancy, Campbell Timberland Management, CDFW, Mendocino Redwood Company, NMFS, NOAA RC, Private Landowners, Trout Unlimited						0	As most of the land is used for forest management, most of this cost will be absorbed as part of on going forestry practices. Cost of easements cannot be made without specific information. Action is considered In-Kind
NR-CCCh-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
NR-CCCh-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in the MRC Noyo River Watershed Analysis or the Jackson Demonstration State Forest Road Management Plan.	1	5	CalFire, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners						TBD	Cost difficult to estimate because assessments for the magnitude of the problem were not available. Additionally, many sediment sources in high priority watersheds have been addressed, often through the timber harvest process and these costs should be considered an ongoing operation expense.

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-8.1.1.2	Action Step	Sediment	NMFS and other landowners will work with RCD or NRCS to encourage sediment reduction assessments.	2	10	CalFire, Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, RCD						0	Since majority of watershed is owned by private timber companies, much of the road network has likely been assessed. Action is considered In-Kind
NR-CCCh-8.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CalFire, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners	250.00	250.00	250.00	250.00	250.00	3,000	This infrastructure is likely present in many of the Noyo subwatersheds. Additional sites may be installed as part of the timber harvest plan process and the cost for construction will likely be absorbed on a harvest plan by harvest plan basis. Ongoing maintenance will likely occur as part of yearly evaluation prior to the winter period. Maintenance costs are estimated at \$50,000/yr.
NR-CCCh-8.1.1.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period. □	2	2	CalFire, CDFW, Mendocino County Department of Public Works, NMFS							Cost is likely to be low, since agency staff time will likely cover much of the work.
NR-CCCh-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-10.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
NR-CCCh-10.1.1.1	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	20	Hawthorne Timber Co., Mendocino Redwood Company, NOAA RC						TBD	Cost dependent upon fair market value, landowner participation, and amount of habitat needed for recovery of species.
NR-CCCh-10.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
NR-CCCh-10.1.2.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Haysheh Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	40	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners						TBD	Cost accounted for in riparian recovery actions.

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-10.1.2.2	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.	3	30	CalFire, Campbell Timberland Management, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners						0	Cost of this action step is likely covered through future THPs in the watershed. Action is considered In-Kind
NR-CCCh-10.1.2.3	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	2	20	Campbell Timberland Management, CDFW, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NOAA RC, NRCS, Private Landowners						0	Action is considered In-Kind
NR-CCCh-10.1.2.4	Action Step	Water Quality	Work with landowners to purchase easements on water rights to encourage the maintenance of surface flows.	3	20	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, SWRCB						TBD	Cost will depend upon landowner willingness and fair market value.
NR-CCCh-10.1.2.5	Action Step	Water Quality	See hydrology, riparian, and temperature sections										
NR-CCCh-11.1	Objective	Viability	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure, and diversity										
NR-CCCh-11.1.1.1	Action Step	Viability	Continue and improve upon monitoring activities to determine the population status of adult and smolt salmonids in the watershed and its tributaries.	3	20	Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-11.1.1.2	Action Step	Viability	Promote development of a life cycle station (Gallagher and Gallagher 2005). A likely location would be at the former egg taking station located on the South Fork Noyo River in the Jackson Demonstration State Forest.	2	5	Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, Private Landowners						TBD	Cost accounted for in the Monitoring Chapter.
NR-CCCh-11.1.1.3	Action Step	Viability	Continue juvenile monitoring efforts initiated by Burns (1972) and continued by Valentine and Jamison (CDFW 1992) and Georgia-Pacific Corp. and Campbell Timberland Management (1994-1998) in Little North Fork Noyo River.	2	30	Campbell Timberland Management, CDFW, Mendocino Redwood Company, Private Landowners							Cost accounted for in the Monitoring Chapter.
NR-CCCh-11.1.1.4	Action Step	Viability	Determine the need for a conservation hatchery/supplementation/augmentation program.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.5	Action Step	Viability	Identify if the population is at short-term or immediate risk of extinction.	2	5	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.6	Action Step	Viability	Identify how a conservation hatchery/supplementation/ augmentation program will complement the overall recovery effort.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.7	Action Step	Viability	Identify the biological or DPS significance of the subject population.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.8	Action Step	Viability	Identify population viability goals and the expectations of a conservation hatchery/supplementation/augmentation program.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.9	Action Step	Viability	Investigate the current population dynamics and viability status.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.10	Action Step	Viability	Investigate the current status of the population genetic diversity.	2	10	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-11.1.1.11	Action Step	Viability	If determined necessary, identify an out-of-basin source population that could be used to start a population augmentation/supplementation/broodstock program.	2	20	CDFW, NMFS						0	Action is considered In-Kind
NR-CCCh-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
NR-CCCh-19.1.1.1	Action Step	Logging	Complete comprehensive assessment/implementation of erosion control measures in the entire North Fork River basin (CDFG 2004).	2	5	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NOAA RC, Trout Unlimited	30.00					30	

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-19.1.1.2	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, and disconnected from the stream network as appropriate.	2	40	Campbell Timberland Management, CDFW, Mendocino Redwood Company, NMFS, NOAA RC, Private Consultants, Private Landowners						0	Action is considered In-Kind
NR-CCCh-19.1.1.3	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	1	10	CalFire, CDFW, Mendocino Redwood Company, Private Consultants, Private Landowners, Trout Unlimited						0	Action is considered In-Kind
NR-CCCh-19.1.1.4	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	Board of Forestry, CalFire, CDFW, Mendocino Redwood Company, NMFS, Private Consultants						0	Action is considered In-Kind
NR-CCCh-19.1.1.5	Action Step	Logging	Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of salmonids.	3	20	Board of Forestry, CalFire, CDFW, Mendocino Redwood Company, NMFS, Private Consultants						0	Action is considered In-Kind
NR-CCCh-19.1.1.6	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	3	20	CDFW						0	Similar existing programs could be modified and implemented at minimal cost. Action is considered In-Kind
NR-CCCh-19.1.1.7	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFW Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	3	5	CalFire, Campbell Timberland Management, CDFW, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS						0	The cost in considering development of the above mentioned plan is unlikely to cost much. Action is considered In-Kind
NR-CCCh-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
NR-CCCh-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas within the Noyo River watershed.	1	60	CalFire, CDFW, Mendocino County, NMFS, RWQCB						0	Discouraging incompatible land uses can likely be done through existing regulatory channels utilizing staff time. Action is considered In-Kind
NR-CCCh-19.2.1.2	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency of operations within salmonid areas.	2	40	Board of Forestry, CalFire, Mendocino Redwood Company, NMFS, Private Consultants						0	Action is considered In-Kind
NR-CCCh-19.2.1.3	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, Campbell Timberland Management, NMFS, Private Consultants, Private Landowners						0	Action is considered In-Kind
NR-CCCh-19.2.1.4	Action Step	Logging	Provide information to BOF regarding salmonid priorities and recommend upgrading relevant forest practices.	2	60	CalFire, Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						0	Similar existing programs could be modified and implemented at minimal cost. Action is considered In-Kind
NR-CCCh-19.2.1.5	Action Step	Logging	The priorities in this recovery plan should serve as a guide for independent Forest Certification.	2	100	CalFire, Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners							
NR-CCCh-19.2.1.6	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through Section 10(a)(1)(B).	3	5	NMFS	30.00					30	The cost in considering development of the above mentioned plan is unlikely to cost much.
NR-CCCh-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
NR-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	5	Campbell Timberland Management, Mendocino Redwood Company, NMFS, Private Consultants, Private Landowners, Trout Unlimited	50.00					50	
NR-CCCh-23.1.1.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	2	20	CalTrans, Campbell Timberland Management, CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind
NR-CCCh-23.1.1.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, Campbell Timberland Management, CDFW, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind
NR-CCCh-23.1.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	10	Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	102.50	102.50				205	Cost for road inventory estimated at \$927/mile. Assume 25% of road network inventoried per year.
NR-CCCh-23.1.1.5	Action Step	Roads/Railroads	Encourage County of Mendocino to address and adequately maintain the Sherwood Ridge Road. Encourage County of Mendocino to completely close and monitor gates and barriers during the winter period.	2	10	Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						0	This likely already exists for large timberland owners in the basin. Action is considered In-Kind

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-23.1.1.6	Action Step	Roads/Railroads	Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads (Sommarstrom et al., 2002).	1	20	Mendocino County Department of Public Works, NOAA RC, Private Landowners						0	Work with Mendocino County DOT to develop cost estimate for BMP cost in Noyo River watershed. Action is considered In-Kind
NR-CCCh-23.1.1.7	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in high priority areas should be considered an extremely high priority for funding (e.g., PCSRF).	1	10	Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	500	500				1,000	Based on 100 miles od upgrades and decommissioning.
NR-CCCh-23.1.1.8	Action Step	Roads/Railroads	Fully implement the Noyo River TMDL.	3	30	Campbell Timberland Management, CDFW, Mendocino Redwood Company, Private Landowners, RWQCB						0	Action is considered In-Kind
NR-CCCh-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										
NR-CCCh-23.1.2.1	Action Step	Roads/Railroads	Continue education of County road engineers, timber company, and railroad maintenance staff regarding watershed processes and the adverse effects of improper road/railroad construction and maintenance to salmonids and their habitats.	2	60	CalFire, Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind
NR-CCCh-23.1.2.2	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	3	10	CalTrans, Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind
NR-CCCh-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	1	5	CalFire, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners							Difficult to assess without further information.
NR-CCCh-23.1.3.2	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	60	Cal Western Railroad, California Department of Mines and Geology, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners						TBD	Costs may vary depending on number of road crossings. Road assessment should identify key stream crossings.
NR-CCCh-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanism										
NR-CCCh-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize increased landscape disturbance										
NR-CCCh-23.2.1.1	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, Campbell Timberland Management, CDFW, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners						0	Action is considered In-Kind
NR-CCCh-23.2.1.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Campbell Timberland Management, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind

Noyo River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
NR-CCCh-23.2.1.3	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	60	Cal Western Railroad, CalFire, California Department of Mines and Geology, Campbell Timberland Management, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB						TBD	Costs may vary depending on number of road crossings.
NR-CCCh-23.2.1.4	Action Step	Roads/Railroads	Ensure all existing and new road and railway crossings minimize potential sediment delivery to the stream environment and allow upstream and downstream passage of adult and juvenile salmonids.	2	20	Cal Western Railroad, CDFW, NMFS, NOAA RC						0	Action is considered In-Kind
NR-CCCh-24.1	Objective	Severe Weather Patterns	Address the inadequacy of existing regulatory mechanisms										
NR-CCCh-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
NR-CCCh-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for the mainstem Noyo River impacted by water diversions for the City of Fort Bragg.	3	10	CDFW, NMFS, Private Landowners, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at \$63,005/project.
NR-CCCh-24.1.1.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	3	60	CDFW, NMFS, Private Landowners, SWRCB						TBD	This action is predicated on above actions. Cost is expected to be minimal due to relatively few diversions in the watershed.
NR-CCCh-24.1.1.3	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows during drought years.	3	10	Campbell Timberland Management, City of Fort Bragg, Mendocino Redwood Company, Private Consultants, Private Landowners						TBD	Cost depends upon landowner participation.

CC Chinook Salmon ESU Rapid Assessment Profile: North-Central Coastal Diversity Stratum Populations

Ten Mile River

- Role within ESU: Independent Population
- Spawner Abundance Target: 401– 804 adults
- Current Intrinsic Potential: 67.2 IP-km

Albion River

- Role within ESU: Dependent Population
- Spawner Abundance Target: 104 – 209 adults
- Current Intrinsic Potential: 17.6 IP-km

For information regarding NC steelhead and CCC coho salmon for this watershed, please see the NC steelhead volume of this recovery plan and the CCC coho salmon recovery plan (<http://www.westcoast.fisheries.noaa.gov/>).

Chinook Salmon Abundance and Distribution

Historically, the Ten Mile River Basin was known to have productive salmonid fishery resources. While overall fish numbers have diminished, the basin still maintains important runs of CCC coho salmon and CC Chinook salmon and NC steelhead (CWPAP 2013). Surveys of juveniles from the early 1990s through 2000 suggest NC steelhead are the most numerous salmonid species in the watershed, and CC Chinook salmon are present in very low numbers (KRIS 2013).

Starting in 1989, spawning surveys were sporadically conducted in the Ten Mile River (Salmon Trollers Marketing Association 1990, Maahs and Gilleard 1994, Maahs 1996, and Maahs 1997). These surveys focused on documenting CC Chinook salmon and CCC coho salmon presence and abundance, and were not focused at estimating NC steelhead abundance. The surveys documented very low numbers of CC Chinook salmon, mainly via carcass surveys. Spence *et al.* noted over the last 10-15 years, there have been sporadic reports of CC Chinook salmon in the Ten Mile River (2008). They also noted that the lack of reliable information on abundance in the Ten Mile River (and five other coastal watersheds between the Russian River and the Mattole River historically supporting CC Chinook salmon) suggests CC Chinook salmon were extirpated from this Diversity Stratum (Spence *et al.* 2008). However, more recent sampling in

2013 documented many young of the year CC Chinook salmon in outmigrant traps, and CC Chinook salmon redds in the watershed (Wright, personal communication, 2013)(Photo 1).



Photo 1. Juvenile CC Chinook salmon captured on the South Fork Ten Mile River in Spring 2013. *Photo Courtesy: Campbell Timberland Management.*

The current salmonid resources of the Albion Basin include CCC coho salmon and winter-run NC steelhead and incidental reports and anecdotal information also record CC Chinook salmon and pink salmon (*Oncorhynchus gorbuscha*). The Albion River appears to have sustainable CCC coho salmon and NC steelhead populations due to the suitable fresh water temperatures, year-round open river mouth, and large estuary (CWPAP 2013). As a historically dependent population, the Albion River likely supported only small or sporadic populations of CC Chinook salmon. However, these smaller populations provide genetic material and protection from stochastic events and, therefore, contribute to overall ESU viability in addition to meeting connectivity and occupancy criteria necessary for recovery in the Diversity Stratum.

History of Land Use, Land Management and Current Resources

The Ten Mile River is located approximately eight miles north of Fort Bragg in Mendocino County and drains a forested, coastal watershed of approximately 120 square miles. Elevation in the watershed ranges from sea level to 3,205 feet. The watershed experiences a Mediterranean-type climate and is dominated by coastal conifer forests of redwood and Douglas-fir. The mouth of the river is semi-enclosed by a sandbar which forms a tidal estuary.

The Ten Mile watershed is largely defined by timber harvest, which began in the lower basin about 1870. Major portions of the watershed were harvested between the mid-1940s and the mid-1960s using tractor yarding, with its associated road, skid trails, log layouts, and landing construction. Second growth logging began in the 1960s and continues today using about a 60 year average rotation age. The Ten Mile River watershed is almost entirely privately owned, with Hawthorne Timber Company, LLC (managed by Campbell Timberland Management, LLC), the successor to Georgia-Pacific West, owning about 85 percent of the watershed. There are three small non-industrial timber owners and a handful of other residences within the watershed. The 2010 census estimated the human population in the watershed at about 191 people.

Numerous restoration projects have occurred in the Ten Mile River, including barrier modifications (generally culvert upgrades), upslope sediment remediation, and instream habitat enhancement. Until recently, most restoration actions were focused on reducing sediment input from upslope roads associated with ongoing timber management. In the past few years, Campbell Timberland Management has conducted, with funding through FRGP, significant effort to improve instream habitat complexity for salmonids through the addition of large woody material.

The EPA listed the Ten Mile River as having water quality impaired by sediment in 1998. The listing determined sediment was impairing the migration, spawning, reproduction and early development of CC Chinook salmon, and identified non-point source silviculture as the probable cause. Since then, the EPA has established a TMDL for the watershed (USEPA 2000).

The Albion River watershed is located in central Mendocino County and encompasses approximately 43 square miles. Most of the watershed is managed by the Mendocino Redwood Company. Its headwaters are located approximately 12 miles inland and reach an elevation of 600 feet. The Albion Basin also has a Mediterranean climate and is also dominated by conifers, primarily redwood, and Douglas fir. About 90 percent of the precipitation in this area falls

between October and April, with the highest average precipitation in January. Snowfall in this basin is very rare. The watershed has a large estuary with tidal influence extending as much as five miles upstream (Albion NCWAP 2004).

The EPA listed the Albion River as having water quality impaired by sediment in 2001 (USEPA 2001). The listing determined that sediment was impairing the migration, spawning, reproduction, and early development of CC Chinook salmon, and identified non-point source silviculture as the probable cause.

There are two post office towns in the Albion Basin: Comptche near the headwaters and Albion near the mouth. The total Albion Basin resident population in the year 2010 census was estimated at about 938 people.

Salmonid Viability and Habitat Conditions

Currently impaired conditions resulting directly or indirectly from human activities, are expected to continue until restored and/or the threat acting on these condition is abated. The majority of conditions evaluated for the Diversity Stratum rated as minor effects to most lifestages. Overall, the Ten Mile and Albion watersheds are subject to fewer conditions than many other watersheds in the Diversity Stratum due to a singular land use (timber harvest) and a general lack of urban or rural residential impacts.

The following discussion focuses on those conditions that rated as Poor or Fair to CC Chinook salmon life history stages (see North-Central Coastal Diversity Stratum Rapid Assessment). These were: Habitat Complexity: Percent Primary/Staging Pools and Pool/Riffle/Flatwater Ratios; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels; Viability: Density, Abundance and Spatial Structure; and Water Quality: Turbidity or Toxicity. Recovery strategies will focus on improving these conditions as well as those needed to ensure population viability and functioning watershed processes.

Habitat Complexity: Percent Primary Pools/Staging and Pool/Riffle/Flatwater Ratios

Complexity: Percent Primary Pools/Staging and Pool/Riffle/Flatwater Ratios is rated as Good for adults and smolts, but is rated as Fair for pre smolt lifestage. This indicates that this factor is potentially limiting for that lifestage. Of reaches sampled in the Ten Mile River and Albion River, data from CDFW habitat inventories indicate pool complexity and pool/riffle ratios are in generally poor condition. Threats that have caused, are causing, or may contribute to this condition include Logging, and Roads/Railroads.

Habitat Complexity: Large Wood and Shelter

Lack of habitat complexity in the form of wood and high levels of instream sediment is rated as Fair and is having a moderate adverse effect on the adult and pre smolt lifestages. The lack of instream complexity is likely the result of long term land uses related to timber harvest in both watersheds, particularly impacts associated with mechanized logging practices prior to the California Forest Practice Rules. Of reaches sampled in the Ten Mile River and Albion River, data from CDFW habitat inventories indicate large wood is lacking. However, since these surveys were conducted, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the Ten Mile River (South Fork, Clark Fork and North Fork)(Photo 2).



Photo 2. LWD on Ten Mile Creek. *Photo Courtesy: Campbell Timberland Management.*

To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future by Campbell Timberland Management (CTM) (Wright, personal communication, 2011). While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM) are not at the viability targets for these attributes. Threats that have caused, are causing, or may cause this condition to continue to impair CC Chinook salmon life history targets include Logging and Roads/Railroads.

In the Albion watershed, the Mendocino Redwood Company is also planning projects to improve habitat complexity by installing large wood through their HCP and FRGP funding.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Gravel quality and quantity is rated as Fair and has had a moderate adverse effect on the egg and pre smolt lifestages, and is potentially limiting for those lifestages. This factor is rated as Good and has only had a minor effect on the adult and smolt lifestages. These ratings reflect the generally high sediment loads in the Diversity Stratum. Threats that have caused, are causing, or may cause this condition to continue to impair CC Chinook salmon life history targets include the Logging and Roads/Railroads.

Viability: Density, Abundance and Spatial Structure

Viability: Density, Abundance and Spatial Structure are rated as Poor and have had major effects on the target lifestages. CC Chinook salmon populations are severely depressed across the Diversity Stratum, and are currently not viable. These very small populations are at high risk of extinction (Spence *et al.* 2008).

Water Quality: Turbidity or Toxicity

Water Quality: Turbidity or Toxicity is rated as Good and has only had a minor effect on pre smolts and smolts. High levels of instream sediment are having a moderate effect on the adult lifestage and rated as Fair. While some herbicides are used to control tan oak or other plant competitors, they are typically directly applied to cuts or stumps, and offer little risk of adverse impacts to the aquatic environment.

Threats

Most threats in this Diversity Stratum were rated as Very Good or Good and were negligible or minor contributors to the conditions. The following discussion focuses on those threats that rate as a primary (Poor) or secondary concern (Fair) (see North-Central Coastal Diversity Stratum Rapid Assessment). Recovery strategies will focus on ameliorating primary threats; however, some strategies may address other threat categories when the strategy is essential to recovery efforts. Two potentially increasing threats are timberland conversion to rural residential uses, and illegal cultivation of marijuana. The figures and tables that display data used in this analysis are provided in North-Central Coastal Diversity Stratum Rapid Assessment.

Population and Habitat Threats

Agriculture

Agriculture comprises less than 0.1 percent of the land acreage in the Diversity Stratum, and is rated as Very Good and is considered a negligible or minor contribution to the conditions. However, should native forests be converted through forestland conversions, to vineyards or other crops, many of the resulting impacts can disproportionately adversely affect salmonids and their habitat, especially the increase of sediment sources from bare slopes, removal of riparian vegetation and water diversion for irrigation.

As in many watersheds in California, illegal marijuana cultivation occurs in some areas, and has the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. It is unknown to what degree marijuana cultivation may be impacting listed salmonid populations in this Diversity Stratum; however, it is likely to increase the adverse impacts associated with agriculture to some degree.

Fire, Fuel Management and Fire Suppression

This threat is rated as Very Good and is considered a negligible or minor contribution to all but one of the conditions. It is considered to be a moderate contributor to the condition of Water Quality: Turbidity or Toxicity and is rated as Fair due to the potential use of toxic fire retardant materials and increased rates of sediment input following runoff in response to winter rainfall. According to CalFire data, some areas in the Ten Mile River watershed have high fire hazard rating. A major fire, particularly if located in areas with a High erosion hazard rating, could result in major increases in fine sediment and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, increases in instream temperatures would likely result.

Livestock Farming and Ranching

There is little or no livestock, farming or ranching in this Diversity Stratum, and this threat is rated as Very Good and is considered a negligible or minor contribution to the conditions. The one exception is rated as Fair and is a moderate contribution to the condition of Estuary: Quality and Extent in the Ten Mile River estuary where cattle-grazing currently occurs.

Logging and Wood Harvesting

Timber harvest is rated as Fair and remains a moderate contributor to four conditions for CC Chinook salmon habitat in both the Ten Mile and Albion watersheds, but at diminished levels compared to historical practices. It is considered a moderate contributor to the conditions of

Habitat Complexity: Percent Primary/Staging Pools and Pool/Riffle/Flatwater; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels; and Water Quality: Turbidity or Toxicity. Even with application of new California Forest Practice Rules this threat is anticipated to continue into the foreseeable future.

Residential and Commercial Development

As noted above, as a result of extensive private land ownership, there is little if any development ongoing in the Diversity Stratum, and this threat is rated as Very Good and considered a negligible or minor contribution to the conditions. The one exception is rated as Fair and is a moderate contribution to the condition of Estuary: Quality and Extent. This development includes California Highway 1, a 22 acre campground and small boat harbor, and is illustrated in Photo 3.

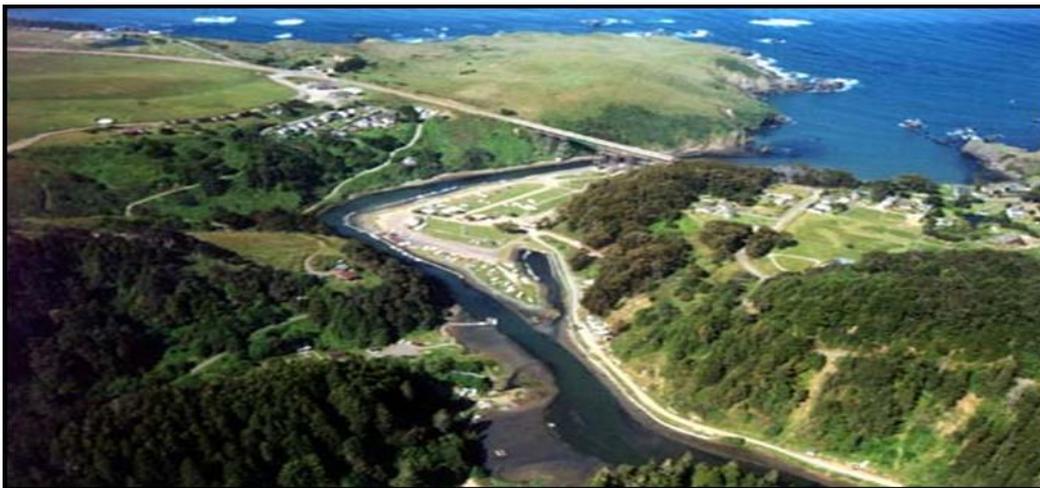


Photo 3. Development around the Albion River estuary. Photo provided by Friends of the Gualala River, photographer Rixanne Wehren, and is used with permission. All rights reserved.

Roads and Railroads

Roads are rated as Good and are a minor contributor to four conditions, and rated as Fair and are a moderate contributor to four others. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in the Diversity Stratum. Road densities are high throughout the watershed and are estimated for the Tem Mile River at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. In the Albion River, there is an estimated 7.7 miles of road per square mile of watershed area, and at 6.4 miles per square mile of riparian area. Many of these roads were poorly situated and

constructed¹, improperly maintained, and many have been abandoned rather than properly decommissioned. Both major landowners, CTM and the Mendocino Redwood Company have upgraded many roads, and conditions are improving, particularly along the mainstems in both watersheds and South Fork Albion River.

Severe Weather Patterns

The potential for severe weather to affect flows is rated as Fair and is considered a Medium threat to Hydrology: Redd Scour, and Hydrology: Baseflow and Passage Flows.

Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. This could contribute to Sediment: Gravel Quality and Distribution of Spawning Gravels. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting High risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat.

Fishing and Collecting

NMFS is aware of unsubstantiated reports regarding unauthorized fishing in the estuary, which may impact rearing juveniles during the summer period. Poaching of adults or smolts may further reduce the viability of the populations. This threat, however, is rated as Good and is a minor contributor to the condition.

Hatcheries and Aquaculture

No fish hatcheries currently operate within the Ten Mile or Albion watersheds. In the past the Salmonid Restoration Association operated a small NC steelhead hatchery in the Ten Mile watershed, near Vallejo Gulch. This operation was discontinued in approximately 2000 and the remaining infrastructure was removed about five years ago. As a result, this threat is rated as Very Good and considered a negligible contribution to the conditions.

Limiting Conditions, Lifestages, and Habitats

The adult, egg, and pre smolt lifestages are most limited by current conditions and future threats facing CC Chinook salmon in North-Central Coastal Diversity Stratum. The conditions most limiting include: Habitat Complexity: Percent Primary/Staging Pools and Pool/Riffle/Flatwater Ratios; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels; and Water Quality: Turbidity or Toxicity. The primary condition for adults, pre smolt and smolt lifestages is Viability: Density, Abundance

¹ The majority of these roads were constructed prior to the passing of the California Forest Practices Rules in 1973.

and Spatial Structure. The greatest threats to recovery in this Diversity Stratum result from Logging and Roads.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating conditions and threats identified as having moderate or major effects, as discussed above, although strategies that address other factors may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategies for the populations in this Stratum are discussed below with more detailed and site-specific recovery actions provided in North-Central Coastal Diversity Stratum Rapid Assessment.

Increase Survivorship at Every Lifestage

To achieve viability, particularly in the independent population of the Ten Mile River, increasing survival is critical. This goal will only be achieved with focused habitat restoration, sound management, and careful stewardship.

Habitat Complexity: Large Wood and Shelter

Many reaches of the Ten Mile and Albion watersheds would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with landowners in the floodplain to increase riparian buffer widths. Fencing and planting in the floodplains could result in major improvement to the lower reaches of the South Fork and mainstem Ten Mile River, and in the upper Albion River. As stated above, Campbell Timberland Management has initiated a program of LWD supplementation program to enhance habitat complexity. Continuation of this program will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones. In addition to directly contributing to habitat complexity, LWD and other habitat features such as boulders support development of complex pools, and improve pool/riffle ratios.

Address Upslope Sediment Sources to Improve Gravel Quality and Quantity

Active and abandoned logging roads and skid trails are located throughout the Diversity Stratum and likely contribute large volumes of sediment into the stream environment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Ongoing road work should include a component that closes and decommissions unnecessary and abandoned roads and skid trails to

effectuate lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority.

Literature Cited

- Ambrose J., D. Hines, and D. Lundby. 1996. Ten Mile River Watershed 1995 Instream Monitoring Results. Georgia-Pacific West, Inc. Fort Bragg, California. Available at: <http://www.krisweb.com/kristenmile/krisdb/html/ten.htm#htcfish>
- Ambrose, J., and D. Hines. 1997. Ten Mile River watershed 1996 Instream Monitoring Results. Georgia-Pacific West Inc. dba The Timber Company. Fort Bragg, California. Available at: <http://www.krisweb.com/kristenmile/krisdb/html/ten.htm#htcfish>
- Ambrose, J., and D. Hines. 1998. Ten Mile River watershed 1997 Instream Monitoring Results. Georgia-Pacific West Inc. dba The Timber Company. Fort Bragg, California. Available at: <http://www.krisweb.com/kristenmile/krisdb/html/ten.htm#htcfish>
- CWPAP (Coastal Watershed Planning and Assessment Program). Accessed July 9, 2013. <http://coastalwatersheds.ca.gov/Watersheds/tabid/55/Northcoast/tabid/56/TenMileRiver/tabid/729/Default.aspx>
- CWPAP. (Coastal Watershed Planning and Assessment Program). Accessed July 9, 2013. <http://coastalwatersheds.ca.gov/Watersheds/NorthCoast/Albion/AlbionOverview/tabid/58/Default.aspx>
- KRIS (Klamath River Information system). Accessed July 9, 2013. http://www.krisweb.com/kristenmile/krisdb/webbuilder/bw_c4.htm
- Maahs, M., and J. Gilleard. 1994. Anadromous Salmonid Resources of Mendocino County coastal and inland rivers 1990 - 1991 through 1991 - 1992: an evaluation of 36 rehabilitation efforts based on carcass recovery and spawning activity. Report to California Department of Fish & Game, Fishery Division, Fish Restoration Program, Contract F-9364, 66p.
- Maahs, M. 1996b. 1996 South Fork Ten Mile River and Little North Fork Noyo outmigrant trapping. Salmon Trollers Marketing Association, Inc. Report submitted to Humboldt County Resource Conservation District. 27p.
- Maahs, M. 1997. 1997 Outmigrant trapping, coho relocation and sculpin predation survey of the South Fork Ten Mile River. Prepared for Humboldt County Resource Conservation District. Salmon Trollers Marketing Association, Inc. Fort Bragg, California. 37 pp. without appendices.
- Salmon Trollers Marketing Association, I. 1990(?). Undated. Preliminary report for February 1990 - Georgia-Pacific Property, carcass surveys. 4 pp. Available at: www.krisweb.com/biblio/tenmile_stma_xxxx_1990.pdf

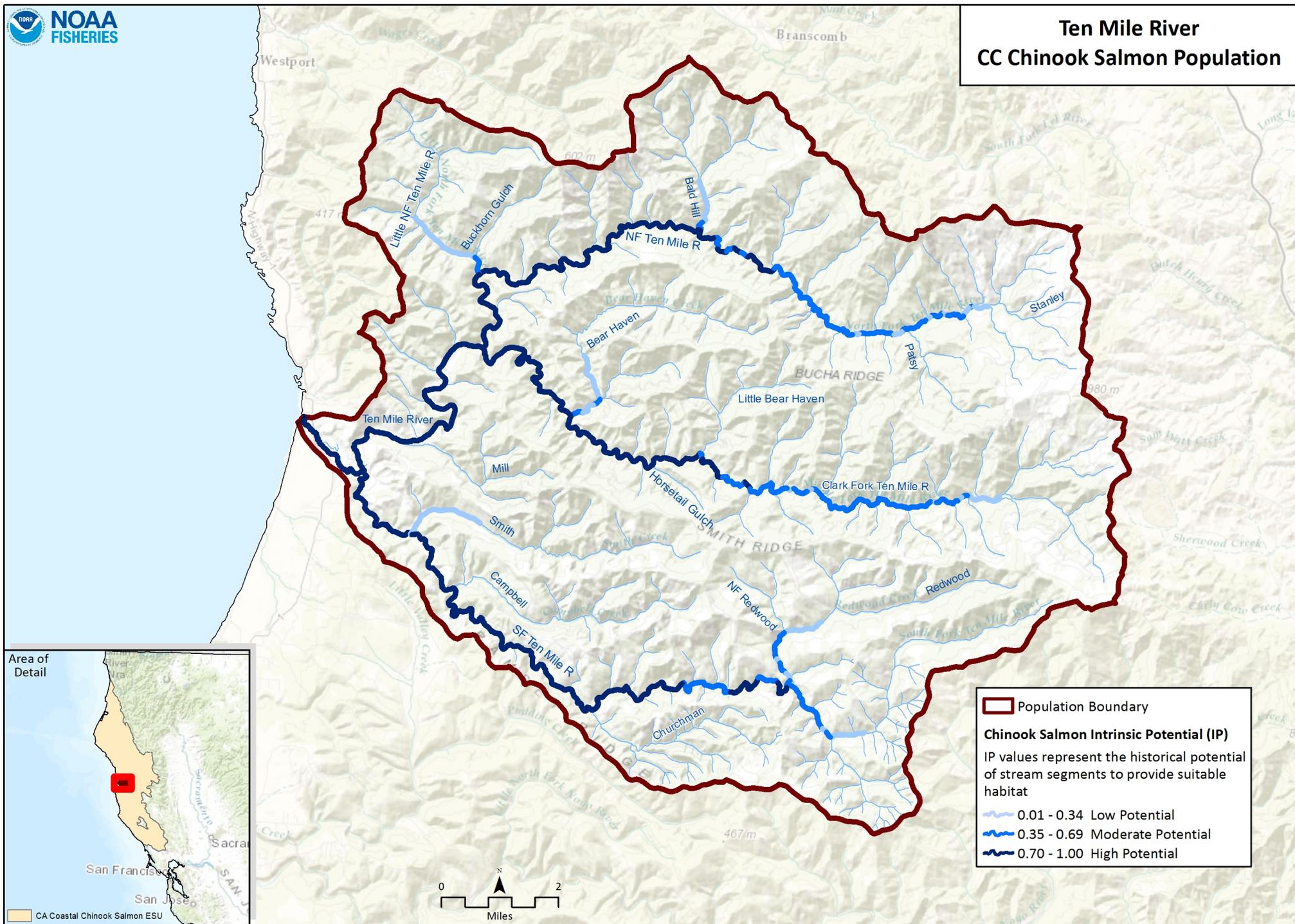
USEPA (U.S. Environmental Protection Agency). Ten Mile River Total Maximum Daily Load for Sediment. 2000. Available at: <http://www.epa.gov/region9/water/tmdl/tenmile/tenmile.pdf>

USEPA (U.S. Environmental Protection Agency). Albion River Total Maximum Daily Load for Sediment. 2001. Available at: <http://www.epa.gov/region9/water/tmdl/albion/albionfinaltmdl.pdf>

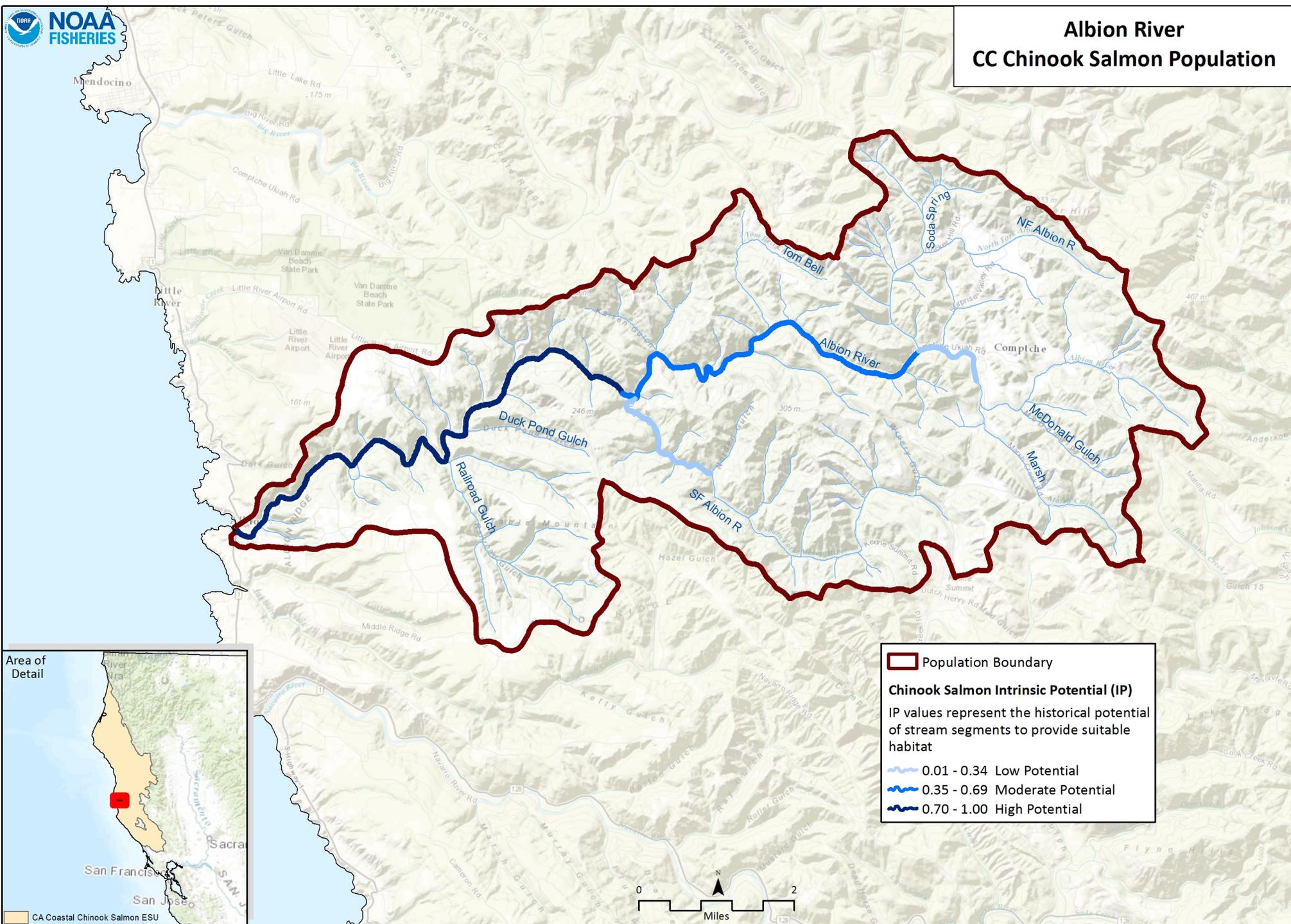
Wright, D. 2011. Campbell Timberland Management. Personal Communication to Jon Ambrose, NMFS.

Wright, D. May 1, 2013. Campbell Timberland Management. Personal Communication to Jon Ambrose, NMFS.

Ten Mile River CC Chinook Salmon Population



Albion River CC Chinook Salmon Population



CC Chinook Salmon ESU: North Central Coastal Diversity Stratum (Albion/ Ten Mile)

Habitat & Population Condition Scores By Life Stage: VG = Very Good G = Good F = Fair P = Poor		Chinook Salmon Life History Stages			
		Adults	Eggs	Pre-Smolt	Smolts
Stresses: Key Attribute: Indicators	Estuary: Quality & Extent	G		G	G
	Velocity Refuge: Floodplain Connectivity	G		G	G
	Hydrology: Redd Scour		G		
	Hydrology: Baseflow & Passage Flows	G	G	G	G
	Passage/Migration: Mouth or Confluence & Physical Barriers	G		VG	VG
	Habitat Complexity: Percent Primary/Staging Pools & Pool/Riffle/Flatwater Ratios	G		F	G
	Habitat Complexity: Large Wood & Shelter	F		F	G
	Sediment: Gravel Quality & Distribution of Spawning Gravels	G	F	F	G
	Viability: Density, Abundance & Spatial Structure	P		P	P
	Water Quality: Turbidity & Toxicity	F		G	G

CC Chinook Salmon ESU: North Central Coastal Diversity Stratum (Albion/ Ten Mile)

Threat Scores L: Low M: Medium H: High		Stresses									
		Estuary: Impaired Quality & Extent	Floodplain Connectivity: Impaired Quality & Extent	Hydrology: Gravel Scouring Events	Hydrology: Impaired Water Flow	Impaired Passage & Migration	Instream Habitat Complexity: Altered Pool Frequency and/or Pool/Riffle Ratios	Instream Habitat Complexity: Reduced Large Wood and/or Shelter	Instream Substrate/Food Productivity: Impaired Gravel Quality & Quantity	Reduced Density, Abundance & Diversity	Water Quality: Increased Turbidity or Toxicity
Threats - Sources of Stress	Agriculture	L	L	L		L	L	L	L		L
	Channel Modification	L	L	L	L	L	L	L	L		L
	Disease, Predation, and Competition	L	L			L	L	L		M	L
	Fire, Fuel Management, and Fire Suppression	L	L	L		L	L	L	L		M
	Livestock Farming and Ranching	L	L	L		L	L	L	L		L
	Logging and Wood Harvesting	L	L	L		L	M	M	M		M
	Mining	L	L	L		L	L	L	L		L
	Recreational Areas and Activities	L	L	L		L	L	L	L		L
	Residential and Commercial Development	L	L	L	L	L	L	L	L		L
	Roads and Railroads	L	L	L	L	L	M	L	M		M
	Severe Weather Patterns	L	L	L	L	L	L	L	L		L
	Water Diversions and Impoundments	L	L	L	L	L	L	L	L	L	L
	Fishing and Collecting									M	
Hatcheries and Aquaculture									L	L	

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-1.1.1	Recovery Action	Estuary	Increase the quality and extent of estuarine habitat										
TMR-CCCh-1.1.1.1	Action Step	Estuary	Initiate estuary study to evaluate limiting factors in Ten Mile River estuary.	3	5	CDFW, NOAA RC, RWQCB, The Nature Conservancy, Trout Unlimited	283.00					283	Estimate based on a three year study period and relative costs from other estuary studies. Development of a multi-disciplinary Technical Advisory Committee (TAC) to develop the scientific foundation for this study is recommended. The TAC should be familiar with other estuaries and estuary reaches within the Lost Coast Diversity Stratum as well as past and ongoing studies within the CCC ESU. Cost based on estuary use/residence timing at a cost of \$282,233.
TMR-CCCh-1.1.1.2	Action Step	Estuary	Where feasible, remove structures and modify practices that degrade or reduce the historical estuarine extent or functions to benefit Chinook salmon.	3	10	CDFW, NOAA RC, Private Landowners, The Nature Conservancy, Trout Unlimited						TBD	Ten Mile Estuary is relatively intact and likely has few structures that have significantly modified the historical tidal prism and feeding and transition habitat. Costs are difficult to determine until after an evaluation is conducted outlines the extent of the habitat impairment.
TMR-CCCh-1.1.1.3	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CDFW, Private Landowners, The Nature Conservancy	106.50	106.50				213	Targeting likely limiting factors such as over wintering and smolt transition habitats should be a high priority. Cost based on wetland restoration at a cost of \$213,307.
TMR-CCCh-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
TMR-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	5	CalFire, Campbell Timberland Management, CDFW, NOAA RC, Private Landowners	1029.00	1029.00	1029.00			3,088	These actions should initially target habitat in the lower portions of the three mainstems (North Fork, Clark Fork, and South Fork). Cost based on treating 8.3 miles (assume 1 project/mile in 25% High IP with 10 acres/mile treated) at a rate of \$37,200/acres.
TMR-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Existing beaver habitat should be protected, and issues related to flooding resolved without the removal of beaver habitat (e.g. flow reduction devices, etc.)	3	100	CalFire, Campbell Timberland Management, CDFW, Private Landowners						0	Action is considered In-Kind
TMR-CCCh-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD and shelters.										

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-6.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	5	Campbell Timberland Management, CDFW, Private Landowners, The Nature Conservancy	260.00					260	In addition to projects that increase large wood volumes in the three major subwatersheds and their tributaries attention should also be focused in the lower floodplain areas along the lower South Fork Ten Mile and areas below the Clark Fork/North Fork confluence. Projects designed to increase winter refuge habitat in these floodplain areas should be considered a high priority for salmonid habitat recovery. In the past few years, Campbell Timberland Management has conducted significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland has indicated that these efforts will continue into the near future. Cost based on treating 10 miles (assume 1 project/mile in 50% High IP) at a rate of \$26,000/mile. Additional features such as riparian vegetation and boulders will increase cost.
TMR-CCCh-6.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	1	10	Campbell Timberland Management, CDFW, Private Consultants, Private Landowners, The Nature Conservancy, Trout Unlimited						TBD	Campbell Timberlands has implemented numerous LWD projects at relatively low cost due their use of non-anchored material. This is significantly less expensive than engineered approaches. Data from CDFW habitat inventories indicate shelters throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were completed in the mid-1990's, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork using the Accelerated Recruitment approach. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future by Campbell Timberland Management. While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM) are not at the viability targets for these attributes.

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-6.1.1.3	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	1	100	CalFire, Campbell Timberland Management, CDFW, Private Landowners, RCD, RWQCB						0	To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In Ten Mile stream reaches where there is little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Ten Mile has been habitat typed and thus the stream reaches lacking wood can be readily identified. Projects will occur as part of ongoing timber harvest actions and have lower overall costs, resulting in significant savings compared to restoration projects occurring without timber management equipment already nearby. Installing large woody material into a stream deficient in large wood should be considered a top restoration priority. Action is considered In-Kind
TMR-CCCh-6.1.1.4	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CalFire, CDFW, Private Landowners, RWQCB, USACE						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-7.1.1	Recovery Action	Riparian	Improve tree diameter										
TMR-CCCh-7.1.1.1	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, Campbell Timberland Management, CDFW, Private Landowners	104.00	104.00	104.00	104.00		415	Most of these lands (inset floodplains and riparian corridors) are used for forest management and it is anticipated that most of this cost will be absorbed as part of on going forestry practices. Additional cost may be incurred in the lower watershed where other land management actions occur, including minimal farming and minimal grazing. Many of the areas historically used for agricultural purposes have been extensively cleared of all riparian vegetation. Targeting restoration in these areas may result in some lands no-longer being farmed for hay production, etc. Landowner outreach will likely be required in these areas. Cost based on treating 1 mile (assume 20 acres/mile treated in 5% High IP) at a rate of \$20,719/acre.

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-7.1.1.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Campbell Timberland Management, Private Landowners	177.00	177.00				354	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Ten Mile watershed suggests that riparian stands are relatively well stock, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Cost based on riparian thinning 3 miles (assume 80 acres/mile in 15% High IP) at a rate of \$1,468/acre. Cost is expected to be minimal because most of the watershed is subject to active timber management. Additional cost may be incurred in the lower watershed where other land management actions occur.
TMR-CCCh-10.1	Objective	Water Quality	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-10.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
TMR-CCCh-10.1.1.1	Action Step	Water Quality	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						0	Action is considered In-Kind

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-10.1.1.2	Action Step	Water Quality	Fully implement Ten Mile River TMDL.	2	20	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						0	High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in Ten Mile River Watershed (USEPA 2000). The source analysis in Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, the USEPA (2000) determined that sediment generation from road surface erosion had increased. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for salmonid protection. It is anticipated most cost will be included as part of upgrades associated with future timber harvest actions. Ten Mile River TMDL does not have time lines specified. Rapid implementation will result in greater cost, but it could result in significant benefits. It is anticipated most cost will be included as part of upgrades associated with future timber harvest actions. Action is considered In-Kind
TMR-CCCh-10.1.1.3	Action Step	Water Quality	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	, CalFire, California Geological Survey, Campbell Timberland Management, Private Landowners, RWQCB	119.00	119.00				238	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identifying areas for prioritization. Cost for erosion assessment estimated at \$12.62/acre (assume 25% of total watershed acres)
TMR-CCCh-10.1.1.4	Action Step	Water Quality	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching salmonid streams.	2	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						TBD	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching salmonid streams (CDFG 2004).
TMR-CCCh-11.1	Objective	Viability	Address other natural or manmade factors affecting the species' continued existence										
TMR-CCCh-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity										
TMR-CCCh-11.1.1.1	Action Step	Viability	Re-establish a naturally reproducing run of Chinook salmon, with representation for each year class cohort.	1	5	Campbell Timberland Management, CDFW, NOAA SWFSC, Private Landowners						0	Action is considered In-Kind

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-11.1.1.2	Action Step	Viability	Develop and implement a program to regularly add salmon carcasses and/or salmon analogs to key locations within the watershed.	1	20	Campbell Timberland Management, CDFW, NMFS, The Nature Conservancy, Trout Unlimited						TBD	Costs vary depending on source material and associated costs. Cost of implementation is considered In-Kind.
TMR-CCCh-11.2	Objective	Viability	Address the inadequacy of existing regulatory mechanisms										
TMR-CCCh-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity										
TMR-CCCh-11.2.1.1	Action Step	Viability	Establish life cycle stations in the Ten Mile River watershed (Gallagher and Gallagher 2005). Consider placing a life cycle station on one key tributary (e.g., Little North Fork Ten Mile, Bear Haven, Campbell creeks) or, if possible, in each subwatershed (North Fork, Clark Fork, South Fork).	2	20	Campbell Timberland Management, CDFW, NMFS							Costs for monitoring status and trends of the population in the Ten Mile River are accounted for in the Monitoring Chapter.
TMR-CCCh-11.2.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFW habitat assessment protocols) to ensure ESU-wide consistency.	3	60	Campbell Timberland Management, CDFW, NMFS, RWQCB						TBD	The watershed has been habitat typed and has had extensive instream monitoring occur in the past.
TMR-CCCh-15.1	Objective	Fire/Fuel Management	Address the inadequacy of existing regulatory mechanisms										
TMR-CCCh-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
TMR-CCCh-15.1.1.1	Action Step	Fire/Fuel Management	Continue to use the recommendations given in NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local fire fighting agencies and CalFire.	2	2	CalFire, NMFS						0	Action is considered In-Kind
TMR-CCCh-15.1.1.2	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various salmonid life stages.	2	100	CalFire, Campbell Timberland Management						0	This recommendation should be considered a standard practice. Action is considered In-Kind
TMR-CCCh-15.1.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated. Action is considered In-Kind
TMR-CCCh-15.1.2	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCCh-15.1.2.1	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Action is considered In-Kind
TMR-CCCh-15.1.2.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Standard business practice. Action is considered In-Kind

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-15.1.3	Recovery Action	Fire/Fuel Management	Prevent or minimize impairment to stream hydrology (impaired water flow)										
TMR-CCCh-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, storage tanks, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFW and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Standard business practice. Action is considered In-Kind
TMR-CCCh-15.1.4	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
TMR-CCCh-15.1.4.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	3	100	CalFire, Campbell Timberland Management						0	Standard business practice. Action is considered In-Kind
TMR-CCCh-18.1	Objective	Livestock	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-18.1.1	Recovery Action	Livestock	Prevent or minimize impairment to the estuary (impaired quality and extent)										
TMR-CCCh-18.1.1.1	Action Step	Livestock	Address water quality and nutrient loading issues by encouraging sustainable land management practices, controlling sediment sources, protecting riparian zones and employing BMPs that encourage permeability and infiltration (CDFG 2004).	2	100	Campbell Timberland Management, Private Landowners						TBD	Costs may vary with methods utilized (e.g. permanent fencing, or other techniques).
TMR-CCCh-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCCh-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to off-channel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Timber harvest remains a threat to salmonid habitat in Ten Mile River, but at diminished levels compared to historical practices. There is a high rate of harvest in many of the planning watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue. Action is considered In-Kind
TMR-CCCh-19.1.2	Recovery Action	Logging	Prevent or minimize impairment to stream hydrology (impaired water flow)										
TMR-CCCh-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Road surface treatment options will vary widely on road use and geology. Action is considered In-Kind
TMR-CCCh-19.1.3	Recovery Action	Logging	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes). Action is considered In-Kind
TMR-CCCh-19.1.3.4	Action Step	Logging	Minimize timber harvest on unstable slopes adjacent to Class 1 streams in the North Fork Ten Mile.	1	30	CalFire, CDFW, RPFs, RWQCB						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.4	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
TMR-CCCh-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.4.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.4.3	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered. Action is considered In-Kind
TMR-CCCh-19.1.4.4	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire, Campbell Timberland Management						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.5	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
TMR-CCCh-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.6	Recovery Action	Logging	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-19.1.6.2	Action Step	Logging	Avoid new road construction in riparian zones	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to Class 1 streams with high IP value habitat. Action is considered In-Kind
TMR-CCCh-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms										
TMR-CCCh-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
TMR-CCCh-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within areas supporting listed salmonids.	3	20	CalFire, Campbell Timberland Management, Private Landowners						0	Action is considered In-Kind
TMR-CCCh-19.2.1.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization (no-take rules) and promote survival and recovery of listed salmonids.	3	20	CalFire, Campbell Timberland Management, Private Landowners						TBD	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially covering timber harvest activities for multiple watersheds within Mendocino County. A multiple landowner HCP is preferable due to economy of scale and overall, similar land management actions across the watershed. The high cost of HCP development is considered a major impediment and disincentive for many landowners.
TMR-CCCh-19.2.1.3	Action Step	Logging	Until no-take rules are developed or forest landowners have secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	15	NMFS						0	The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process. Action is considered In-Kind
TMR-CCCh-19.2.1.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	CalFire, Campbell Timberland Management, Private Landowners						TBD	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
TMR-CCCh-19.2.1.5	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CalFire, Mendocino County, Private Landowners						0	

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

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TMR-CCCh-19.2.1.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Mendocino County, Private Landowners						0	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
TMR-CCCh-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
TMR-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to watershed hydrology										
TMR-CCCh-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	5	CalFire, Campbell Timberland Management, Private Landowners	231.00					231	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on treating 1 stream crossing (assume minor 2 lane road) at a rate of \$230,411/unit.
TMR-CCCh-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, Campbell Timberland Management, Private Landowners						TBD	These will likely be replaced as part of future timber harvest plans in Ten Mile watershed.
TMR-CCCh-23.1.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCCh-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	50	CalFire, Campbell Timberland Management, Private Landowners						0	Legacy roads from past logging activity continue to impact Ten Mile watershed. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned and not properly decommissioned. Cost accounted for LANDSCAPE PATTERNS.
TMR-CCCh-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Many roads in the watershed have inside ditches. Cost should be considered part of road maintenance costs. Action is considered In-Kind
TMR-CCCh-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input. Action is considered In-Kind

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

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TMR-CCCh-23.1.2.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Campbell Timberland Management, Private Landowners						TBD	Sediment traps will require a significant maintenance commitment. Conduct inventory of culverts needing sediment traps.
TMR-CCCh-23.1.2.5	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Campbell Timberland Management, Private Landowners						TBD	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct inventory of culverts needing energy dissipaters.
TMR-CCCh-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2	5	CalFire, Campbell Timberland Management, Private Landowners						TBD	Assess the feasibility and extent of spoils storage site. Cost will be determined once an assessment is completed.
TMR-CCCh-23.1.2.7	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, Campbell Timberland Management, Private Landowners	397.50	397.50				795	Active and abandoned logging roads and skid trails exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but a lot of work remains before this sediment source is thoroughly minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed. The potential for sediment (both through chronic input and large episodic events) is likely to continue. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules. Cost based on road assessment for 830 miles (assume 75% of road network) at a cost of \$957/mile.

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
TMR-CCCh-23.1.2.8	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, Campbell Timberland Management, Private Landowners, Trout Unlimited	306.00	306.00				612	Costs may vary widely depending on number of riparian roads and the magnitude of the problem associated with the roads. Additionally, many roads have been addressed and hydrologically disconnected - often through the timber harvest process - and these costs should be considered an ongoing operation expense. Focus initial efforts (and/or continue ongoing efforts) in Little North Fork Ten Mile, Bear Haven (CDFG 2004), Mill, Campbell, and Smith Creeks. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 51 miles of riparian road network at a rate of \$12,000/mile. TU has partnered with CTM and Pacific Watershed Associates to upgrade 3.4 miles of inner gorge roads in Little North Fork which should be considered a major priority considering the importance of the salmonid populations in the Little North Fork.
TMR-CCCh-23.1.2.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	1	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						0	Action is considered In-Kind
TMR-CCCh-23.1.2.10	Action Step	Roads/Railroads	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain or remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.
TMR-CCCh-23.1.2.11	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	10	CalFire, Campbell Timberland Management, Private Landowners	660	660				1,320	Costs may be significant and benefits should be weighed against additional upland disturbance and overall costs. This recommendation is more feasible within Ten Mile watershed because a large portion of it is owned by one landowner. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 110 miles of road network at a rate of \$12,000/mile.
TMR-CCCh-23.1.3	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCCh-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, Campbell Timberland Management, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-23.1.4	Recovery Action	Roads/Railroads	Prevent or minimize impairment to passage and migration										

Ten Mile River Chinook Salmon (North-Central Coastal) Recovery Actions

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TMR-CCCh-23.1.4.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings. Action is considered In-Kind
TMR-CCCh-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
TMR-CCCh-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCCh-23.2.1.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	1	10	CalFire, Campbell Timberland Management, Private Landowners						0	A well designed road management plan should result in overall cost savings due to lower maintenance costs. Action is considered In-Kind
TMR-CCCh-23.2.2	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCCh-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, Campbell Timberland Management, Private Landowners						0	This action is part of ongoing road maintenance and should be directed at the entire road network.
TMR-CCCh-23.2.2.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Cost should be considered part of land owner road management plans.
TMR-CCCh-23.2.2.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Campbell Timberland Management, Private Landowners						0	Action is considered In-Kind
TMR-CCCh-23.2.2.4	Action Step	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	100	CalFire, Campbell Timberland Management						0	Action is considered In-Kind
TMR-CCCh-23.2.2.5	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFW, NRCS, RWQCB, USACE						0	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate. Action is considered In-Kind
TMR-CCCh-24.1	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species' continued existence										
TMR-CCCh-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to passage and migration										
TMR-CCCh-24.1.1.1	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonid recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	3	20	CDFW, NOAA RC, Private Landowners, The Nature Conservancy						TBD	Cost is unknown. The main benefit of this action is to improve flow conditions in the lower portion of the watershed where a few homes and limited agricultural use occurs.
TMR-CCCh-24.1.2	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to floodplain connectivity (impaired quality & extent)										

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TMR-CCCh-24.1.2.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future rural residential or urban development of any kind.	2	100	Campbell Timberland Management, CDFW, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
TMR-CCCh-24.1.3	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCCh-24.1.3.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	Campbell Timberland Management, RWQCB						TBD	Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat. Assess extent of high-risk shallow-seeded landslide areas and develop rehabilitation plan.

Albion River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
AlbR-CCCh-1.1	Objective	Estuary	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
AlbR-CCCh-1.1.1	Recovery Action	Estuary	Increase quality and extent of estuarine habitat										
AlbR-CCCh-1.1.1.1	Action Step	Estuary	Remove riprap and gabion rock within the estuary and restore with a bioengineering solution.	2	5	California Coastal Conservancy, CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited						TBD	Cost determined by extent of riprap and gabion rock to be removed and suitable bioengineered solution to employ.
AlbR-CCCh-1.1.1.2	Action Step	Estuary	Identify key locations to install LWD structures to improve shelter within the estuary.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	125.00	125.00				250	Based on implementing 10 LWD at a rate of \$25,000/mile.
AlbR-CCCh-2.1	Objective	Floodplain Connectivity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
AlbR-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
AlbR-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited	20.00					20	Use existing MRC watershed analysis, and channel typing information from habitat typing with field verification to determine floodplain restoration sites.
AlbR-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners	5.50	5.50				11	Use information from Action Step #1 to determine reaches for restoration. Cost based on treating 3 miles (assume 1 project per mile in 5% High IP) at a rate of \$36,046/mile.
AlbR-CCCh-3.1	Objective	Hydrology	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
AlbR-CCCh-3.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
AlbR-CCCh-3.1.1.1	Action Step	Hydrology	Require streamflow gaging devices to determine the level of impairment to natural flow. Determine sites appropriate for gaging below Comptche on the mainstem and the North Fork.	3	10	CDFW, Mendocino Redwood Company, NMFS, Private Landowners, USGS	100.00	100.00				200	Based on 2 gages for 10 years.
AlbR-CCCh-3.1.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the Comptche area to minimize effects to the North Fork Albion and mainstem Albion.	2	5	CDFW, NOAA RC, Private Landowners, SWRCB	50.00					50	Cost based on small number of landowners participating in program during the first five years.

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AlbR-CCCh-3.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and California Water Code §1707 (CDFG 2004).	2	30	CDFW, NOAA RC, SWRCB						TBD	
AlbR-CCCh-5.1	Objective	Passage	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
AlbR-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
AlbR-CCCh-5.1.1.1	Action Step	Passage	Investigate the feasibility of removing the earthen dam on Marsh Creek to increase habitat availability for salmonids.	2	2	CDFW, NOAA RC, Private Consultants, Private Landowners	126.00					126	Cost based on treating non-structural element at a rate of \$126,000/unit.
AlbR-CCCh-5.1.1.2	Action Step	Passage	Investigate a potential passage barrier for salmonids on the South Fork Albion River below Bull Team Gulch. A low flow concrete structure placed in the mid-1990s may be causing passage problems for adult salmonids	2	5	CDFW, Mendocino Redwood Company, NOAA RC	75.00					75	Cost based on estimate by NMFS staff. Small concrete structure was constructed in early 1990's. This structure needs to be evaluated and may need to be removed or modified.
AlbR-CCCh-5.1.1.3	Action Step	Passage	Continue to identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001).	2	20	CDFW, Mendocino Redwood Company, NMFS, Private Landowners						0	Action is considered In-Kind
AlbR-CCCh-6.1	Objective	Habitat Complexity	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
AlbR-CCCh-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters										
AlbR-CCCh-6.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	1	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited						0	Work with stakeholders to develop a Plan. Action is considered In-Kind
AlbR-CCCh-6.1.1.2	Action Step	Habitat Complexity	Utilize information developed on LWD demand and recruitment potential in the MRC Albion Watershed Analysis.	2	2	CDFW, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						0	This recommendation will direct other action steps. Action is considered In-Kind
AlbR-CCCh-6.1.1.3	Action Step	Habitat Complexity	Improvement of in-channel LWD densities, and associated habitat benefits, could be most easily accomplished by the addition of large key pieces, conifer trees and root wads. It is recommended that this be achieved by cutting large trees and dropping them into the channel, or preferably by pulling them partially into the channel complete with rootwad, at appropriate upstream locations. Downed logs may be transported to proper location to be placed in the stream.	2	10	CalFire, CDFW, Private Landowners	84.00	84.00				168	Cost based on treating 6.5 miles (assume 50% High IP) at a rate of \$26,000/mile.

Albion River Chinook Salmon (North-Central Coastal) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs (\$K)					Entire Duration	Comment
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
AlbR-CCCh-6.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking. Consider falling existing riparian trees as a method to increase complexity and LWD frequencies.	3	50	CDFW, Mendocino Redwood Company, Private Landowners, Trout Unlimited						0	Conducting LWD placement when crews and equipment are available should be standard business practice. Action is considered In-Kind
AlbR-CCCh-7.1	Objective	Riparian	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
AlbR-CCCh-7.1.1	Recovery Action	Riparian	Improve tree diameter										
AlbR-CCCh-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Investigate additional conservation easements with MRC, or other willing landowners.	3	20	CDFW, Private Landowners						TBD	Cost will depend on size and scope of easements, current market value, and rate of turnover.
AlbR-CCCh-8.1	Objective	Sediment	Address the present or threatened destruction, modification, or curtailment of the species habitat or range.										
AlbR-CCCh-8.1.1	Recovery Action	Sediment	Improve instream gravel quality										
AlbR-CCCh-8.1.1.1	Action Step	Sediment	Treat high priority slides and landings that are identified in the MRC Albion River Watershed Analysis or other credible assessments.	1	10	CDFW, Mendocino County, NOAA RC, Private Landowners						TBD	Need additional analysis to estimate. Cost for sediment assessment is estimated at 70,000.
AlbR-CCCh-8.1.1.2	Action Step	Sediment	Provide technical assistance and incentives to landowners/managers in developing and implementing fine sediment reduction plans in high priority areas as determined by watershed analysis, CDFW, or CalFire.	2	20	CDFW, FishNet 4C, NOAA RC, NRCS						0	Action is considered In-Kind
AlbR-CCCh-11.1	Objective	Viability	Address the inadequacy of existing regulatory mechanisms.										
AlbR-CCCh-11.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
AlbR-CCCh-11.1.1.1	Action Step	Viability	Monitor the response of population abundance and key habitat attributes to recovery efforts across the watershed.	3	24	CDFW, Mendocino Redwood Company, NMFS, Private Landowners							Cost accounted for in Monitoring Chapter
AlbR-CCCh-11.1.1.2	Action Step	Viability	Conduct salmon carcass surveys in areas of the mainstem Albion, South Fork Albion, and the North Fork Albion, and selected tributaries.	2	20	CDFW, Mendocino Redwood Company, NMFS							Cost accounted for in Monitoring Chapter
AlbR-CCCh-11.1.1.3	Action Step	Viability	Support a community based salmonid monitoring program in the Albion watershed.	3	10	CDFW, NOAA RC, Private Landowners, Public						0	Cost accounted for in above action step. Cost could be less with community involvement.
AlbR-CCCh-11.2	Objective	Viability	Address other natural or manmade factors affecting the species' continued existence										
AlbR-CCCh-11.2.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity										

Albion River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
AlbR-CCCh-11.2.1.1	Action Step	Viability	Develop and implement a program to regularly add salmon carcasses and/or salmon analogs to key locations within the watershed.	1	20	CDFW, Mendocino Redwood Company, NMFS, Private Landowners						TBD	Costs vary depending on source material and associated costs. Cost of implementation is considered In-Kind.
AlbR-CCCh-19.1	Objective	Logging	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
AlbR-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
AlbR-CCCh-19.1.1.1	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	60	CalFire, CDFW, Mendocino County, NMFS, NOAA RC, Private Landowners						0	This recommendation should be considered standard practice. Action is considered In-Kind
AlbR-CCCh-19.1.1.2	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CalFire, Mendocino County, Mendocino Redwood Company, NMFS						0	Action is considered In-Kind
AlbR-CCCh-19.1.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire, Mendocino Redwood Company, Private Landowners						0	Action is considered In-Kind
AlbR-CCCh-19.2	Objective	Logging	Address the inadequacy of existing regulatory mechanisms.										
AlbR-CCCh-19.2.1	Recovery Action	Logging	Prevent or minimize increased landscape disturbance										
AlbR-CCCh-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	2	20	CalFire, CDFW, NMFS, RWQCB						0	Action is considered In-Kind
AlbR-CCCh-19.2.1.2	Action Step	Logging	Reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period.	2	20	CalFire, CDFW, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB						TBD	Work with private and corporate companies to reduce annual acres harvested.
AlbR-CCCh-19.2.1.3	Action Step	Logging	Work with private landowners to achieve reductions in area harvested.	2	20	CDFW, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB						0	Action is considered In-Kind
AlbR-CCCh-23.1	Objective	Roads/Railroads	Address the present or threatened destruction, modification, or curtailment of the species habitat or range										
AlbR-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Albion River Chinook Salmon (North-Central Coastal) Recovery Actions

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25		
AlbR-CCCh-23.1.1.1	Action Step	Roads/Railroads	Assess and implement road upgrades on Docker Hill Road along the North Fork Albion River.	1	10	CDFW, Mendocino County, NOAA RC, Private Landowners						TBD	
AlbR-CCCh-23.1.1.2	Action Step	Roads/Railroads	Conduct road and sediment assessment on the Comptche Ukiah Road segment that drains to the Albion Watershed.	2	5	Mendocino County Department of Public Works, NOAA RC	50.00					50	May be possible to use some existing Mendocino County DOT road data.
AlbR-CCCh-23.1.1.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CDFW, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB						0	Action is considered In-Kind
AlbR-CCCh-23.2	Objective	Roads/Railroads	Address the inadequacy of existing regulatory mechanisms										
AlbR-CCCh-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
AlbR-CCCh-23.2.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	20	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB						TBD	Cost associated with increased costs for land managers is unknown at this time, additional analysis needed to determine.
AlbR-CCCh-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	5	CDFW, NOAA RC, NRCS, Private Landowners, RCD	50.00					50	Estimated cost for materials to block roads and trails, large rock and gates.
AlbR-CCCh-23.2.1.3	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagens, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	20	Mendocino County, NOAA RC, NRCS, Private Landowners, RCD						TBD	Number of rural roads and associated costs are unknown at this time.
AlbR-CCCh-23.2.1.4	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources.	2	15	CDFW, Mendocino Redwood Company, Private Landowners, RWQCB						TBD	Many road upgrades have been done in this watershed. Additional information needed on the remaining road segments that need work to estimate cost.
AlbR-CCCh-23.2.1.5	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, Mendocino Redwood Company, Private Landowners	300.00	300.00	300.00	300.00		1,200	Costs may be significant and benefits should be weighed against additional upland disturbance and overall costs. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 93 miles of road network at a rate of \$12,000/mile.
AlbR-CCCh-24.1	Objective	Severe Weather Patterns	Address other natural or manmade factors affecting the species continued existence										

Albion River Chinook Salmon (North-Central Coastal) Recovery Actions

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AlbR-CCCh-24.1.1	Recovery Action	Severe Weather Patterns	Prevent or minimize impairment to stream hydrology (impaired water flow)										
AlbR-CCCh-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users in the Comptche area to minimize depletion of summer base flows during droughts. Provide restoration funding for alternatives such as storage tanks and rainwater harvest to rural residential residents.	2	10	Mendocino County, NOAA RC, Private Landowners, Trout Unlimited	500	500				1,000	Estimate based on 100 land owners at 10k per water storage system.
AlbR-CCCh-24.1.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for salmonids recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of salmonids (CDFG 2004)(Water Code § 1707).	2	20	CDFW, Private Landowners, SWRCB						TBD	The main benefit of this action is to improve flow conditions in the lower portion of the watershed where the majority of home owners and agricultural use occurs. Cost for a stream flow model estimated at \$63,005. Acquiring or leasing water is contingent upon landowner participation and extent of protection for base flows.