North Mountain-Interior Diversity Stratum

This stratum includes populations or parts of populations that spawn in watersheds that penetrate considerable distances inland, and (in most cases) attain sufficient elevations for snowmelt to contribute significantly to the annual hydrograph. Two northern tributaries to the lower Eel River, the Van Duzen River and Larabee Creek, exhibit these characteristics. While we consider Chinook salmon that spawn in these tributaries to be part of the Lower Eel River population, these basins represent important environmental diversity within that population. Thus, we consider that a viable population of fall-run Chinook salmon in the Lower Eel River that included components in northern basins would contribute significantly to this diversity stratum.

The populations that have been selected for the recovery scenario are listed in the table below and their profiles, maps, results, and recovery actions are in the pages following. Populations are listed by alphabetical order within the diversity stratum:

CC Chinook Salmon North Mountain Interior 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). The Chinook salmon Lower Eel River is one population divided between two diversity strata. *The Lower Eel River Chinook population is divided between two diversity strata, and as a result has one recovery target for the North Mountain Interior DS (Van Duzen and Larabee) and one for the North Coastal DS (Lower and South Fork Eel River).

Diversity Stratum	CC Chinook salmon Populations	Historical Population Status	Population's Role In Recovery	Current Weighted IP-km	Spawner Density	Spawner Abundance
North Mountain Interior	Lower Eel River ~ *Larabee Creek/ Van Duzen River**	I	Essential	143.7	20.0	2,900
	Upper Eel River	I	Essential	521.4	20.0	10,400
	Diversity Stratum Recovery Target					13,300

CC Chinook salmon North Mountain Interior Diversity Stratum Populations selected for the recovery scenario. There are no Supporting populations within this Diversity Stratum.

Larabee Creek Subset of the Lower Eel River Population

CC Chinook Salmon Fall-Run

- Role within ESU: Role within ESU: A subset with the Lower Eel River Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 2,900 adults (includes Van Duzen Subset)
- Current Intrinsic Potential: 143.7 IP-km (includes Van Duzen Subset)

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

Chinook Salmon Abundance and Distribution

Historical Chinook salmon abundance estimates for Larabee Creek are lacking, but insight as to how prolific the anadromous salmonid runs were at the start of European settlement within the watershed may be gleaned from early fishing records at the mouth of the Eel River (Yoshiyama and Moyle 2010). An estimated 585,000 Chinook salmon were caught and processed at the Eel River canneries during the peak harvest year of 1877, with average runs of 100,000 to 200,000 adults per year. Given the amount of habitat available historically within Larabee Creek, Chinook salmon runs likely numbered in the thousands prior to the habitat degradation and overfishing that began during the latter 19th century.

No man-made barriers exist on mainstem Larabee Creek, although a mile-long series of falls and cascades beginning near the confluence of Larabee Creek and Smith Creek may preclude upstream distribution of Chinook salmon (PALCO 2007). CDFW spawning surveys have reported spawning Chinook salmon in mainstem Larabee Creek and Carson Creek, a low-gradient tributary that enters Larabee Creek approximately 2.5 miles upstream from the Eel River (Becker and Reining 2009). Most tributaries are inaccessible to Chinook salmon due to steep gradients at their confluence with mainstem Larabee Creek.

History of Land Use

Historically, the Larabee Creek watershed contained primarily late-seral redwood/Douglas-fir (coniferous) forests, with limited open oak woodland/prairies farther inland at higher elevations (PALCO 2007). The first logging activities occurred in the 1900s and 1910s in the floodplain areas of lower Larabee Creek where timber was large and easily accessible (PALCO 2007). More than 60 percent of the lower Larabee Creek area, including significant portions of the

Chris, Carson, Smith, Balcom, Dauphiny, Scott, and Arnold creek drainages, was logged by the end of the 1920s (PALCO 2007). Following the initial logging, technological developments after World War II enabled logging and road building in steeper, more landslide prone areas, which caused excessive sediment delivery to streams. Massive erosion and instream sedimentation occurred following large floods in 1955 and 1964, filling in pools and widening stream channels. The remainder of the old-growth timber in the Larabee Creek watershed was harvested by the 1980s, and second-growth logging activities have occurred since (PALCO 2007). After settlement by ranchers in the early 1900s, the lower Larabee Creek area was burned repeatedly for cattle grazing (PALCO 2007).

Current Resources and Land Management

Ninety-nine percent of the Larabee Creek watershed is under private ownership, with much of the lower one-third of the watershed actively managed for timber production by the Humboldt Redwood Company (HRC; formerly PALCO). Timber holdings owned by HRC are managed according a Habitat Conservation Plan (HCP) that seeks to minimize adverse effects to aquatic and terrestrial habitat during timberland operations. The goals of the HRC HCP include trending towards properly functioning aquatic conditions and reducing sediment input by upgrading 1,500 miles of roads on their timberlands (HRC 2012). Other land uses occurring within the Larabee Creek watershed include rural residential, agriculture, and livestock grazing. There are several active watershed groups in the area: the Eel River Watershed Improvement Group, Friends of the Eel River, and the Eel River Restoration Project. The following are pertinent reports or plans for Larabee Creek:

- Humboldt Redwood Company HCP (HRC 2012);
- HRC Watershed Analyses for: Lower Eel/Eel Delta and Upper Eel (PALCO 2007);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997); and
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007).

Salmonid Viability and Watershed Conditions

The following indicators were rated Poor through the CAP process for Chinook salmon: shelter rating, canopy cover, streamside road density, aquatic invertebrates, estuary quality and extent, water temperature, timber harvest, and riparian tree diameter. Recovery strategies will 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.

Current Conditions

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

Population and Habitat Stresses

Viability: Density, Abundance, and Spatial Structure

The abundance of Chinook salmon in Larabee Creek is likely well below Low-risk abundance targets and is likely limiting their ability to successfully reproduce and increase in abundance. However, habitat conditions are improving in many areas and are currently adequate for Chinook to successfully complete their freshwater life history. Restoration of degraded habitat, combined with improved land management, should allow the Larabee Creek Chinook salmon population to increase in abundance.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of all Eel River salmonid populations. The Eel River estuary is severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the Chinook Salmon Eel River Overview for a complete discussion and recovery actions.

Habitat Complexity: Large Wood and Shelter

The Habitat Complexity condition has a Poor rating for pre-smolts and smolts. PALCO (2007) determined tree size resulting from young forest stands is currently the limiting factor for recruitment of functional large wood in the management unit that includes lower Larabee Creek. However, PALCO (2007) concluded that nearly 90 percent of the riparian forests in the management unit will meet or exceed riparian composition goals within 40 years. This condition is rated as Poor for summer rearing and winter rearing juveniles, and summer-run adults.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Sediments conditions have an overall Fair rating for all life stages. Embeddedness levels are high within Larabee Creek tributaries and the upper mainstem (PALCO 2007). Suitable spawning gravel exists in some areas within the watershed but other areas are still impaired (*e.g.,* excess fine sediments) from past land use. Larabee Creek Chinook salmon rely on clean and stable spawning gravel in the mainstem for egg incubation and survival. Impaired gravel quality may reduce macro-invertebrate production that supports summer and seasonal rearing salmonids. Threats contributing to this stress include Logging and Wood Harvesting and Roads and Railroads.

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

PALCO (2007) determined pool complexity and pool: riffle ratio metrics for Larabee Creek mostly met properly functioning conditions, although distinct differences were observed between streams sampled in the lower watershed (Wildcat geology) versus upper watershed sites (Yager geology). Average pool depths are typically greater than 3 feet in the mainstem; however, tributary pools are shallower. For instance, average pool depth in Larabee Creek tributaries was 1.5 feet (PALCO 2007). These stressors primarily affect pre-smolt Chinook salmon. Due to contribution of fine sediment, the primary threats contributing to this stress are Logging and Wood Harvesting and Roads and Railroads.

Riparian Vegetation: Composition, Cover & Tree Diameter

Riparian Vegetation conditions have an overall Fair rating for the watershed processes in the Larabee Creek population area. Where data exist, streamside canopy cover shows a range of conditions, with some good to very good conditions (70 percent to 100 percent shade) in tributaries, and poor cover and shade conditions in the mainstem channel. For instance, over half of the channel length of lower Larabee Creek has less than 20 percent canopy cover. Even where streamside canopy cover is good, such as in first and second order channels of many Larabee Creek tributaries, riparian areas consist predominantly of hardwood species and immature conifers that are not yet of size to effectively function as LWD (PALCO 2007). The primary threat contributing to this stress is Logging and Wood Harvesting.

Sediment Transport: Road Density

Sediment Transport has an overall Poor rating due to roads in the Larabee Creek population area. The Eel River watershed is one of the most naturally erodible watersheds in the United States (Brown and Ritter 1971) because of the highly active tectonic setting, highly erodible soils in the area, and high precipitation. Anthropogenic activities in Larabee Creek, primarily legacy logging and associated road building, have exacerbated these naturally high sediment loads (USEPA 2007). Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of land, with up to 7.8 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007).

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Major legacy and current landscape disturbance within Larabee Creek, primarily associated with timber harvest and associated road building results a rating of Poor for Timber Harvest on watershed processes.

Water Quality: Turbidity or Toxicity

The combination of landscape disturbance and erosive soils in the Larabee Creek watershed results in increased turbidity, and this condition is considered a Fair rating to pre-smolt, particularly during storms. Threats contributing to this stress are Logging and Wood Harvesting and Roads and Railroads.

Very Good or Good Current Conditions

The Floodplain Connectivity condition has an overall Good rating for juveniles, smolts, and adults. Floodplains in Larabee Creek were determined to be fully functional (PALCO 2007), but excessive sediment loads and dysfunctional riparian processes (*i.e.,* poor LWD recruitment) in the mainstem Eel River below the confluence with Larabee Creek, and levees in the Eel River estuary limit floodplain access for Larabee Creek salmonids during outmigration. Barriers to fish passage do not present a major impediment to recovery of Chinook salmon in Larabee Creek, although a long-standing road-crossing barrier on Chris Creek and log-jams in several tributaries are believed to partially impede adult passage.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Larabee Creek 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 Larabee Creek CAP results.

Population and Habitat Threats

Roads and Railroads

Roads constitute a High threat to watershed processes. Most subwatersheds in the Larabee Creek basin exhibit road densities much higher than 3 road miles per square mile of watershed, with up to 7.78 road miles per square mile in the mid-Larabee subcomplex of tributaries (PALCO 2007). Road storm proofing, reconstruction, and upgrading have occurred on a significant portion of HRC's roads (PALCO 2007) and will continue to occur under the HCP.

Logging and Wood Harvesting

Logging and Wood Harvesting is a High threat to watershed processes. Many of the changes that have occurred to instream and riparian conditions in Larabee Creek reflect legacy effects of more intensive harvest from previous decades. In the future, given the percentage of the watershed that is actively managed as timberland, and that most of the watershed has been logged in the past, continuing harvest on these areas will likely continue to affect habitat downstream by introducing more sediment than would occur naturally.

Channel Modification

Channel modification is rated as a High threat for Chinook salmon smolts. Channel modification is not pervasive in Larabee Creek, but the Eel River estuary and mainstem have been significantly channelized by dikes and levees and subsequent filling for ranching or livestock purposes. Please see the Chinook Salmon Eel River Overview for a complete discussion and recovery actions.

Disease, Predation and Competition

Competition and predation from non-native Sacramento pikeminnow (predation and competition) and California roach (competition) pose a High stress to pre-smolt and smolt Chinook salmon. These non-native species have the greatest impact in wide, low gradient mainstem reaches where degraded instream habitat and water quality conditions favor their production over indigenous Chinook salmon and increase their risk of predation by Sacramento pikeminnow.

Fishing and Collecting

Fishing and Collecting is rated a High threat to adult Chinook salmon. Although the fishery is catch-and-release only, the activity attracts hundreds, if not thousands, of anglers every season. Regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration, particularly Chinook salmon. Currently, sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1 of each year and expires on January 31, which allows anglers to target Chinook salmon staging in low flow conditions throughout September or after January. Adults are easy targets for both fisherman and poachers in these extremely low flows. Poor water quality in September contributes to the stress and likely results in increased hook-and-release mortalities (Clark and Gibbons 1991).

Bycatch of Chinook salmon occurs in ocean fisheries targeting Chinook salmon that are not protected under the Endangered Species Act. In a biological opinion on the effects of ocean fisheries managed under the Pacific Coast Salmon Plan, NMFS determined the bycatch impacts of these fisheries are likely to jeopardize the continued existence of CC Chinook salmon, and NMFS provided a Reasonable and Prudent Alternative under which the fisheries are managed to avoid the likelihood of jeopardizing the continued existence of CC Chinook salmon (NMFS 2000).

Low or Medium Rated Threats

Less than one percent of the Larabee Creek population area is currently used for agriculture, and residential development is sparse and low in density; therefore, these threats are a Low to Medium threat. Fuel management and fire suppression is a Medium threat because it may increase the potential for a catastrophic fire in the future, particularly in the interior portion of the watershed.

Currently, the extent of marijuana production in the Larabee Creek drainage is unknown; however it is likely to be increasing as it has in other sub-watersheds throughout the Eel River system. The potential implications of expanding marijuana production on stream flow quantity and quality and habitat availability in the Larabee Creek drainage should be assessed.

Limiting Stresses, Lifestages, and Habitats

Juvenile Chinook salmon pre-smolt productivity is likely limiting subsequent adult abundance within the Larabee Creek watershed. Inadequate stream shading, high water temperatures, impaired gravel quality (spawning and benthic food productivity), and reduced habitat complexity have reduced the quality and extent of rearing habitat.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions within the watershed. The general recovery strategy for the Larabee Creek population is discussed below with more detailed and site-specific recovery actions provided in Larabee Creek CAP Results, which provides the Implementation Schedule for this population.

Improve Riparian Habitat Function and Composition

Increase the quality and quantity of riparian vegetation through appropriate silvicultural prescriptions such as thinning (for release of conifers) and planting. Reestablishment of coniferous forests in the lower mainstem floodplain will improve canopy cover and instream temperatures.

Increase Habitat Complexity

Pools in Larabee Creek and mainstem Eel River are too simplified and shallow to adequately support juvenile Chinook salmon growth and survival. Large wood, boulders, or other instream structure should be added in proximity to cool water refugia in order to increase complexity and sort sediment. Off-channel ponds, alcoves, and backwater habitat should be re-created in the low-gradient areas of the population area, as well as the lower mainstem Eel River.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor salmonid habitat. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. A grading ordinance which minimizes effects on salmonid habitat should be developed for building and maintenance of private roads.

Reduce Abundance of Sacramento Pikeminnow

Explore how best to reduce the abundance of the Sacramento pikeminnow population. Provide increased refugia habitat for salmonids through the creation of cool and complex habitats, and make habitat less suitable for pikeminnow by managing to reduce water temperature.

Literature Cited

Becker, G. S., and I. J. Reining. 2009. Steelhead/Rainbow Trout (*Oncorhynchus mykiss*): Resources of the Eel River Watershed, California. Prepared for the California State Coastal Conservancy. Cartography by D.A. Asbury. Center for Ecosystem Management and Restoration, Oakland, CA.

Brown, W. M., III, , and J. R. Ritter. 1971. Sediment transport and turbidity in the Eel river basin. Water Supply Paper 1986. United State Geological Survey.

California Department of Fish and Game. 1997. Eel River Salmon and Steelhead Restoration Action Plan. California Department of Fish and Game, Inland Fisheries Division, Sacramento.

California Department of Fish and Game. 2010. Lower Eel River Watershed Assessment. Coastal Watershed Planning and Assessment Program. California Department of Fish and Game. Inland Fisheries Division.

Clark, R. N., and D. R. Gibbons. 1991. Recreation. W. R. Meehan, editor. Influences of Forest and Rangeland Management. 1991 AFS Publication 19. American Fisheries Society, Bethesda, MD.

Humboldt Redwood Company. 2012. Habitat Conservation Plan for the Properties of The Pacific Lumber Company, Scotia Pacific Holding Company, and Salmon Creek Corporation Under the Ownership and Management of Humboldt Redwood Company, LLC, as of July 2008. Established February 1999. Revised 15 February 2012 Containing Language Changes From Adaptive Management, Minor Modification, and Property-Wide Consultations. 161 p.

National Marine Fisheries Service. 2000. Endangered Species Act reinitiated section 7 consultation/biological opinion: Effects of the Pacific Coast Salmon Plan on California Central Valley spring-run Chinook, and California Coastal Chinook salmon. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest and Southwest Regional Sustainable Fisheries Divisions.

National Marine Fisheries Service. 2002. Biological Opinion for the Proposed license amendment for the Potter Valley Project (Federal Energy Regulatory Commission Project Number 77-110). National Marine Fisheries Service, Santa Rosa, CA.

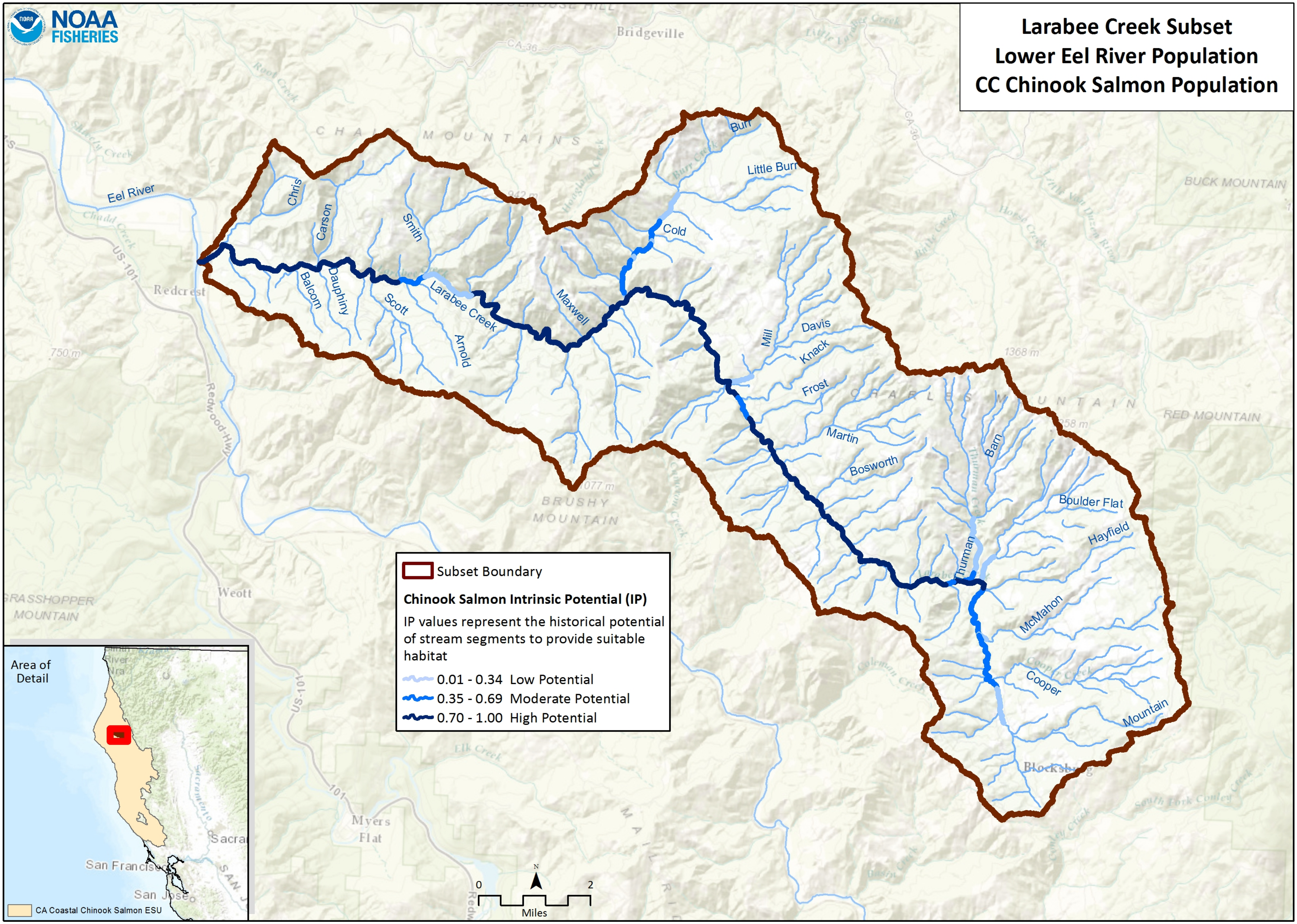
Pacific Lumber Company. 2007. Upper Eel Watershed Analysis. Cumulative Watershed Effects. Final Report. 255 pp.

Steiner Environmental Consulting. 1998. Potter Valley project monitoring program (FERC Project Number 77-110, Article 39): effects of operations on upper Eel River anadromous salmonids: March 1998 final report. Prepared for the Pacific Gas and Electric company San Ramon, CA.

United States Environmental Protection Agency. 2007. Lower Eel River Total Maximum Daily Loads for Temperature and Sediment. United States Environmental Protection Agency, Region IX.

Venture Tech Network Oregon Inc. 1982. Potter Valley Project (FERC project number 77-110) Fisheries Study, Final Report, Volumes I and II. Prepared for Pacific Gas and Electric Company, San Ramon, CA.

Yoshiyama, R. M., and P. B. Moyle. 2010. Historical review of Eel River anadromous salmonids, with emphasis on Chinook salmon, coho salmon and steelhead. University of California Davis, Center for Watershed Sciences working paper. A Report Commissioned by California Trout, 2010. Center for Watershed Sciences University of California, Davis, CA.


Larabee Creek Subset
Lower Eel River Population
CC Chinook Salmon Population
NOAA FISHERIES
Subset Boundary
Chinook Salmon Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
CA Coastal Chinook Salmon ESU
San Francisco
San Jose
0
2
Miles
Eel River
Bridgeville
Redcrest
Weott
Myers Flat
Blocksburg
BUCK MOUNTAIN
RED MOUNTAIN
BRUSHY MOUNTAIN
GRASSHOPPER MOUNTAIN
US-101
CA-36
Larabee Creek
Chris
Carson
Smith
Balcom
Dauphiny
Scott
Arnold
Maxwell
Cold
Burr
Little Burr
Mill
Davis
Knack
Frost
Martin
Bosworth
Barn
Thurman
Boulder Flat
Hayfield
McMahon
Cooper
Mountain

#	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		Impaired/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 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 (Bankfull Width 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% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			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 67	Fair
			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	34.69 Class 5 & 6 across IP-km	Poor

			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	50% of IP-km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Good
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	>80% Response Reach Connectivity	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No acute or chronic known	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)		1-20 Spawners per IP-km	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	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 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 67	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)	13.5% (0.85mm) and <30% (6.4mm)	Good
			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)	50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	Good
3	Pre Smolt	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly functioning condition		Impaired/non-functional	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-km (>49% average primary pool frequency)	Fair
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)	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% to 74% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			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 83	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	NMFS Flow Protocol: Risk Factor Score 67	Fair
			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	0.01 - 1 Diversions/10 IP-km	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 67	Fair
			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	Species Composition	≤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	34.69 Class 5 & 6 across IP-km	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60 to 80	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)	50% to 74% of streams/ 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	<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)	20 to 22 IP-km (>6 and <14 C)	Good
			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No acute or chronic known	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	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	75-90% of Historical Range	Good
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly functioning condition		Impaired/non-functional	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)	<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	0.01 - 1 Diversions/10 IP-km	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 67	Fair
			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)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	60-80	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)	50% to 74% of streams/ 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)	20 to 22 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	>80% Response Reach Connectivity	Good

			Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No Evidence of Toxins or Contaminants	No acute or chronic known	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	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)			
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	72.08	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	15	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	24	Poor
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	0.03% 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% 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	44.22% of Watershed in Timber Harvest	Poor
			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	0% 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	51-74% Intact Historical Species Composition	Good

			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	6.83 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	5.01 Miles/Square Mile	Poor

Larabee Creek 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	Medium	Low	Medium	Medium	Low	Medium
2	Channel Modification	Medium	Low	Medium	High	Low	Medium
3	Disease, Predation and Competition	Medium		High	High	Low	High
4	Hatcheries and Aquaculture	Low		Low	Low		Low
5	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium
6	Fishing and Collecting	High		Medium	Low		Medium
7	Livestock Farming and Ranching	Medium	Low	Medium	Medium	Low	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	High	Medium
9	Mining	Medium	Low	Medium	Medium	Low	Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Medium	Low	Medium
11	Residential and Commercial Development	Medium	Low	Medium	Medium	Low	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	High	Medium
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Low	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Low	Medium
	Threat Status for Targets and Project	High	Medium	High	High	High	Very High

Larabee Creek Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
LbC-CCCh-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LbC-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Assess watershed for areas to reconnect the floodplain.	2	1	Private	115.00					115	Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
LbC-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows to re-connect the floodplain, guided by assessment.	2	5	Private						TBD	Based on amount of habitat identified to be reconnected from fish/habitat restoration assessment in action step above. Cost estimated at $37,200/acre.
LbC-CCCh-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
LbC-CCCh-5.1.1.1	Action Step	Passage	Remove road crossing barrier on Larabee Ranch.	2	1	Private	260					260	Cost based on replacing culvert at a rate of 259,870/culvert.
LbC-CCCh-5.1.1.2	Action Step	Passage	Assess passage at logjam barriers in tributaries and provide passage if feasible.	2	5	Private						0	Action is considered In-Kind
LbC-CCCh-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
LbC-CCCh-6.1.1.1	Action Step	Habitat Complexity	Assess habitat to determine location and amount of instream structure needed.	2	1	CDFW	115					115	Mainstem Larabee Creek and lower tributaries. Cost based on fish/habitat restoration assessment at a rate of $114,861/project.
LbC-CCCh-6.1.1.2	Action Step	Habitat Complexity	Place LWD, boulders, or other instream structure, guided by assessment.	2	10	CDFW						TBD	Mainstem Larabee Creek and lower tributaries. Costs will vary depending on methods implemented and extent of rehabilitation.
LbC-NCSW-14.1	**Objective**	**Disease/ Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-14.1	**Objective**	**Disease /Predation /Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-14.1.1	Recovery Action	Disease /Predation /Competition	Prevent or minimize reduced density, abundance, and diversity based on based on the biological recovery criteria										
LbC-CCCh-14.1.1.1	Action Step	Disease /Predation /Competition	Conduct studies to determine distribution and habitat preferences of pikeminnow in the Eel River basin.	2	5	CDFW						TBD	
LbC-CCCh-14.1.1.2	Action Step	Disease /Predation /Competition	Conduct studies to determine how competition with pikeminnow alters the natural behavior and survival of juvenile salmonids.	2	5	CDFW						TBD	
LbC-CCCh-14.1.1.3	Action Step	Disease /Predation /Competition	eradicate or suppress Sacramento pikeminnow, including genetic technology methods (e.g., deleterious genes).	2	5	CDFW						TBD	
LbC-CCCh-14.1.1.4	Action Step	Disease /Predation /Competition	Take measures to eradicate or suppress fish species using genetic technology or other methods identified as feasible.	2	25	CDFW						TBD	
LbC-CCCh-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
LbC-CCCh-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on based on the biological recovery criteria										

Larabee Creek Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
LbC-CCCh-16.1.1.1	Action Step	Fishing/Collecting	Change the low flow season for the mainstem Eel River to start on a date that minimizes incidental fishing impacts to ESA-listed salmonids.	1	5	CDFW						0	Action is considered In-Kind
LbC-CCCh-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
LbC-CCCh-19.1.1.1	Action Step	Logging	Determine appropriate silvicultural prescription for benefits to listed salmonids.	2	1	Private						0	Lower mainstem Larabee Creek. Action is considered In-Kind
LbC-CCCh-19.1.1.2	Action Step	Logging	Thin, or release conifers, guided by prescription.	2	10	Private						TBD	Lower mainstem Larabee Creek. Costs will vary depending on methods implemented and extent of rehabilitation. Riparian thinning estimated at $1,468/acre.
LbC-CCCh-19.1.1.3	Action Step	Logging	Plant conifers, guided by prescription.	2	5	Private						TBD	Lower mainstem Larabee Creek. Costs will vary depending on methods implemented and extent of rehabilitation. Cost for riparian planting estimated at $20,719/acre.
LbC-CCCh-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LbC-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
LbC-CCCh-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	2	1	Private						TBD	Total road miles in watershed is unknown. Cost for road inventory estimated at $957/mile.
LbC-CCCh-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	2	10	Private						TBD	Cost for number of miles of road to decommission is unknown. Cost to decommission is estimated at $12,000/mile.
LbC-CCCh-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	10	Private						TBD	Miles to upgrade is unknown. Cost to upgrade is estimated at $21,000/mile.
LbC-CCCh-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	2	25	Private						0	Action is considered In-Kind
LbC-CCCh-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
LbC-CCCh-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
LbC-CCCh-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance which minimizes effects of road maintenance and construction on salmonid habitat.	2	1	County						0	Action is considered In-Kind

Upper Eel River Population

CC Chinook Salmon Fall-Run

- Role within ESU: Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 10,400 adults
- Current Intrinsic Potential: 521.4 IP-km

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

Chinook Salmon Abundance and Distribution

The Chinook salmon population of the Upper Eel River includes all watersheds from the South Fork Eel River confluence upstream along the mainstem Eel River. Major subbasins included in this population are Dobbyn Creek, North Fork Eel River, Middle Fork Eel River, Outlet Creek, Tomki Creek, and the upper mainstem Eel River. The Middle Fork Eel is considered the anchor for production of Chinook salmon in the Upper Eel River (Bjorkstedt et al. 2005).

Late 1800s Cannery records for the Eel River system indicate that historic runs of Chinook salmon ranged between 300,000 and 800,000 annually, declining to roughly 50,000-100,000 year annual returning spawners in the first half of the 20th century (Yoshiyama and Moyle, 2010). After the historic floods of 1955 and 1964, annual runs were generally considerably less than 10,000 Chinook (Yoshiyama and Moyle, 2010). Monitoring efforts at the Van Arsdale Fish Station (VAFS) and some carcass index reaches occurring in the Tomki Creek watershed have shown that abundance of fall-run Chinook salmon in the Upper Mainstem Eel River was extremely low in the 1990s and 2000s. In the recent years 2009/10 and 2010/11 adult Chinook salmon abundance has improved in some Eel River watersheds and remained scant in other areas. For example, the VAFS averaged around 500 spawners in recent years, but have had record numbers in the last three spawning seasons. In 2010/11 a record 2,315 adults Chinook salmon pass the facility, with record numbers of spawners in 2011/12 (2,436) and in 2012/13 (3,471) (S. Harris, personal communication 2013). Based on Spence *et al*. (2008), and assessments by NMFS staff, the current habitat available in the Upper Eel River Chinook salmon population (including the habitat above Scott Dam) needs to produce a spawner abundance of 9,500 adults to be considered low risk of extinction.

Chinook salmon are present in most of the larger tributaries across the basin (NMFS, 2005). Generally, CDFW conducts spot surveys during the fall and winter months to determine spawning distribution of adult salmon. Abundance estimates for juvenile or smolt Chinook salmon are not available for this population.

History of Land Use

Prior to the European intrusion in the 17th and 18th centuries, native Indians utilized the fishery resources of the Eel River. Native Americans also used fire in coastal areas to clear areas for tribal activities. It is very evident that the Eel River system has undergone profound changes in its physical and biological features since the initial Euro-American settlement in the region 150 years ago.

In 1908, construction of Cape Horn Dam was completed on the mainstem Eel River and water diversions to the Russian River for hydroelectric power and agriculture began via the Potter Valley Project (SEC 1998). Water diverted through the tunnel for power and not collected by the Potter Valley Irrigation District (PVID) continues down the East Fork of the Russian River. Scott Dam was built upstream in 1922, creating Pillsbury Reservoir to store water in order make the diversion continuous year around, along with hydropower production. Construction of Scott Dam blocked about 100 miles of Chinook salmon and steelhead habitat (USFS and BLM 1995).

Following WWII, mechanized logging was conducted in many areas of the watershed. Due to the near-absence of regulations, large swaths were clear-cut and subject to highly-erodible road construction on steep hillsides. The watershed was then susceptible to massive erosion as the result of record rainfall and floods in 1955 and 1964 (EPA 2005). The erosion resulted in 10-20 m of sediment being deposited in the main river channels, filling in most deep pools (Lisle 1982). River channels became wide and shallow, with little riparian vegetation for stabilization or shade. Following the massive 1964 flood, populations of anadromous fish did not recover, a recovery made even more difficult by the illegal introduction and explosive population expansion of the predatory Sacramento pikeminnow in 1979 (Brown and Moyle 1997).

In 1972, protection of the Eel River and its forks from new dams was more or less assured by declaring much of it as a California Wild and Scenic River, a status adopted by the Federal government in 1981. Headwaters of the Eel River were protected by designation by Congress of the Yolla Bolly Eel River Wilderness area in 1964, the North Fork Wilderness in 1984, and the South Fork Eel Wilderness in 2006 (http://www.fs.fed.us/r5/mendocino/recreation/). In addition various stands of redwood forest were protected in state and national parks, as well as in preserves.

Salmon canneries operated on the Eel River during the late-19th and early-20th centuries, producing a peak output of 15,000 cases of canned salmon during 1883 (Yoshiyama and Moyle, 2010). The cannery data can be roughly translated into minimal population estimates which average about 93,000 fish per year during the period 1857-1921 and evidently approached 600,000 fish in the peak year 1877, mostly Chinook salmon. Given that the cannery records result in a very conservative estimate of Chinook salmon numbers, the records suggest that historic runs of Chinook salmon probably ranged between 100,000 and 800,000 fish per year, declining to roughly 50,000-100,000 fish per year in the first half of the 20th century (Yoshiyama and Moyle, 2010).

Since the early 1900s SEC (1998) reports that more than 39 million Chinook salmon fry have been planted in the Eel River system. The vast majority of these were eggs and fry of Sacramento River origin planted in the lower mainstem prior to 1920. Between 1921 and 1960, the number of Chinook salmon planted to the Eel River is unknown due to lack detailed planting records. From 1971 to 1980, most Chinook salmon plantings occurred at the Van Arsdale Fisheries Station (upper mainstem Eel River) or in the South Fork Eel River. The vast majority of these fish originated from Iron Gate Hatchery on the Trinity River. The South Fork Eel River and Outlet Creek were the sites of most planting between 1981 and 1990. All Chinook salmon planted after 1981 were of Eel River origin.

Current Resources and Land Management

Land use in the watershed is a mixture of private and public, including the Mendocino and Six Rivers National forests, BLM, and tribal land. There are four wilderness areas managed by the USFS and BLM in the watershed. The San Hedrin Wilderness (10,571 acres), Yolla Bolly Middle Eel Wilderness (approximately 180,000 acres), Snow Mountain Wilderness (60,076 acres) and the Yuki Wilderness area (53,887 acres) which is managed by the USFS and BLM. The USFS manages the upper watershed in the Middle Fork Eel River, Black Butte River, and Eel River (above Lake Pillsbury) under the Land and Resource Management Plan (LRMP) for the Mendocino National Forest. The Round Valley Indian Tribe (RVIT) manages their portion of the watershed under a Resource Management Plan.

Today the Potter Valley Project (PVP) is operated by the Pacific Gas & Electric Company (PG&E) and includes the mainstem Eel River from Scott Dam downstream to Van Arsdale Reservoir, (Steiner Environmental Consulting, 1998). Since November of 2002, the PVP is operated under the conditions set forth in NMFS' 2002 Biological Opinion (BO) for the project. The BO requires prescribed flow releases from Scott Dam targeting improved spawning, rearing, and passage flows for Chinook salmon and NC steelhead downstream of the dam.

The predominant land use is grazing and logging, with patches set aside for recreation, agriculture, and other uses. Conifers dominate only the upper watershed areas across the large area included that provides habitat for this salmon population. Much of the upper Eel River watershed is covered by shrub, grasslands, and oak woodlands. These areas consist of large ranches, many of which are increasingly divided into smaller parcels (EPA 2005). Many of the smaller parcels are used to produce medical and commercial cannabis which there has been a dramatic increase in the last 10 years in the Outlet Creek watershed (LeDoux-Bloom and Downie 2008). The Round Valley area and the Willits Valley are interior valleys consisting of the main population centers within the Upper Eel River watershed.

Watershed and restoration groups such as the Friends of the Eel River which is a non-profit organization dedicated to restore the Eel River watershed to its natural function. Other groups, including the Eel River Watershed Improvement Group and the Willits Watershed Group, are focused more on community members or landowners that implement restoration projects in specific subbasins. In addition to these groups, the Round Valley Indian Tribe and the USFS Mendocino National Forest are actively engaged in watershed restoration projects which are predominately located in the Middle Fork Eel River and its tributaries, and the upper Mainstem Eel River below Scott Dam.

Salmonid Viability and Watershed Conditions

The following habitat indicators were rated Poor through the CAP process: LWD frequency, shelter rating, pool frequency, gravel embeddedness, and riparian vegetation for pre-smolts, smolts and adult lifestages. Gravel embeddedness for egg incubation was rated Poor and for watershed processes, road densities, and riparian road densities were rated as Poor. Viability for spawning Chinook salmon adults was rated as Fair based on recent spawning surveys conducted by CDFW.

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 passage barriers, and pike minnow predation on juvenile lifestages of Chinook salmon.

Current Conditions

The following discussion focuses on those conditions that rated Fair or Poor as a result of our CAP viability analysis. The Upper Eel 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

Suitable shelter ratings are required by juvenile salmonids as well as adult spawners for protection from predators, partitioning of habitat from other fish, and providing areas of reduced velocity for energy conservation. Data from CDFW habitat inventories indicate shelter ratings throughout the Upper Eel River and its tributaries are poor with a few of surveyed 82 habitat surveyed reaches meeting suitability targets for shelter. Poor to fair LWD ratings were also documented within these drainages, due largely to a lack of functional riparian corridors and recruitment of large conifer and hardwoods species from adjacent upslope areas. Reduced shelter ratings in most stream reaches limit the quality of available habitat for juvenile salmon that likely reduces survival prior to their outmigration during the spring and early summer.

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

The frequency of primary pools is poor in most of the tributary streams habitat typed by CDFW. Most sampled streams have a high percentage of flatwater or run habitat that are not preferred by rearing lifestages of salmonids due to the general lack of depth, complexity and velocity refuge. The lack of pools in this basin likely limits the space available for juveniles attempting to maintain territory for feeding and protection from predators. Lack of pool habitats in the all surveyed stream in this basin stems from high sediment production (pool filling) and loss of LWD recruitment from past land use practices and large flood events.

Sediment: Gravel Quality and Distribution of Spawning Gravels

Spawning habitat quality is poor in many streams due to road related and chronic mass wasting from slides that occur in the basin. Fifty-three of 82 surveyed reaches did not meet suitable targets for spawning gravel quality. While some recovery of large sediment pulses from the 1955 and 1964 flood events has occurred, road systems, high natural erosion rates, existing slides and grazing to some extent result in high sediment loads that continue to cause reduction in egg survival, and reduce food production and pool volume for rearing.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

Sediment transport conditions in the Upper Eel River watershed have a Poor rating in relation to the 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, it was only rated as Fair, and therefore was not suitable in much of the available stream habitat.

Landscape Pattern conditions have an overall Fair rating with respect to overall watershed process. Disturbance in the form of timber harvest, and roads across the basin which act to alter sediment transport have been and continue to cause landscape disturbance in this basin.

Very Good or Good Current Conditions

Changes in riparian species composition and structure has occurred due to past land use and natural events. The Riparian Vegetation, species composition condition has a Fair rating due to the recovery that has occurred from past land use and natural events such as the 1964 flood. The lack of large riparian species available for recruitment to stream channels throughout the watershed. Stress of altered riparian species composition results in reduced habitat complexity in tributary habitats used for both spawning and rearing. To determine the level of degradation of riparian corridors we relied on riparian shading information developed and used in analysis EPA TMDLs for the Eel River watershed as a surrogate. For example, in the Middle Fork Eel River, EPA (2003) reports that small (2-3 percent) improvements in canopy in the tributaries and slightly larger (9 percent) in the mainstem reaches is needed to meet natural background levels for this basin. In general, stands are younger (120 years or less) and usually 18-24 inches in diameter (EPA 2005) and in the process of recovery.

Fish passage conditions have an overall Fair rating and should be addressed in this watershed. Although the majority of the potential habitat available for spawning and rearing is open to migration, many barriers in tributary streams continue to reduce migration of adult fish into historical habitat. Complete or partial barriers such as dams or road crossings identified in the CDFW passage assessment database may need further assessment to develop specific restoration of migration across the watershed. In addition, recreational fishing and poaching of adult salmon is known to be a stress to the abundance of adult fish in this population.

Threats

The following discussion focuses on those threats that rate as High or Very High (See Upper Eel 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 the Upper Eel CAP results.

Severe Weather Patterns

Large flood events and drought are the greatest threat to this highly erosive watershed. Past flood events in 1995 and 1964 have had devastating effects to salmonid habitat by filling pools that are required in the summer for both adults and juvenile NC steelhead. These floods have also reduced canopy levels further impacting suitability stream temperatures for rearing juvenile salmonids. Drought conditions can reduce migration potential for both winter and summer spawners and reduce suitability of stream temperature in the spring and summer through reductions in snowpack and subsequent runoff.

Roads and Railroads

High road densities exist throughout most of the Upper Eel River watershed. Roads on both private and public land have been identified in specific EPA TMDL documents as a source of sediment through increased landslides and surface erosion. Riparian road densities associated with multiple land uses such as forest roads and private ownerships, including rural residential, continue to reduce salmonid habitat suitability by delivering fine sediment to spawning and rearing reaches. Road densities are high across the basin and within riparian areas are 7.0 miles per square mile, and 7.4 miles per square mile, respectively.

Fire, Fuel Management and Fire Suppression

Fire and fuel management associated with high fuel loads exists in the some areas of the watershed, such the Middle Fork Eel River. Due to past fire suppression actions, the watershed had the potential for large scale, high intensity stand replacing wildfires that can then result in increased sediment delivery to stream channels (USFS and BLM 1994). Since the late 1990s, the USFS has implemented prescribed burning to reduce the potential for high intensity fires on their lands in the upper portions of the Middle Fork Eel River. We rated fire management as a Medium threat in this watershed because fire mapping very high fuel loading and Very High threat of fire to occurs in the upper watershed area of the Middle Fork Eel River, the southern watershed area of Tomki Creek, scattered areas in the North Fork Eel River and Outlet Creek.

Water Diversion and Impoundments

Although adult passage across the watershed is good, there are watershed areas where improved passage would provide access to additional spawning and rearing opportunities. Since 1922 Scott Dam has blocked passage to approximately 35-45 miles of Chinook salmon spawning and rearing habitat in the upper mainstem Eel River (VTN 1982). Passage at this facility would provide habitat for an estimated 1200 spawning adults (Spence *et al*. 2008). Other passage barriers in the watershed include road or highway crossings that are partial barriers.

Channel Modification

Actions which modify or disrupt the natural channel-forming processes and morphology of the Lower Eel River and its estuary have degraded habitat utilized by Chinook salmon and NC steelhead. Dikes and levees were constructed in the estuary in order to restrict flow and reclaim tide lands. Remaining streams and sloughs in confined channels have slower flow, allowing them to fill with sediment. The estuary is a fraction of its former size due to extensive channel modification that causes stressful rearing conditions for Chinook salmon and NC steelhead.

Disease Predation and Competition

In the 1980s pike minnow were introduced Lake Pillsbury, these non-native species eventually colonized most of the Eel River system. Predation by large pike minnow on Chinook salmon pre-smolts produced in the Upper Eel River is likely an ongoing impact on the population. Quantitative information is not available regarding the level predation and effect on abundance of pre-smolt Chinook salmon. Therefore, a moderate threat level was assigned for loss in abundance and competition that these non-native species present to juvenile lifestages of Chinook salmon.

Fishing and Collecting

Upper Eel River salmon are susceptible to catch and release stress and potential mortality in the estuary and lower mainstem when they enter these reaches during the fall. Sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1st of each year, which allows anglers to target Chinook salmon staging in low flow conditions during late August and September. Adult Chinook salmon are easy targets for both fisherman and poachers in these extremely low flows. Anglers are reported to handle hundreds of adult salmon as these fish stage prior to the first fall rains (Higgins 2010). Also, tributary areas throughout the basin have long been used by local residents as an opportunity to obtain salmon for food or black market sales.

Low or Moderate Threats

Timber harvest has been conducted in the watershed for over 150 years. Methods of harvest and regulations have reduced the overall impact of this threat in recent decades. The rate of harvest in this basin has slowed in the last decade, but this threat will continue to exist in the future. For all but the adult lifestage, the threat of timber harvesting activities is rated as a Medium threat to lifestages of salmonids and overall watershed processes. Improved logging methods such as yarding of trees which reduces ground disturbance and reduction in harvesting within riparian zones could keep this threat from becoming a large contributor to habitat stresses throughout the basin.

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, it is likely that the egg and the pre-smolt lifestage survival are most limited and that gravel quality and rearing habitat is lacking for this population. Pre-smolt rearing habitat is impaired by lack of instream shelter and overall lack of channel complexity instream reaches throughout the basin. Lack of channel complexity results in lack of pools and riffles, reduced cover, and reduce velocity refuge for young salmonids that emerge from the gravel. In addition, the egg lifestage is limited by elevated fine sediment that reduces survival to emergence in many spawning areas of the Upper Eel River and its tributaries. Adult salmon entering the system in late August and September are subjected to recreational fishing impacts in the estuary and lower river prior to low flow closures that begin in October. Adults fish are also subjected to some poaching in remote areas of the watershed.

General Recovery Strategy

Improve Habitat Complexity

Our strategy is to improve large woody debris (LWD) frequency across the Upper Eel River watershed. Improvement in tributary streams such as Outlet Creek, Tomki Creek, Dobbyn Creek and others is likely more realistic due to their size and importance as rearing areas. Riparian areas are in the process of recovery with stands of smaller diameter conifers and hardwoods that currently buffer stream areas. Addition of LWD will provide much needed complexity to stream channel until riparian areas reach maturity at which time they can begin to recruit LWD naturally to channels. LWD will improve instream habitat attributes such as pool and riffle frequency and habitat complexity. LWD will improve survival of Chinook salmon fry as they emerge from gravels and seek cover. Our 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 spring. Increasing the LWD frequency is also expected to improve sediment routing by slowing transport and improving spawning gravel quality and cover for adult Chinook salmon.

Improve Habitat and Substrate Quality

Reduced sediment delivery from management caused sources of roads and timber harvest is likely to improve a number of key habitat attributes. Road related sediment delivery has increased in the recent past and must be reduced as part of the recovery in this basin. Upgrading or decommissioning of roads throughout the basin is expected to improve sediment quality for improved egg survival, improve benthic macro-invertebrate production for juvenile feeding, and reduce pool filling for improved juvenile rearing and migration conditions.

Reduce Sediment Delivery from Road Systems

Many of the road systems on USFS lands, private timberlands, and tribal lands need to be upgraded or decommissioned. Road upgrades and stream crossing repair throughout the watershed will reduce fine sediment delivery to streams and reduce the probability of increasing landslide potential. The frequency of severe weather patterns is expected to increase, and therefore, roads in this basin must be disconnected from stream networks or decommissioned to provide additional resiliency to large flood events that have had devastating effects to salmonid habitat in the past.

Improve Canopy Cover and LWD Frequency

Tributaries streams within this watershed would benefit from improved riparian composition and structure, which would increase stream shading, improve LWD recruitment, and increase instream shelter for juvenile fish. General practices to improve riparian condition include increased number of riparian conservation easements (Covelo area), reduced harvest and improved protection of riparian areas, riparian planting and livestock exclusion fencing where appropriate.

Restore and Improve Fish Passage

Thirty to forty-five miles of historical Chinook habitat is blocked by Scott Dam. Of this, much of the highest quality spawning habitat is inundated by Lake Pillsbury. Therefore, a fish passage facility *only* providing access over Scott Dam may not yield desired productivity targets for Chinook salmon. Thorough investigations need to occur to determine if decommissioning of Scott Dam is a feasible options and if it is necessary to achieve long-term viability of the Upper Eel River Chinook population. If decommissioning of Scott Dam were to occur, natural hydrologic and sediment transport conditions would return to the Eel River while providing Chinook salmon with access to historical spawning habitat. The FERC re-licensing process for the Potter Valley Project begins in 2017 and will require thorough evaluations of all potential impacts associated with the Potter Valley Project. These evaluations may require additional measures than those that currently exist to ensure that the Upper Eel River Chinook population is on a viable long-term recovery trajectory. Additional areas to address Upper Eel River Chinook population barriers include impediments in Long Valley and Cave creeks as identified by CDFW.

Reduce Illegal Poaching and Recreation Fishing Pressure

Additional resources must be allocated to protect adult Chinook salmon from poaching during the fall migration and during spawning in smaller tributary streams. Reduction or halting recreational fishing for adult Chinook salmon in the lower mainstem Eel River and estuary should be considered to reduce incidental take from recreational fishing. Coordination with the RVIT to reduce fishing on tribal lands, this will improve abundance and ensure future use by tribal members.

Literature Cited

Brown, L.R. and P.B. Moyle. 1997. Invading species in the Eel River, California: successes, failures, and relationships with resident species. Environmental Biology of Fishes 49:271-291.

EPA, Environmental Protection Agency. 2005. Middle Mainstem Eel River and Tributaries (from Dos Rios to the South Fork). U.S. Environmental Protection Agency Region IX, December 2005.

Higgins, P. 2010. Eel River Fall Chinook Monitoring Project Final 2010 Report. Prepared for: Friends of the Eel River. Patrick Higgins, Consulting Fisheries Biologist, Arcata, California.

LeDoux-Bloom, C. M. and S.T. Downie. 2008. Outlet Creek Basin Assessment Report. Coast Watershed planning and Assessment Program, p. 195. California Natural resources Agency's Department of Fish and Game, Fortuna, California.

Lisle, T.E. 1982. The recovery of stream channels in north coastal California from recent large floods. K.A. Hashagan (editor). In, Habitat Disturbance and Recovery. Proceedings of a Symposium. California Trout, Inc. San Francisco.

NMFS (National Marine Fisheries Service). 2005. Final Assessment of the National Marine Fisheries Service's Critical Habitat Analytical Reivew Teams (CHARTs) for Seven Salmon and Steelhead Evolutionarily Significant Units (ESUs) in California. Southwest Region, Protect Resources Division, Long Beach, California. July.

SEC (Steiner Environmental Consulting). 1998. Potter Valley Project Monitoring Program (FERC No. 77, Article 39) Effects of Operations on the Upper Eel River Anadromous Salmonids, Final Report March 1998. Prepared for the Pacific Gas and Electric Company Technical and Ecological Services, 3400 Crow Canyon Road, San Ramon, California 94583.

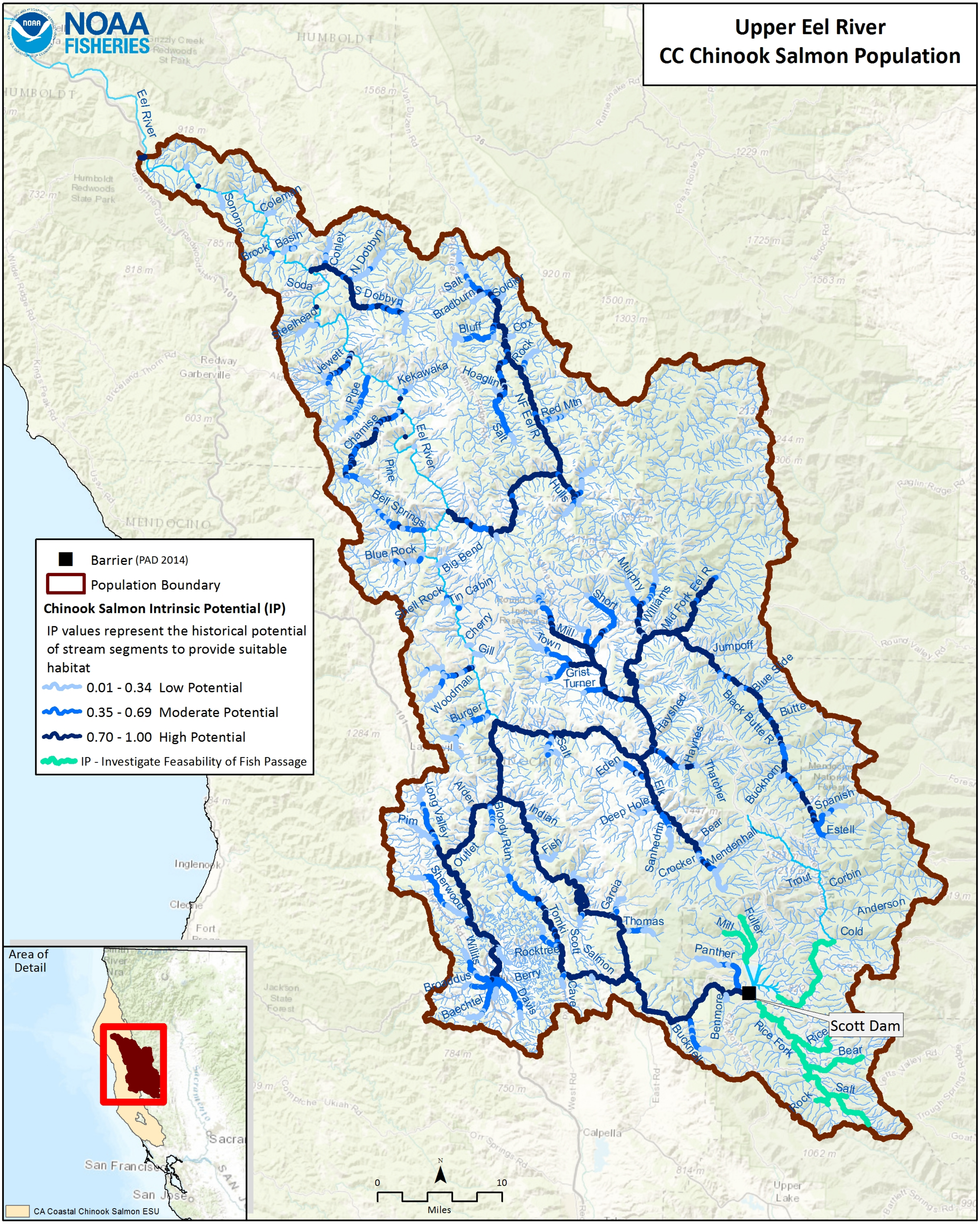
Spence B. C., E. P. Bjorkstedt, J.C. Garza, J.J. Smith, D.G. Hankin. D. Fuller, W.E Jones, R. Macedo, T. H. Jones, E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast Recovery Domain. NOAA Technical memorandum NMFS, NOAA-TM-NMFS-SWFSC-423. Southwest Fisheries Science Center, Santa Cruz, CA.

Yoshiyama R. M. and Peter B. Moyle. 2010. Historical review of Eel River anadromous salmonids, with emphasis on Chinook salmon, coho salmon and steelhead. UC Davis, Center for Watershed Sciences working paper. A Report Commissioned by California Trout, 2010. Center for Watershed Sciences University of California, Davis, CA.

USFS and BLM (United States Forest Service and Bureau of Land Management). 1995. Watershed analysis report for the upper Eel River watershed. USFS Willows, California.

VTN (Venture Tech Network Oregon). 1982. Potter Valley project (FERC Project Number 77-110) Fisheries Study. Final report volumes I & II. Prepared for the Pacific and Electric Company, San Ramon, California.

Upper Eel River
CC Chinook Salmon Population



#	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/non-functional	Poor
			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)	51% to 74% 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)	2% streams/ 3% 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	50% of IP-km to 74% of IP-km	Fair
			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	50% of IP-km to 74% of IP-km	Fair
			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	20% Class 5 & 6 across IP-km	Poor

			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	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)		1-20 Spawners per IP-km: low risk spawner density per Spence (2008)	Fair
			Viability	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair
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 67	Fair
			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)	35% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor

3	Pre Smolt	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			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)	1% streams 17% 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)	2% streams/ 3% IP-km (>40% Pools; >20% Riffles)	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)	5% streams/ 4% 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 51-75	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 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	0.49 Diversions/10 IP-km	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	50% of IP-km to 74% of IP-km	Fair
			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	20% % Class 5 & 6 across IP-km	Poor

			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)	35% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor
			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)	50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)	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	Spatial Structure	<50% of Historical Range	50-74% of Historical Range	75-90% of Historical Range	>90% of Historical Range	50-74% of Historical Range	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	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)	5% streams/ 4% 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	0.49 Diversions/10 IP-km	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)	35% streams/ 28% IP-km (>50% stream average scores of 1 & 2)	Poor
			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	0.093% 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	0.153% 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	4% 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	1.7 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	1.6 Miles/Square Mile	Poor

Upper Eel 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	Low	Low	Low	Low	Low	Low
2	Channel Modification	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition			Medium	Medium		Medium
4	Hatcheries and Aquaculture	Low					Low
5	Fire, Fuel Management and Fire Suppression	Low	Medium	Low	Low	Medium	Medium
6	Fishing and Collecting	Medium					Low
7	Livestock Farming and Ranching	Low	Low	Low		Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Low	Low	Medium
9	Mining	Low	Low	Low	Low	Low	Low
10	Recreational Areas and Activities					Low	Low
11	Residential and Commercial Development	Low	Low	Low	Low	Low	Low
12	Roads and Railroads	Medium	High	High	Medium	High	High
13	Severe Weather Patterns	Medium	High	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Low	Low	Low	Low
	Threat Status for Targets and Project	Medium	High	Medium	Medium	Medium	High

Upper Eel River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
UER-CCCh-3.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-3.1.1	Recovery Action	Hydrology	Improve flow conditions										
UER-CCCh-3.1.1.1	Action Step	Hydrology	Restore unimpaired flows and access to historical spawning and rearing areas.	1	20	FERC, NMFS						TBD	Cost based on stream flow/precipitation model at a rate of $65,084/project. Cost to restore unimpaired flows based on a variety of methods such as conservation, storage, and water lease/acquisition.
UER-CCCh-3.1.1.2	Action Step	Hydrology	Investigate modifying operations of Van Arsdale Fish Station then consider the decommissioning of Scott Dam.	2	5	CDFW, FERC, NMFS, PG&E						TBD	Cost accounted for in other action steps.
UER-CCCh-3.1.1.3	Action Step	Hydrology	Investigate the feasibility of decommissioning and removing Scott Dam located on the mainstem Eel River.	1	5	CDFW, FERC, NMFS, PG&E, Sonoma County Water Agency	500					500	
UER-CCCh-3.1.1.4	Action Step	Hydrology	Investigate the effectiveness of "block water" releases from Scott Dam.	2	5	CDFW, FERC, NMFS, PG&E	50.00					50	
UER-CCCh-3.1.1.5	Action Step	Hydrology	Install flow gages at above Lake Pillsbury on the Eel River and the Rice Fork of the Eel River, and below the dam at Tomki Creek.	2	20	FERC, NMFS, USFS, USGS	0.75	0.75	0.75	0.75		3	Cost based on installing a minimum of 3 stream flow gauges at a rate of $1,000/gauge. Cost does not account for data management or maintenance.
UER-CCCh-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
UER-CCCh-5.1.1.1	Action Step	Passage	Investigate the physical condition and future viability of Scott Dam.	1	3	FERC, NMFS, PG&E, Private Consultants						TBD	
UER-CCCh-5.1.1.2	Action Step	Passage	Evaluate and prescribe volitional and non-volitional passage methodologies above Scott Dam (including the actions below).	3	5	CDFW, NMFS, PG&E						TBD	
UER-CCCh-5.1.1.3	Action Step	Passage	Determine the quantity and quality of historic habitat above Scott Dam.	2	3	CDFW, FERC, NMFS, PG&E, USFS						TBD	
UER-CCCh-5.1.1.4	Action Step	Passage	Investigate the current fish species composition and population dynamics above Scott Dam.	2	5	CDFW, FERC, NMFS, PG&E, USFS	134.00					134	Cost based on abundance/distribution model at a rate of $133,640/project.
UER-CCCh-5.1.1.5	Action Step	Passage	Determine the potential for habitat restoration for Chinook salmon above Scott Dam.	2	2	CDFW, FERC, NMFS, PG&E, USFS	25.00					25	
UER-CCCh-5.1.1.6	Action Step	Passage	Provide passage over physical barriers that preclude Chinook salmon from accessing important habitat areas (list below indicates the locations with passage problems).	2	10	CDFW, NOAA RC						TBD	Cost accounted for in below action step.
UER-CCCh-5.1.1.7	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Salt Creek in the North Fork Eel River watershed (Passage Assessment ID 715446).	2	5	CDFW, Mendocino County RCD, NOAA RC	213.00					213	Cost based on providing passage at rate of $213,081/project.
UER-CCCh-5.1.1.8	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Island Mountain Bridge on Chamise Creek (Passage Assessment ID 722589).	2	5	CDFW, NOAA RC	213.00					213	Cost based on providing passage at a rate of $213,081/project.
UER-CCCh-5.1.1.9	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at the culvert on Sonoma Creek on the Whitlow Road Bridge (Passage Assessment ID 715488).	2	5	CDFW, NOAA RC	213.00					213	Cost based on providing passage at a rate of $213,081/project.

Upper Eel River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
UER-CCCh-5.1.1.10	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Bluft Creek (Passage Assessment ID 707894).	2	5	CDFW, NOAA RC	213.00					213	Cost based on providing passage at a rate of $213,081/project.
UER-CCCh-5.1.1.11	Action Step	Passage	Evaluate, design, and implement appropriate fish passage on Long Valley Creek at Highway 101 at three sites (Passage Assessment ID 707090, 707091, and 707094).	2	5	CDFW, NOAA RC	213.00					213	Cost based on providing passage at a rate of $213,081/project.
UER-CCCh-5.1.1.12	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at nine road crossings on Cave Creek in the Tomki Creek watershed.	2	5	CDFW, NOAA RC	213.00					213	Cost based on providing passage at a rate of $213,081/project.
UER-CCCh-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-6.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
UER-CCCh-6.1.1.1	Action Step	Habitat Complexity	Implement a large woody debris or other large roughness elements supplementation program to increase stream complexity to improve pool frequency and depth.	2	20	CDFW, NRCS, Private Landowners, USFS	2,535	2,535	2,535	2,535		10,140	Cost based on treating 39 miles (assume 1 project/mile in 50%high IP) at a rate of $260,000/mile. (Cost revised by information provided by Mendocino National Forest).
UER-CCCh-6.1.1.2	Action Step	Habitat Complexity	Develop a plan or priority list that identifies specific stream reaches that would suitable for conducting instream habitat complexity projects.	2	1	CDFW, NMFS, Round Valley Indian Tribe, USFS	115					115	Cost based on fish/habitat restoration model at a rate of $114,861/project.
UER-CCCh-6.1.1.3	Action Step	Habitat Complexity	Encourage landowners (private, USFS, and Round Valley Indian tribe) to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	20	CDFW, Private Landowners, USFS						0	Action is considered In-Kind
UER-CCCh-7.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-7.1.1	Recovery Action	Riparian	Improve canopy cover										
UER-CCCh-7.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers.	2		CDFW, Mendocino County RCD, NMFS, Private Landowners						TBD	Cost based on amount of habitat needed, fair market value, and landowner participation.
UER-CCCh-7.1.1.2	Action Step	Riparian	Protect existing riparian areas from timber harvest, rural residential, and grazing activities to maintain LWD supply and canopy recovery.	1	60	CalFire, CDFW, County of Mendocino, CDFW, NMFS						0	Action is considered In-Kind
UER-CCCh-7.1.1.3	Action Step	Riparian	Prioritize and fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	10	CDFW, Mendocino County RCD, NOAA RC, NRCS, Private Landowners	37.50	37.50				75	Cost based on treating 3.9 miles (assume 1 project/mile in 5% high IP) at a rate of $3.63/ft.
UER-CCCh-11.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-11.1.1	Recovery Action	Viability	Increase density, abundance, spatial structure and diversity										
UER-CCCh-11.1.1.1	Action Step	Viability	Evaluate the potential loss of habitat above Scott dam relative to the potential contribution to the overall Chinook recovery population target in the Eel river watershed.	3	5	CDFW, NMFS, PG&E, USFS						TBD	Costs considered in previous actions

Upper Eel River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
UER-CCCh-11.1.1.2	Action Step	Viability	Investigate juvenile Chinook migratory patterns through the Van Arsdale diversion facility. Consider utilizing radio telemetry equipment to conduct study.	3	5	CDFW, NMFS, PG&E	50.00					50	
UER-CCCh-11.1.1.3	Action Step	Viability	Conduct spawning surveys to determine habitat use above the Van Arsdale Fish station.	3	5	CDFW, PG&E, USFS	30.00					30	
UER-CCCh-11.1.1.4	Action Step	Viability	Continue and conduct annual monitoring of adult and juvenile Chinook salmon at the Van Arsdale Fish Station.	2	10	CDFW, FERC, NMFS, PG&E	37.50	37.50				75	
UER-CCCh-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent or minimize reduced density, abundance, and diversity based on based on the biological recovery criteria										
UER-CCCh-14.1.1.1	Action Step	Disease/Predation/Competition	Reduce predation and competition of pike minnow on juvenile Chinook salmon.	2	20	CDFW, FERC, NMFS, PG&E, Sonoma County Water Agency						TBD	Cost based on amount of exotic piscivorous fish species to be removed. Cost for pikeminnow eradication estimated at $9.38/fish.
UER-CCCh-14.1.1.2	Action Step	Disease/Predation/Competition	Implement the most cost effective methods or programs of pike minnow control in the Upper Eel River watershed.	3	20	CDFW, FERC, NMFS, PG&E						TBD	Cost accounted for in above action step.
UER-CCCh-14.1.1.3	Action Step	Disease/Predation/Competition	Support investigations that determine the most effective methods to control the pike minnow population.	3	20	CDFW, NMFS, PG&E						TBD	
UER-CCCh-15.1	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**										
UER-CCCh-15.1.1	Recovery Action	Fire/Fuel Management	Prevent or minimize increased landscape disturbance										
UER-CCCh-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	5	NMFS, USFS						0	Action is considered In-Kind
UER-CCCh-15.1.1.2	Action Step	Fire/Fuel Management	Work with Calfire to reduce fuel loads on private lands ranked as Very High within the Middle Fork Eel River, Tomki Creek, and the mainstem Eel River upstream of Dos Rios.	2	10	CalFire, Private Landowners, USFS	100.00	100.00				200	
UER-CCCh-15.1.1.3	Action Step	Fire/Fuel Management	Work with USFS to reduce fuel loads in the Mendocino National Forest through prescribed burns or other methods.	2	10	NMFS, USFS, USFWS	250.00	250.00				500	
UER-CCCh-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
UER-CCCh-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance, and diversity based on based on the biological recovery criteria										
UER-CCCh-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFW to modify Section 7.50. Eel River regulations (A) 1-3 mainstem, (B)2 Van Duzen, (C) South Fork Eel River. Modify open season for these streams to January 1 through March 31 with the use of barbless hooks.	1	5	CDFW, NMFS						0	Action is considered In-Kind
UER-CCCh-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult Chinook salmon by increasing law enforcement.	2	10	CDFW Law Enforcement, NMFS OLE	50.00	50.00				100	
UER-CCCh-16.1.1.3	Action Step	Fishing/Collecting	Work with RVIT to promote recovery of Chinook salmon.	3	10	CDFW Law Enforcement, NMFS OLE, Pomo Tribe, Round Valley Indian Tribe	25.00	25.00				50	

Upper Eel River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
UER-CCCh-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UER-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
UER-CCCh-23.1.1.1	Action Step	Roads/Railroads	Develop a Riparian Road Sediment Reduction Plans for private landowners or associations that prioritizes sites and outlines implementation and a time line to complete necessary actions.	2	5	CDFW, Mendocino County Department of Public Works, NMFS, Private Landowners						TBD	Cost based on conducting a road inventory. Estimate for road inventory is $957/mile.
UER-CCCh-23.1.1.2	Action Step	Roads/Railroads	Implement road upgrades at high priority sites or systems.	2		CDFW, Mendocino County RCD, NMFS, NRCS, Private Landowners						TBD	Can not make cost estimate at this time.
UER-CCCh-23.1.1.3	Action Step	Roads/Railroads	Implement road upgrades and/or decommissioning on industrial timberland in the upper Black Butte watershed.	2	10	CDFW, NOAA RC, Private Landowners	100.00	100.00				200	Very rough guess based on estimates from similar areas of US Forest Service land.
UER-CCCh-23.1.1.4	Action Step	Roads/Railroads	Upgrade USFS roads that are used for public or administrative use. Decommission roads in the Mendocino National Forest based on USFS prioritization.	2	10	Alameda Flood Control, CDFW, NOAA RC, USFS	2,500	2,500				5,000	This estimate based on CDFW and USFS rough estimates. (Cost revised based on comments from the Mendocino National Forest).
UER-CCCh-23.1.1.5	Action Step	Roads/Railroads	Work with the County of Mendocino DOT to upgrade existing high priority riparian road segments identified by the county.	2	5	CDFW, County of Mendocino, NMFS	400.00					400	Estimate 20 miles at 20k
UER-CCCh-23.1.1.6	Action Step	Roads/Railroads	Work with private landowners to upgrade existing high priority roads, or those identified in a sediment reduction plan.	2	10	CDFW, County of Mendocino, NMFS, Private Landowners	400.00	400.00				800	Estimate 40 miles at 20k

Van Duzen River Subset of the Lower Eel River Population

CC Chinook Salmon Fall-Run

- Role within ESU: Role within ESU: A subset with the Lower Eel River Functionally Independent Population
- Diversity Stratum: North Mountain Interior
- Spawner Abundance Target: 2,900 adults (includes Larabee Subset)
- Current Intrinsic Potential: 143.7 IP-km (includes Larabee Subset)

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

Chinook Salmon Abundance and Distribution

There are two natural barriers on the mainstem of the Van Duzen River that limit passage of adult Chinook salmon (CDFG 2012a): Salmon Falls, at River Mile 36.7 near the confluence of Bloody Run Creek, and Eaton Roughs located at River Mile 46. Salmon Falls usually blocks upstream access to adult Chinook salmon however the mainstem of Yager Creek is accessible to Chinook salmon for spawning and rearing. There are limited data documenting Chinook salmon abundance in the Van Duzen River, and existing data are inconclusive (CDFG 2012b).

There are no abundance data for Chinook salmon in the Van Duzen River. However, increased numbers of adult fall-run Chinook salmon have returned to the Van Arsdale Fishery Station (VAFS) on the Upper Eel River since 2010. Although the relationship between returns to Eel River tributaries such as the Van Duzen River and VAFS counts in the Upper Eel River is unknown, a record number of Chinook salmon were counted at the VAFS in 2010, 2011, and 2012 with 2,315 Chinook salmon in 2010; 2,436 returning in 2011; and 3,471 in 2012 (CDFG 2012b and 2014). It is likely that the Van Duzen River has experienced a similar upward trend in recent years. On October 28, 2012, divers observed an estimated 800 to 1,200 adult fall-run Chinook salmon in a pool at the mouth of the Van Duzen River (Higgins 2012). The proportion of these fish which ultimately spawned in the Van Duzen River population area is unknown.

History of Land Use

Historically, the Van Duzen River basin consisted primarily of late-seral redwood/Douglas-fir (coniferous) forests with limited open oak woodland/prairies farther inland at higher elevations. Beginning near the turn of the twentieth century, logging led to development of hardwooddominated forests and reduced large wood recruitment potential to streams (CDFG 2012a). In addition, floodplain and estuarine wetland areas were cleared, diked, and drained to provide land for agriculture and urban development. Technological developments after World War II enabled logging and road building in steeper, more landslide prone areas. This caused excessive sediment delivery to streams, especially following large floods in 1955 and 1964, resulting in shallow pools and wide streams. Past gravel mining in the Lower Eel River likely contributed to braiding and flattening of the Eel River between the confluence with the Van Duzen River to one mile downstream of Fernbridge (Humboldt County Department of Public Works 1992).

Rural residences, small ranches, and agriculture have increased the demand for water. Currently, much of this demand is accommodated through instream diversions or shallow wells, which have lowered streamflows during summer low-flow periods.

Current Resources and Land Management

About 18 percent of the Van Duzen River basin is under Federal ownership, and the remaining 82 percent is owned by private entities. Of this 82 percent, 15 large ranches make up 30 percent of the land, industrial timberlands make up 27 percent, and small private rural developments make up 25 percent (CDFG 2012a).

Several watershed groups are active in the basin: the Eel River Watershed Improvement Group, Friends of the Eel River, Friends of the Van Duzen River, and the Yager/Van Duzen Environmental Stewards. NMFS considered the following existing management plans and other documents, which identify actions to improve conditions in the Van Duzen River basin, during preparation of this document.

- Recovery Strategy for California CCC Coho Salmon (CDFG 2004);
- Eel River Salmon and Steelhead Restoration Action Plan (CDFG 1997);
- Van Duzen Basin Assessment Report (CDFG 2012a);
- Lower Eel River Watershed Assessment (CDFG 2010);
- Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment (USEPA 1999);
- Lower Eel River Total Maximum Daily Loads for Temperature and Sediment (USEPA 2007);
- Green Diamond Resource Company (GDRC) Habitat Conservation Plan (GDRC 2006);
- Humboldt Redwood Company Habitat Conservation Plan (HRC 2012); and
- Yager-Lawrence Watershed Analysis (HRC 2009).

Salmonid Viability and Watershed Conditions

NMFS ranked the following indicators as Poor for Chinook salmon through the CAP process (see Van Duzen CAP results, Volume III, this plan): quality and extent of estuary habitat, canopy cover, primary and staging pools, passage flows and passage at the confluence with the Eel River, baseflow, gravel quality, gravel embeddedness, shelter, turbidity, spatial distribution, extent of timber harvest, road density, and streamside road density. Other indicators that warrant habitat restoration because they are rated fair include the following: passage flows, frequency of large wood, the ratio of pools to riffles and flatwater, tree diameter, spawning gravels, floodplain connectivity, toxicity, population density, the species richness of aquatic invertebrates, redd scour, instantaneous flow conditions, diversions, passage flows, passage at the mouth for smolts, floodplain connectivity, water temperature, and smolt and adult abundance.

The recovery strategy focuses on improving the habitat conditions described by these indicators. Strategies that address other indicators are 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 (see Volume III of this plan). The following discussion elaborates on those conditions that rated Fair or Poor as a result of our CAP viability analysis (see Volume III of this plan). The Van Duzen River CAP Viability Table results are provided below. Recovery strategies will focus on improving these conditions.

Population and Habitat Stresses

Unless otherwise noted, conditions are assessed in all areas utilized by Chinook salmon in the Van Duzen River, including the lower Eel River downstream of the confluence with Van Duzen River and the Eel River estuary.

Sediment: Gravel Quality and Distribution of Spawning Gravels

The EPA listed the Van Duzen River and the Lower Eel rivers as impaired by sediment (USEPA 1999 and 2007). The Eel River is one of the most erodible watersheds in the United States (Brown and Ritter 1971) because of the active tectonic setting, highly erodible soils, and high precipitation. The Eel River carries 15 times as much sediment as the Mississippi River, and more than four times as the Colorado River (Brown and Ritter 1971). Anthropogenic activities in the Eel and Van Duzen rivers have exacerbated these naturally high sediment loads. A study of the continental shelf deposits offshore from the mouth of the Eel River indicates that there has been a sudden, three-fold increase in the rate of sedimentation since 1954 (USEPA 2007).

Fine sediment loads are very high in much of the Van Duzen (CDFG 2012a, USEPA 1999, HRC 2009) and Lower Eel rivers (CDFG 2010, USEPA 2007), leading to embedded gravels and a small average particle size. Sedimentation of spawning gravel throughout much of the Van Duzen River watershed is a limiting factor to Chinook salmon production (CDFG 2012a).

Sediment conditions have a Poor rating for eggs and pre-smolts and a Fair rating for adults and smolts. Eggs may fail to hatch if excessive sediment loads keep oxygen from reaching them (CDFG 2012a). Summer adults hold in deep pools over the hot summer months; sediment reduces the depth of these pools. Juveniles and presmolts also rely on pools for shelter, and feed on insect prey produced in riffles upstream of pools. Insect production can be impaired by excess sedimentation on these riffles (CDFG 2012a). Aggradation has interrupted the connectivity of surface flow in several areas. The Van Duzen River is often isolated from the Eel River by subsurface flows in late summer and early fall, affecting movement of juveniles and migrating adults. An overabundance of sediment is deposited at the confluence of the Van Duzen and Eel rivers each year, which results in sub-surface flows and dry channels (CDFG 2010).

The naturally highly erosive soil in the Van Duzen watershed, combined with steep slopes and dormant landslides resulting from prior land use, leads to higher risk of shallow landslides and debris slides (CDFG 2012a). Treatment of past landslides, and prevention of future ones, is important to reduce sediment delivery to the Van Duzen River and its tributaries. Unstable banks are also sources of sediment delivery.

Habitat Complexity: Large Wood and Shelter

Surveys conducted by CDFW indicate that large wood and shelter ratings are Poor throughout the population area, with 3 percent of surveyed streams meeting desired levels for shelter and LWD (SEC 2012). Habitat, large wood and shelter conditions have an overall Poor rating for the pre-smolt and smolt lifestages. Habitat complexity is reduced by a deficit of large wood and a large supply of sediment (CDFG 2012a).

Viability: Density, Abundance, and Spatial Structure

The distribution and abundance of Chinook salmon in the Van Duzen River is unknown but likely limited compared to historical levels, based on poor habitat conditions in much of the watershed (CDFG 2010, USEPA 1999, HRC 2007, SEC 2012). Although recent trends indicate improved abundance of Chinook salmon in the mainstem Eel River (CDFG 2012b and Scott Harris, CDFW, personal communication, January 14, 2013), and some of these fish likely returned to the Van Duzen River, longer-term data sets (CDFG 2012b) suggest that abundance is well below that needed for the Van Duzen River to be at low risk of extinction (2,186 adults).

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

Available data indicate that there are not enough suitable juvenile rearing pools or adult holding pools in the Van Duzen River (CDFG 2012a) and the Yager and Lawrence Creek watersheds of the Van Duzen River (HRC 2009). Many pools are too shallow due to excessive sediment inputs (CDFG 2012a), and those pools available for juvenile use provide insufficient number and diversity of cover elements such as undercut banks, woody debris, and root masses (SEC 2012). Pools in the Van Duzen River are often shorter than is optimal for Chinook salmon use, likely due to excessive sediment loading (CDFG 2012a). The impacts of reduced pool volume and complexity are exacerbated by the presence of predatory Sacramento pikeminnow, which further limit the use of pools by rearing juvenile Chinook salmon.

Water Quality: Temperature

High water temperature is common during the summer in the mainstem Van Duzen River and many of its tributaries (SEC 2011), which affects rearing juvenile Chinook salmon (CDFG 2012a). Water temperature is also a problem in the summer in the mainstem Eel River and estuary (CDFG 2010, EPA 2007) affecting juveniles and smolts that utilize this area for rearing and passage. The Lower Eel River is listed as temperature-impaired under section 303(d) of the Clean Water Act (EPA 2007). Water quality concerns in the Lower Eel River are further described in the profile for the South Fork Eel/Lower Eel River in this document.

Estuary: Quality and Extent

The Eel River estuary was once a highly complex and extensive habitat area that played a vital role in the health and productivity of Eel River Chinook salmon populations. The Eel River estuary is currently severely impaired because of past diking and filling of tidal wetlands for agriculture and flood protection. Please see the CC Chinook salmon Eel River Overview for a complete discussion of estuarine conditions and needed recovery actions for this area.

Riparian Vegetation: Composition, Cover & Tree Diameter

Tree diameter rated as Fair overall because much of the Van Duzen River is forested with moderate-sized trees, and the species composition is rated Very Good because the watershed is estimated to have 75 percent intact historical riparian species. Riparian conditions have a Fair rating, however many areas of the lower Eel River have poor canopy cover, which falls short of the 80 percent shade canopy target value used by CDFW (CDFG 2010) to assess habitat condition relative to the target leading to a Poor rating for watershed processes.

Sediment Transport: Road Density

Sediment Transport from road density conditions was rated as Poor. There is an average of 6.8 miles of road per square mile of land in the Van Duzen watershed. Most of these roads are associated with timber harvest activities and rural residences. USEPA (2009) found that half of the human-caused sediment loading in the watershed was due to roads.

Landscape Patterns: Agriculture, Timber Harvest, and Urbanization

The effect of landscape disturbance on watershed conditions has an overall Poor rating because at least one land-disturbing activity occurs in all areas of the watershed: Road density is high across the watershed, forestry occurs over much of watershed, and ranching occurs in some areas. The impact of this disturbance is compounded by the highly erosive soil in the Van Duzen River watershed (CDFG 2012a).

Passage/Migration: Mouth or Confluence and Physical Barriers

Passage/Migration conditions have an overall Poor rating for adults. Passage into the Van Duzen River by adults is severely limited by aggraded sediment at the confluence with the Eel River until flows increase late in the year (CDFG 2012a). These fish must endure poor mainstem conditions while waiting for passage flows, leaving them vulnerable to poaching and predation as well as degrading their condition and health. Sediment accumulation at the mouths of Hely and Root creeks impairs adult fish passage into these tributaries by reducing surface flow (CDFG 2012a).

Water Quality: Turbidity or Toxicity

Extended periods of high turbidity after rain events have been documented in Cummings Creek, Grizzly Creek, Wolverton Gulch, and other areas of the Van Duzen basin (CDFG 2012). Turbidity levels high enough to affect SONCC coho salmon health (>25 NTU) were documented in several tributaries of the Van Duzen River from 2000 to 2003 (Harkins 2004). Turbidity conditions were rated as Poor for Chinook salmon. Wastewater treatment facilities affect the Lower Eel downstream of the Van Duzen (CDFG 2010). The Loleta wastewater treatment facility accepts both municipal wastewater and wastewater from the Humboldt Creamery and the Loleta Cheese Factory. This facility discharges into percolation/evaporation ponds on the Eel River, and in the winter, these ponds overflow into the Eel River (CDFG 2010).

Hydrology: Impervious Surfaces and Diversions and Impoundments

The proportion of the Van Duzen River watershed covered by impervious surfaces is low (SEC 2012). However, the number of diversions in the Van Duzen River is unknown but likely increasing due to the medical marijuana industry (see rating of threat of diversions as High). Given that one plant uses 900 gallons of water per season (Humboldt Growers Association 2010), the impacts of water diversions for this industry are likely significant. Water diversion and impoundments pose a medium threat to the adult steelhead that need sufficient flows to migrate upstream.

Hydrology: Baseflow and Passage Flows

Baseflow and Passage Flows conditions have an overall rating of Fair for all life stages. Chinook salmon are not typically in the river during summer low flow conditions. In early fall or winter, shallow riffles limit upstream migration of adults until sufficient runoff has produced conditions suitable for migration. Erosion and subsequent deposition during larger storm events may be the primary cause for the shallow riffles, rather than the flow conditions present during periods of low stream flow (CDFG 2010).

Hydrology: Redd Scour

Hydrology, redd scour conditions have a Fair rating for eggs in the Van Duzen River. CDFG (2012a) found that peak flows may be more extreme in the Van Duzen River than in past due to timber harvest and other land alterations which may have accelerated the rate at which rainwater runs off the land.

Threats

The following discussion focuses on those threats that rate as High or Very High (see Van Duzen 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 Van Duzen CAP Results.

Unless otherwise noted, threats are assessed in all areas utilized by fish originating in the Van Duzen River, including the lower Eel River (downstream of the confluence with Van Duzen River) and the Eel River estuary.

Population and Habitat Threats

Channel Modification

Actions which modify or disrupt the natural channel-forming processes and morphology of the Lower Eel River and its estuary have degraded habitat utilized by Chinook salmon. Dikes and levees were constructed in the estuary in order to restrict flow and reclaim tide lands. Please see the CC Chinook salmon Eel River Overview for a complete discussion and recovery actions.

Water Diversion and Impoundments

Water diversion and impoundments pose a High threat to adult and presmolt Chinook salmon. As of July 2010, there were 25 licensed, permitted, or pending water rights within the Lower Eel basin (estuary to River Mile 21) and lower Van Duzen River (CDFG 2012a); this is not a complete number of diversions because it does not include users of riparian rights and other diversions that are not registered with the State Division of Water Rights. Water is diverted to water row crops and home gardens, for watering cattle, and for domestic and municipal use by the cities of Fortuna and Rio Dell. Marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 2012), and the water diversion required to support these plants is placing a high demand on a limited supply of water (S. Bauer, CDFW, personal communication, 1/17/13). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per season (Humboldt Growers Association 2010). Diversions affect flow in the Eel River and Van Duzen River, and impact Chinook salmon by degrading instream habitat conditions. The effects of reduced flow on Chinook salmon is described under the stress "Hydrology: Baseflow and Passage Flows."

Disease, Predation and Competition

The invasive Sacramento pikeminnow is common in some areas of the lower Eel River basin (CDFG 2010) and is abundant in some locations of the mainstem Van Duzen River and in Yager Creek (CDFG 2012a). This species preys upon and competes with juvenile Chinook salmon. The lifestages most affected are presmolt and smolt Chinook salmon. Removal of pikeminnow has been unsuccessful in the Eel River (CDFG 2012a). Pikeminnow prefer warmer water than Chinook salmon do (Bettelheim 2001), so reducing water temperature to match Chinook salmon habitat requirements would make the habitat less suitable to pikeminnow and may help control the species.

Roads and Railroads

As described under the "Sediment Transport: Road Density" stress in this document, high road density in the Van Duzen River and the lower Eel River is problematic for recovery of Chinook salmon in these areas due to its effects on watershed processes. Roads can also alter the hydrology of stream systems resulting in higher peak flows (Ziegler *et al.* 2002).

Fishing and Collecting

Fishing is a High threat to adult Chinook salmon and summer adult steelhead. There is a popular catch-and-release fishery targeting Chinook salmon and steelhead in the Eel River which attracts hundreds, if not thousands, of anglers every season. California sport fishing regulations do not currently protect these fish during the entire period of lower flow conditions that occur coincident with their spawning migration. Sport fishing in the mainstem Eel River is subject to a low flow fishing closure whenever the gage at Scotia is recording flows less than 350 cubic feet per second. However, the low flow season does not begin until October 1st of each year, which allows anglers to target Chinook salmon and summer adult steelhead staging in low flow conditions during September. The low flow season expires on January 31, which also leaves adults vulnerable to fishing pressure during low flows occurring after February 1. Adult Chinook salmon are easy targets for both fisherman and poachers in these extremely low flows. Poor water quality in September stresses the fish and likely results in increased hook-and-release mortality (Clark and Gibbons 1991). NMFS has not formally evaluated the effect of recreational fisheries in California on steelhead and Chinook salmon.

Bycatch of Chinook salmon occurs in ocean fisheries targeting Chinook salmon originating from other areas. In a biological opinion on the effects of ocean fisheries managed under the Pacific Coast Salmon Plan, NMFS determined that bycatch in these fisheries are likely to jeopardize the continued existence of CC Chinook salmon (NMFS 2000).

Low or Medium Rated Threats

Livestock Farming and Ranching

The irreversibility of the stresses (*e.g*., Habitat Complexity: Percent Primary Pools and Pool/Riffle/Flatwater ratios; Habitat Complexity: Large Wood and Shelter; Sediment: Gravel Quality and Distribution of Spawning Gravels) that result from this threat is generally Low, leading to an overall Medium threat rating. Cattle grazing, the predominant land use in the delta grasslands has been a major factor in the degradation of habitat and reduced floodplain connectivity in the Lower Eel and estuary. Ongoing impacts include degradation of water quality by cattle waste and erosion of stream banks and damage to riparian vegetation where cattle have unrestricted access to streams. Diversions associated with livestock watering are considered in the 'Water Diversions and Impoundments' threat.

Logging and Wood Harvesting

Timber harvest is a dominant land use in the basin (CDFG 2012a). The rate of timber harvest on California's north coast has generally decreased over the last 25 years, but in the Van Duzen River basin, the acreage harvested has increased since 1990 (CDFG 2012a). Timber harvest has numerous effects on Chinook salmon habitat, including reducing recruitment of large wood into streams, reduced instream habitat complexity, reducing shade, which can lead to increased water temperature, and increasing sedimentation. USEPA (1999) found that half of the anthropogenic sediment loading there was due to timber harvest. Much of the forested lands are managed under Habitat Conservation Plans held by Humboldt Redwood Company and Green Diamond Resource Company. The conservation measures in these HCPs (GDRC 2006, HRC 2012) are generally more protective of Chinook salmon habitat than the regulations that would otherwise apply at the time the HCPs were finalized. California's Forest Practice Rules (CFPR) regulate timber harvest on all private lands. NMFS is working collaboratively with the California Board of Forestry to limit the effects of forestry operations on threatened and endangered salmonid populations in California through the CFPR. At this time, however, the rules do not fully address the limiting factors for Chinook salmon.

Agriculture

Agriculture, as defined for this plan, excludes ranching, which is a separate threat. Some row crops are planted and pasture grasses are bailed for winter feed in the lower Eel River (CDFG 2012a), and marijuana cultivation has become locally abundant in the Van Duzen River (CDFG 2012a), but aside from associated water diversions agricultural impacts are of minor impact to Chinook salmon and their habitat. Water diversions to support this agriculture are considered under the 'Water Diversions and Impoundments' threat.

Residential and Commercial Development

Several small towns lie within the Eel River watershed downstream of the Van Duzen River, and the town of Fortuna is the population center in the area. About 12,500 people lived in this area (represented by the principal communities of Ferndale and Fortuna) when the 2004 census was conducted (CDFG 2010). Rural residences also occur elsewhere in the basin. Diversions to support these communities are considered under the 'Water Diversions and Impoundments' threat, and roads associated with these communities are considered under the 'Roads' threat, both elsewhere in this document.

Hatcheries and Aquaculture

There are currently no hatcheries or fish collecting operations in the Eel River or Van Duzen River basin. Adult steelhead originating from hatcheries elsewhere (*e.g.*, Mad River) sometimes stray to the Eel River and the Van Duzen River and are caught by recreational anglers (F. Bajjaliya, CDFG, personal communication, 7/24/12). These hatchery fish likely have a minor effect on Chinook salmon and steelhead in the Van Duzen River.

Mining

Past gravel mining in the Lower Eel River likely contributed to braiding and flattening of the Eel River between the confluence with the Van Duzen River to one mile downstream of Fernbridge (Humboldt County Department of Public Works 1992). A shallow, wide channel provides less cover from predation, less food, and higher water temperatures for juvenile fish as the channel is often decoupled from riparian vegetation. Braiding reduces water depth and can become a migration barrier for adult fish, sometimes leading to stranding on shallows and mortality. Gravel extraction occurs in the Lower Eel River from the mouth upstream to Eaton Falls. These operations are conducted with State and Federal oversight. The Medium threat rating reflects sensitivity of the channel to additional disturbances (*i.e.*, lack of floodplain and channel structure). However, certain gravel extraction trenching methods have been used successfully to address some of the problems associated with the high sediment load in the lower Eel River, including the adult migration barrier that develops at the Van Duzen/Eel River confluence. Current gravel mining methodologies accommodate the narrowing and deepening of channels by using wet trenching techniques.

Recreational Areas and Activities

Recreational activities such as biking, hiking, and equestrian uses occur in the Van Duzen watershed but have a minimal impact on Chinook salmon habitat. In 2010, the U.S. Forest Service approved a motorized travel management plan for the Six Rivers National Forest, including land in the headwaters of the Van Duzen River (USFS 2010). This plan minimizes potential resource damage resulting from use of motorized vehicles in the national forest. Fishing is considered under the "Fishing and Collecting" threat.

Severe Weather Patterns

Floods and droughts constitute a low threat to Chinook salmon in the Van Duzen River basin and the lower Eel River areas they utilize. Sea-level rise associated with climate change is likely to affect Van Duzen River Chinook salmon by reducing the amount of habitat available to Chinook salmon in the Eel River estuary. The amount of sea-level rise expected to occur in the next ten years poses a low threat to Chinook salmon.

Limiting Stresses, Lifestages, and Habitats

Juvenile Chinook salmon are limited by poor rearing conditions during the summer months caused by high water temperature in the lower Eel River, inadequate pools throughout the Van Duzen River and lower Eel River which don't have enough cover and are too shallow, and much-reduced and degraded estuarine habitat. Fine sediments negatively impact existing habitat throughout both basins. Further, water diversions reduce instream flow in the lower Eel River, exacerbating water temperature issues and limiting passage of juvenile and adult Chinook salmon.

General Recovery Strategy

In general, recovery strategies focus on improving conditions and ameliorating stresses and threats discussed above, although strategies that address other indicators may also be developed where their implementation is critical to restoring properly functioning habitat conditions. The recovery strategy for the Van Duzen River populations is discussed below with more detailed and site-specific recovery actions provided in the Implementation Schedule (see Van Duzen CAP results).

Restore Access to Habitat

Barriers to fish passage do not present a major impediment to restoration and recovery, as reflected by their low stress ranking. Many tributaries to the mainstem Eel River become disconnected and inaccessible in the summer months due to sediment deposition and the resulting sub-surface flows. If the tributaries were accessible, they may provide refuge which is very limited in the Eel River mainstem reaches.

Investigate and Address Water Diversion and Groundwater Extraction and Ensure Instream Flows Are Sufficient

In the Lower Eel and Van Duzen rivers, diversions likely limit Chinook salmon production by impeding passage and degrading habitat. Instream flows should be increased during the summer months by providing incentives to reduce diversions during the summer, establishing a forbearance program using water storage tanks to decrease diversions during periods of low flow, creating water budgets to avoid over allocating water diversions, and ensuring that General Plan or City ordinances account for salmonid habitat needs.

Increase Habitat Complexity

Pools in the Van Duzen and Lower Eel rivers are too simplified and shallow to support Chinook salmon growth and survival. Large wood, boulders, or other instream structure should be added (especially in areas with cool water) in order to increase complexity and sort sediment.

Off-channel ponds, alcoves, and backwater habitat should be restored in the Van Duzen River and its tributaries and in lower Eel River tributaries.

Reduce Water Temperature

High water temperatures limit growth and survival of juvenile Chinook salmon. In streams with insufficient stream canopy, riparian vegetation should be managed to increase shade. Livestock fencing should be used to protect riparian vegetation from cattle to maintain existing shade from this vegetation. Instream flows should be sufficient so that they do not contribute to excessive water temperature.

Reduce Sediment Supply

Ongoing sediment loading from roads and unstable slopes contributes to poor Chinook salmon habitat conditions. Roads should be hydrologically disconnected from streams; road-stream connections should be assessed and prioritized, and this assessment should be used to determine which roads to decommission, upgrade, or maintain. Local government should develop a grading ordinance for building and maintenance of private roads that minimizes effects on Chinook salmon habitat.

Improve Fishing Regulations

The recreational fishery for Chinook salmon and steelhead on the Eel River is likely impacting both species. The effects of this fishery on these species should be determined, and regulators should consider changes to regulations to protect these species during low flows.

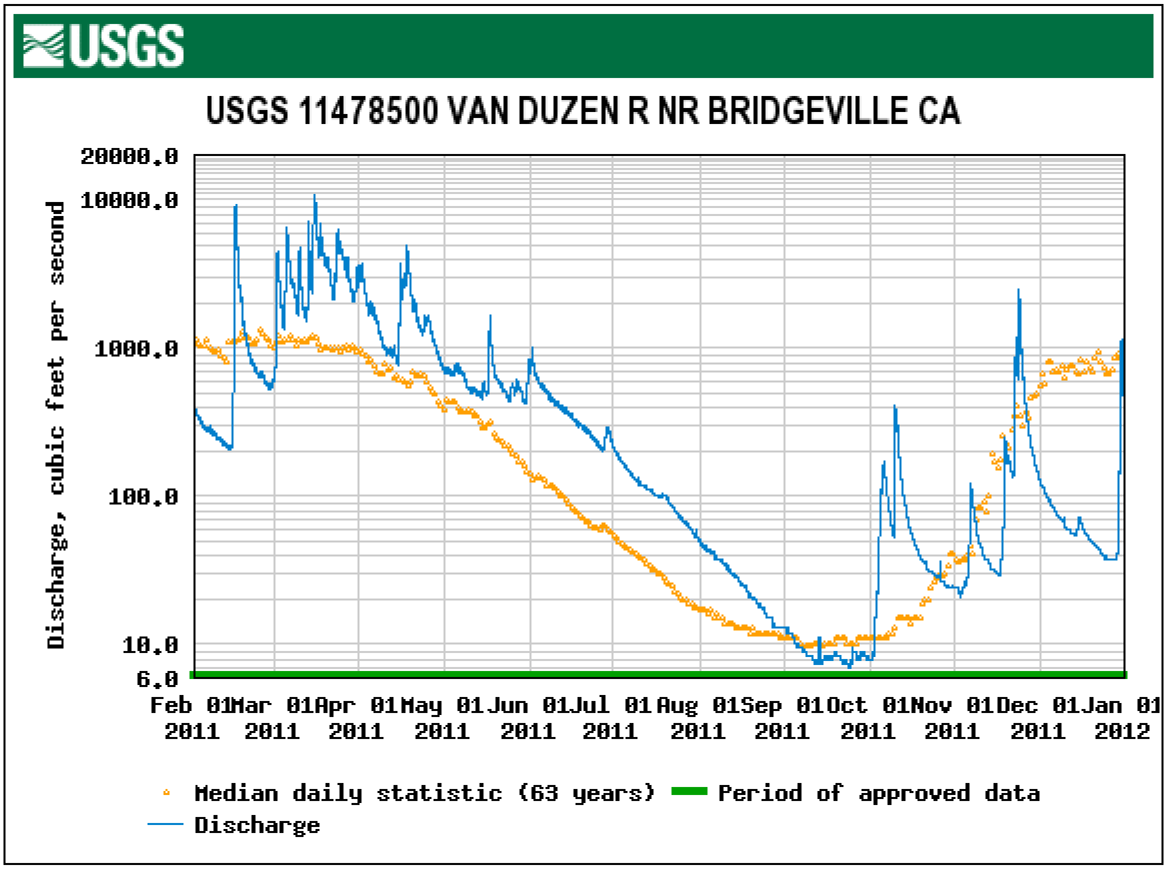


Figure 1: Daily discharge measured at USGS flow gage in Bridgeville, California in 2011 (http://nwis.waterdata.usgs.gov/nwis, accessed 1/21/15).

Literature Cited

Bettelheim, M. 2001. Temperature and flow regulation in the Sacramento River and its effect on the Sacramento pikeminnow (*Ptychocheilus grandis*): A literature review. California Department of Fish and Game, Bay-Delta and Special Water Projects Division.

Brown, W. M., III, , and J. R. Ritter. 1971. Sediment transport and turbidity in the Eel river basin. Water Supply Paper 1986. United State Geological Survey.

California Department of Fish and Game. 1997. Eel River Salmon and Steelhead Restoration Action Plan. California Department of Fish and Game, Inland Fisheries Division, Sacramento.

California Department of Fish and Game. 2004. Recovery strategy for California coho salmon: report to the California Fish and Game Commission. California Department of Fish and Game, Native Anadromous Fish and Watershed Branch, Sacramento, CA.

California Department of Fish and Game. 2010. Lower Eel River Watershed Assessment. Coastal Watershed Planning and Assessment Program. California Department of Fish and Game. Inland Fisheries Division.

California Department of Fish and Game. 2012a. DRAFT Van Duzen River Watershed Assessment. Coastal Watershed Planning and Assessment Program. California Department of Fish and Game.

California Department of Fish and Game. 2012b. DRAFT Annual Report, Van Ardsale Fisheries Station 2010-2011. Fisheries Branch Administrative Report.

Clark, R. N., and D. R. Gibbons. 1991. Recreation. W. R. Meehan, editor. Influences of Forest and Rangeland Management. 1991 AFS Publication 19. American Fisheries Society, Bethesda, MD.

Humboldt Growers Association. 2010. Humboldt County Outdoor Medical Cannabis Ordinance. Presented to Humboldt County December 13, 2010. 11 p.

Federal Energy Regulatory Commission. 2000. Proposed changes in minimum flow requirements at the Potter Valley Project (FERC Project Number 77-110), Final Environmental Impact Statement. Federal Energy Regulatory Commission, Washington D.C.

Green Diamond Resource Company. 2006. Aquatic habitat conservation plan and candidate conservation agreement with assurances. Volume 1–2, Final report. Prepared for the National Marine Fisheries Service and U.S. Fish and Wildlife Service.

Harkins, J. P. 2004. Summary of 1st three years of a 50 year Van Duzen water quality monitoring project. Friends of the Van Duzen River, Carlotta, CA.

Higgins, P. T. 2012. Lower Eel River 2012 Fall Chinook Dive Census: Eel River Recovery Project: Draft Eel River 2012 Fall Chinook Dive Report V 2.0 (12/26/12), Arcata, CA.

Humboldt County Department of Public Works. 1992. Final program EIR on gravel removal from the lower Eel River. Natural Resources Division.

Humboldt Redwood Company. 2009. Yager-Lawrence Watershed Analysis: Fish Habitat Assessment, Appendix E. Final version: January 26, 2009. 69 p.

Humboldt Redwood Company. 2012. Habitat Conservation Plan for the Properties of The Pacific Lumber Company, Scotia Pacific Holding Company, and Salmon Creek Corporation Under the Ownership and Management of Humboldt Redwood Company, LLC, as of July 2008. Established February 1999. Revised 15 February 2012 Containing Language Changes From Adaptive Management, Minor Modification, and Property-Wide Consultations. 161 p.

National Marine Fisheries Service. 2000. Endangered Species Act reinitiated section 7 consultation/biological opinion: Effects of the Pacific Coast Salmon Plan on California Central Valley spring-run Chinook, and California Coastal Chinook salmon. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest and Southwest Regional Sustainable Fisheries Divisions.

National Marine Fisheries Service. 2001. Effects of the Pacific Coast Salmon Plan and U.S. Fraser Panel Fisheries on Upper Willamette River Chinook, Lower Columbia River Chinook, and Lower Columbia River chum. Biological Opinion and Incidental Take Statement, Endangered Species Act – Reinitiated Section 7 Consultation. National Marine Fisheries Service, Sustainable Fisheries Divisions. Date Issued: April 30, 2001. 57 p.

Pacific Watershed Associates. 2007. Sediment source assessment for the Lower Eel River watershed. 32 p. Appendix C in Lower Eel River TMDL, prepared by EPA in 2007.

Perry, T. D. 2007. Do vigorous young forests reduce streamflow? Results from up to 54 years of streamflow records in eight paired-watershed experiments in the H.J. Andrews and South Umpqua Experimental Forests. Master's Thesis. Oregon State University, Corvallis, OR.

Sonoma Ecology Center. 2012. Data summaries of the California Department of Fish and Game's Stream Habitat Program Stream Summary Application. Provided to the National Marine Fisheries Service, December 2009, by the University of California Hopland Research and Extension Center.

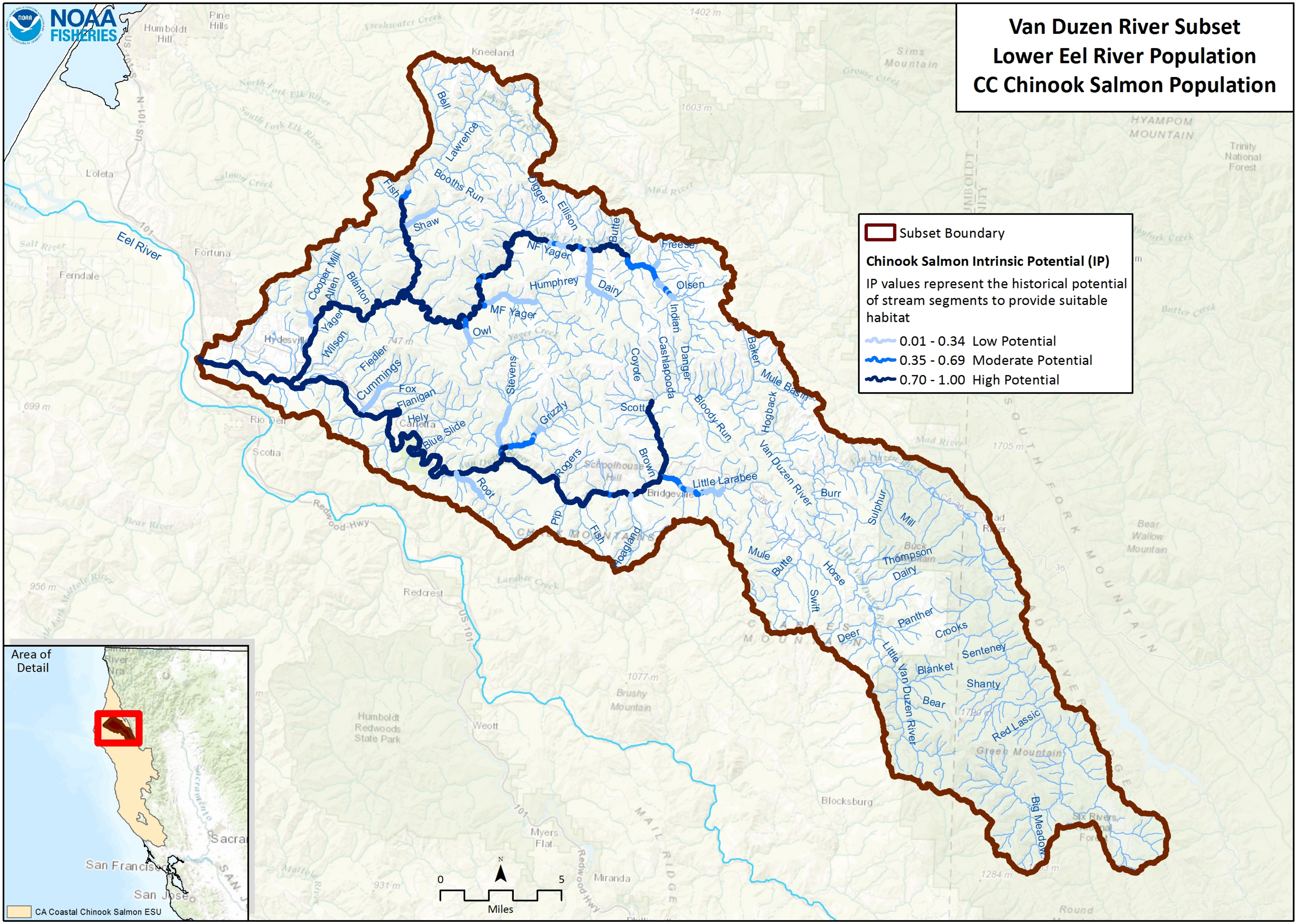
Spence, B. C., E. P. Bjorkstedt, J. C. Garza, J. J. Smith, D. G. Hankin, D. Fuller, W. E. Jones, R. Macedo, T. H. Williams, and E. Mora. 2008. A Framework for Assessing the Viability of Threatened and Endangered Salmon and Steelhead in the North-Central California Coast Recovery Domain U.S. Department of Commerce, National Marine Fisheries Service, Southwest Fisheries Service Center, NOAA-TM-NMFS-SWFSC-423, Santa Cruz, CA.

United States Environmental Protection Agency. 1999. Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment. U. S. Environmental Protection Agency Region IX.

United States Environmental Protection Agency. 2007. Lower Eel River Total Maximum Daily Loads for Temperature and Sediment. United States Environmental Protection Agency, Region IX.

United States Forest Service. 2010. Final Environmental Impact Statement Record of Decision: Lower Trinity and Mad River Motorized Travel Management. United State Department of Agriculture, Forest Service, Pacific Southwest Region, R5-MB-203. April 2010. 29 p.

Ziegler, A. D., T.W. Giambelluca, and R. A. Sutherland. 2002. Improved method for modeling sediment transport on unpaved roads using KINEROS2 and dynamic erodibility. Hydrological Processes 16:3079-3089.


Van Duzen River Subset
Lower Eel River Population
CC Chinook Salmon Population
Subset Boundary
Chinook Salmon Intrinsic Potential (IP)
IP values represent the historical potential of stream segments to provide suitable habitat
0.01 - 0.34 Low Potential
0.35 - 0.69 Moderate Potential
0.70 - 1.00 High Potential
Area of Detail
CA Coastal Chinook Salmon ESU
0
5
Miles

#	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/non-functional	Poor
			Habitat Complexity	Large Wood Frequency (Bankfull Width 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 (Bankfull Width 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% to 74% of streams/ IP-km (>1.3 Key Pieces/100 meters)	Fair
			Habitat Complexity	Percent Staging Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	0% of streams/ IP-Km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	76% of streams/ IP-km (>30% Pools; >20% Riffles)	Fair
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			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 >75	Poor
			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	<50% of IP-km or <16 IP-km accessible	Poor
			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	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	41.45% 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	50% of IP-km to 74% of IP-km	Fair
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
			Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined	<50% 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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		Size	Viability	Density	<1 spawner per IP-km (Spence et al. 2008), 109.3 IP km so <109 spawners (Spence et al. 2012)	>1 and <20 spawners per IP km, so between 109 and 2,186	There should be 20 Spawners per IP-km to achieve a low risk of extinction (Spence et al. 2008), 109.3 IP km (Spence et al. 2012) so need 2,186 spawners to achieve a low risk of extinction		1-20 Spawners per IP-km	Fair
			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
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	69.17	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.35	Fair

			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28.92	Fair
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)	18.15	Poor
			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)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	Fair
3	Pre Smolt	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	Poor
			Habitat Complexity	Percent Primary Pools	<50% of streams/ IP-Km (>49% average primary pool frequency)	51% to 74% of streams/ IP-Km (>49% average primary pool frequency)	75% to 89% of streams/ IP-Km (>49% average primary pool frequency)	>90% of streams/ IP-Km (>49% average primary pool frequency)	<50% of streams/ IP-km (>49% average primary pool frequency)	Poor
			Habitat Complexity	Pool/Riffle/Flatwater Ratio	<50% of streams/ IP-Km (>30% Pools; >20% Riffles)	50% to 74% of streams/ IP-Km (>30% Pools; >20% Riffles)	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)	>90% of streams/ IP-Km (>30% Pools; >20% Riffles)	76% of streams/ IP-km (>30% Pools; >20% Riffles)	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)	1% of streams/ IP-km (>80 stream average)	Poor
			Habitat Complexity	VStar	>0.35	0.22-0.35	0.15 - 0.21	<0.15	0.22-0.35	Fair
			Hydrology	Flow Conditions (Baseflow)	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	NMFS Flow Protocol: Risk	Poor

		Factor Score >75	Factor Score 51-75	Factor Score 35-50	Factor Score <35	Factor Score >75.	
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 51-75	Fair
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	1.1 - 5 Diversions/10 IP km	Fair
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 51-75	Fair
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	<50% of IP-km or <16 IP-km accessible	Fair
Riparian Vegetation	Species Composition	≤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	41.45% Class 5 & 6 across IP-km	Fair
Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	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)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
Velocity Refuge	Floodplain Connectivity	<50% Response Reach Connectivity	50-80% Response Reach Connectivity	>80% Response Reach Connectivity	Not Defined		
Water Quality	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
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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	69.17	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.35	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28.92	Fair
5	Smolts	Condition	Estuary/Lagoon	Quality & Extent	Impaired/non-functional	Impaired but functioning	Properly Functioning Condition	Unimpaired Condition	Impaired/non-functional	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)	1% 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	1.1 - 5 Diversions/10 IP km	Fair
			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 51-75	Fair
			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	50% of IP-km to 74% of IP-km.	Fair
			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	Good

			Sediment (Food Productivity)	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95	38-50 & 110-128	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)	43% of streams/ IP-km (>50% stream average scores of 1 & 2)	Poor
			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% of streams/ IP-km maintains severity score of 3 or lower	Poor
		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)			
			Water Quality	Aquatic Invertebrates (B-IBI NorCal)	0-40	40-60	60-80	80-100	69.17	Good
			Water Quality	Aquatic Invertebrates (EPT)	<=12	12.1-17.9	18-22.9	>=23	17.35	Fair
			Water Quality	Aquatic Invertebrates (Rich)	<25	25-30	30-40	>40	28.92	Fair
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	0.12% 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	2.13% 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	>35% of Watershed in Timber Harvest	Poor
			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	>75% Intact Historical Species Composition:	Very Good
			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	6.76 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	5.68 Miles/Square Mile	Poor

Van Duzen 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	Medium	Low	Medium	Medium	Low	Medium
2	Channel Modification	Medium	Low	High	High	Medium	High
3	Disease, Predation and Competition	Medium	Low	High	High		High
4	Hatcheries and Aquaculture	Low		Low	Low		Low
5	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Low	Medium
6	Fishing and Collecting	High		Low	Low		Medium
7	Livestock Farming and Ranching	Medium	Low	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Medium	Medium	Medium	Medium	Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Medium	Low	Medium
11	Residential and Commercial Development	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	High	Medium
13	Severe Weather Patterns	Medium	Low	Medium	Medium	Low	Medium
14	Water Diversion and Impoundments	High	Low	High	Medium	Medium	High
	Threat Status for Targets and Project	High	Medium	High	High	High	Very High

Van Duzen River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
VDR-CCCh-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VDR-CCCh-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
VDR-CCCh-2.1.1.1	Action Step	Floodplain Connectivity	Develop plan to recreate off-channel ponds, alcoves, and backwater habitat.	3	5	NGO	115					115	Cost based on amount of habitat to be restored. Cost for fish/habitat restoration monitoring estimated at $114,861/project.
VDR-CCCh-2.1.1.2	Action Step	Floodplain Connectivity	Recreate habitat guided by plan.	3	5	NGO						TBD	Cost based on amount of floodplain habitat to be restored. Cost estimated at $37,200/acre.
VDR-CCCh-5.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VDR-CCCh-5.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
VDR-CCCh-5.1.1.1	Action Step	Passage	Evaluate annually if plan addressing the sediment barrier at mouth of Van Duzen River is working effectively and modify if needed.	2	10	NGO	58	58				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. Additional cost expected for implementation of the plan once finalized.
VDR-CCCh-5.1.1.2	Action Step	Passage	Develop and implement plan to address sediment barrier at mouth of Hely Creek.	2	10	NGO	58	58				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project. Additional cost expected once plan is finalized.
VDR-CCCh-5.1.1.3	Action Step	Passage	Develop and implement plan to address sediment barrier at mouth of Root Creek.	2	10	NGO	58	58				115	Cost based on fish/habitat restoration monitoring at a rate of $114,861/project.
VDR-CCCh-5.1.1.4	Action Step	Passage	Develop and implement plan to address barrier at Wolverton Gulch.	2	10	CDFW	22	22				43	Cost based on treating unknown partial barrier at a rate of $42,616/project.
VDR-CCCh-5.1.1.5	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Cummings Creek.	2	10	NGO	22	22				43	Cost based on improving passage at unknown partial barrier at a rate of $42,616/project.
VDR-CCCh-5.1.1.6	Action Step	Passage	Develop and implement plan to address barrier at confluence of Van Duzen River with Fiedler Creek.	2	10	NGO	22	22				43	Cost based on improving passage at unknown partial barrier at a rate of $42,616/project.
VDR-CCCh-5.1.1.7	Action Step	Passage	Develop and implement plan to address culvert on Highway 36.	2	10	CalTrans	267	267				533	Cost based on improving passage at unknown partial barrier at a rate of $532,706/project.
VDR-CCCh-5.1.1.8	Action Step	Passage	Develop and implement plan to address culvert on Rohnerville Road.	2	10	County	267	267				533	Cost based on improving passage at unknown partial barrier at a rate of $532,706/project.
VDR-CCCh-5.1.1.9	Action Step	Passage	Restore passage to all life stages.	2	100	NGO							Cost accounted for in above action steps.
VDR-CCCh-6.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VDR-CCCh-6.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelters.										
VDR-CCCh-6.1.1.1	Action Step	Habitat Complexity	Develop plan to add large wood, boulders, or other instream structure to specific areas in specific quantities.	2	5	NGO	115					115	Cost based on fish/habitat monitoring at a rate of $114,861/project. This action step should be coordinated with above action step, which can reduce redundancy and cost.
VDR-CCCh-6.1.1.2	Action Step	Habitat Complexity	Add structure, guided by plan.	3	5	NGO						TBD	Costs will vary depending on methods implemented and extent of rehabilitation.

Van Duzen River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
VDR-CCCh-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**										
VDR-CCCh-16.1.1	Recovery Action	Fishing/Collecting	Prevent or minimize reduced density, abundance and diversity based on the biological viability criteria										
VDR-CCCh-16.1.1.1	Action Step	Fishing/Collecting	Continue to work with the state, to improve the low flow fishing closures.	3	5	CDFW, NMFS						0	Action is considered In-Kind
VDR-CCCh-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VDR-CCCh-18.1.1	Recovery Action	Livestock	Prevent or minimize adverse alterations to riparian species composition and structure										
VDR-CCCh-18.1.1.1	Action Step	Livestock	Identify areas where livestock have access to riparian vegetation, develop plan to fence livestock from areas.	3	5	NGO	173					173	Cost based erosion assessment of 5% of total acres at a rate of $12.62/acre.
VDR-CCCh-18.1.1.2	Action Step	Livestock	Install fence, guided by plan.	2	5	NGO						TBD	Cost based on amount of area to be fenced identified from assessment. Cost estimated at $3.63/ft.
VDR-CCCh-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
VDR-CCCh-19.1.1	Recovery Action	Logging	Prevent or minimize adverse alterations to riparian species composition and structure										
VDR-CCCh-19.1.1.1	Action Step	Logging	Develop plan that identifies areas in need of more shade that currently supports Chinook salmon and describes timber management methods that will increase shade overtime.	3	5	NGO	74.00					74	Cost based on riparian restoration monitoring at a rate of $73,793/project.
VDR-CCCh-19.1.1.2	Action Step	Logging	Manage forests in identified areas to increase shade, guided by plan.	3	5	Private						0	Action is considered In-Kind
VDR-CCCh-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of habitat or range**										
VDR-CCCh-23.1.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
VDR-CCCh-23.1.1.1	Action Step	Roads/Railroads	Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective.	2	5	NGO						TBD	Cost based on miles of road network. Cost for road inventory is estimated at $957/mile.
VDR-CCCh-23.1.1.2	Action Step	Roads/Railroads	Decommission roads, guided by assessment.	3	5	NGO						TBD	Cost based on amount of road network needing to be decommissioned. Cost to decommission roads estimated at $12,000/mile.
VDR-CCCh-23.1.1.3	Action Step	Roads/Railroads	Upgrade roads, guided by assessment.	2	5	NGO						TBD	Cost based on amount of road network needing to be upgraded. Cost to upgrade estimated at $21,000/mile.
VDR-CCCh-23.1.1.4	Action Step	Roads/Railroads	Maintain roads, guided by assessment.	3	5	NGO						0	Action is considered In-Kind
VDR-CCCh-23.1.1.5	Action Step	Roads/Railroads	Develop and implement a plan to stabilize hillslope at Hely Creek 1,440 feet above Highway 36.	3	2	NGO						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.
VDR-CCCh-23.1.1.6	Action Step	Roads/Railroads	Assess and prioritize bank stabilization needs and stabilize banks at Grizzly Creek.	3	4	NGO						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.
VDR-CCCh-23.1.1.7	Action Step	Roads/Railroads	Assess and prioritize bank stabilization needs and stabilize banks at Cummings Creek.	3	4	NGO						TBD	Cost based on size of unstable hillslope. Cost for erosion assessment estimated at $12.62/acre.

Van Duzen River, Chinook Salmon (North Mountain Interior) Recovery Actions

Action ID	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partner	Costs ($K) FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	Comment
VDR-CCCh-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
VDR-CCCh-23.2.1	Recovery Action	Roads/Railroads	Prevent or minimize alterations to sediment transport (road condition/density, dams, etc.)										
VDR-CCCh-23.2.1.1	Action Step	Roads/Railroads	Develop grading ordinance for maintenance and building of private roads that minimizes the effects to Chinook salmon.	3	5	County						0	Action is considered In-Kind
VDR-CCCh-25.1	**Objective**	**Water Diversion /Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
VDR-CCCh-25.1.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
VDR-CCCh-25.1.1.1	Action Step	Water Diversion /Impoundment	Provide incentives to reduce diversions during the summer.	3	5	NGO						TBD	Cost based on amount of incentives to provide to reduce diversions during the summer. Some incentive programs are currently in place and this recommendation should coordinate with those efforts.
VDR-CCCh-25.1.1.2	Action Step	Water Diversion /Impoundment	Document reduction in diversions and effects on salmonid habitat.	2	5	NGO	65.00					65	Cost based on stream flow/precipitation monitoring at a rate of $65,084/project.
VDR-CCCh-25.1.1.3	Action Step	Water Diversion /Impoundment	Implement forbearance program.	3	5	NGO						0	Action is considered In-Kind
VDR-CCCh-25.1.1.4	Action Step	Water Diversion /Impoundment	Create water budgets to avoid over-allocating water diversions.	2	5	CDFW	65.00					65	Cost based on stream flow/precipitation monitoring at a rate of $65,084/project. This recommendation could be coordinated with above action steps.
VDR-CCCh-25.1.1.5	Action Step	Water Diversion /Impoundment	Utilize water budgets when allocating diversions.	3	5	RWQCB						0	Action is considered In-Kind
VDR-CCCh-25.1.1.6	Action Step	Water Diversion /Impoundment	Conduct a study to document extent of water diversions and the effects these diversions have on salmonids, which includes recommendations for amount of diversions that would not limit recovery of salmonids.	3	5	RWQCB						TBD	Cost accounted for in above action step.
VDR-CCCh-25.1.1.7	Action Step	Water Diversion /Impoundment	Reduce diversions to level that would not limit recovery of salmonids.	3	5	RWQCB						TBD	Cost based on amount of diversions and stream flow levels needed for salmonids. The magnitude of diversion numbers, rates, and timing should be identified in above action step.
VDR-CCCh-25.2	**Objective**	**Water Diversion /Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
VDR-CCCh-25.2.1	Recovery Action	Water Diversion /Impoundment	Prevent or minimize impairment to stream hydrology (impaired water flow)										
VDR-CCCh-25.2.1.1	Action Step	Water Diversion /Impoundment	Revise County General Plan as needed to account for salmonid habitat needs.	3	5	County						0	Action is considered In-Kind
VDR-CCCh-25.2.1.2	Action Step	Water Diversion /Impoundment	Revise City ordinances as needed to account for salmonid habitat needs.	3	5	City						0	Action is considered In-Kind