44. Middle Fork Eel River Population

Interior Eel River Stratum

Non-Core 2, Potentially Independent Population

Recovery criteria: 80% of available IP habitat must be occupied in years following spawning of brood years with high marine survival

753 mi^2 watershed (64% Federal ownership)

78 IP-km (48 IP-mi) (13% High)

Dominant Land Uses are Agriculture and Recreation

Key Limiting Stresses are 'Impaired Water Quality' and 'Lack of Floodplain and Channel Structure'

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

Highest Priority Recovery Actions

• Improve grazing practices • Reduce stream bank erosion • Increase large woody debris (LWD), boulders, and other instream structure	• Determine the effects of marijuana cultivation and minimize if necessary • Reduce abundance of Sacramento pikeminnow • Reduce road-stream hydrologic connection

44.1 History of Habitat and Land Use

Historic land use activities in the Middle Fork Eel River include grazing, agriculture, timber harvest, and residential development. In the early 1900s, Round Valley streams in the area near Covelo were extensively channelized for agriculture and residential development, which resulted in incision that disconnected streams from their floodplains. Overgrazing in the early 1900s resulted in soil erosion and altered vegetation (California Department of Water Resources (DWR) 1982). In 1862, small-scale timber harvest began near Covelo and continued until after World War II. An estimated 46 percent of the timbered land in the population area, which is approximately 23 percent of the overall land in the population area, was logged by either clear cut or partial cut methods from 1950 to 1981 (DWR 1982).

USFS Watershed Analyses for the Middle Fork Eel River (USFS 1994c) and Black Butte River (USFS 1996d) watersheds concluded that, "human activities contributed to conditions that resulted in increased erosion and sedimentation, direct removal of riparian vegetation, and secondary impacts resulting from bank erosion and decreased vegetation in the watershed." The Watershed Analyses also indicated that fish habitat conditions appear to be improving at the time the documents were being drafted (1994 and 1996) and were projected to continue to improve over time. Past timber harvest practices along intermittent and perennial streams contributed to increases in stream temperatures. Floods in 1955 and 1964, as well as high densities of dirt roads, are responsible for excessive sedimentation that is especially apparent in the Round Valley watershed.

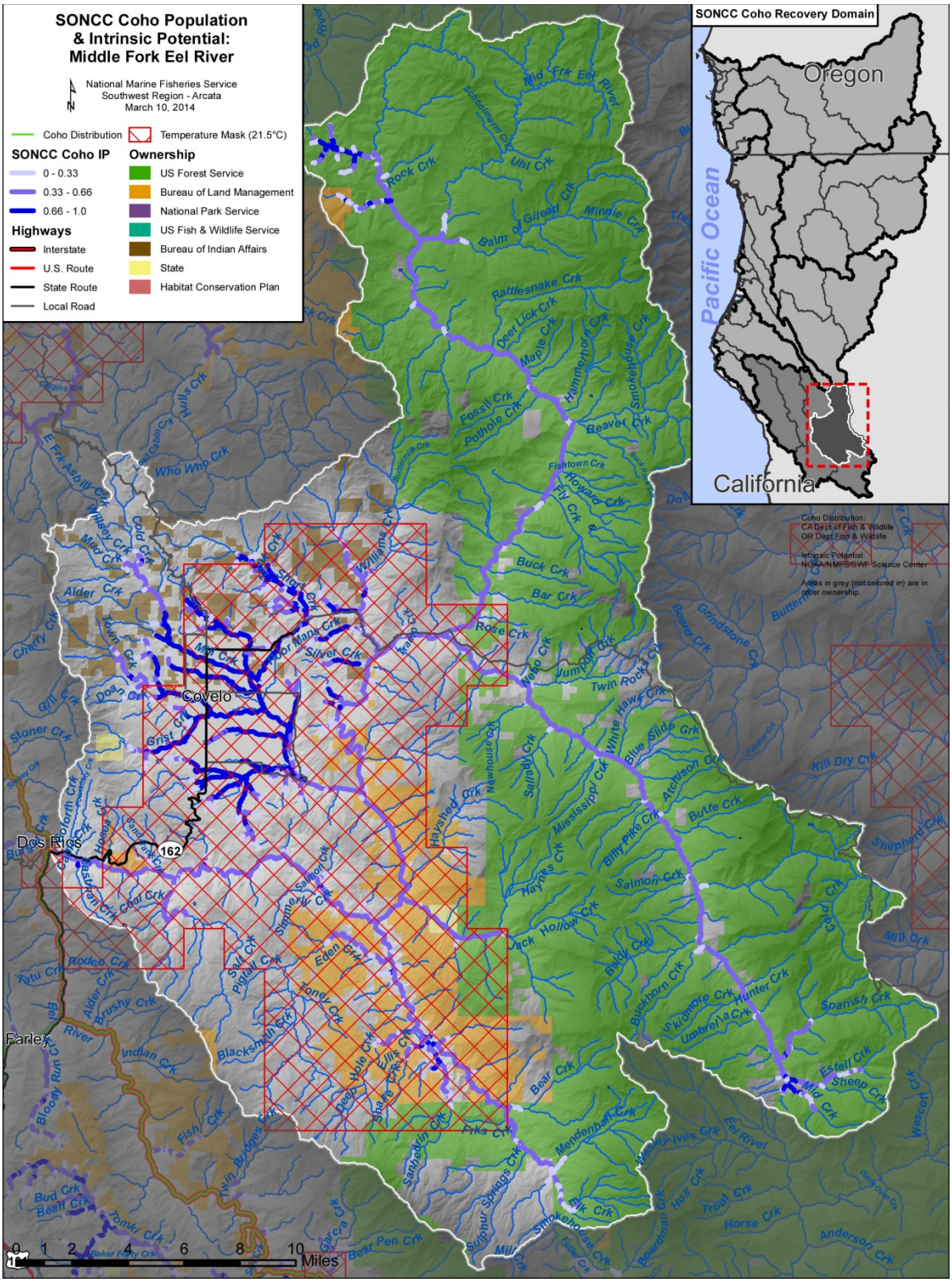

Figure 44-1. The geographic boundaries of the Middle Fork Eel River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), a temperature mask (indicating areas that are inherently too warm for rearing coho salmon), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Eel River diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

44.2 Historic Fish Distribution and Abundance

Middle Fork Eel River historic coho salmon population size estimates are not available. Coho salmon are believed to have historically inhabited the Middle Fork Eel River and its tributaries Rattlesnake, Mill, Grist, and Rock creeks (Brown and Moyle 1991). However, coho salmon have not been documented in the Middle Fork Eel River or its tributaries since annual summer surveys began in 1979 (Garwood 2012).

Table 44-1. Tributaries with high IP reaches (IP >0.66). Many of these tributaries occur under the temperature mask (Williams et al. 2006).

Sub-basin	Stream Name	Sub-basin	Stream Name
Round Valley	Grist Creek	Black Butte River	Basin Creek
	Little Salt Creek		Estell Creek
	Little Valley Creek		Middle Creek
	Mill Creek		Spanish Creek
	Poor Man's Creek	Eden Valley	Bennett Creek
	Short Creek		Elk Creek
	Silver Creek		Ellis Creek
	Tank Creek		Sanhedrin Creek
	Town Creek		Shake Creek
	Turner Creek	Wilderness	Willow Creek
	Williams Creek		unnamed tributary of the North Fork Middle Fork Eel River

44.3 Status of Middle Fork Eel River Coho Salmon

Spatial Structure and Diversity

Except for occasional strays, the current distribution of spawners is extremely limited or non-existent in most years. Due to extremely low number of individuals, diversity is also extremely low.

Population Size and Productivity

The Middle Fork Eel River coho salmon population size is unknown and all three cohorts are presumed to be absent. Under the current climate, some speculation exists as to whether the Middle Fork Eel River may have ever sustained a coho salmon population (U.S. Forest Service (USFS) 2009d). Areas with the highest intrinsic potential are primarily in the Round Valley; however, most of the tributaries in the Round Valley are under the temperature mask and are usually dry in the summer (U.S. Environmental Protection Agency (EPA) 2003b), which likely restricts juvenile distribution.

Extinction Risk

The Middle Fork Eel River population is at high risk of extinction because NMFS estimates the ratio of the three consecutive years of lowest abundance within the last twelve years to the

amount of IP-km in a watershed is less than one, the criterion described by Williams et al. (2008). However, because it is a non-core 2 population, the recovery target for the population is not to reduce the risk of extinction; rather, 80% of available IP habitat must be occupied in years following spawning of brood years with high marine survival.

Role in SONCC Coho Salmon ESU Viability

The Middle Fork Eel River population is considered to be a non-core 2 "Potentially Independent" population within the Interior Eel River diversity stratum meaning that it has a high likelihood of persisting in isolation over a 100-year time scale, but is too strongly influenced by immigration from other populations to exhibit independent dynamics. The demographic target for recovery is juvenile occupancy. Because the Middle Fork Eel River population may be functionally extinct, source populations such as the South Fork Eel River are needed to provide a source of straying individuals that could recolonize the Middle Fork Eel population area.

44.4 Plans and Assessments

Environmental Protection Agency

Total Maximum Daily Loads for the Eel River

In December 2003, the USEPA published the final Total Maximum Daily Loads (TMDL) for temperature and sediment for the Middle Fork Eel River. The North Coast Regional Water Quality Control Board is required to develop measures which will result in implementation of the TMDLs in accordance with the requirements of 40 CFR 130.6.

State of California

Eel River Salmon and Steelhead Restoration Action Plan

In 1997, the California Department of Fish and Game completed its assessment of the Eel River basin and provided recommendations for restoration of salmonid stocks. Primary recommendations included removing barriers, reducing sediment inputs, improving riparian forest conditions, reducing water withdrawals, enhancing habitat, and suppressing Sacramento pikeminnow.

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

The specific restoration recommendations developed by the Coho Recovery Team and CDFG for the Middle Fork Eel River (for Subareas Eden Valley, Round Valley, Black Butte River, and Wilderness) have been considered and incorporated into the table of population-specific recovery actions.

U.S. Forest Service

Watershed Analysis

The U.S. Department of Agriculture Forest Service completed watershed analyses for the Upper Middle Fork Eel River and the Black Butte River in 1994 and 1996, respectively.

44.5 Stresses

Table 44-2. Severity of stresses affecting each life stage of coho salmon in the Middle Fork Eel River. Stress rank categories, assessment methods, and data used to assess stresses are described in Appendix B.

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

[1] Key limiting stresses and limited life stage.

Limiting Stresses, Life Stages, and Habitat

The key limiting stresses for this population are lack of floodplain and channel structure and impaired water quality, as they have the greatest impact on the population's ability to recover. The juvenile life stage is likely the most limited, and quality summer and winter rearing habitat is lacking due to high water temperatures and a lack of adequate pool and off-channel habitat.

Floodplain and Channel Structure

Habitat complexity, including presence of pools, large wood cover, and floodplains, is essential for juvenile coho salmon to optimize forage, avoid predation, and access thermal and velocity refuges. Inadequate floodplain and channel structure presents a high stress for fry, juveniles, and smolts. Pool frequency is poor throughout the population area, and pool depth varies from good

to poor. In the early 1900s, Round Valley streams were extensively modified which resulted in significant stream incision throughout the valley that disconnected the streams from their floodplains. Although almost all of the streams in Round Valley are under the temperature mask, they may have potential to provide winter refugia habitat.

Impaired Water Quality

Suitable water quality, especially appropriate temperature, is essential for juvenile coho salmon growth and survival. Impaired water quality is a very high stress for juveniles and a medium stress for fry, smolts, and adults. Although benthic macroinvertebrate metrics are rated very good (indicating little to no water quality contamination and good dissolved oxygen levels), summer rearing stream temperature is poor throughout most of the population area. Most of the exposed main channels are close to lethal stream temperatures during the hottest part of the summer (USEPA 2003). However, the headwaters of Black Butte River may have thermal refugia, and the upper Middle Fork Eel River has many stratified pools that support other salmonids.

Altered Sediment Supply

Excessive sediment presents a high stress for most of the life stages of coho salmon. Sediment delivery resulted in a high percentage of embeddedness in the Middle Fork Eel River and a number of its tributaries. Measurements in the upper sub-basin show limited sediment deposition in pools, where the median particle size is good to fair. The USEPA (2003b) estimated that 95 percent (574 tons/mi^2/year) of the sediment load is due to the natural, highly erosive geology of the upper sub-basin, and the remaining 5 percent (29 tons/mi^2/year) of the sediment load is management related. High sediment loads embed spawning gravel, rendering spawning beds less suitable, bury redds, and fill-in pools.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions are a high stress for the fry, juvenile, and smolt life stages. Riparian shade is generally fair in the valleys while the upper sub-basin has fair to good shade cover. Streamside areas are dominated by the early seral conditions of either open or hardwood canopies. The lack of mature riparian vegetation and an insufficient forest canopy results in inadequate water temperatures for juvenile rearing.

Sudden oak death (SOD) is an exotic pathogen affecting almost all native species of plants, shrubs, and trees. SOD is in epidemic stages in population areas downstream of the population, in which coho salmon must migrate through. Because the SOD pathogen is water borne and can travel downstream in watercourses, the likelihood of SOD outbreaks in the population area and adjacent populations are high. One of the largest areas infected by SOD occurs near Redway and is growing at a very fast rate.

Increased Disease, Competition, and Predation

The non-native Sacramento pikeminnow poses a high threat to coho salmon fry, juveniles, and smolts and also competes with juveniles for limited food and habitat. The pikeminnow is

successful in the Middle Fork Eel River because it thrives in degraded habitat that is less favorable for salmonids.

Impaired Estuary/Mainstem Function

All coho salmon that originate from the Middle Fork Eel River migrate to and from the ocean through the mainstem Eel River and the Eel River estuary. 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 coho salmon populations. The degraded function of the Eel River estuary and mainstem migratory corridor today constitutes a high stress for this population. The Eel River estuary is severely impaired because of past diking and filling of wetlands for agriculture and flood protection. Approximately 60 percent of the estuary has been lost through the construction of levees and dikes (CDFG 2010b). There is evidence that the estuary once supported a high degree of estuarine habitat and rearing potential, but very little of that historic function still exists. Mainstem conditions contribute to this stress because of water quality issues, predation pressure, and degraded habitat. Juveniles, smolts, and adults suffer from lost opportunities for increased growth and survival in formerly extensive and now degraded estuarine and mainstem rearing and migratory habitats.

Barriers

Barriers are a medium stress for all life stages. Some dams and natural barriers block access to high IP habitats, such as on Cutfinger Creek. A barrier on Willow Creek may also partially or completely block access to high IP habitat.

Altered Hydrologic Function

Altered hydrologic function is a medium stress for all life stages. Most of the tributaries in the Round Valley and Elk/Thatcher areas are dry or intermittent in the summer, except in their uppermost portions (USEPA 2003). Water quantities in the upper sub-basin are believed to be very good. Flow data for the lower sub-basin wherein most of the high IP areas occur does not exist.

Adverse Fishery- and Collection-Related Effects

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

Adverse Hatchery-Related Effects

Hatchery-origin coho salmon may stray into the Middle Fork Eel River; however, the proportion of adults that are of hatchery origin is likely less than five percent and there are no hatcheries in the basin. Therefore, adverse hatchery-related effects pose a low risk to all life stages (Appendix B).

44.6 Threats

Table 44-3. Severity of threats affecting each life stage of coho salmon in the Middle Fork Eel River. Threat rank categories, assessment methods, and data used to assess threats are described in Appendix B.

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

[1]Key Limiting Threats and limited life stage.
[2]Gravel Mining/Gravel Extraction is not considered a threat to this population.

Key Limiting Threats

The two key limiting threats, those which most affect recovery of the population by influencing stresses, are roads and channelization/diking.

Roads

Roads are a significant threat to coho salmon in this population. Road density is very high in Round Valley, overlapping the highest concentration of high IP habitat in the population area, albeit under the temperature mask. Road-related landsliding rates are highest in Black Butte, Elk Creek and Round Valley subareas, with rates as high as 9 to 13 tons per square mile per year (USEPA 2003). With few road decommissioning and upgrading projects in the population area and the likelihood of more road building, this threat is likely to continue in the future.

Channelization/Diking

Tributaries to the Middle Fork Eel River in the Round Valley area have been channelized for residential and agricultural purposes. Channelization significantly degrades juvenile coho salmon rearing habitat by increasing flow velocities, reducing creek meanders, and impeding the creeks' abilities to access floodplains during high flows.

High Severity Fire

High severity fire is a high threat to the population. Past timber harvest practices coupled with decades-long fire-suppression efforts have rendered understory forest fuel loads excessive. High severity fires regularly result from these excessive forest fuel loads and are likely to continue in this sub-basin. Such high severity fires negatively affect coho salmon because they remove vegetation and plant litter that protects or minimizes soil erosion, gullying, and mass wasting that contributes to high sediment loads within coho salmon habitats. High sediment loads embed spawning gravel, making it less suitable for spawning or burying redds and alevins. Lastly, high severity fires remove riparian trees, thus increasing solar radiation in the mainstem and tributaries and resulting in elevated water temperatures.

Climate Change

Climate change is a high threat to juveniles, smolts, and adults. The current climate is generally warm and regional average temperature models indicate average temperatures could increase by up to 3 °C in the summer and by up to 1 °C in the winter (see Appendix B for modeling methods). Annual precipitation in this area is predicted to change little over the next century. However, snowpack in upper elevations of the Eel River basin will decrease with changes in temperature and precipitation (California Natural Resources Agency 2009). The vulnerability of the Eel River estuary to sea level rise is very high. Juvenile and smolt rearing and migratory habitats are most at risk to climate change. Increasing temperatures and changes in the amount and timing of precipitation and snowmelt will impact water quality and hydrologic function in the summer and winter. Rising sea level may also impact the quality and extent of wetland rearing habitat in the estuary. Overall, the range and degree of variability in temperature and precipitation is likely to increase in all populations. As with all populations in the ESU, adults will be negatively impacted by ocean acidification, changes in ocean conditions, and prey availability (see Independent Science Advisory Board 2007, Portner and Knust 2007, Feely et al. 2008).

Invasive Non-Native/Alien Species

The non-native Sacramento pikeminnow is a high threat to fry, juveniles, and smolts because they compete with and prey upon young coho salmon. Sacramento pikeminnow were introduced in Lake Pillsbury in 1979 (Brown and Moyle 1997) and have spread throughout all suitable habitat in the Eel River basin. The warm water temperatures in the Eel River and Lake Pillsbury allow this voracious predator to thrive in this system. The Sacramento pikeminnow's presence in Lake Pillsbury makes eradication of this species extremely difficult. Any effort to remove this species in the Eel River without treating the lake will only be temporary because the lake will continue to be the source population for the rest of the Eel River basin.

Timber Harvest

Timber harvest poses a medium threat to the Middle Fork Eel River population. Many of the changes that have occurred to instream and riparian conditions in the Middle Fork Eel River reflect legacy effects of more intensive harvest from previous decades. Most of the timberlands in the population area are owned by the USFS and are managed for the conservation of salmonids.

Dams/Diversions

Diversions pose a medium threat to fry, juveniles, smolts, and adults and a low threat to eggs. Marijuana cultivation has become increasingly abundant in the Middle Fork Eel River. Most diversions for marijuana cultivation occur at headwater springs and streams, thereby removing the coldest, cleanest water at the most stressful time of the year for coho salmon (Bauer 2013b). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per growing season (HGA 2010).

Agricultural Practices

Agricultural practices present a medium threat to adults, eggs, and fry and a low threat to the other life history stages. Grazing occurs throughout the lower sub-basin, and where exclusionary fencing has not been installed and maintained, may contribute to increased bank erosion and riparian vegetation degradation. Herbicides, pesticides, and fertilizers used for marijuana cultivation are likely impairing water quality in coho salmon streams.

Urban/Residential/Industrial Development

Urban, residential, and industrial development pose medium threats to adults and fry. The largest developed areas within the population area are located in the valley reaches near Covelo. However, this threat is not expected to change significantly because Covelo is not expected to significantly expand in the near future.

Fishing and Collecting

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

Road-stream Crossing Barriers

Road-related barriers are a low threat to coho salmon. There are six complete and three partial barriers resulting from road culverts in the population area. However, most of these barriers occur outside of high IP reaches.

Hatcheries

Hatcheries pose a low threat to all life stages of coho salmon in the Middle Fork Eel River population area. The rationale for these ratings is described under the "Adverse Hatchery-Related Effects" stress.

44.7 Recovery Strategy

The Middle Fork Eel River population has unique challenges in that most of the high IP habitat within its boundaries exists under the temperature mask and in areas with the greatest human impacts. Coho salmon abundance and distribution in the Middle Fork Eel River are currently minimal to nonexistent, making population recovery extremely difficult. Currently, excessively high water temperatures severely limit available juvenile coho salmon summer rearing habitat, and lack of floodplain connectivity limits winter rearing. Recovery activities in the population area should focus on the most limiting habitat, and occur only within the streams with the highest potential to support strays from other populations. An important area to recovery is the Round Valley sub-basin, in which most of the high IP habitat occurs. Although almost all of the streams in Round Valley are under the temperature mask, they likely have potential to provide winter and cold water refugia habitat. Although the Middle Fork Eel River may not support coho salmon at this time, watershed improvement would improve conditions in the mainstem Eel River and benefit the coho population utilizing the mainstem. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 44-4 on the following page lists the recovery actions for the Middle Fork Eel River population.

Table 44-4. Recovery action implementation schedule for the Middle Fork Eel River population. Recovery actions for monitoring and research are listed in tables at the end of Chapter 5.

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MFER.2.1.2	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	All streams where coho salmon would benefit immediately	2b
SONCC-MFER.2.1.2.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MFER.2.1.2.2	*Place instream structures, guided by assessment results*					
SONCC-MFER.2.2.22	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	All streams where coho salmon would benefit immediately	2b
SONCC-MFER.2.2.22.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MFER.2.2.22.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MFER.2.2.3	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	All streams where coho salmon would benefit immediately	2b
SONCC-MFER.2.2.3.1	*Assess feasibility and develop a plan to remove or set back levees and dikes that includes restoring the natural channel form and floodplain connectivity once the levees or dikes have been removed or set back*					
SONCC-MFER.2.2.3.2	*Remove or setback levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					
SONCC-MFER.10.1.29	Water Quality	Yes	Reduce water temperature, increase dissolved oxygen	Increase conifer riparian vegetation	Population wide	2b
SONCC-MFER.10.1.29.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-MFER.10.1.29.2	*Plant conifers, guided by the plan*					
SONCC-MFER.10.1.29.3	*Thin, or release conifers, guided by the plan*					
SONCC-MFER.2.1.43	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2c
SONCC-MFER.2.1.43.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MFER.2.1.43.2	*Place instream structures, guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MFER.2.2.44	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Population wide	2c
SONCC-MFER.2.2.44.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MFER.2.2.44.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MFER.2.2.45	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	Population wide	2c
SONCC-MFER.2.2.45.1	*Assess feasibility and develop a plan to remove or set back levees and dikes that includes restoring the natural channel form and floodplain connectivity once the levees or dikes have been removed or set back*					
SONCC-MFER.2.2.45.2	*Remove or setback levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					
SONCC-MFER.3.1.25	Hydrology	No	Improve flow timing or volume	Determine effects of marijuana cultivation	Population wide	3b
SONCC-MFER.3.1.25.1	*Assess cumulative effects (e.g., flow, water quality) of marijuana cultivation*					
SONCC-MFER.3.1.25.2	*If needed, develop plan to reduce effects of marijuana cultivation*					
SONCC-MFER.3.1.25.3	*Implement plan*					
SONCC-MFER.10.7.41	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3b
SONCC-MFER.10.7.41.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MFER.10.7.41.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-MFER.10.7.42	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-MFER.10.7.42.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MFER.10.7.42.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-MFER.7.1.5	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	All streams where coho salmon would benefit immediately	3c
SONCC-MFER.7.1.5.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-MFER.7.1.5.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-MFER.7.1.5.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MFER.7.1.46	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Population wide	3d
SONCC-MFER.7.1.46.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-MFER.7.1.46.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-MFER.7.1.46.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-MFER.8.1.9	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All streams where coho salmon would benefit immediately	3c
SONCC-MFER.8.1.9.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MFER.8.1.9.2	*Decommission roads, guided by assessment*					
SONCC-MFER.8.1.9.3	*Upgrade roads, guided by assessment*					
SONCC-MFER.8.1.9.4	*Maintain roads, guided by assessment*					
SONCC-MFER.8.1.48	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	3d
SONCC-MFER.8.1.48.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MFER.8.1.48.2	*Decommission roads, guided by assessment*					
SONCC-MFER.8.1.48.3	*Upgrade roads, guided by assessment*					
SONCC-MFER.8.1.48.4	*Maintain roads, guided by assessment*					
SONCC-MFER.8.1.8	Sediment	No	Reduce delivery of sediment to streams	Reduce stream bank erosion	All streams where coho salmon would benefit immediately, including Round Valley, Eden Valley, wilderness, and Black Butte River HSAs	3c
SONCC-MFER.8.1.8.1	*Inventory sediment sources, and prioritize for treatment*					
SONCC-MFER.8.1.8.2	*Treat priority sediment source sites, guided by assessment*					
SONCC-MFER.8.1.47	Sediment	No	Reduce delivery of sediment to streams	Reduce stream bank erosion	Population wide	3d
SONCC-MFER.8.1.47.1	*Inventory sediment sources, and prioritize for treatment*					
SONCC-MFER.8.1.47.2	*Treat priority sediment source sites, guided by assessment*					
SONCC-MFER.1.2.23	Estuary	No	Improve estuarine habitat	Improve estuary condition	Eel River Estuary	3d
SONCC-MFER.1.2.23.1	*Implement recovery actions for Lower Eel/Van Duzen population that address the target "Estuary"*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MFER.7.1.4	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Population wide	3d
SONCC-MFER.7.1.4.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-MFER.7.1.4.2	*Develop watershed-specific guidance for managing riparian vegetation*					
SONCC-MFER.16.1.11	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Incorporate SONCC coho salmon VSP delisting criteria when formulating salmonid fishery management plans affecting SONCC coho salmon	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-MFER.16.1.11.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-MFER.16.1.11.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-MFER.16.1.39	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Incorporate SONCC coho salmon VSP delisting criteria when formulating salmonid fishery management plans affecting SONCC coho salmon	Tribal land	3d
SONCC-MFER.16.1.39.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-MFER.16.1.39.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-MFER.16.1.12	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Reduce fishing impacts to levels that do not limit recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-MFER.16.1.12.1	*Determine actual fishing impacts*					
SONCC-MFER.16.1.12.2	*If actual fishing impacts limit attainment of population-specific viability criteria, modify management so that fishing does not limit attainment of population-specific viability criteria*					
SONCC-MFER.16.1.40	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Reduce fishing impacts to levels that do not limit recovery	Tribal lands	3d
SONCC-MFER.16.1.40.1	*Determine actual fishing impacts*					
SONCC-MFER.16.1.40.2	*If actual fishing impacts limit attainment of population-specific viability criteria, modify management so that fishing does not limit attainment of population-specific viability criteria*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MFER.16.2.13	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Incorporate SONCC coho salmon VSP delisting criteria when formulating scientific collection authorizations affecting SONCC coho salmon	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-MFER.16.2.13.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-MFER.16.2.13.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-MFER.16.2.14	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Reduce impacts of scientific collection to levels that do not limit recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3d
SONCC-MFER.16.2.14.1	*Determine actual impacts of scientific collection*					
SONCC-MFER.16.2.14.2	*If actual scientific collection impacts limit attainment of population-specific viability criteria, modify collection so that impacts do not limit attainment of population-specific viability criteria*					
SONCC-MFER.8.1.7	Sediment	No	Reduce delivery of sediment to streams	Reduce risk of catastrophic fire	Population wide	3d
SONCC-MFER.8.1.7.1	*Identify forested stands for fire hazard reduction*					
SONCC-MFER.8.1.7.2	*Apply appropriate management techniques (e.g. thinning, burning) to reduce risks of high severity fire*					
SONCC-MFER.14.2.1	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of Sacramento pikeminnow	Population wide	3d
SONCC-MFER.14.2.1.1	*Determine the effectiveness of various pikeminnow suppression techniques and develop experimental control methods. Develop a plan that identifies watersheds suitable for experimental pikeminnow suppression*					
SONCC-MFER.14.2.1.2	*Suppress Sacramento pikeminnow, guided by the suppression plan*					