43. North 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

Habitat likely available to support all life stages

283 mi^2 watershed (52% Federal ownership)

54 IP-km (34 IP-miles) (9% high)

Dominant Land Uses are Ranching and Timber Harvest

Key Limiting Stresses are ‘Impaired Water Quality’ and ‘Altered Sediment Supply’

Key Limiting Threats are ‘Roads’ and ‘High Severity Fire’

High Priority Recovery Actions

• Increase instream flows by establishing a forbearance program • Increase riparian vegetation • Increase cool water refugia	• Improve grazing practices • Re-establish a natural fire regime • Manage riparian vegetation to reduce evapotranspiration and recharge groundwater

43.1 History of Habitat and Land Use

Historic land use of the North Fork Eel River consisted primarily of episodic timber harvest and intense livestock grazing. Euro-American Settlers first arrived in 1854 and by the 1870s approximately 60,000 sheep were grazing within the watershed (USFS-BLM 1996). Intensive timber harvest on private lands occurred in the 1950s and 1960s, predominately removed by tractor-hauling which commonly occurred on slopes greater than 70-percent (USFS-BLM 1996). Timber harvest on public lands peaked on USFS lands during the 1970s, with approximately 1,200 acres clear cut during that time (USFS-BLM 1996).

Stream habitat in the North Fork Eel River has been significantly modified by both human and natural causes. Floods in 1955 and 1964 severely modified the stream channel and riparian vegetation. A local resident indicated that the "channel was so heavily filled with soil and debris that the river bed was level and vehicles could drive for miles up the river bed" (Keter 1995). USFS (2002) noted that approximately 90% of the mainstem North Fork Eel River riparian canopy was removed by the 1964 flood. Large landslides continued to fill in the stream bed years after the flood, severely aggrading the channel (USFS 2002).

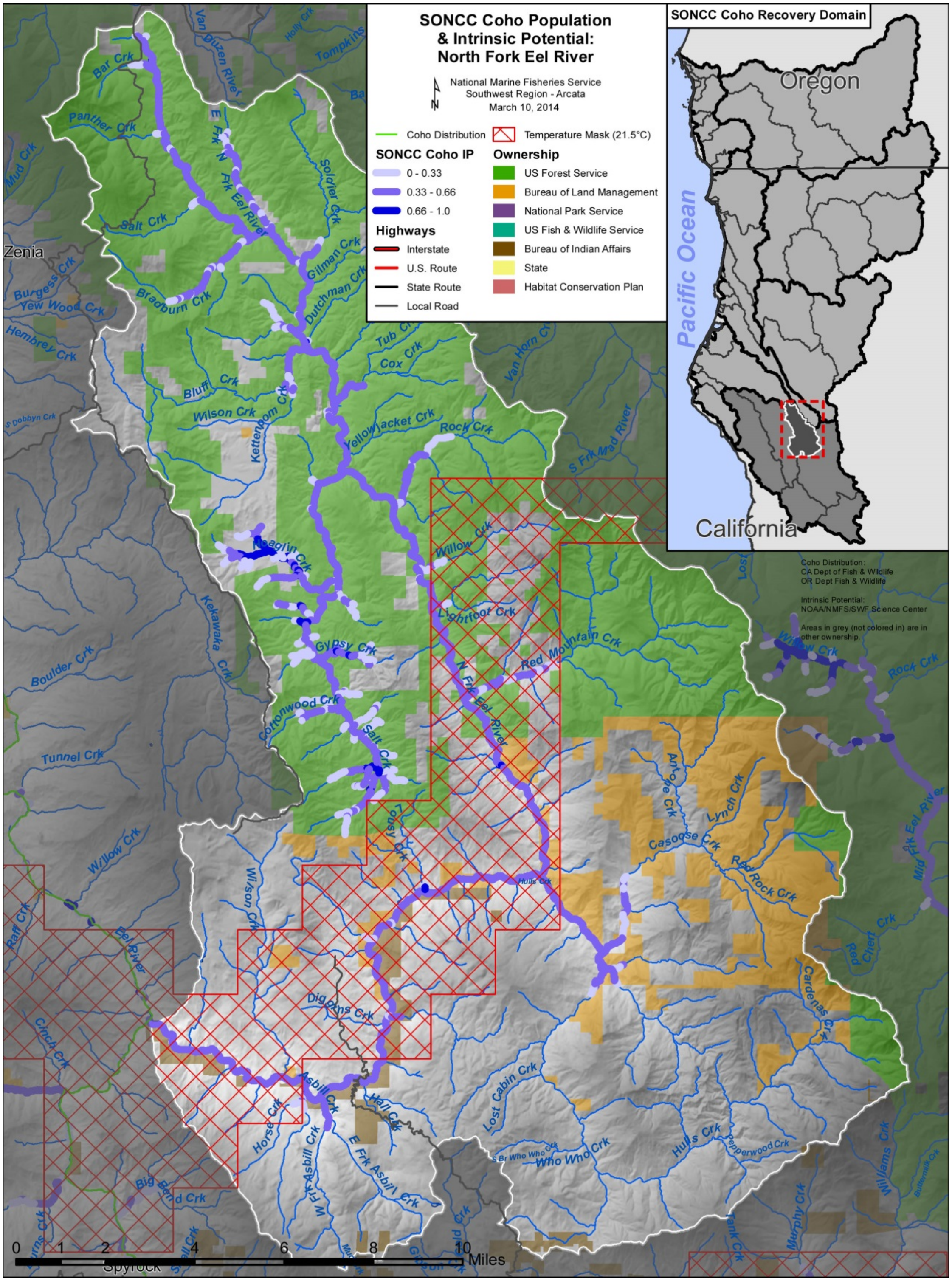

Figure 43-1. The geographic boundaries of the North Fork Eel River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), a temperature mask (indicating areas that are inherently too warm for rearing coho salmon), land ownership, coho salmon distribution (CDFG 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.

43.2 Historic Fish Distribution and Abundance

Brown and Moyle (1991) determined the coho population in North Fork Eel River was likely extirpated based on stream surveys and reports from CDFW files. Other reports (CDFG 1994, CDFG 2004b) also state the population is likely extirpated. A few (USFS-BLM 1996, USEPA 2002) suggest the North Fork Eel was never occupied by coho salmon; however, the CDFG (2004b) claim coho salmon were once present in the North Fork Eel River and its tributary Bluff Creek. The IP model shows potential for coho production throughout the watershed, indicating the North Fork Eel could have been used by coho salmon.

A boulder-built barrier is located approximately 5 miles upstream of the confluence with the mainstem. The barrier, referred to as Split Rock, did not exist prior to 1964 when a flood moved the boulder into its current location. A large scale snorkel survey did not document juvenile coho salmon following several years of high flows, further confirming Split Rock as a total barrier (BLM 2002). The permanence of Split Rock is uncertain, and passage for coho salmon may become possible in the future if conditions at the site change.

43.3 Status of North Fork Eel River Coho Salmon

Spatial Structure and Diversity

Except for occasional strays, the current distribution of spawners is extremely limited if present at all, and due to the paucity of individuals, diversity is assumed to be extremely low.

Williams et al. (2008) determined at least 54 coho salmon must spawn in the North Fork Eel River each year to avoid extinction resulting from extremely low population sizes. The North Fork Eel River coho salmon population size is unknown and is presumed to be extirpated. Until passage is possible at the Split Rock barrier, the population will only have access to the lower portion of the watershed.

Extinction Risk

The North 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 North 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 North 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 available habitat in the North Fork Eel River population area.

43.4 Plans and Assessments

Environmental Protection Agency

Total Maximum Daily Loads for the Eel River

In December 2002, the USEPA published the final Total Maximum Daily Loads (TMDL) for temperature and sediment for the North 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

Recovery Strategy for California Coho Salmon

http://www.dfg.ca.gov/fish/Resources/Coho/SAL_CohoRecoveryRpt.asp

The Recovery Strategy for California Coho Salmon was adopted by the California Fish & Game Commission in February 2004. The Recovery Strategy includes analyses and recommendations regarding coho salmon recovery in the North Fork Eel River.

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.

U.S. Forest Service and U.S. Bureau of Land Management

Watershed Analysis

The U.S. Forest Service and U.S. Bureau of Land Management completed a watershed analysis for the North Fork Eel River in 1996 (USFS and BLM 1996). Coho salmon were described as having never occupied the watershed and were not further discussed in the analysis.

43.5 Stresses

Table 43-1. Severity of stresses affecting each life stage of coho salmon in the North Fork Eel River population. 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	Altered Sediment Supply[1]	Very High	High	High[1]	High	High	Very High
2	Impaired Water Quality[1]	Low	Medium	Very High[1]	High	Medium	High
3	Altered Hydrologic Function	Medium	Medium	Very High	Medium	Medium	High
4	Degraded Riparian Forest Conditions	Low	High	High	High	High	High
5	Increased Disease/Competition/Predation	Low	High	High	High	Low	High
6	Lack of Floodplain and Channel Structure	Low	Low	High	High	High	High
7	Impaired Estuary/Mainstem Function	-	Low	High	High	Medium	High
8	Barriers	-	Medium	Medium	Medium	High	Medium
9	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Low	Low
10	Adverse Hatchery-Related Effects	Low	Low	Low	Low	Low	Low

[1] Key limiting stresses and limited life stage.

Key Limiting Stresses, Life Stages, and Habitat

The key limiting stresses for this population are impaired water quality and altered hydrologic function, as they have the greatest impact on the population's ability to recover. The juvenile life stage is likely the most limited due to the lack of habitat resulting from high water temperatures and inadequate summer base flows.

Altered Sediment Supply

Altered sediment supply is a very high stress to the egg life stage. The North Fork Eel watershed is highly confined in many areas with steep slopes and highly erodible Franciscan soil. Excessive sedimentation can have severe effects on fish and their habitat through widening the channel, filling in pools, increasing gravel embeddedness, and ultimately raising water temperature through the shallowing of the channel. Hulls Creek and Bluff Creek were rated as having poor conditions related to embeddedness which degrades spawning gravel quality and decreases survival of eggs. Although gravel quality is currently poor, improved management on federal lands combined with natural passive recovery from the 1964 flood should produce more suitable gravels in the future.

Impaired Water Quality

Impaired water temperature is a very high stress for juveniles. The naturally hot climate, combined with excess sediment, low summer base flows, and a lack of riparian vegetation results in near-lethal or lethal water temperature in many parts of the population area. A thermal infrared and color videography snapshot of stream temperatures on the entire stretch of the mainstem North Fork Eel during July 2001 showed the mainstem North Fork Eel to be over 20 °C (considered inadequate for coho salmon) for its entire 35.3 mile extent, with many sections over 24 °C (USEPA 2002).

Potential summer juvenile distribution would likely be limited to those areas of the watershed with cold spring upwelling or cold tributary inflow. It is likely that under current conditions summer rearing juveniles would have to leave the North Fork Eel River prior to onset of summer base flow to take advantage of more suitable conditions in the coastally influenced climate of the lower mainstem Eel River and Eel River estuary.

Altered Hydrologic Function

Altered hydrologic function is a high stress to juveniles. Due to changes in land uses following settlement, the extent of Douglas-fir forests in the North Fork Eel River population area has increased, resulting in a corresponding loss of the oak-woodland vegetation type and the increase in the density of brush and understory species (Keter 1995). This change from historic conditions has resulted in an increased loss of ground water (and therefore summer base flow) through interception and evapotranspiration (Keter 1995). The southern portion of the watershed is primarily privately owned and has many water rights diversions.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions is as a high stress for the population. In the few surveys that have been completed, the percent canopy cover in Hulls Creek and parts of Bluff Creek were rated as fair to poor and in the upper watershed, riparian corridor canopy cover was listed as fair. The lack of riparian vegetation has reduced large wood recruitment to the stream and is not providing adequate shade to maintain cool water temperatures.

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 is a high stress to coho salmon fry, juveniles, and smolts and also competes with juveniles for limited food and habitat. The pikeminnow is successful in the lower portion of the North Fork Eel River because it thrives in severely impacted habitat that is less favorable for salmonids.

Floodplain and Channel Structure

Lack of floodplain and channel structure is a high stress for juveniles, smolts, and adults. The combination of decreased large wood and aggraded channel conditions has simplified the stream habitat. Pool depths are rated as fair in the few places where surveys were conducted, and pool frequency is rated as poor. The overall simplified stream habitat lacks places of refuge for juvenile fish such as deep pools and side channels during high flow events or times of low water. It is likely the system is still recovering from the channel aggradation after the 1964 flood and would benefit from large wood to facilitate pool scouring.

Impaired Estuary/Mainstem Function

All salmon that originate from the North 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 represent a high stress to adults. Most barriers are upstream of Split Rock where there is currently no effect on coho salmon. Although composed of natural materials, the relatively recently formed boulder falls at Split Rock is a complete barrier to adult coho salmon, preventing them from accessing the majority of the North Fork Eel watershed. Modifications to Split Rock could potentially provide passage for coho salmon.

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 North 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).

43.6 Threats

Table 43-2. Severity of threats affecting each life stage of coho salmon in the North Fork Eel River population. 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]	Very High	Very High	High[1]	High	High	Very High
2	High Severity Fire[1]	High	High	High[1]	High	High	High
3	Climate Change	Medium	Medium	High	High	High	High
4	Invasive Non-Native/Alien Species	Low	High	High	High	Low	High
5	Road-Stream Crossing Barriers	-	Low	Low	Low	Low	Low
6	Dams/Diversions	Low	Medium	High	Medium	Medium	Medium
7	Agricultural Practices	Medium	Medium	Low	Low	Medium	Medium
8	Urban/Residential/Industrial Dev.	Low	Low	Low	Low	Low	Low
9	Fishing and Collecting	-	-	Low	Low	Low	Low
10	Channelization/Diking	Low	Low	Low	Low	Low	Low
11	Timber Harvest	Medium	Medium	Medium	Medium	Low	Medium
12	Hatcheries	Low	Low	Low	Low	Low	Low

[1]Key limiting threats and limited life stage.
[2]Gravel Mining/Gravel Extraction is not considered threats 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 high severity fire.

Roads

Roads represent the most significant threat across all life stages of coho salmon. Road density is rated as very high throughout the watershed. There are approximately 1.7 miles of road/square mile of land on the Forest Service land, which is only a moderate road density; however, Louisiana Pacific Timber Company estimated there were between 4 and 5 miles of road/square mile on the private lands in the southern watershed (USEPA 2002). The high density of unpaved roads is the most significant driver to increased sediment within the river. Roads are often built within the riparian corridor and actively erode surface gravel and sediment into waterways, requiring continual maintenance which creates additional disturbance. Roads also interfere with hydraulic connectivity through water diversion along inboard ditches. Additionally, the high densities of roads often lead to an increase in road/stream crossings and associated barriers. In the last decade, effort has been directed toward disconnecting the road system from hydrologic function and decommissioning and storm-proofing roads on public land. The extent to which these problems persist on private lands is unknown and, if significant, could impact coho salmon recovery.

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 will have the greatest impact upon 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 the entire 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.

Road-stream Crossing Barriers

Road/stream crossing barriers are a low threat. Access to most of the tributaries in the watershed is prevented by natural conditions rather than man-made barriers. Because of their position in the watershed, road/stream crossing barriers do not pose significant threats to the population.

Dams/Diversions

Diversions are a high threat to coho salmon. Approximately 29 water diversions are scattered throughout the watershed, with the majority concentrated in the southern portion of the basin. These diversions are mainly on private land where small communities and ranches draw water for irrigation. The total withdrawal of water from these diversions is unknown; however, they may contribute to lower flows which have the potential to increase water temperature. There has been no assessment of the adequacy of water quantity and flow regime on the private lands dominating the lower portions of the watershed. These areas likely have more significant water withdrawals that could be contributing to low flows.

Although no assessment has been conducted, it is likely that marijuana cultivation has become increasingly abundant in the North 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. Agriculture, primarily grazing, is scattered throughout the basin with the majority of the agricultural land located in the southern portion of the watershed on privately owned lands and the Round Valley Reservation. Many of the local ranches have grazing livestock with no exclusion from the riparian zone. Grazing pressure removes much of the bank-stabilizing vegetation on the upslope, which contributes to landslides and erosion as well as degrading overhanging banks along the stream. This results in poor water quality through the delivery of excess sediment and nutrients into the stream. Because these activities are confined to a small portion of the watershed and do not affect a large area, they are considered a medium threat

Urban/Residential/Industrial Development

Development is a low threat to the North Fork Eel River due to its remote location. The population has not significantly increased over the past 10 years; however, there is a trend developing for residents to buy land for vacation or retirement homes. Larger tracts of land may be sub-divided and sold as smaller parcels. Sub-division has the potential to increase road densities, impervious surfaces, and further fragment the landscape from its currently large undeveloped tracts.

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.

Channelization/Diking

Because the lower watershed is dominated by private land with light agricultural use, some channelization likely exists on the lands that contain tributaries to the North Fork Eel River. The level of these activities is believed to be small in scope and therefore a low threat to coho salmon. The North Fork itself is confined by bedrock in many places and is difficult to manipulate through channelization and diking.

Timber Harvest

Timber harvest is a medium threat to the population. Many of the changes that have occurred to instream and riparian conditions in the North Fork Eel River reflect legacy effects of more intensive harvest from previous decades. Some small scale timber harvest occurs on private lands watershed, particularly in the Long Ridge region. However, most of the timberlands in the population area are owned by the USFS and are managed for the conservation of salmonids.

Hatcheries

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

43.7 Recovery Strategy

The North Fork Eel River coho salmon population faces significant challenges due to poor habitat quality and a very limited amount of accessible habitat. Although the North Fork Eel River may not support a coho salmon population at this time, watershed restoration would improve conditions in the mainstem Eel River and benefit other coho salmon populations utilizing the mainstem. Instream habitat restoration efforts in the North Fork Eel River should be focused in the mainstem and tributaries downstream of Split Rock, and overall watershed restoration should focus on decreasing water temperatures, improving flows, reducing sediment supply, and decreasing the likelihood of catastrophic fire. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 43-3 on the following page lists the recovery actions for the North Fork Eel River population.

Table 43-3. Recovery action implementation schedule for the North 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-NFER.8.1.9	Sediment	Yes	Reduce delivery of sediment to streams	Improve grazing practices	Private ranchlands along streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3b
SONCC-NFER.8.1.9.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-NFER.8.1.9.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-NFER.8.1.9.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-NFER.8.1.36	Sediment	Yes	Reduce delivery of sediment to streams	Improve grazing practices	Population wide	3c
SONCC-NFER.8.1.36.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-NFER.8.1.36.2	*If problems are identified, develop and implement grazing management strategy that decreases delivery of sediment and pollutants to streams and improves riparian condition*					
SONCC-NFER.8.1.36.3	*Monitor effectiveness of grazing management to ensure grazing does not limit recovery of SONCC coho salmon*					
SONCC-NFER.8.1.1	Sediment	Yes	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All areas where coho salmon would benefit immediately	3b
SONCC-NFER.8.1.1.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-NFER.8.1.1.2	*Decommission roads, guided by assessment*					
SONCC-NFER.8.1.1.3	*Upgrade roads, guided by assessment*					
SONCC-NFER.8.1.1.4	*Maintain roads, guided by assessment*					
SONCC-NFER.10.1.11	Water Quality	Yes	Reduce water temperature, increase dissolved oxygen	Increase cool water and thermal refugia	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3b
SONCC-NFER.10.1.11.1	*Assess sources of cool water and develop techniques to protect and/or improve cool water habitat*					
SONCC-NFER.10.1.11.2	*Implement techniques aimed to protect and/or improve cool water habitat*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-NFER.10.1.30	Water Quality	Yes	Reduce water temperature, increase dissolved oxygen	Increase cool water and thermal refugia	Population wide	3c
SONCC-NFER.10.1.30.1	*Assess sources of cool water and develop techniques to protect and/or improve cool water habitat*					
SONCC-NFER.10.1.30.2	*Implement techniques aimed to protect and/or improve cool water habitat*					
SONCC-NFER.10.7.29	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3b
SONCC-NFER.10.7.29.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-NFER.10.7.29.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-NFER.10.7.31	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-NFER.10.7.31.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-NFER.10.7.31.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-NFER.3.1.3	Hydrology	No	Improve flow timing or volume	Increase instream flows	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3c
SONCC-NFER.3.1.3.1	*Establish and implement a forbearance program, using water storage tanks to decrease diversion during periods of low flow*					
SONCC-NFER.3.1.3.2	*Monitor forbearance compliance and flow*					
SONCC-NFER.3.1.34	Hydrology	No	Improve flow timing or volume	Increase instream flows	Population wide	3d
SONCC-NFER.3.1.34.1	*Establish and implement a forbearance program, using water storage tanks to decrease diversion during periods of low flow*					
SONCC-NFER.3.1.34.2	*Monitor forbearance compliance and flow*					
SONCC-NFER.3.1.4	Hydrology	No	Improve flow timing or volume	Recharge groundwater	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3c
SONCC-NFER.3.1.4.1	*Assess watershed for areas where conifers have replaced oak woodlands*					
SONCC-NFER.3.1.4.2	*Manage riparian vegetation to reduce evapotranspiration and recharge groundwater*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-NFER.3.1.35	Hydrology	No	Improve flow timing or volume	Recharge groundwater	Population wide	3d
SONCC-NFER.3.1.35.1	*Assess watershed for areas where conifers have replaced oak woodlands*					
SONCC-NFER.3.1.35.2	*Manage riparian vegetation to reduce evapotranspiration and recharge groundwater*					
SONCC-NFER.7.1.6	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase riparian vegetation	Population wide	3c
SONCC-NFER.7.1.6.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-NFER.7.1.6.2	*Plant conifers, guided by the plan*					
SONCC-NFER.7.1.6.3	*Thin, or release conifers, guided by the plan*					
SONCC-NFER.7.1.10	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Reestablish natural fire regime	Population wide	3c
SONCC-NFER.7.1.10.1	*Identify areas prone to high severity fire and develop a plan to reestablish a natural fire regime*					
SONCC-NFER.7.1.10.2	*Carry out fuel reduction projects such as thinning and prescribed burning, guided by the strategic plan*					
SONCC-NFER.2.1.2	Floodplain and Channel Structure	No	Increase channel complexity	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3c
SONCC-NFER.2.1.2.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-NFER.2.1.2.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-NFER.2.1.32	Floodplain and Channel Structure	No	Increase channel complexity	Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows	Population wide	3d
SONCC-NFER.2.1.32.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-NFER.2.1.32.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-NFER.2.1.7	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	All streams where coho salmon would benefit immediately (mainstem and tributaries downstream of Split Rock)	3c
SONCC-NFER.2.1.7.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-NFER.2.1.7.2	*Place instream structures, guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-NFER.2.1.33	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	3d
SONCC-NFER.2.1.33.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-NFER.2.1.33.2	*Place instream structures, guided by assessment results*					
SONCC-NFER.1.2.5	Estuary	No	Improve estuarine habitat	Improve estuary condition	Eel River estuary	3d
SONCC-NFER.1.2.5.1	*Implement recovery actions for Lower Eel/Van Duzen River population that address the target "Estuary"*					
SONCC-NFER.14.2.8	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of Sacramento pikeminnow	Population wide	3d
SONCC-NFER.14.2.8.1	*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-NFER.14.2.8.2	*Suppress Sacramento pikeminnow, guided by the suppression plan*					