45. Middle Mainstem Eel River Population

Interior Eel River Diversity Stratum

Core, Functionally Independent Population

High Extinction Risk

Population likely below depensation threshold

6,300 Spawners Required for ESU Viability

347 mi^2 watershed (11% Federal ownership)

232 IP-km (144 mi) (58% High)

Dominant Land Uses are Agriculture and Timber Production

Key Limiting Stresses are 'Altered Hydrologic Function' and 'Altered Sediment Supply'

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

Highest Priority Recovery Actions

• Implement an enhancement program such as captive broodstock, rescue rearing, or conservation hatchery • Increase instream flows by reducing diversions and establishing a forbearance program • Minimize mass wasting	• Improve regulatory mechanisms to avoid over allocating water diversion • Remove, set back, or reconfigure levees and dikes • Reduce abundance of Sacramento pikeminnow

45.1 History of Habitat and Land Use

Agricultural and urban land development profoundly affected the landscape of the Middle Mainstem Eel River. Historically, Little Lake Valley was a large seasonal lake (Figure 45-2) that likely served as productive rearing habitat for coho salmon. In 1910, the lake was drained to repurpose the former lakebed for cattle grazing and potato production (LeDoux-Bloom and Downie 2007). During the same timeframe, the thalwegs through Little Lake were connected via dredging to Outlet Creek and the creek and its tributaries were channelized. Subsequent Highway 101 construction precipitated Outlet Creek's realignment. Erosion from poorly constructed roads in the highly erosive Franciscan geology contributed to increased sediment loading within the region's rivers, leaving streams shallower, warmer, and more prone to flooding (Bodin et al. 1982).

The 1955 and 1964 floods caused significant sedimentation in the Eel River and its tributaries, filled in many pools, destroyed riparian vegetation, and widened channels. Historic timber harvest contributed to significant erosion and sedimentation of stream channels. The current landscape is comprised of hardwood-dominated forest stands and pasture lands. Late seral stands are largely absent from the population area.

Rural residence and small ranch establishment, coupled with early 1990s agricultural intensification, has increased water supply demands. Currently, water users rely on in-stream diversions, shallow wells, or impoundments to satisfy their water demands, thereby reducing stream flows during summer low-flow periods. Prolific marijuana cultivation within the population area results in large quantities of water to be diverted, which has profoundly impacted the region's hydrology (LeDoux-Bloom and Downie 2007).

The Potter Valley Project's 1908-built Cape Horn and 1922-erected Scott hydropower production dams significantly altered Middle Mainstem Eel River coho salmon habitat. The Potter Valley Project diverts flows from the mainstem Eel River to areas outside of the basin (Russian River). Prior to 2004, summer instream flows recorded downstream of Cape Horn Dam typically measured between 2 and 3 cfs. Summer flow reductions degraded riparian vegetation, restricted coho salmon rearing habitat, and restricted coho salmon tributary access. In 2004, the Federal Energy Regulatory Commission (FERC) required Pacific Gas and Electric (PG&E) to implement an instream flow regime consistent with the Reasonable and Prudent Alternative in the National Marine Fisheries Service's (NMFS) 2002 Biological Opinion. The new flow requirement increased Cape Horn Dam's minimum water release volume, incorporated within-year and between-year variability, and replaced the formerly constant 2 cfs summer instream flow minimum.

In 1979, predatory Sacramento pikeminnow were introduced into Lake Pillsbury (California Department of Fish and Game (CDFG) 1997b), and have since colonized the entire Eel River watershed. This predator thrives in warmer waters like those in the mainstem Eel River. Increased sedimentation, dams, diversions, and degraded riparian forests have decreased the number of high-quality pool refugia that could have provided some protection for juvenile coho salmon.

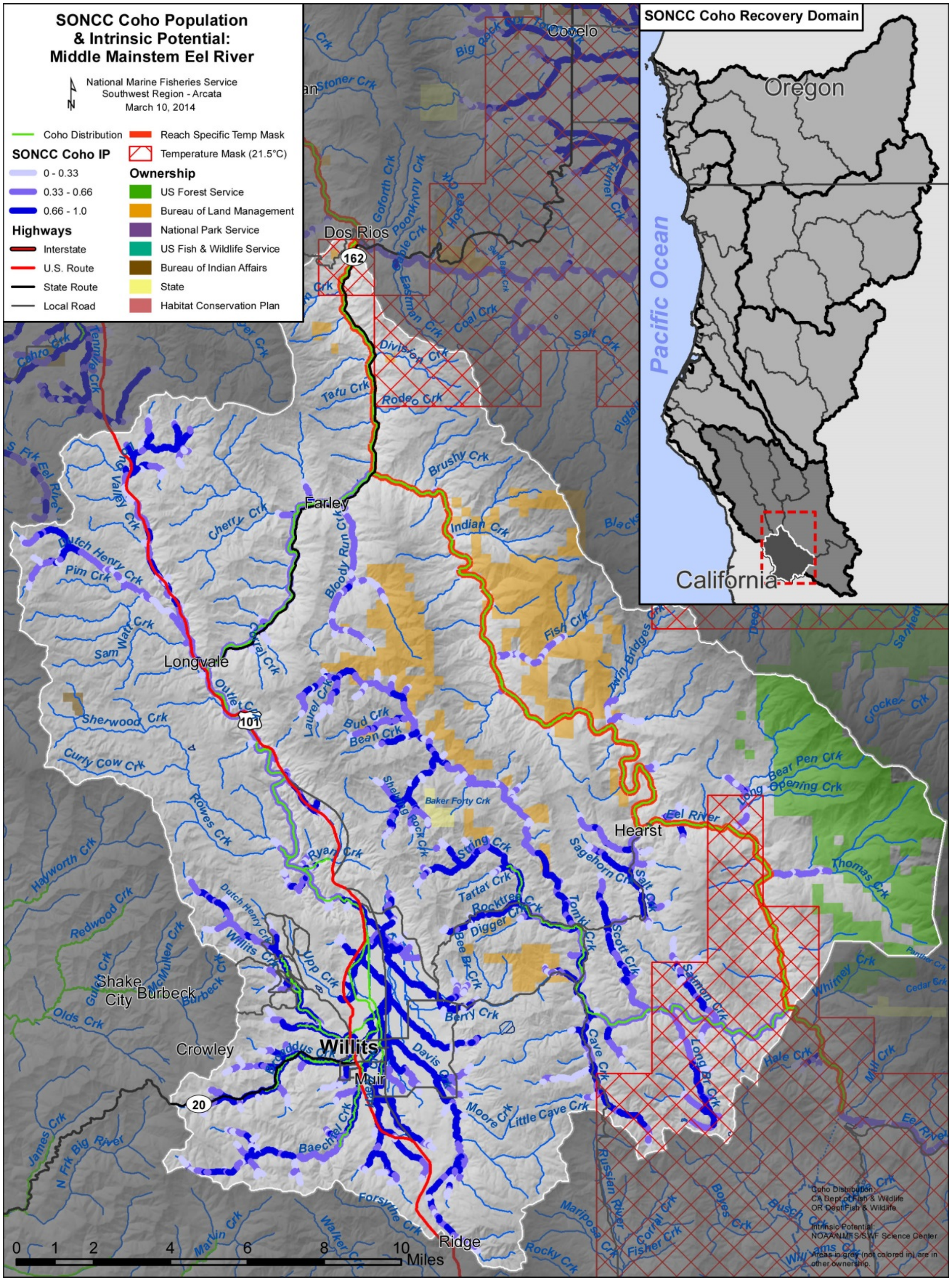

Figure 45-1. The geographic boundaries of the Middle Mainstem Eel River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), a temperature mask (indicating areas that are inherently too warm for rearing coho salmon), land ownership, coho salmon distribution (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.

Figure 45-2. Little Lake Valley in 1905, prior to diking and draining for agriculture (photo source unknown).

45.2 Historic Fish Distribution and Abundance

While historic estimates of Middle Mainstem Eel River coho salmon population abundance do not exist, two major tributaries (Outlet and Tomki creeks) have been monitored in the past. Outlet Creek was historically the largest producer of coho salmon in the population area. In the 1989/1990 season there was an estimated 240 spawning adults in Outlet Creek (Brown and Moyle 1991). No population estimates for Tomki Creek have been made, and brood year surveys since 1979 in the Tomki Creek watershed have not confirmed any presence of coho salmon, except for one observation in Cave Creek. The entire Eel River basin was estimated to have supported 70,000 coho salmon spawners in 1900 (CDFG 1997b). By 1964, less than 500 coho salmon spawners were estimated to return to the Eel River above the South Fork (CDFG 1965).

Records from the late 1980s determined that coho salmon spawned in Long Valley, Reeves Canyon, Ryan, and Haehl creeks and several Outlet Creek tributaries, including Willits, Broaddus, and Baechtel creeks (Brown and Moyle 1991). Based upon recorded juvenile observations, the Indian, Bloody Run, Reeves, Rowes, Mill, Dutch Henry, Rocktree, String, and Tarter creek tributaries to Outlet Creek are believed to have also supported coho salmon (Brown and Moyle 1991, Downie and Gleason 2007). In 1949, approximately 16,815 juveniles were rescued from Tomki Creek and 5,629 juveniles were rescued from Baechtel Creek (Downie and

Gleason 2007). Tomki Creek presumably does not currently support coho salmon, Outlet Creek escapement is low, and two year classes are believed to be missing.

Table 45-1. Tributaries with high IP reaches (IP > 0.66). (Williams et al. 2006).

Subarea	Stream Name	Subarea	Stream Name
Outlet Creek	Baechtel Creek[1]	Tomki Creek	Bean Creek
	Berry Creek		Bud Creek
	Bloody Run Creek[1]		Cave Creek[2]
	Broaddus Creek[1]		Elk Creek
	Davis Creek		Laurel Creek
	Dutch Henry Creek		Long Branch Creek[2]
	Fulweiter Creek		Rocktree Creek
	Haehl Creek		Sagehorn Creek
	Long Valley Creek		Salmon Creek[2]
	Mill Creek[1]		Salt Creek
	Moore Creek		Scott Creek
	Outlet Creek[1]		Shelving Rock Creek
	Ryan Creek[1]		String Creek
	Upp Creek		Tarter Creek
	Willits Creek[1]		Tomki Creek
			Unnamed tributary to Garcia Creek
			Wheelbarrow Creek

[1] Denotes a "Key Stream" as identified in the State of California's Coho Recovery Strategy
2 Stream is under the temperature mask, as modeled by Williams et al. (2006)

45.3 Status of Middle Mainstem Eel River Coho Salmon

Spatial Structure and Diversity

Current spawner and juvenile distribution is unknown but is expected to be limited to the Outlet Creek watershed. The coho salmon in the Middle Mainstem Eel River population area have one of the longest migrations in the ESU, and therefore may maintain unique genetic diversity characteristics in the ESU.

Population Size and Productivity

Williams et al. (2008) determined at least 232 coho salmon must spawn in the Middle Mainstem Eel River population each year to avoid effects of extremely low population sizes. CDFG annual surveys of Outlet Creek have estimated the escapement ranges from 0 to 25 coho salmon annually (LeDoux-Bloom and Downie 2007); however, in 2007/08 over 40 spawners were observed during a survey of Willits and Mill creeks (tributaries of Outlet Creek)(Harris 2010) and in 2010/11 the spawner population was estimated to be approximately 298 individuals (Harris and Thompson 2011). However, of particular concern is that two year classes have been mostly absent. In all Middle Mainstem Eel River streams, breeding groups have been lost or severely depressed. The population growth rate is unknown but is likely negative in most years.

Extinction Risk

The Middle Mainstem 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). NMFS' determination of population extinction risk is based on the viability criteria provided by Williams et al. 2008 (Table 3, pg. 17). These viability criteria reflect population size and rate of decline. As Williams et al. (2008) provided no viability criteria for assessing moderate and high risk based on spatial structure and diversity, spatial structure and diversity were not considered in NMFS' determination of population extinction risk.

Role in SONCC Coho Salmon ESU Viability

The Middle Mainstem Eel River population is a core, Functionally Independent population within the Interior Eel River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams et al. 2006). To contribute to stratum and ESU viability, the Middle Mainstem Eel River core population should have at least 6,300 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, as a core population the Middle Mainstem Eel River population may serve as a source of spawner strays for nearby coastal populations. At present, the capacity of the Middle Mainstem Eel River coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Middle Mainstem Eel River coho salmon possess the "long run" life history as they must migrate long distances within the Eel River to reach their spawning grounds. Their life history strategy is unique to the Eel River basin and important to the long term survival and recovery of the SONCC coho salmon ESU as well as to the Interior Eel River Diversity Stratum.

45.4 Plans and Assessments

Environmental Protection Agency

Total Maximum Daily Loads
http://www.swrcb.ca.gov/northcoast/

In January 2006, the USEPA published the final Total Maximum Daily Loads (TMDLs) for temperature and sediment for the Middle Main Eel River and tributaries. 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 Middle Mainstem 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.

Outlet Creek Basin Assessment

CDFG's The Outlet Creek Basin Assessment analyzed conditions for salmonids and developed watershed and habitat improvement activities for each of three identified sub-basins.

45.5 Stresses

Table 45-2. Severity of stresses affecting each life stage of coho salmon in the Middle Mainstem 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	Altered Sediment Supply[1]	Very High	High	High[1]	High	High	Very High
2	Altered Hydrologic Function[1]	Medium	Very High	Very High[1]	High	Low	Very High
3	Degraded Riparian Forest Conditions	-	High	High	High	Medium	High
4	Impaired Water Quality	Medium	High	Very High	High	Medium	High
5	Lack of Floodplain and Channel Structure	Medium	High	Very High	High	Medium	High
6	Increased Disease/Predation/Competition	Low	High	High	High	Low	High
7	Impaired Estuary/Mainstem Function	-	Low	High	High	Medium	High
8	Barriers	-	Low	Medium	Low	Medium	Medium
9	Adverse Fishery-and Collection-Related Effects	-	-	Low	Low	Medium	Low
10	Adverse Hatchery-Related Effects		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 altered hydrologic function and altered sediment supply, as they have the greatest impact on the population's ability to produce sufficient spawners to support recovery. The juvenile life stage is most limited, primarily due to reductions in quality and quantity of summer and winter rearing habitat. Juvenile summer rearing habitat is impaired by low flow conditions exacerbated by water withdrawals and a reduced water table. The lack of flow results in dried stream reaches during the summer season, thereby reducing the extent of available habitat and nutrient transport through drift. High instream sediment loads from past and current land use and flood events have resulted in simplified habitat.

Altered Sediment Supply

High percentages of fine sediment (<1mm) and sand (<6.4mm) are observed in Willits Creek. Except for the lowest reach of Tomki Creek, all surveyed reaches have high or very high embeddedness. Sediment loading can be inferred from road density because the majority of sediment originates from unmaintained and legacy dirt and gravel roads. Road density is very high (>3 mi/sq. mi) throughout most of the population area. High road density areas result in higher sediment mobilization into adjacent waterways. Other sources of sedimentation include soils exposed to high severity fires, the 1955 and 1964 floods, highly erodible slopes, and historic timber harvest.

Excessive sedimentation reduces habitat diversity, embeds spawning gravel, and reduces channel stability. Such habitat changes hinder successful spawning and emergence; reduce pool frequency and depth; increase competition and predation; and reduce macroinvertebrate densities. Suspended sediment loads and high turbidity can negatively impact juvenile salmon by interfering with gill function as well as feeding and other behaviors.

Altered Hydrologic Function

Six dams have been constructed for water supply and recreation in the Outlet Creek watershed. The City of Willits operates two of these dams, which are located on Davis Creek. Morris Dam (constructed in 1924) and Centennial Dam (1989) store a combined total of 1,359 acre-feet (LeDoux-Bloom and Downie 2008). The Brooktrails Township Community Service also operates two dams, Lake Emily on Willits Creek and Lake Ada Rose, which is an off-channel reservoir. Lake Emily stores approximately 275 acre-feet and Lake Ada Rose stores 138 acre-feet. The largest impoundment is operated by the Boy Scouts of America, a reservoir impounding 800 acre-feet of water located on a tributary to Berry Creek. The smallest reservoir holds 45 acre-feet of water and is operated by Pine Mountain Mutual Water Company.

In the last 10 years there has been a dramatic increase in cultivation of marijuana in the Outlet Creek watershed. LeDoux-Bloom and Downie (2007) report juvenile salmonid stranding due to stream diversions from the large number of grow operations within the watershed. Bauer (2012) estimated that during the summer and fall marijuana cultivation uses approximately 150,000 gallons of water per day in the Outlet Creek watershed and over 23,000,000 gallons over the entire grow season. These diversions are on top of the estimated 594,825 gallons per day used by residences (Bauer 2012).

Potter Valley Project instream flow requirements incorporate within-year and between-year variability. Although in-stream flow remains less than that of un-impaired flow, the flow regime approximates a natural hydrograph. Eel River minimum in-stream flows have increased and the total water diverted out of the Eel River and into the East Fork Russian River has been reduced from up to 160,000 to between 60,000 to 138,000 acre-feet per year based on the water year.

Degraded Riparian Forest Conditions

Although Outlet Creek’s upstream reach has good stream canopy cover, all other surveyed reaches of Broaddus, Tomki, and Long Valley creeks have either fair or poor canopy cover. The lack of canopy cover is likely due to a lack of mature riparian zones resulting from past timber harvest, agricultural clearing, grazing, urbanization, high severity fires, and the major floods in 1955 and 1964 that obliterated riparian areas’ mature conifer trees. Riparian stands are currently dominated by willows, alders, and hardwoods. All surveyed reaches of Tomki, Long Valley, Outlet, and Broaddus creeks have at least 40 percent hardwood canopy. Lack of suitable riparian forests results in increased solar radiation that elevates water temperatures to stressful or lethal levels for juvenile coho salmon. Healthy and mature riparian forests stabilize banks, reduce and filter erosion, and contribute large wood to streams which create complex channel and floodplain structure.

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

Impaired Water Quality

Benthic macroinvertebrate sampling within Willits, Broaddus, and Baechtel creeks revealed either fair or poor conditions. Summer rearing stream temperatures are poor with values exceeding 17 °C for the maximum weekly average temperature (MWAT) throughout most of the population area. Extensive water quality monitoring (Humboldt County Resource Conservation District (HCRCD) 1998) revealed that many Middle Mainstem Eel River tributary water temperatures were marginal, stressful, or lethal (19 °C to over 24 °C) to coho salmon. Excessively warm water temperatures can occur as early as late May during hot years with low flows, but more commonly occur during late June and early July. Elevated temperature is problematic throughout the population area, thus prompting the listing for temperature under the Clean Water Act Section 303(d). Temperature-induced stress can lead to decreased growth and survival of juveniles and increased mortality of adult coho salmon.

Lack of Floodplain and Channel Structure

The majority of surveyed reaches and tributaries have fair or poor pool depths (<2.0 ft.). The lower half of Tomki Creek has very poor pool frequency (<35 percent by length), whereas Outlet Creek and its tributaries have mostly good and very good pool frequencies (>50 percent by length). Between the mouth of String Creek and Cave Creek, 1952-dated photos indicate maximum channel widths of 200 feet; in 1983, the maximum width expanded to 400 feet, primarily resulting from gravel extraction during that time period (U.S. Environmental Protection Agency (EPA) 2004). Large woody debris data are lacking, but it is likely the Middle Mainstem Eel River's large wood volume is inadequate given current habitat conditions and disturbance history.

Channelization and routing of streams for roads, railroads, farming, ranching, and subdivisions have significantly diminished floodplain connectivity in the lower reaches of tributaries in the southern sub-basin of Outlet Creek (LeDoux-Bloom and Downie 2007).

Increased Disease/Predation/Competition

Sacramento pikeminnow thrive within the population area's warmer water temperatures, prey upon coho salmon, and displace coho salmon from other available habitats.

Impaired Estuary/Mainstem Function

All Middle Mainstem Eel River coho salmon 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. Agriculture and flood protection-induced diking and wetland filling have resulted in severe impairment and a 60 percent reduction in the size of the Eel River estuary (CDFG 2010b). Mainstem conditions contribute to this stress because of the issues with water quality, predation, and degraded habitat. Juveniles, smolts, and adults transitioning through mainstem and estuarine habitat suffer from the lost opportunity for increased growth and survival.

Barriers

CDFW's Passage Assessment Database indicates that at least 15 road crossing barriers and 6 dams within the Middle Mainstem Eel River population area completely block fish passage. Except for one road crossing, all of these complete barriers are located within the Outlet Creek watershed, and several of these barriers block access to suitable rearing habitats, including high IP reaches.

Adverse Fishery- and Collection-Related Effects

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

Adverse Hatchery-Related Effects

Hatchery-origin coho salmon may stray into the Middle Mainstem 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).

45.6 Threats

Table 45-3. Severity of threats affecting each life stage of coho salmon in the Middle Mainstem Eel River. Threat rank categories, assessment methods, and data used to assess threats are described in Appendix B.

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

[1]Key limiting threats and limited life stage.

Key Limiting Threats

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

Roads

Throughout most of the population area, paved, gravel, and dirt road densities are very high (>3 mi/mi^2), especially in areas with high IP reaches. If not properly maintained, these extensive road networks can increase erosion and sediment availability and facilitate sediment transport into streams. Excessive stream sedimentation causes substrate embeddedness, smothers eggs, reduces pool depths, and results in habitat simplification. Roads can also influence peak flows and contribute to higher peak flows in areas with high paved road densities.

Road building for access to marijuana cultivation sites is common in many areas of the population area. It is likely that many of these roads are unpermitted and contribute excessive amounts of fine sediment to coho salmon streams.

Dams/Diversions

Within the Outlet Creek watershed, 6 dams completely block coho salmon migration. These dams are all located within 4 miles of the city of Willits. Localized residential and agricultural water diversions within the Tomki Creek and Outlet Creek watersheds reduce streamflows during critical juvenile rearing periods and restrict fish passage.

Marijuana cultivation has become abundant in many areas of the population area. Although the number of plants grown each year is unknown, the water diversion required to support these plants is placing a high demand on a limited supply of water (Bauer 2013a). Most diversions for marijuana cultivation occur at headwater springs and streams, thereby removing the coldest, cleanest water at the most stressful time of the year for coho salmon (Bauer 2013b). Based on an estimate from the medical marijuana industry, each marijuana plant may consume 900 gallons of water per growing season (HGA 2010).

Climate Change

Climate change will have the greatest impact upon coho salmon juveniles, smolts, and adults. The current climate is generally warm and regional average temperature models indicate average temperatures could increase by up to 2.6 °C in the summer and by up to 1.2 °C in the winter over the next 50 years (see Appendix B for modeling methods). Area annual precipitation is already low and is predicted to decrease over the next century. In upper elevations of the Eel River basin, snowpack will decrease with temperature and precipitation changes (California Natural Resources Agency 2009).

Juvenile and smolt rearing and migratory habitat are most at risk to climate change. Increasing temperatures and changes in the amount and timing of precipitation and snowmelt will impact water quality and hydrologic function in the summer and winter. Rising sea level may also impact the quality and extent of wetland rearing habitat for smolts in the estuary. Overall, the range and degree of variability in temperature and precipitation are 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).

High Severity Fire

Past timber harvest practices coupled with fire-suppression efforts over the past century have resulted in excessive understory forest fuel loads. High severity fires result from these excessive forest fuel loads and often mobilize sediment downslope into streams. The altered vegetation in the population area increases High severity fire potential that presents a high threat to all coho salmon life stages. Until upland regions undergo fuel reduction, high severity fires are expected to occur in the future and will continue to alter sedimentation processes and riparian vegetation characteristics.

Timber Harvest

Timber harvest poses a high threat to the Middle Mainstem Eel River population. Many of the changes that have occurred to instream and riparian conditions in the Middle Mainstem Eel River reflect legacy effects of more intensive harvest from previous decades. Although the majority of the effects to habitat were the result of legacy timber harvesting, the landscape is privately owned timberlands that may be harvested in the future.

Forest lands are being cleared and graded to create new marijuana cultivation sites. In many cases the land disturbance is not regulated, and likely contributes excessive amounts of fine sediment to coho salmon streams.

Agricultural Practices

Agriculture is predominantly low within this population area with the exception of Little Lake Valley. The gentle slopes of Little Lake Valley accommodate various agricultural uses such as pastures for livestock and growing crops. Unfortunately, several high IP reaches are located in and around Little Lake Valley. During the summer and fall low-flow periods, the upper reach of Outlet Creek may be impacted by nutrients and bacteria from livestock (LeDoux-Bloom and Downie 2007). Local watershed groups are working with landowners to exclude cattle from riparian areas. Agriculture-induced lack of riparian vegetation exacerbates negative water quality and habitat conditions.

Marijuana cultivation has become abundant in many areas of the population area. Although the number of plants grown each year is unknown, the herbicides, pesticides, and fertilizers used to support these plants are likely impairing water quality in coho salmon streams.

Invasive Non-Native/Alien Species

The warm water in the Eel River and Lake Pillsbury create ideal conditions for the non-native Sacramento pikeminnow, a voracious predator. The presence of the Sacramento pikeminnow in Lake Pillsbury makes eradication of this species extremely difficult. Any effort to remove this species from the Eel River without treating the lake will only be temporary because the lake will continue to be a source population for the Eel River basin. As more water is released into the mainstem Eel River, more refuge habitat should become available. Moreover, to the extent that restoration activities restore cooler water temperatures, habitat conditions will become less ideal for the pikeminnow.

Urban/Residential/Industrial Development

The majority of high IP habitat reaches are located within or near the city of Willits. Future urbanization is likely as transportation infrastructure improves and northerly migration from San Francisco Bay Area metropolitan areas increases. In addition, increased rural residential development is likely as large agricultural holdings are subdivided into smaller ranches. These land use changes will culminate in increased road building, land clearing, and other development activities.

Channelization/Diking

Channelization is especially prominent in the Little Lake Valley, where many of the highest potential tributaries in the population area are channelized for agricultural production. Within the city of Willits, tributaries are channelized along roads and other urban infrastructures. Because the city of Willits is expected to expand, the threat of channelization and diking could potentially increase.

Mining/Gravel Extraction

Very little gravel mining occurs in the Middle Mainstem Eel River. In the past, four gravel mining operations were permitted to operate near Dos Rios, but these operations have ceased.

Road-Stream Crossing Barriers

CDFW's Passage Assessment Database reports 15 road crossings are complete barriers to coho salmon migration. Most of these fish passage barriers are in the Outlet Creek watershed and result from either Hwy 101 or 20. Most of these road crossing barriers block high IP reaches, especially in the Willits area.

Fishing and Collecting

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

Hatcheries

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

45.7 Recovery Strategy

Current Middle Mainstem Eel River habitat conditions, combined with a severely depressed coho salmon population with restricted distribution, significantly increase the extinction risk of this important, long-run coho salmon population. To ensure recovery of the population, the remnant coho salmon run in Outlet Creek must be stabilized, grown, and expanded to other tributaries, most notably Tomki Creek. Currently, the lack of adequate flow in the summer is likely most limiting coho salmon survival; therefore, immediate action must be taken to ensure summer baseflow is guaranteed. Due to the lack of a source population in the vicinity of the population area, the likelihood of straying spawners rebuilding the two missing year classes is very low. Therefore, it may be necessary to take enhancement measures such as rescue and relocation of juveniles during summer months or population supplementation through a well-thought out program.

Considering that most of the population area is privately owned, much of the highest potential habitat is located within developed areas; therefore, actions must be taken to educate and motivate local landowners to support recovery efforts. Activities that increase summer flows, increase connectivity to the floodplain, reduce sediment input, increase riparian vegetation, and reduce the abundance of Sacramento pikeminnow should be immediately implemented. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 45-4 on the following page lists the recovery actions for the Middle Mainstem Eel River population.

Table 45-4. Recovery action implementation schedule for the Middle Mainstem 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-MMER.3.1.10	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Mainstems and tributaries of Outlet and Tomki creeks, and all streams where coho salmon would benefit immediately	1
SONCC-MMER.3.1.10.1	*Provide incentives to reduce water use by reducing diversion during summer*					
SONCC-MMER.3.1.10.2	*Establish and implement a forbearance program to reduce diversions during summer*					
SONCC-MMER.3.1.10.3	*Monitor forbearance compliance and flow*					
SONCC-MMER.3.1.39	Hydrology	Yes	Improve flow timing or volume	Increase instream flows	Population wide	1
SONCC-MMER.3.1.39.1	*Identify and cease unauthorized water diversions*					
SONCC-MMER.3.1.38	Hydrology	Yes	Improve flow timing or volume	Provide adequate instream flow for coho salmon	Population wide	1
SONCC-MMER.3.1.38.1	*Conduct study to determine instream flow needs of coho salmon at all life stages.*					
SONCC-MMER.3.1.38.2	*If coho salmon instream flow needs are not being met, develop plan to provide adequate flows. Plan may include water conservation incentives for landowners and re-assessment of water allocation.*					
SONCC-MMER.3.1.38.3	*Implement coho salmon instream flow needs plan.*					
SONCC-MMER.26.1.1	Low Population Dynamics	No	Increase population abundance	Implement an enhancement program	Population wide	1
SONCC-MMER.26.1.1.1	*Assess impacts and benefits associated with different enhancement programs such as captive broodstock, rescue rearing, and conservation hatcheries*					
SONCC-MMER.26.1.1.2	*If enhancement is determined to be beneficial, obtain a permit and develop a facility to rear fish*					
SONCC-MMER.26.1.1.3	*Operate enhancement program as a temporary strategy to prevent extirpation*					
SONCC-MMER.26.1.1.4	*Monitor fish populations at all life stages including juvenile snorkel counts, downstream migrant counts, spawning surveys, and Passive Integrated Transponder (PIT) tagging*					
SONCC-MMER.8.1.17	Sediment	Yes	Reduce delivery of sediment to streams	Minimize mass wasting	All streams where coho salmon would benefit immediately	2a
SONCC-MMER.8.1.17.1	*Assess and map mass wasting hazard, prioritize treatment of sites most susceptible to mass wasting, and determine appropriate actions to deter mass wasting*					
SONCC-MMER.8.1.17.2	*Implement plan to stabilize slopes and revegetate areas*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID		*Step Description*				
SONCC-MMER.8.1.60	Sediment	Yes	Reduce delivery of sediment to streams	Minimize mass wasting	Population wide	2b
SONCC-MMER.8.1.60.1	*Assess and map mass wasting hazard, prioritize treatment of sites most susceptible to mass wasting, and determine appropriate actions to deter mass wasting*					
SONCC-MMER.8.1.60.2	*Implement plan to stabilize slopes and revegetate areas*					
SONCC-MMER.3.1.40	Hydrology	Yes	Improve flow timing or volume	Determine effects of marijuana cultivation	Population wide	2b
SONCC-MMER.3.1.40.1	*Assess cumulative effects (e.g., flow, water quality) of marijuana cultivation*					
SONCC-MMER.3.1.40.2	*If needed, develop plan to reduce effects of marijuana cultivation*					
SONCC-MMER.3.1.40.3	*Implement plan*					
SONCC-MMER.3.1.12	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-MMER.3.1.12.1	*Work with partners to streamline the process needed for the dedication of water to fish and wildlife resources under CA Water Code section 1707*					
SONCC-MMER.3.1.12.2	*Implement water dedications to increase instream flows using the streamlined process*					
SONCC-MMER.3.1.13	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-MMER.3.1.13.1	*Establish a categorical exemption under CEQA for water leasing to increase instream flows*					
SONCC-MMER.3.1.14	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	2b
SONCC-MMER.3.1.14.1	*Establish a comprehensive groundwater permit process*					
SONCC-MMER.5.1.7	Passage	No	Improve access	Remove barriers	All streams where coho salmon would benefit immediately	2b
SONCC-MMER.5.1.7.1	*Evaluate and prioritize barriers for removal*					
SONCC-MMER.5.1.7.2	*Remove barriers, based on evaluation*					
SONCC-MMER.5.1.8	Passage	No	Improve access	Remove barriers	Ryan Creek	2b
SONCC-MMER.5.1.8.1	*Remediate culverts that have been identified as high priority for fish passage*					
SONCC-MMER.5.1.58	Passage	No	Improve access	Remove barriers	Population wide	2d
SONCC-MMER.5.1.58.1	*Evaluate and prioritize barriers for removal*					
SONCC-MMER.5.1.58.2	*Remove barriers, based on evaluation*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MMER.1.2.34	Estuary	No	Improve estuarine habitat	Improve estuary condition	Eel River Estuary	2b
SONCC-MMER.1.2.34.1	*Implement recovery actions for Lower Eel/Van Duzen River population that address the target "Estuary"*					
SONCC-MMER.2.1.2	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	All streams where coho salmon would benefit immediately	2b
SONCC-MMER.2.1.2.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MMER.2.1.2.2	*Place instream structures, guided by assessment results*					
SONCC-MMER.2.1.55	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2d
SONCC-MMER.2.1.55.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MMER.2.1.55.2	*Place instream structures, guided by assessment results*					
SONCC-MMER.26.1.52	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	2b
SONCC-MMER.26.1.52.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-MMER.2.2.53	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	All streams where coho salmon would benefit immediately	2b
SONCC-MMER.2.2.53.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MMER.2.2.53.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MMER.2.2.57	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	Population wide	2d
SONCC-MMER.2.2.57.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MMER.2.2.57.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MMER.2.2.37	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	All streams where coho salmon would benefit immediately, including Mainstem Outlet Creek and its tributaries	2b
SONCC-MMER.2.2.37.1	*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 and dikes have been removed or set back*					
SONCC-MMER.2.2.37.2	*Remove or set back levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MMER.2.2.56	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Remove, set back, or reconfigure levees and dikes	Population wide	2d
SONCC-MMER.2.2.56.1	*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 and dikes have been removed or set back*					
SONCC-MMER.2.2.56.2	*Remove or set back levees and dikes and restore channel form and floodplain connectivity, guided by the plan*					
SONCC-MMER.14.2.9	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of Sacramento pikeminnow	Population wide	2b
SONCC-MMER.14.2.9.1	*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-MMER.14.2.9.2	*Suppress Sacramento pikeminnow, guided by the suppression plan*					
SONCC-MMER.3.1.11	Hydrology	Yes	Improve flow timing or volume	Educate stakeholders	Population wide	3a
SONCC-MMER.3.1.11.1	*Develop an educational program about water conservation programs and instream leasing programs*					
SONCC-MMER.8.1.16	Sediment	Yes	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	3b
SONCC-MMER.8.1.16.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					
SONCC-MMER.8.1.15	Sediment	Yes	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Tomki and Outlet Creek watersheds, and all streams where coho salmon would benefit immediately	3b
SONCC-MMER.8.1.15.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MMER.8.1.15.2	*Decommission roads, guided by assessment*					
SONCC-MMER.8.1.15.3	*Upgrade roads, guided by assessment*					
SONCC-MMER.8.1.15.4	*Maintain roads, guided by assessment*					
SONCC-MMER.8.1.59	Sediment	Yes	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	3d
SONCC-MMER.8.1.59.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MMER.8.1.59.2	*Decommission roads, guided by assessment*					
SONCC-MMER.8.1.59.3	*Upgrade roads, guided by assessment*					
SONCC-MMER.8.1.59.4	*Maintain roads, guided by assessment*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MMER.7.1.4	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase regulatory oversight	Population wide	3b
SONCC-MMER.7.1.4.1	*Ensure channel modifications are permitted and reviewed*					
SONCC-MMER.7.1.3	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Revegetate riparian areas	Mainstems and tributaries of Outlet and Tomki creeks	3b
SONCC-MMER.7.1.3.1	*Identify and prioritize locations for planting*					
SONCC-MMER.7.1.3.2	*Plant conifers and other native species in riparian areas, guided by assessment results*					
SONCC-MMER.10.7.51	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3b
SONCC-MMER.10.7.51.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MMER.10.7.51.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-MMER.10.7.54	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-MMER.10.7.54.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MMER.10.7.54.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-MMER.7.1.5	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide	3d
SONCC-MMER.7.1.5.1	*Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements specified in 14 CCR 898.2(d) prior to approval by the Director (similar to a Spotted Owl Resource Plan).*					
SONCC-MMER.7.1.6	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Reestablish natural fire regime	Population wide	3d
SONCC-MMER.7.1.6.1	*Identify areas prone to high severity fire and develop a plan to reestablish a natural fire regime*					
SONCC-MMER.7.1.6.2	*Carry out fuel reduction or modification projects such as thinning, prescribed burning, and piling, guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MMER.16.1.19	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-MMER.16.1.19.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-MMER.16.1.19.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					
SONCC-MMER.16.1.20	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-MMER.16.1.20.1	*Determine actual fishing impacts*					
SONCC-MMER.16.1.20.2	*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-MMER.16.2.21	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-MMER.16.2.21.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-MMER.16.2.21.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-MMER.16.2.22	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-MMER.16.2.22.1	*Determine actual impacts of scientific collection*					
SONCC-MMER.16.2.22.2	*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-MMER.10.2.36	Water Quality	No	Reduce pollutants	Improve regulatory mechanisms	Population wide	3d
SONCC-MMER.10.2.36.1	*Develop a pesticide management plan*					
SONCC-MMER.10.2.36.2	*Implement pesticide management plan and technical assistance program*					