22. Strawberry Creek Population

Central Coastal Stratum

Dependent 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

4 mi^2 watershed (0% Federal ownership)

7 IP-km (4 IP-mi) (60% High)

Dominant Land Uses are 'Residential Development' and 'Agriculture'

Key Limiting Stresses are 'Barriers' and 'Impaired Estuary/Mainstem Function'

Key Limiting Threats are 'Road-Stream Crossing Barriers' and 'Channelization/Diking'

Highest Priority Recovery Actions

• Remediate structural road-stream crossing barriers • Prevent damage from vehicular traffic near the estuary and Clam Beach parking area • Construct additional wetland habitat in tidally-inundated stream reaches	• Relocate parking area at Clam Beach and reconnect the adjacent wetland area • Restore natural channel form and function by removing concrete channel in Lower Strawberry Creek • Increase large woody debris (LWD), boulders, and instream structure

22.1 History of Habitat and Land Use

The community of McKinleyville encompasses most of the Strawberry Creek basin, with nearly 100 percent of the land privately owned. About 13.8 percent of the basin is owned by Green Diamond Resource Company (GDRC) as industrial timberlands covered under a Habitat Conservation Plan (HCP). Historically, much of the basin was cleared for rural development, agriculture and timber harvest purposes. Although historically timber harvest and agricultural practices took place within the basin, low-density rural residential and low intensity agricultural land uses now dominate. The foothills, which contain the headwaters, have a more recent history of timber harvest with secondary growth currently dominating the basin.

Highway 101, which crosses Strawberry Creek low in the basin, was established in the 1920s and is responsible for some of the earliest and more significant habitat changes in Strawberry Creek. The highway culvert and the concrete channel immediately upstream are significant impediments to coho salmon passage. Additional partial barriers are present at road crossings upstream on Strawberry Creek. On Patrick Creek, the most downstream tributary to Strawberry Creek, the Highway 101 crossing completely blocks fish passage.

Natural instream structures such as wood were likely removed during road construction to facilitate unimpeded flow through culverts and narrow channels. The original riparian vegetation containing old growth trees was removed during past timber practices. A majority of the basin contains second growth mixed conifer, redwood, Sitka spruce, and other riparian vegetation maintaining relatively complex channel conditions. Large trees are found embedded in the banks throughout much of the basin and cool water with good stream flow exists throughout most of the area.

Strawberry Creek is subject to increased storm water runoff in areas adjacent to the impervious surfaces of the Arcata/Eureka Airport in the lowest part of the basin. Low-density rural residential development in the Strawberry Creek basin, and associated impervious surfaces such as roads, has also increased storm water runoff and associated pollutants.

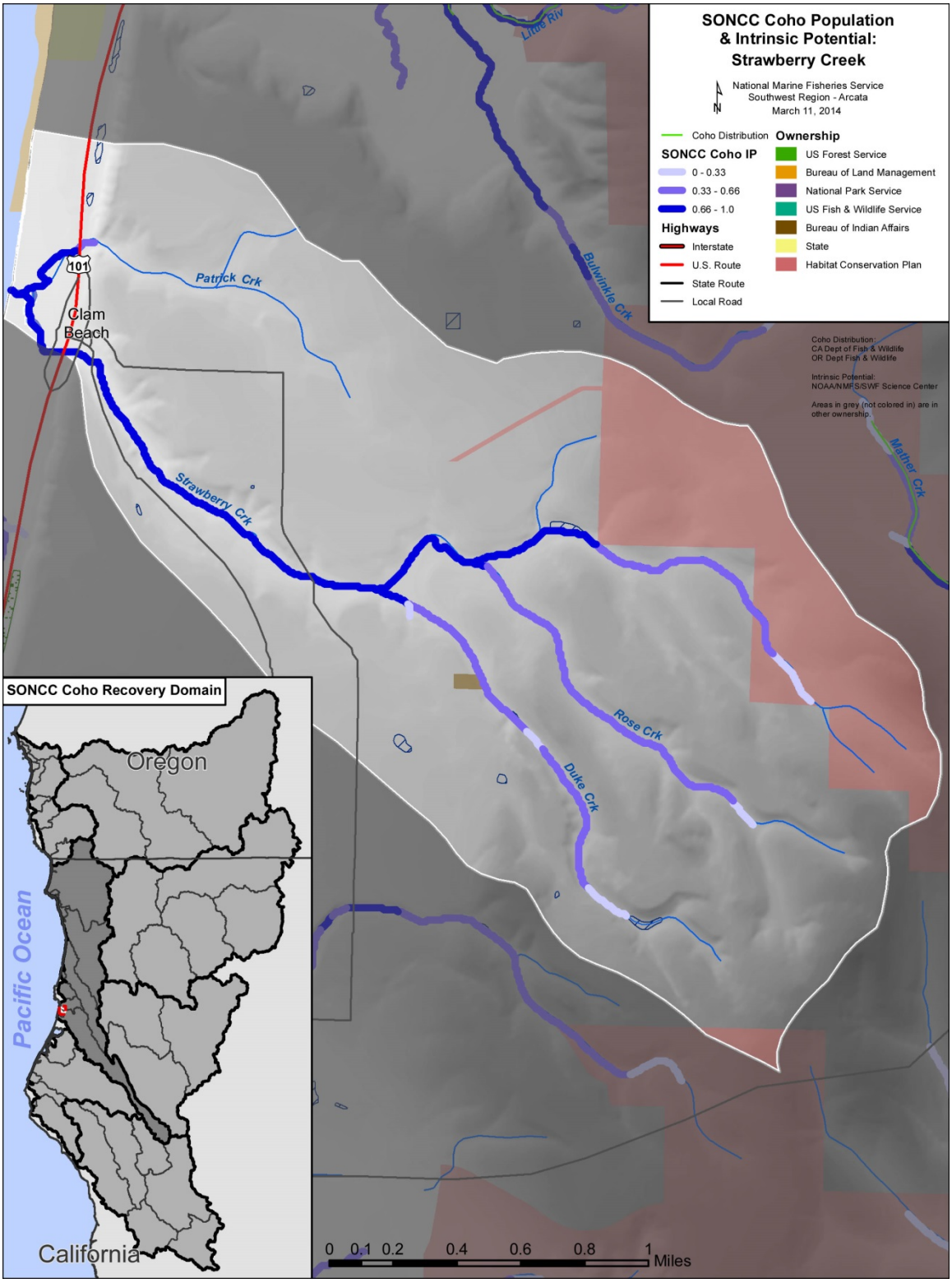

Figure 22-1. The geographic boundaries of the Strawberry Creek coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

22.2 Historic Fish Distribution and Abundance

Potential coho salmon habitat is distributed throughout the Strawberry Creek basin, which comprises about four square miles. The IP modeled results suggest that high value (IP > 0.66) coho salmon habitat occurs in about 50 percent of the basin, particularly in the section of Strawberry Creek from the ocean to the confluence of the tributary Duke Creek. Medium potential coho salmon habitat (IP 0.33 – 0.66) occurs in the upper basin areas of Strawberry Creek and in the Duke Creek and Rose Creek tributaries. The small tributary Patrick Creek contains a small amount of high value coho salmon habitat while the remaining portion contained medium potential habitat.

Although coho salmon have been found historically in Strawberry Creek, no historic data exist to describe run characteristics, fish distribution or population abundance for coho salmon in Strawberry Creek or in its tributaries, Duke Creek, Rose Creek, and Patrick Creek. Surveys did not detect presence of coho salmon for brood years 2000-2002 in Strawberry Creek, although there is a historical record of coho presence for brood year 1967 (Garwood 2012).

Table 22-1. Tributaries with high IP reaches (IP value > 0.66) (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Strawberry Creek	Patrick Creek	Duke Creek

22.3 Status of Strawberry Creek Coho Salmon

Spatial Structure and Diversity

About 50 percent of the Strawberry Creek basin has a high IP value, indicating there is potential for good spatial distribution of coho salmon in the basin. However, in the recent past, fish have been restricted during most years to just the lowest reaches of the basin by partial barriers in Strawberry Creek and many tributaries and a complete barrier on the Patrick Creek tributary near the Pacific Ocean. No stream crossings have been improved in the Strawberry Creek basin and the existing barriers likely inhibit coho salmon recovery in the majority of the basin.

The more restricted and fragmented the distribution of individuals within a population, and the more spatial distribution and habitat access diverge from historical conditions, the greater the extinction risk. Although the amount of habitat currently utilized by coho salmon is unknown, it is presumed to be very limited due to the presence of passage barriers and habitat degradation associated with low density rural development.

Population Size and Productivity

There are no data available on the current or historic coho salmon abundance in Strawberry Creek; however, it is designated as a dependent population and likely is dominated by strays from nearby basins. Due to migration barriers and habitat degradation within the Strawberry Creek basin, it is likely that coho salmon numbers are very low, and may even be extirpated from the basin. Sampling efforts have been limited, but coho salmon have not been detected in Strawberry Creek during the past 40 years. Nearby coho salmon populations include the dependent Norton/Widow White Creek population and the functionally independent Mad River

and Little River populations. The Mad River and Norton/Widow White Creek populations are severely depressed, and therefore are not likely contributing strays into Strawberry Creek. The Little River population is low but stable, and therefore could be a source of colonists to Strawberry Creek.

Extinction Risk

Not applicable because Strawberry Creek is not an independent population.

Role of Population in SONCC Coho Salmon ESU Viability

The Strawberry Creek population is considered dependent because it does not have a high likelihood of sustaining itself over a 100-year time period in isolation and likely received sufficient immigration to alter its dynamics and extinction risk (Williams et al. 2006). Although such populations may not be fully viable on their own, they do increase connectivity by allowing dispersal among independent populations, acting as a source of colonists in some cases. Historically, the Strawberry Creek population would have interacted with other Central Coastal populations such as the potentially independent Little River population to the north, the functionally independent Mad River population to the south, or the dependent Norton/Widow White Creek population to the south. Any restored habitat in Strawberry Creek provides potential connectivity and increased resiliency in the SONCC coho salmon ESU.

22.4 Plans and Assessments

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. Strawberry Creek is located in the Trinidad HU. Problems for coho salmon recovery in the Trinidad HU include high levels of fine sediment, stream channel aggradation, lack of instream LWD, insufficient levels of recruitable conifer LWD, poor estuary conditions, and barriers to anadromy.

Green Diamond Resource Company (GDRC)

Green Diamond Habitat Conservation Plan (HCP)

The GDRC HCP (GDRC 2006) contains measures that will aid in conservation of aquatic species in the Strawberry Creek basin. The GDRC owns 14 percent of the Strawberry Creek watershed. The plan has a number of provisions designed to protect coho salmon and salmon habitat on GDRC land in the Strawberry Creek basin. The plan was developed in accordance with section 10(a)(1)(B) of the ESA and contains a conservation strategy to minimize and mitigate the potential adverse effects of any authorized take of aquatic species that may occur incidental to GDRC's activities. The authorized take and its probable impacts will not appreciably reduce the likelihood of survival and recovery in the wild of aquatic species. Elements of the HCP are expected to contribute to efforts to reduce the need to list currently

unlisted species in the future under the ESA by providing early conservation benefits to those species. More information about the GDRC HCP can be found in Section 3.2.5.

22.5 Stresses

Table 22-2. Severity of stresses affecting each life stage of coho salmon in Strawberry Creek. Stress rank categories, assessment methods, and data used to assess stresses are described in Appendix B.

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

[1] Key stresses and limited life stage.
[2] Increased Disease/Predation/Competition are not considered stresses for this population.

Key Limiting Stresses, Life Stages, and Habitat

The key limiting stresses for the Strawberry Creek population are road-crossing barriers in the lower basin and impaired estuary/mainstem function. Barriers limit, if not completely block, all migration into the upper parts of the basin where spawning and rearing habitat occur. If adults are able to migrate through these barriers, smolt outmigration may be hindered. Strawberry Creek estuary is impaired. Tidal freshwater habitat is important for the growth and survival of juvenile coho salmon. Significant amounts of high IP habitat exist in the lower Strawberry Creek, including the tidally influenced areas of Strawberry and Patrick Creek. These high IP habitats may be valuable for winter and summer rearing and should be prioritized for recovery.

Barriers

Barriers pose a very high stress to juveniles, smolts, and adults. At least four barriers have been assessed in the Strawberry Creek basin, which are located at major road-stream crossings. As discussed in more detail in the section below regarding road-stream crossing threats, the crossing on Patrick Creek is a complete barrier to both juvenile and adult coho salmon and there are three other known partial barriers on the mainstem of Strawberry Creek. Additional road-stream crossings also likely occur on private roads and driveways, which have not been surveyed, and the extent of fish passage at these stream crossings is unknown.

Impaired Estuary/Mainstem Function

This stress refers to just the estuary conditions in Strawberry Creek, since this is a single population basin. Mainstem conditions are addressed through other stresses such as floodplain and channel structure, riparian condition, and hydrologic function. Estuary function is important to the population because of its unique role in the life history and survival of coho salmon

The Strawberry Creek basin has a small and narrow estuary that is heavily impacted by Highway 101 and a parking area off Clam Beach Drive. The development of this four-lane stretch of Highway 101 in the estuary has reduced the current extent of habitat to just a few acres downstream of the highway. Patrick Creek, a tributary to the estuary is completely blocked to fish at Highway 101 (CalFish 2009). The Highway 101 culvert on Strawberry Creek is partially filled with sediment, which restricts tidal exchange and estuarine wetland habitat. Currently, the estuary area adjacent to the ocean has large pieces of embedded, old growth wood that probably provide limited function as refugia. Vehicular access to riparian areas on Clam Beach might negatively affect migrating or rearing coho salmon by increasing turbidity at stream crossings or damaging riparian vegetation. There is no evidence that the mouth of Strawberry Creek closes to the Pacific Ocean during even the lowest water years, meaning bar breaching is not an issue. Given the small size of the basin, estuarine habitat could be very important to juvenile coho salmon rearing and therefore the loss of estuarine function is considered a high stress for the population. Juveniles and smolts are most affected since they rely on rearing and holding habitat in the estuary.

Altered Sediment Supply

Altered sediment supply is a medium stress to all life stages. The sediment supply in Strawberry Creek is being altered by the surrounding residential and urban land uses, as well as timber harvest and road building further up in the basin, and sediment supply to the creeks has increased due to these land use practices. This increase in material contributes to the filling in of pools and widening of channels and the input of fines can create high levels of embeddedness, decreasing the quality of spawning gravel. Considering the continued increases in the human population in the areas surrounding Strawberry Creek, this stress is likely to continue into the future, and may become more detrimental over time.

Lack of Floodplain and Channel Structure

Floodplain and channel structure presents a medium stress across most life history stages. No habitat surveys have been conducted in the Strawberry Creek basin but the removal of large wood from stream channels and the removal/depletion of riparian habitat, which is the source of future large wood input, have likely reduced the structural complexity of stream channels. Fine sediment input from land use practices in the upper basin areas has likely filled pools and simplified habitat, limiting rearing and spawning habitat in accessible areas. In addition, just upstream of the Highway 101 culvert, Strawberry Creek is channelized, creating simplified stream habitat with lack of cover or refuge for about 800 feet, and adding to existing passage problems throughout the basin.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions present a medium stress across most life stages. Forests are present in the majority of riparian areas in the basin; however, the size and age of trees is likely much lower than it was historically. The riparian forest conditions have been most altered through timber harvest in the upper Strawberry Creek basin, which is an area that has medium IP potential habitat. Some of the canopy cover has been depleted from road building and timber harvest in riparian areas and streamside corridors. Many of the legacy trees have been removed, leaving low potential for large wood recruitment and adding to existing sediment issues.

Altered Hydrologic Function

Altered hydrologic function represents a medium stress across most life history stages. The McKinleyville Community Services District provides water from the Mad River to residents of the lower Strawberry Creek basin (MCSD 2010) where the majority of the human population is located. No stream diversions were found in the Strawberry Creek basin, although many of the rural residents in the basin may utilize wells, which could contribute to a lowered water table. On the other hand, no sand berm forms during the summer at Strawberry Creek's confluence with the Pacific Ocean, so the basin still has excellent flow volume and cool water temperatures throughout the year. Thus, hydrologic function is not a significant stress in the basin.

Impaired Water Quality

Water quality poses a medium to low stress to coho salmon in the basin. This stress is most likely in the form of temperature and some rural residential pollutants, but it is unknown what, if any, effect this has on the Strawberry Creek coho salmon population. No water temperature data have been collected in Strawberry Creek or its tributaries, but temperature is not likely a limiting factor because the entire basin falls within coastal influences, where cool and moist conditions dominate.

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 Strawberry Creek; however, the proportion of adults that are of hatchery origin is likely less than five percent and there is no hatchery in the basin producing other species of salmonids. Therefore, adverse hatchery-related effects pose a low risk to all life stages.

22.6 Threats

Table 22-3. Severity of threats affecting each life stage of coho salmon in Strawberry Creek. 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	Road-Stream Crossing Barriers[1]	High	High	High[1]	High	Very High	High
2	Timber Harvest	High	High	High	High	Medium	High
3	Channelization/Diking[1]	Low	Medium	High[1]	High	Medium	High
4	Roads	Medium	Medium	Medium	Medium	Medium	Medium
5	Urban/Residential/Industrial Dev.	Medium	Medium	Medium	Medium	Medium	Medium
6	Agricultural Practices	Medium	Medium	Medium	Medium	Medium	Medium
7	Climate Change			Low	Low	Medium	Low
8	Fishing and Collecting	-	-	Low	Low	Low	Low
9	Dams/Diversion	Low	Low	Low	Low	Low	Low
10	Hatcheries	Low	Low	Low	Low	Low	Low

[1]Key limiting threats and limited life stage
[2]Invasive Non-Native/Alien Species, High Severity Fire, and Mining/Gravel Extraction are 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 road-stream crossing barriers, and channelization/diking.

Road-stream Crossing Barriers

Road-stream crossing barriers constitute a very high threat to coho salmon population in Strawberry Creek. At least four barriers have been assessed in the Strawberry Creek basin, and all are located at major road-stream crossings (Taylor 2000, Lang 2005). The state Highway 101 culvert is located adjacent to Strawberry Creek's outlet to the ocean and is the lower most barrier to passage, and excludes upstream movement of juvenile coho salmon into the majority of the basin during nearly all flows. Adult coho salmon passage occurs during only about 48 percent of flows (Lang 2005). Just upstream of the Highway 101 culvert is a steep trapezoidal concrete channel paralleling Central Avenue in McKinleyville, presenting the next partial barrier to fish passage in the Strawberry Creek basin. Eight-hundred feet upstream is the Humboldt County road crossing at Central Avenue (Lang 2005). This crossing represents a complete barrier to juvenile coho salmon and a partial barrier to adult coho salmon. Further upstream at the Dows Prairie Road crossing, another culvert is a partial barrier to adult and juvenile coho salmon. The small tributary Patrick Creek meets Strawberry Creek below the 101 Highway culvert at Strawberry Creek near Clam Beach. A complete barrier to fish passage on Patrick Creek occurs

upstream of this confluence at Highway 101 (Lang 2005); however there are only a few hundred feet of medium-IP habitat upstream of this barrier.

No efforts have been made to improve these crossings. The culverts under Highway 101 at both Strawberry Creek and the tributary Patrick Creek pose especially significant problems due to their locations low in the Strawberry Creek basin.

Table 22-4. List of prioritized road-stream crossing barriers in the Strawberry Creek population.

IP priority	Stream Name	Road Name	Watershed	County	Miles of upstream habitat
high	Strawberry Creek	Highway 101	Strawberry	Humboldt	>5.2
high	Strawberry Creek	Central Avenue	Strawberry	Humboldt	5.1
high	Strawberry Creek	Dows Prairie Rd.	Strawberry	Humboldt	4.1
high	Strawberry Creek	Highway 101	Patrick Creek	Humboldt	<1

Timber Harvest

Extensive timber harvest likely occurred in the early history of McKinleyville's development, and set the stage for land to be cleared for later agriculture or low-density human settlement. Timber harvest of the basin may have contributed to early degradation of the riparian zone and lack of instream structure. Today, timber harvest is considered a high threat to the Strawberry Creek population.

Thirteen point eight percent of the watershed is owned by GDRC and managed for timber harvest under an aquatic HCP (GDRC 2006) that includes minimization and mitigation measures consisting of road and riparian management, slope stability, and harvesting restrictions. The impacts of timber harvesting, even if carried out under the aquatic HCP, may result in the loss of pool habitat, loss of large wood and stream complexity, altered hydrology and nutrient cycling, and increased sediment loads. Adverse changes in habitat conditions will have a negative effect on all life stages of coho salmon utilizing those areas. GDRC's recent wood additions to streams and their assessments of erosion and sedimentation sources will help mitigate the impacts from future timber harvest in Strawberry Creek.

Channelization/Diking

Channelization and diking is a medium threat to almost all life stages of the Strawberry Creek coho salmon population, but may be a more significant threat in certain areas. In particular, just upstream of the Highway 101 culvert on Strawberry Creek is a steep trapezoidal concrete channel paralleling Central Avenue in McKinleyville. Channelization of the stream, in conjunction with a lack of instream structure, creates a simplified stream habitat with no cover or refuge for about 800 feet. Habitat within the channelized area is unsuitable for coho salmon rearing and presents a barrier to juvenile fish passage and adult passage during some flows.

Roads

Roads pose a medium threat to coho salmon in Strawberry Creek. Many of the roads in the more rural portions of the basin are unpaved and these roads create a significant source of sediment input to the stream. Because these roads are in a rural setting and often in the form of driveways and private roads, they can be difficult to treat, as decommissioning is not an option. In accordance with their aquatic Habitat Conservation Plan, the GDRC intends to maintain or decommission their roads to minimize adverse effects to salmon.

Urban/Residential/Industrial Development

Low-density rural residential development of the area occupied by the Strawberry Creek population of coho salmon contributes to all the stresses affecting this population, and poses a medium threat to all life stages of the Strawberry Creek coho salmon population. This threat is considered medium instead of high because no areas are designated for future medium or high-density residential development, industrial, or mixed use. Further urban development has not occurred in the basin and is not planned. The only industrial-type development is the Arcata/Eureka Airport, which could contribute to runoff of pollutants into the basin due to its impervious surfaces.

Agricultural Practices

Although agriculture may have historically played a larger role in the Strawberry Creek basin, now it presents a medium threat with 5 to 10 percent of the basin affected by agricultural practices. Some of the landowners have a small number of horses or cattle grazing near the stream, and this activity likely contributes to the altered sediment supply seen in many areas of lower Strawberry Creek. Grazing can result in multiple stresses including increased sediment supply, degraded riparian zones, and poor water quality.

Climate Change

There is moderate risk of a change in average precipitation over the next 50 years (Appendix B). Modeled regional average temperature shows a moderate increase over the next 50 years (Appendix B). Average temperature could increase by up to 1^{o} C in the summer and by a similar amount in the winter. The risk of sea level rise is low to moderate (Thieler and Hammer-Klose 2000), which may impact the quality and extent of wetland juvenile and smolt habitat. Adults may be negatively impacted by climate-related ocean acidification and changes in ocean conditions and prey availability (Independent Science Advisory Board 2007, Feely et al. 2008, Portner and Knust 2007).

Fishing and Collecting

California-managed fisheries for species other than coho salmon occur in estuaries, freshwater, and nearshore marine areas. The effects of these fisheries on the continued existence of the SONCC coho salmon ESU have not been formally evaluated by NMFS. As of April 2011, NMFS has not authorized future collection of coho salmon for research purposes in Strawberry Creek.

Dams/Diversions

Aerial photos show the presence of two small ponds on Duke Creek, both likely formed by impoundments. One is about 0.6 miles upstream of the mouth of Duke Creek in an area of medium IP habitat value and other is located an additional 0.8 upstream in an area of low IP habitat value.

Hatcheries

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

22.7 Recovery Strategy

Coho salmon have not been detected in Strawberry Creek during the past 40 years, although survey efforts have been quite limited. The Strawberry Creek population is dependent and therefore cannot be viable on its own; however, it is necessary to restore access and habitat within the basin so that it can provide connectivity between other populations in the ESU. The recovery criterion for the population is that 80% of available IP habitat must be occupied in years following spawning of brood years with high marine survival.

The most immediate need for coho salmon recovery in the Strawberry Creek basin is to provide adult passage at road-stream crossings barriers in the lower basin. The spatial distribution and diversity of coho salmon is below its potential due to these barriers and the population will not recover without passage improvements. With increased passage, coho salmon would have the opportunity to recolonize most of the basin.

There are no survey data to assess habitat quality quantitatively; however, it is likely that habitats are lacking instream complexity and mature riparian forests. Restoration efforts should focus on the mainstem of Strawberry Creek and the lower portions of Patrick Creek, Rose Creek, and Duke Creek, which all have high IP habitat (Figure 22-1). In addition, eliminating impediments to natural estuarine function would increase the value of this habitat and potentially increase growth and survival of juveniles.

Table 22-5, beginning on the following page, lists the recovery actions for the Strawberry Creek population.

Table 22-5. Recovery action implementation schedule for the Strawberry Creek 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-StrC.5.1.1	Passage	Yes	Improve access	Remove structural barrier	Mainstem Strawberry, Patrick, Duke, and Rose creeks, Highway 101 culvert, and all streams where coho salmon would benefit immediately	2c
SONCC-StrC.5.1.1.1	*Assess road-stream crossing barriers*					
SONCC-StrC.5.1.1.2	*Upgrade County culverts to accommodate fish passage at all life stages, based on assessment*					
SONCC-StrC.5.1.1.3	*Prioritize and resolve passage issues at Highway 101*					
SONCC-StrC.5.1.32	Passage	Yes	Improve access	Remove structural barrier	Population wide	2d
SONCC-StrC.5.1.32.1	*Assess road-stream crossing barriers*					
SONCC-StrC.5.1.32.2	*Upgrade County culverts to accommodate fish passage at all life stages, based on assessment*					
SONCC-StrC.5.1.32.3	*Prioritize and resolve passage issues*					
SONCC-StrC.1.2.8	Estuary	Yes	Improve estuarine habitat	Construct additional wetland habitat in tidally-inundated stream reaches	Lower Strawberry Creek, downstream of highway 101	2c
SONCC-StrC.1.2.8.1	*Assess tidally influenced habitat and wetlands and develop a plan to restore wetland and off channel habitat*					
SONCC-StrC.1.2.8.2	*Construct additional wetland habitat (wetland and off-channel habitat) downstream of the highway on tidally-inundated stream reaches*					
SONCC-StrC.1.2.9	Estuary	Yes	Improve estuarine habitat	Relocate parking area	Lower Strawberry Creek	2c
SONCC-StrC.1.2.9.1	*Relocate the parking area on Clam Beach Drive and expand and connect the adjacent wetland area*					
SONCC-StrC.1.4.7	Estuary	Yes	Protect estuarine habitat	Prevent damage from vehicular traffic	Lower Strawberry Creek	2c
SONCC-StrC.1.4.7.1	*Develop regulatory mechanisms to prevent all vehicular traffic on Clam beach and Strawberry Creek estuary*					
SONCC-StrC.2.1.13	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	All streams where coho salmon would benefit immediately	3c
SONCC-StrC.2.1.13.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-StrC.2.1.13.2	*Place instream structures, guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-StrC.2.1.31	Floodplain and Channel Structure	No	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	3d
SONCC-StrC.2.1.31.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-StrC.2.1.31.2	*Place instream structures, guided by assessment results*					
SONCC-StrC.10.7.29	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3c
SONCC-StrC.10.7.29.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-StrC.10.7.29.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-StrC.10.7.30	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-StrC.10.7.30.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-StrC.10.7.30.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-StrC.5.1.18	Passage	Yes	Improve access	Remove barrier	Strawberry Creek, Central Avenue culvert	3d
SONCC-StrC.5.1.18.1	*Remediate barrier at Central Avenue to accommodate fish passage for all life history phases*					
SONCC-StrC.2.2.2	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Restore natural channel form and function	Lower Strawberry Creek	3d
SONCC-StrC.2.2.2.1	*Assess concrete channel and develop a plan to restore natural channel form and function*					
SONCC-StrC.2.2.2.2	*Remove concrete channel and restore natural channel, guided by the plan*					
SONCC-StrC.7.1.5	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Middle Strawberry Creek and tributaries	BR
SONCC-StrC.7.1.5.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-StrC.7.1.5.2	*Develop grazing management plans to improve water quality and coho salmon habitat*					
SONCC-StrC.7.1.5.3	*Plant vegetation to stabilize stream bank*					
SONCC-StrC.7.1.5.4	*Fence livestock out of riparian zones*					
SONCC-StrC.7.1.5.5	*Remove instream livestock watering sources*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-StrC.7.1.6	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Middle and Upper Strawberry Creek	BR
SONCC-StrC.7.1.6.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-StrC.7.1.6.2	*Develop watershed-specific guidance for managing riparian vegetation*					
SONCC-StrC.2.1.19	Floodplain and Channel Structure	No	Increase channel complexity	Improve regulatory mechanisms	Population wide	BR
SONCC-StrC.2.1.19.1	*Improve protective regulations for beaver and develop guidelines for relocation that are practical for restoration groups*					
SONCC-StrC.2.2.14	Floodplain and Channel Structure	No	Reconnect the channel to the floodplain	Increase beaver abundance	Population wide	BR
SONCC-StrC.2.2.14.1	*Develop a beaver conservation plan that includes education and outreach, technical assistance for land owners, and methods for reintroduction and/or relocation of beaver as a last resort*					
SONCC-StrC.2.2.14.2	*Implement education and technical assistance programs for landowners, guided by the plan*					
SONCC-StrC.8.1.10	Sediment	No	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	BR
SONCC-StrC.8.1.10.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					
SONCC-StrC.10.2.12	Water Quality	No	Reduce pollutants	Educate stakeholders	Population wide	BR
SONCC-StrC.10.2.12.1	*Develop an educational program that teaches landowners and businesses about avoiding pollution from septic systems, backyard pesticides, fuels, and nutrients*					
SONCC-StrC.10.2.3	Water Quality	No	Reduce pollutants	Improve regulatory mechanisms	Population wide	BR
SONCC-StrC.10.2.3.1	*Complete sewer system upgrades to achieve Clean Water Act compliance*					
SONCC-StrC.10.2.3.2	*Provide incentives for septic repair and upgrades*					
SONCC-StrC.10.2.24	Water Quality	No	Reduce pollutants	Reduce pesticides	Population wide	BR
SONCC-StrC.10.2.24.1	*Develop a pesticide management plan*					
SONCC-StrC.10.2.24.2	*Implement pesticide management plan and technical assistance program*					
SONCC-StrC.10.2.4	Water Quality	No	Reduce pollutants	Reduce point- and non-point source pollution	Population wide	BR
SONCC-StrC.10.2.4.1	*Using regulatory mechanisms, limit impervious surfaces*					

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