20. Maple Creek/Big Lagoon 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

46.9 mi^2 watershed (1% Federal ownership)

19 IP-km (12 IP-mi) (61% High)

Dominant Land Use is Timber Production

Key Limiting Stresses are 'Lack of Floodplain and Channel Structure' and 'Altered Sediment Supply'

Key Limiting Threats are 'Roads' and 'Timber Harvest'

Highest Priority Recovery Actions

• Increase large woody debris (LWD), boulders, and other instream structure • Re-connect existing off-channel ponds, wetlands, and side channels • Reduce road-stream hydrologic connection	• Install bridges at Highway 101 to increase tidal and riverine exchange, reduced channelization, reduce upland conversion, and increase flushing flows to Big Lagoon • Assess estuary and tidal wetland habitat • Remove Gray Creek dam

20.1 History of Habitat and Land Use

Timber harvest has been the single most disturbing activity in the Maple Creek basin. Intensive timber harvest took place between the 1940s and 1960s and effects of the removal of riparian canopy can still be seen in several stream reaches where the alders dominate. Historic timber harvest practices often made use of mill ponds. Gray Creek still has a remnant dam in place and an associated remnant mill pond.

Currently, timber harvest remains as the dominant land use with over 98 percent of the basin owned by Green Diamond Resource Company (GDRC). Current timber harvest regulations and an Aquatic Habitat Conservation Plan (AHCP) help protect the river from the destructive practices that originally took place. Many roads have been constructed throughout the basin including for residential development on the south end of Big Lagoon and for access to timberland. Timber management roads, which are often built alongside streams and have many stream crossings, have contributed to erosion, runoff, and excess sediment in streams. Increases in sediment supply have left streams wider and shallower, creating more simplified habitat. In addition, sediment accumulating in Big Lagoon contributes to wetland accretion. Marshland increase is documented including the appearance of alluvial islands downstream of the highway where deeper waters previously existed (Parker 1988).

Other large changes affecting sedimentation rates in the estuary and overall estuarine function include the building of Highway 101 and the construction of a dam on Gray Creek. Built in the 1920s, Highway 101 is on dredge spoils across most of the mile-long estuarine floodplain of Maple Creek. On either side of the highway, remnant dredge ditches can still be seen. Numerous historic tidal channels are truncated by the highway dike and most (approximately 90 percent) of the historic tidal wetland area has been lost (Figure 20-1). Flow from Maple Creek is impeded by Highway 101 during flood events, and backs up on the south side of the highway. The building of the Gray Creek dam has also altered the hydrology of the estuary. In what was historically the upper extent of tidal exchange, the creek now builds up behind the dam in a large lake. Although a channelized stream flows from the mill pond providing connectivity, tidal exchange has been truncated and a large section of tidally influenced rearing habitat has been lost (Figure 20-2).

Harry A. Merlo State Recreation Area and Humboldt Lagoons State Park almost completely surround Big Lagoon, and the California Department of Fish and Wildlife manages Big Lagoon as a wildlife area. The park includes a campground, day use area, and a boat launch on the south end of the lagoon that is operated by Humboldt County. Recreational use includes camping, kayaking, fishing, and wildlife viewing in the creek and the lagoon.

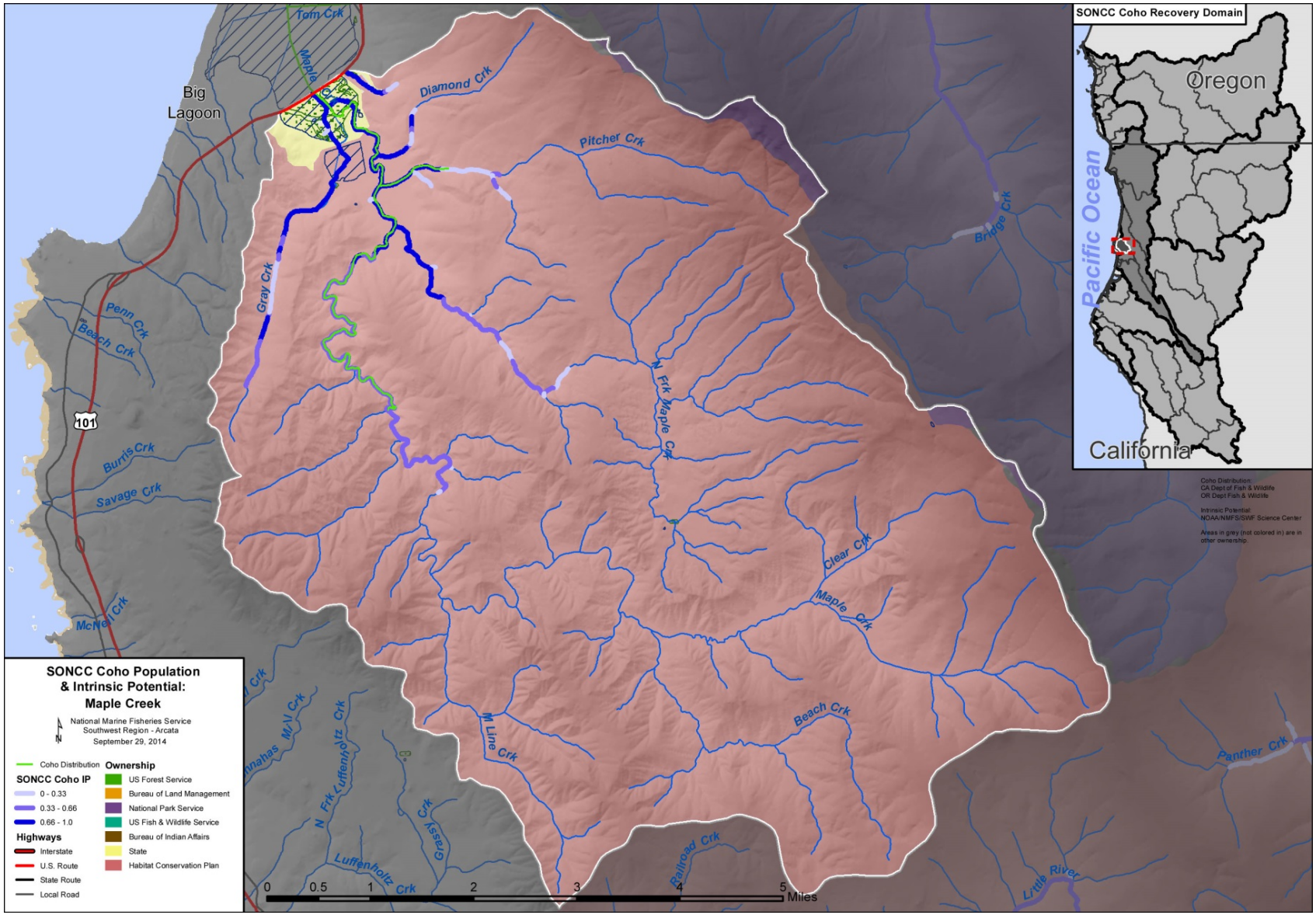

Figure 20-1. The geographic boundaries of the Maple Creek/Big Lagoon coho salmon population (Williams et al. 2006). Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership. Hatched area is included in the Maple Creek/Big Lagoon population area.

Residential development with associated paved or graveled roads is present just off the shoreline of the lagoon next to the park. The Big Lagoon Rancheria owns a nearby 20-acre parcel of land on the south end of Big Lagoon, and there is residential development on this parcel.

Figure 20-2. Photo shows Gray Creek mill pond and channelization of Maple Creek. Note the reduction of tidal exchange as a result of Highway 101.

20.2 Historic Fish Distribution and Abundance

The Maple Creek/Big Lagoon basin has a high potential to support unique life history diversity traits for coho salmon. Maple Creek flows into Big Lagoon, a brackish water body separated from the ocean by a narrow sand spit. Throughout the majority of the year, Big Lagoon is an enclosed lake. Most years, high water levels in the fall and winter cause the lagoon to breach, creating an opening where adult coho salmon can migrate upstream and juvenile salmon can out-migrate to the sea. In low water years when the lagoon does not breach the spit, adult coho salmon cannot enter the basin and juveniles cannot exit the lagoon. Little historic data exists that describes the number of coho salmon in Maple Creek basin or the distribution of fish throughout the basin. The U.S. Fish and Wildlife Service (USFWS) estimated as many as 1,200 coho salmon were present in Maple Creek as late as the 1960s (GDRC 2006).

GDRC, the largest private landowner in the basin, has performed several spawning and juvenile surveys for coho salmon. In the 1998 to 1999 and 1999 to 2000 seasons, no coho salmon redds were observed. Adult coho salmon were not observed in the lagoon or Maple Creek, and one 1+ coho salmon was seen in the summer of 1999 (GDRC 2006). A thorough search of past survey records by CDFG shows that coho salmon have been documented throughout the basin since 1995 (Garwood 2012) (Table 20-1).

Table 20-1. Documented presence of juvenile coho salmon by brood year in the Maple Creek basin. (Garwood 2012).

Stream	BY1995	BY1996	BY1997	BY1998	BY1999	BY2000	BY2001	BY2002
Tom Creek	Y	Y	null	null	null	null	null	null
Maple Creek	null	null	Y	U	Y	U	Y	Y
Pitcher Creek	null	null	Y	U	U	U	U	null
North Fork Maple Creek	null	null	null	U	U	U	null	Y
Y = coho salmon confirmed, U = coho salmon not confirmed, null = not surveyed								

Adult coho salmon have been found lower in the basin during recent spawning and juvenile snorkel surveys (Perry, D., pers. comm. 2009). Adult escapement in streams upstream of the lagoon is likely limited and variable due to the timing of when the lagoon breaches. The absence of 0+ coho salmon during the summer of 1999 and the lack of documented presence for that brood year suggests that Big Lagoon did not breach during the winter of 1998 to 1999, while the presence of 1+ coho salmon indicates that adults were able to enter during the 1997 to 1998 spawning season. The extent to which human activities have changed the timing or frequency of

Accessible habitat with the potential to support rearing coho salmon is distributed throughout most of the basin, with the highest IP values (IP >0.66) in the lower reaches of Maple Creek and its tributaries as well as tributaries to Big Lagoon.

Table 20-2. Tributaries high IP reaches (IP value > 0.66). (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Pitcher Creek	Diamond Creek	Gray Creek
North Fork Maple Creek	Tom Creek	

20.3 Status of Maple Creek/Big Lagoon Coho Salmon

Spatial Structure and Diversity

Spawning, snorkel, and electroshocking surveys have identified coho salmon in the lowest parts of the Maple Creek basin. No juvenile coho salmon were found in Tom Creek, Diamond Creek or Gray Creek in the early 1990s by GDRC. Several natural barriers throughout Maple Creek limit the spatial distribution of coho salmon to the lower reaches of the basin. In addition to the current distribution shown in Figure 20-1, coho salmon also occur in North Fork Maple Creek (GDRC 2006).

The lagoon ecosystem within the Maple Creek basin creates potential for a diversity of life history traits. Because the sand bar does not always breach on an annual basis, emigrating smolts may rear an additional year in the lagoon and adult coho salmon either do not spawn or stray to nearby basins. Diverse life history and gene flow with nearby basins historically increased the overall resiliency of the population and the ESU. Although some of the diverse genetic and life history traits are likely still present, the reduced population abundance diminishes the current diversity of this population.

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. Williams et al. (2008) determined that at least 39 coho salmon per-IP-km of habitat are needed (1600 spawners total) to approximate the historical distribution of Maple Creek/Big Lagoon coho salmon and habitat. The currently restricted distribution of coho salmon in Maple Creek/Big Lagoon due to natural barriers, combined with the occurrence of altered bar breach events, further impact this population.

Population Size and Productivity

If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great. This situation accelerates a decline toward extinction. Williams et al. (2008) determined at least 41 coho salmon must spawn in Maple Creek each year to avoid such depensatory effects.

Spawning surveys completed by GDRC documented low abundance of adult coho salmon adults (From 2 in 2003 to 15 in 2011) in 2003, 2005, 2008, and 2011 (GDRC 2013a). The abundance of the Maple Creek/Big Lagoon coho salmon population is depressed. Six coho salmon smolts were captured in late September 2009 near the GDRC Bridge approximately 2.5 miles upstream

of Hwy 101 (USFWS 2009a). Productivity of coho salmon within the basin is unknown but assumed to be very low, and population growth is likely neutral or negative.

Extinction Risk

Not applicable because Maple Creek/Big Lagoon is not an independent population.

Role in SONCC Coho Salmon ESU Viability

The Maple Creek/Big Lagoon 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 Maple Creek/Big Lagoon population would have interacted with other Central Coastal populations such as the functionally independent Redwood Creek population to the north and the potentially independent Little River population to the south. Any restored habitat in Maple Creek/Big Lagoon provides potential connectivity and increased resiliency in the SONCC coho salmon ESU. An additional factor considered in designating the Maple Creek/Big Lagoon population was the lack of accessibility at the mouth. Because the lagoon does not breach every year, spawners may not be able to enter the watershed, preventing a continuous brood year presence.

There are several populations which may interact with the Maple Creek/Big Lagoon population. Stone Lagoon, which is located just to the north of Big Lagoon, has a similar ecology, where sand spit breaches occur on an annual basis. Adult salmon in some years will not have access to their natal streams when the sand spit remains intact. Those fish must return as strays to other nearby basins. If a breach event were not to occur in Stone Lagoon, but did occur in Big Lagoon, coho salmon may access the Maple Creek basin. Conversely, straying can also occur if returning adults use spawning habitat in adjacent basins when Big Lagoon does not breach. The adjacent basins may also act as potential refugia for this population when Big Lagoon does not breach, thus preventing total loss of that year-class. Because of high straying potential, there is likely a good genetic flow between adjacent basins.

20.4 Plans and Assessments

Green Diamond Resource Company (GDRC)

Green Diamond Aquatic Habitat Conservation Plan (AHCP)

The GDRC AHCP (GDRC 2006) contains measures that will aid in conservation of aquatic species in the Maple Creek/Big Lagoon. Almost all of the 98 percent of private land in the Maple Creek/Big Lagoon basin is owned by GDRC and therefore managed according to the provisions of the AHCP. The plan has a number of provisions designed to protect coho salmon and salmon habitat throughout the Maple Creek/Big Lagoon 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 covered listed aquatic species. Elements of the AHCP 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 AHCP can be found in Section 3.2.5 (Timber Harvest) and Section 3.2.2 (Roads).

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 (CDFG 2004b)was adopted by the California Fish & Game Commission in February 2004. The recommendations developed by CDFG for the Big Lagoon HSA in the Trinidad hydrologic unit address the impacts of timber harvest and restoration of the riparian zone. The strategy identifies recovery actions for the state listed coho salmon.

Maple Creek/Big Lagoon Watershed Inventory and Restoration Planning Project Report

The Maple Creek/Big Lagoon watershed inventory and restoration planning report (Pacific Watershed Associates 2005) identified locations with future road-related sediment delivery, potential projects that could improve in-stream channel conditions for anadromous fish, and a prioritized plan of action for erosion prevention and restoration.

20.5 Stresses

Table 20-3. Severity of stresses affecting each life stage of coho salmon in Maple Creek/Big Lagoon. Stress rank categories, assessment methods, and data used to assess stresses are described in Appendix B.

Stresses		Egg	Fry	Juvenile[1]	Smolt	Adult	Overall Stress Rank
1	Lack of Floodplain and Channel Structure[1]	High	High	Very High[1]	Very High	Very High	Very High
2	Altered Sediment Supply[1]	High	High	Very High[1]	Very High	High	Very High
3	Impaired Estuary/Mainstem Function	-	Low	High	Very High	Very High	Very High
4	Altered Hydrologic Function	Low	Medium	High	Medium	Medium	Medium
5	Degraded Riparian Forest Conditions	-	Medium	Medium	Medium	Low	Medium
6	Adverse Fishery- and Collection-Related Effects	-	-	Low	Low	Medium	Low
7	Impaired Water Quality	Low	Low	Low	Low	Low	Low
8	Barriers	-	Low	Low	Low	Low	Low
9	Adverse Hatchery-Related Effects	Low	Low	Low	Low	Low	Low
10	Increased Disease/Predation/Competition	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 lack of floodplain and channel structure and altered sediment supply. A combination of timber harvest practices and the construction of Highway 101 have significantly reduced the amount and quality of rearing habitat. A large amount of tidal marshland, backwater channels, and wetlands have been converted to dryer uplands due to the highway acting as a dike across the lagoon and an excess of sediment settling in that area. A reduction in large wood simplifies the channel leading to less available refuge during high winter flows and low summer flows. The combined effect of excess sediment filling pools and intertidal rearing areas along with the lack of structure to provide scour mechanisms reduces channel complexity. The juvenile life stage is most limited and quality summer and winter rearing habitat are lacking as vital habitat for the Maple Creek/Big Lagoon population.

The lowest portions of the Maple Creek basin within and just upstream of the estuary contain the highest quality and most connected habitat. There are several small streams that enter the lagoon near the mouth of Maple Creek and tributaries that enter Maple Creek just upstream of the mouth. These tributaries provide the best refuge for coho salmon (Table 20-4), although they are blocked by natural barriers within a half mile. The lower reaches of these small tributaries may still provide refuge from the mainstem Maple Creek or Big Lagoon. Though connectivity has

been reduced, the remaining connected habitat between the tidal wetlands and the freshwater tributaries provide a diversity of habitat types and refugia sites. Several of these tributaries have no documented use by coho salmon, but the streams could still potentially provide refugia for juveniles rearing in the lower basin. The lagoon provides prolonged rearing habitat for juveniles, which increases life history diversity for the ESU since the lagoon does not usually breach during the late spring and summer when most other smolts outmigrate to the ocean.

Table 20-4. Potential refugia areas within the Maple Creek/Big Lagoon basin.

Stream Name	Stream Name	Stream Name
Big Lagoon	Tom Creek	North Fork Maple Creek
Maple Creek	Pitcher Creek	Diamond Creek

Lack of Floodplain and Channel Structure

Lack of floodplain and channel structure is a high to very high stress across all life stages of coho salmon. Simplified channel and floodplain structure are primarily the result of a lack of large wood in the Maple Creek basin, and an overabundance of fine sediment. Although no surveys of large wood structures are available, the history of intensive timber harvest in the area suggests the basin likely experiences low wood recruitment. Large wood is required to sort sediment, scour pools, and facilitate floodplain connectivity. Surveys in the upper basin indicate pool habitat has been filling with sediment. The oversimplified stream channel and floodplain can no longer provide refugia and rearing habitat for juveniles and lacks habitat features, such as deep pools and side channels.

Altered Sediment Supply

Altered sediment supply presents a high to very high stress for all life stages of coho salmon in the Maple Creek/Big Lagoon basin. Surveys indicate that excess sediment has filled pools, widened channels, and simplified stream habitat throughout the basin, including the lagoon. The input of fines also increases embeddedness of the spawning gravel and can suffocate eggs during development. In addition to negative stream impacts in the basin, the increased sediment supply accumulates upstream of the bridge and downstream into the mouth of the lagoon (Figure 20-3), reducing the size of the lagoon and rearing habitat.

Impaired Estuary/Mainstem Function

The impaired estuary/mainstem function stress refers to only the estuary conditions in Maple Creek/Big Lagoon 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

Big Lagoon is one of the few coastal lagoons that is managed by California Department of Fish and Wildlife. Big Lagoon is a brackish lake that is enclosed by a sand spit the majority of the year. Most years, the lagoon breaches, providing adult coho salmon access to the basin from the ocean. For the most part, the lagoon habitat provides opportunities for rearing in wetland areas. However, the overall estuarine function has been degraded by sediment accretion and Highway

101. Elevated sediment accretion in the lagoon and in lower Maple Creek has led to a shallowing of tidal channels and conversion of open water to marsh and uplands. An increase of marshland at the rate of 0.23 ha/year was observed between 1931 and 1978 (Parker 1988). Figure 20-3 shows the conversion of lagoon habitat to upland marsh habitat between 1931 and 1978.

The dike supporting Highway 101 effectively blocks hydrologic connectivity between Big Lagoon and Maple Creek. Numerous large historic tidal channels and tidal wetland have been blocked by the dike. Without tidal exchange, accretion upstream of the highway is converting formally brackish wetland habitat to freshwater wetland, mudflats, and uplands. The conversion from brackish to freshwater wetland has decreased the productivity and rearing potential of wetland areas. Big Lagoon also likely experiences changes due to a loss of exchange with Maple Creek. Riverine flushing is dampened by the dike, potentially impacting salinities, sediment accretion in the lagoon, and breach events at the spit. Based on his work in the small coastal lagoons in Humboldt County, Kraus et al. (2002) found that both riverine and ocean processes can affect breach events in these basins. For the barrier spits, small streams and runoff during the rainy season gradually raise the water level and cause breaching from lagoon to ocean by seepage and failure. The pooling of water upstream of the highway can clearly interfere with this process.

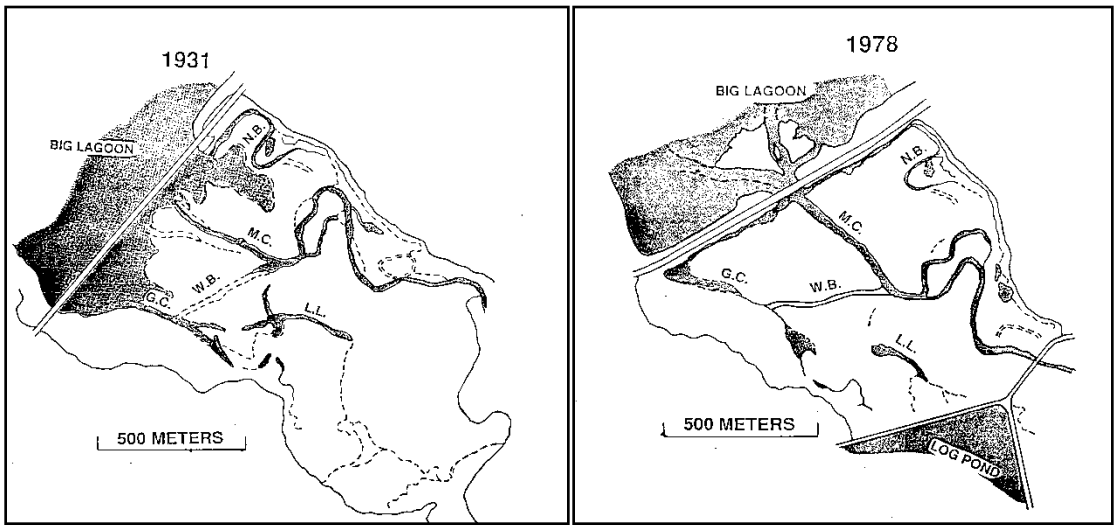

Figure 20-3. Line drawing showing the changes in Big Lagoon between 1931 and 1978. Stippled pattern represents permanent water; dashed lines indicate indefinite banks, dry paleochannels or subaqueous channel banks (Parker 1988). Note the increase in upland marsh habitat and creation of Gray Creek mill pond.

Altered Hydrologic Function

Altered hydrologic function within the Maple Creek basin poses a high risk to juvenile and smolt life stages, a medium risk to fry and adults, and a low risk to the egg life stage. Flows remain intact with few diversions. However, the estuary has been significantly modified by Highway 101 impeding hydrologic exchange between the lagoon and Maple and Gray Creeks. Satellite images show historic tidal channels that have been truncated by the highway. Additionally, flows from the upper basin pool behind the highway, accumulating sediment there. The

accumulation effectively converts tidal wetland to freshwater marshes, which reduces the diversity of habitat and quality of rearing habitat for juveniles.

Degraded Riparian Forest Conditions

Degraded riparian forest conditions represent a low to medium stress on sub-adult life stages of coho salmon in Maple Creek and Big Lagoon. Early timber harvest resulted in the removal of large trees from the riparian zone and the construction of roads alongside streams, so there is a lack of old growth conifers in these areas and many reaches are now dominated by alders. Riparian vegetation should have a diversity of age classes and species that provide a continuous source of large wood input to the stream.

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.

Impaired Water Quality

Impaired water quality is a low to medium stress for all the life stages of coho salmon in Maple Creek/Big Lagoon. The 7 day maximum average water temperature ranged from 14 to 15 °C (GDRC 2006) and there are no apparent sources of excessive nutrient or pollutant runoff.

Barriers

Barriers represent a low stress for coho salmon in the Big Lagoon and Maple Creek basin. A dam on Gray Creek is a complete barrier to all life history phases of coho salmon. The sand spit at the outlet of Big Lagoon is a barrier in years when the lagoon doesn't breach. Numerous natural barriers exist in the basin (D. Perry, pers. comm., 2009, CalFish 2009).

Adverse Hatchery-Related Effects

Hatchery-origin coho salmon may stray into Maple Creek and Big Lagoon; however, the proportion of adults that are of hatchery origin is likely less than five percent. Therefore, adverse hatchery-related effects pose a low risk to all life stages.

Increased Disease/Predation/Competition

There is no documented increase in disease, predation, or competition within the Maple Creek/Big Lagoon basin. Disease, predation, or competition is considered a low stress to the population. Predation from bass and rainbow trout in the old mill pond at Gray Creek may be a concern. Bass and trout prey upon juvenile salmonids and could prevent coho salmon from utilizing the high IP habitat in this creek.

20.6 Threats

Table 20-5. Severity of threats affecting each life stage of coho salmon in Maple Creek/Big Lagoon. Threat rank categories, assessment methods, and data used to assess threats are described in Appendix B.

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

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

Key Limiting Threats

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

Roads

Roads are a high threat across all life stages of coho salmon in the Maple Creek basin. Road density is very high with an average of 9.6 miles per square mile of basin and road networks consist primarily of un-paved roads built on unstable Franciscan soils. The high density of roads is the most significant source of increased sediment in the creeks and the lagoon. As described previously, increased amounts of sediment are contributing to the loss of lagoon habitat. Additionally, roads interfere with tidal exchange, increasing channelization and limiting tidal rearing habitat. Roads often parallel the stream channel and have multiple crossings, increasing runoff and sediment input. Therefore, roads are one of the most serious threats for this population. The GDRC AHCP describes a road maintenance plan to reduce this threat. Roads in

the tidally influenced region and along stream corridors should be prioritized for decommissioning.

Timber Harvest

The GDRC manages the basin for timber harvest under an AHCP (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 AHCP, 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 (NMFS 2007a). GDRC's recent wood additions to streams and their assessment and reduction of erosion and sedimentation sources such as roads, will help mitigate the impacts of future timber harvest in Maple Creek.

Channelization/Diking

Channelization and diking, a medium threat across all life stages, is not widespread throughout the basin but has localized impacts. In the upper basin, there are some reaches where roads parallel the stream, confining the channel and reducing floodplain connectivity and function. Channelization and diking is primarily a problem associated with Highway 101. The highway dike prevents hydrologic connectivity between Maple Creek, Gray Creek, and Big Lagoon, channelizing flows into a single thread channel that must pass under a single bridge constriction. Future impacts upstream of the dike include increased accretion in channel and floodplain habitat, the conversion of open water to mudflats, and wetlands to uplands. Without proper connectivity to Maple Creek and Gray Creek, Big Lagoon will also undergo changes in accretion and estuarine habitat.

Dams/Diversions

Dams and diversions present a medium threat across all life history stages of coho salmon. There is only one dam and associated diversion within the basin. The dam is located near the mouth of Gray Creek and forms a 70 acre pond once used as a mill pond. The unnatural lake is providing habitat for non-native predatory fishes, has converted tidally influenced land to freshwater, and is potentially harboring contaminants from its historic use as a log pond. Coho salmon have not been found in Gray Creek likely because of one or more of these issues associated with the pond.

High Severity Fire

Fire is listed as a medium threat for coho salmon in the Maple Creek basin. The management of the timberlands by GDRC can alter the natural fire regime. Densely wooded and even-aged stands can have increased potential for fire, whereas thinning and prescribed burning can reduce the potential for high severity fire. The GDRC AHCP prioritizes units for low intensity, controlled burns to reduce the buildup of excess fuels and reduce the risk of high severity fire. When fires occur in the basin, the effects could be detrimental, potentially creating excessive amounts of erosion, loss of riparian vegetation, and degraded water quality.

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.

Climate Change

Climate change poses a low threat to this population due to its cooler climate, low risk of temperature increase and precipitation change over the next 50 years (see Appendix B for modeling methods). Also, as with all populations in the ESU, adult coho salmon will be negatively impacted by ocean acidification and changes in ocean conditions and prey availability (see Independent Science Advisory Board 2007, Portner and Knust 2007, Feely et al. 2008).

Urban/Residential/Industrial Development

Development presents a low threat for coho salmon in the Maple Creek/Big Lagoon basin. The Maple Creek basin is almost entirely owned by GDRC and if it remains as such, should have a minimal threat of development. The lagoon is primarily surrounded by public land and also has no threat of development. The Big Lagoon Rancheria Tribe owns 20 acres on the south side of the lagoon and contains a small amount of residential development.

Agricultural Practices

Because 98 percent of the basin is managed for timber harvest by GDRC, there is only a low threat from agricultural practice within the Maple Creek/Big Lagoon basin. The lagoon is protected from agriculture by the state parks that surround the sensitive environment. There are 20 acres of tribal land on the south side of the lagoon that may have the potential for small scale agriculture, but currently are dominated by eight households, roads, and a community water facility.

Road-Stream Crossing Barriers

Road-stream crossing barriers in the Maple Creek basin pose a low to medium threat for coho salmon. Road-stream crossings that have been evaluated as potential barriers are not accessible to coho salmon or they are on tributaries too small to provide coho salmon habitat (Perry, D., pers. comm., 2009). However, road crossings present a major threat through their contribution to high sedimentation rates. Altered sediment supply is ranked as the most significant stress in the basin. Crossings should be regularly evaluated and either maintained, improved or decommissioned to prevent chronic erosion or wash-outs.

Hatcheries

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

Invasive/Non-Native Species

Invasive, non-native species is considered a medium stress in the Maple Creek basin. New Zealand mud snails have been detected in Big Lagoon, Gray Creek, and mainstem Maple Creek. New Zealand mud snails quickly colonize benthic habitats, becoming high in density. Due to their small size, they are a low quality prey item for juvenile SONCC coho and thus disrupt prey assemblage diversity. Predation from largemouth bass in the old mill pond at Gray Creek may be a concern. Bass prey upon juvenile salmonids and could prevent coho salmon from utilizing the high IP habitat in this creek.

20.7 Recovery Strategy

Coho salmon in the Maple Creek/Big Lagoon basin are severely depressed in abundance and have a restricted distribution because of degraded habitat quality. The recovery criterion for the population is that coho salmon must occupy 80% of available IP habitat in years following spawning of brood years with high marine survival. Recovery actions should focus on habitat restoration to enhance survival and growth of juveniles as well as increase spatial distribution by connecting high quality habitat. Activities that reduce sediment delivery and increase the large wood component of streams would increase habitat complexity and quality of water and substrate. Activities that reduce sediment will also be beneficial to the lagoon/estuary. The effects of fishing on this population's ability to meet its viability criteria should be evaluated.

Table 20-6 on the following page lists the recovery actions for the Maple Creek/Big Lagoon population.

Table 20-6. Recovery action implementation schedule for the Maple Creek/Big Lagoon 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-MapC.8.1.4	Sediment	Yes	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All areas where coho salmon would benefit immediately	2b
SONCC-MapC.8.1.4.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MapC.8.1.4.2	*Decommission roads, guided by assessment*					
SONCC-MapC.8.1.4.3	*Upgrade roads, guided by assessment*					
SONCC-MapC.8.1.4.4	*Maintain roads, guided by assessment*					
SONCC-MapC.8.1.34	Sediment	Yes	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	2c
SONCC-MapC.8.1.34.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MapC.8.1.34.2	*Decommission roads, guided by assessment*					
SONCC-MapC.8.1.34.3	*Upgrade roads, guided by assessment*					
SONCC-MapC.8.1.34.4	*Maintain roads, guided by assessment*					
SONCC-MapC.1.2.21	Estuary	No	Improve estuarine habitat	Assess and improve estuary and tidal wetland habitat	Estuary	2b
SONCC-MapC.1.2.21.1	*Identify parameters to assess condition of estuary and tidal wetland habitat*					
SONCC-MapC.1.2.21.2	*Determine amount of estuary and tidal wetland habitat needed for population recovery and develop a plan for restoration*					
SONCC-MapC.1.2.21.3	*Restore estuary and tidal wetland habitat guided by the plan*					
SONCC-MapC.1.3.6	Estuary	No	Increase tidal exchange of water	Install bridges	Highway 101 dyke at Big Lagoon	2b
SONCC-MapC.1.3.6.1	*Develop a plan to install bridges on Highway 101 that will increase tidal and riverine exchange, reduces channelization, reduce upland conversion, and increase flushing flows to Big Lagoon*					
SONCC-MapC.1.3.6.2	*Install bridges, guided by the plan*					
SONCC-MapC.2.1.1	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Big Lagoon, estuary, mainstem Maple Creek, and all streams where coho salmon would benefit immediately	2c
SONCC-MapC.2.1.1.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MapC.2.1.1.2	*Place instream structures, guided by assessment results*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MapC.2.1.31	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	Population wide	2d
SONCC-MapC.2.1.31.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MapC.2.1.31.2	*Place instream structures, guided by assessment results*					
SONCC-MapC.2.2.2	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Re-connect channel to existing off-channel ponds, wetlands, and side channels	Mill/Pitcher Creek, and all streams where coho salmon would benefit immediately	2c
SONCC-MapC.2.2.2.1	*Assess habitat and develop a plan to restore the historic floodplain through reconnection of side channels and off channel habitat*					
SONCC-MapC.2.2.2.2	*Restore the historic floodplain, guided by the plan*					
SONCC-MapC.2.2.32	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Re-connect channel to existing off-channel ponds, wetlands, and side channels	Population wide	2d
SONCC-MapC.2.2.32.1	*Assess habitat and develop a plan to restore the historic floodplain through reconnection of side channels and off channel habitat*					
SONCC-MapC.2.2.32.2	*Restore the historic floodplain, guided by the plan*					
SONCC-MapC.2.2.29	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	2c
SONCC-MapC.2.2.29.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MapC.2.2.29.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MapC.2.2.33	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-MapC.2.2.33.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MapC.2.2.33.2	*Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results*					
SONCC-MapC.1.3.7	Estuary	No	Increase tidal exchange of water	Remove dam	Gray Creek Mill Pond	3b
SONCC-MapC.1.3.7.1	*Develop a plan to remove Gray Creek dam that will restore tidal wetland habitat and improve hydrologic connectivity*					
SONCC-MapC.1.3.7.2	*Remove Gray Creek dam, guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MapC.14.3.9	Invasive, Non-native Species	No	Reduce competition	Reduce abundance of New Zealand mud snail	Big Lagoon, Lower Maple Creek	3b
SONCC-MapC.14.3.9.1	*Investigate New Zealand Mud Snail presence in Big Lagoon and Maple Creek. Assess the risk to coho salmonids and determine a strategy for control if necessary*					
SONCC-MapC.14.3.9.2	*Control New Zealand Mud Snails guided by assessment results*					
SONCC-MapC.14.2.8	Invasive, Non-native Species	No	Reduce predation and competition	Reduce abundance of warm-water, non-native fish species	Gray Creek Mill Pond	3b
SONCC-MapC.14.2.8.1	*Assess the different exotic species and the abundance of each species in the mill pond behind Gray Creek dam. Develop a plan to eradicate exotic species in conjunction with dam removal*					
SONCC-MapC.14.2.8.2	*Eradicate or suppress exotic species, guided by assessment results*					
SONCC-MapC.7.1.3	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Big Lagoon, estuary, lower Maple Creek	3c
SONCC-MapC.7.1.3.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-MapC.7.1.3.2	*Thin, or release conifers, guided by the plan*					
SONCC-MapC.7.1.3.3	*Plant conifers, guided by the plan*					
SONCC-MapC.26.1.28	Low Population Dynamics	No	Increase population abundance	Rescue and relocate stranded juveniles	Population wide	3c
SONCC-MapC.26.1.28.1	*Survey coho-bearing tributaries and relocate juveniles stranded in drying pools*					
SONCC-MapC.10.7.27	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	All streams where coho salmon would benefit immediately	3c
SONCC-MapC.10.7.27.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MapC.10.7.27.2	*Supply marine-derived nutrients to streams guided by the plan*					
SONCC-MapC.10.7.30	Water Quality	No	Restore nutrients	Add marine-derived nutrients to streams	Population wide	3d
SONCC-MapC.10.7.30.1	*Develop a plan to supply appropriate amounts of marine-derived nutrients to streams (e.g. carcass placement, pellet dispersal)*					
SONCC-MapC.10.7.30.2	*Supply marine-derived nutrients to streams guided by the plan*					

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MapC.16.1.11	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-MapC.16.1.11.1	*Determine actual fishing impacts*					
SONCC-MapC.16.1.11.2	*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-MapC.16.2.12	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-MapC.16.2.12.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-MapC.16.2.12.2	*Identify level of scientific collection impact that does not limit attainment of population-specific viability criteria*					
SONCC-MapC.16.2.13	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-MapC.16.2.13.1	*Determine actual impacts of scientific collection*					
SONCC-MapC.16.2.13.2	*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-MapC.8.1.5	Sediment	Yes	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	BR
SONCC-MapC.8.1.5.1	*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*					
SONCC-MapC.16.1.10	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	BR
SONCC-MapC.16.1.10.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-MapC.16.1.10.2	*Identify level of fishing impacts that does not limit attainment of population-specific viability criteria*					