27. Guthrie Creek Population

- Southern Coastal Stratum
- Dependent Population
- Recovery criteria: 20% of IP habitat must be occupied in years following spawning of brood years with high marine survival
- 20.74 mi^2
- 14 IP km (9 mi) (57% High)
- Dominant Land Uses are Timber Harvest and Agriculture
- Principal Stresses are 'Altered Sediment Supply' and 'Impaired Water Quality'
- Principal Threats are 'Timber Harvest' and 'Agriculture'

27.1 History of Habitat and Land Use

The Guthrie Creek population occupies four streams along a three-mile stretch of coast south of the Eel River (Figure 27-1). These include, from north to south, Fleener Creek, Guthrie Creek, Bear Creek, and Oil Creek. These watersheds have been impacted by both natural and anthropogenic changes over the past century, leading to degraded habitat conditions for coho salmon. The soils in this area of coastal California are highly erodible and naturally tend to produce mass wasting, bank destabilization, and high volumes of silt and cementation of gravel. Landslides and bank failures are particularly common in the lower part of Guthrie, Fleener, and Oil Creek due to both natural soil instability in this area and decades of grazing. Land use throughout these watersheds has been limited by the rugged terrain and most areas have been used solely for grazing and timber production over the past century. There is little to no development in these watersheds.

Historically, the lower reach of all three major coho streams (Guthrie, Fleener, and Oil Creeks) have been highly grazed and consequently suffer from bank instability, degraded riparian forest conditions, and sediment loading. Early timber harvest in these areas originally removed any riparian cover and since then there has been little recovery due to the effects of grazing which continue to suppress regeneration. However, through a series of recent acquisitions by the California State Coastal Conservancy, the lower portions of Guthrie and Fleener Creek are now managed by the BLM as part of the Lost Coast Headlands.

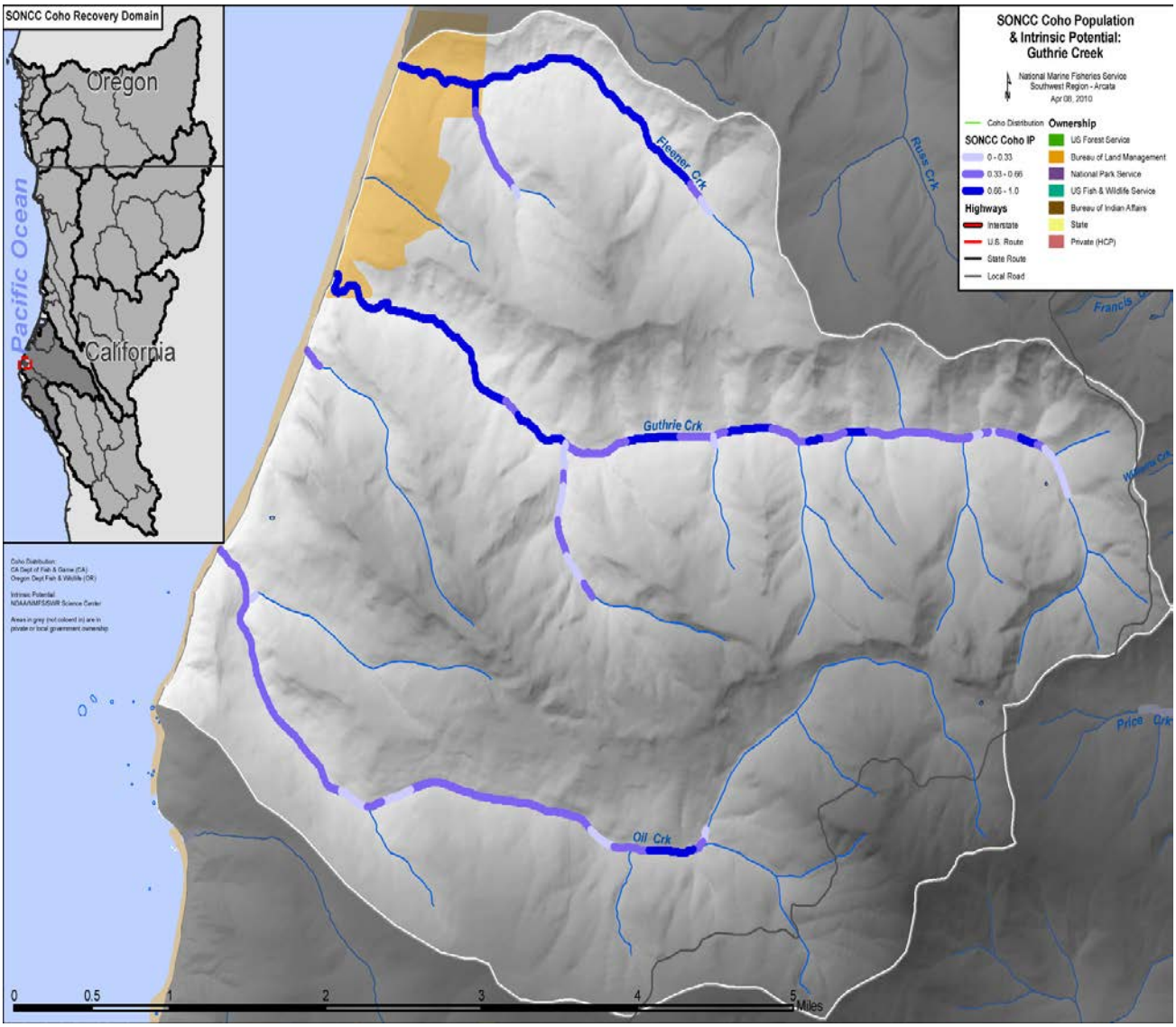

Figure 27-1. The geographic boundaries of the Guthrie Creek coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (CDFG 2009a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

Management practices by the BLM include light and low impact passive recreational uses and managed livestock grazing. There is no public land grazing in Guthrie Creek and the established grazing allotment includes new fencing along Fleener Creek (and elsewhere) and a rotation strategy using five pastures per year with water troughs located away from riparian areas (Fuller 2010). As part of their goal to provide coastal access and recreation opportunities, the BLM has constructed two coastal trails, the Fleener Creek and Guthrie Creek trails, to provide visitor access to the coast.

Timber harvest continues to impact the middle and upper reaches of streams in the Guthrie Creek population area which are privately-owned and managed for timber production. Impacts primarily manifest through the loss of riparian conifers, lack of large woody debris in streams,

and elevated rates of sediment loading and accretion. Currently, many areas are actively being harvested or remain in an early seral condition.

27.2 Historic Fish Distribution and Abundance

Based on the IP values for the streams included in the Guthrie Creek population area, Fleener, Guthrie, and Oil creek have potential for coho salmon spawning and rearing (Table 27-1). Guthrie Creek is the largest of these streams and comprises about 60 kilometers of stream channel. Habitat suitable for coho salmon quickly diminishes upstream of the lowest tributary, however isolated pockets of high IP habitat (>0.66) occur along the mainstem up to 4 miles upstream of the mouth (Figure 27-1). The tributaries of Guthrie Creek currently do not provide substantial spawning area because of degraded conditions within the smaller channels. Within most tributaries the wetted channel narrows to less than 4 inches and is characterized by a steep incline and silt deposits that make it unsuitable for anadromous fish habitat (CDFG 1982). The lowest tributary is currently the only tributary considered to offer habitat for salmonids based on low to moderate IP values (<0.66). Based on survey data from the CDFG North Coast California Coho Salmon Investigation Project (NCCCSI) between 1982 and 2003 there were no observations of coho salmon in Guthrie Creek. Surveys were completed over three years during the study, with collected data being supplemented by literature research and anecdotal information. One streamside observation of a coho salmon exists but the year of that observation was undocumented. Currently, coho salmon abundance in the Guthrie Creek watershed is unknown and the population is presumed to be extirpated or sustainably below historic levels because of habitat degradation and region-wide decline in coho salmon populations.

Based on IP habitat value, both Oil and Fleener Creeks also have potential to support coho salmon. Of the two watersheds, Fleener Creek has a larger proportion of IP habitat, with the majority of the mainstem having high IP (>0.66). The major tributary to Fleener Creek also has moderate to high IP (>0.33). Although little is known about fish use of Fleener Creek, the Bureau of Land Management in previous documents and in personal communications has stated that anadromous fish do not occupy this watershed (BLM 2004c). Residents along Fleener Creek support the claim that anadromous fish do not enter the creek and it is thought that the driftwood log jam may act as a barrier to migration (Fuller 2010). High sediment loads and accretion along with heavy grazing in the lower mainstem may prevent use of any high IP habitat in this watershed.

One young-of-the-year coho salmon was reported in Oil Creek in 1994 (CDFG 2004b) and the watershed has moderate IP habitat (0.33 to 0.66) throughout much of its mainstem. The stream has been significantly altered, however, and although few survey data exist, it likely is unable to support substantial numbers of coho salmon in its current state. Coho that do use Oil Creek must migrate upstream several miles to find suitable spawning and rearing habitat given that the lower part of the watershed has little if any riparian forest and has experienced high sedimentation. The last of the Guthrie Creek population area streams, Bear Creek, has a small amount (<0.5 miles) of moderate IP near its mouth, however the stream is unable to support coho salmon spawning due to its small size and degraded habitat conditions in the lower watershed. There are no records to indicate historic use of this stream by coho salmon.

Table 27-1. Tributaries with instances of high IP reaches (IP > 0.66) (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Fleener Creek	Guthrie Creek	Oil Creek

27.3 Status of Guthrie Creek Coho Salmon

Spatial Structure and Diversity

The creeks in the Guthrie Creek population area are relatively short and have limited habitat available for spawning and rearing. Furthermore, the narrow and shallow qualities of most tributaries make them unsuitable for coho salmon. Although Fleener, Guthrie, and Oil Creek likely once supported coho salmon based on their IP values, there is little evidence to indicate that any of these creeks are currently used for coho spawning or rearing. The only observations of coho salmon over the past 20 years have been in Guthrie and Oil Creek. Habitat degradation through erosion, aggradation, and loss of riparian cover likely has contributed to the decline of salmon in these streams. All of the high IP reaches in the population area have been heavily grazed over the past century and lack suitable spawning gravel and or complex rearing habitat. The upper and middle reaches of the creeks have fewer historical impacts, however, IP habitat values are lower in these regions reducing the suitability for coho. 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. Therefore the Guthrie Creek population is at an elevated risk of extinction.

The location of the Guthrie Creek population between two larger populations, the Eel and the Mattole, provides the potential for greater diversity within the population. The influx of genetic and life history traits from the Eel River population to the north and the Mattole River to the south is naturally common in this population due to the straying that likely occurs into these nearby coastal streams. Potential additions add diversity and genetic strength to the Guthrie Creek populations (Meffe 1986). Nonetheless, because the current extent of suitable spawning and rearing habitat is severely limited, the Guthrie Creek coho salmon population may not be able to support the opportunity for mixing, reducing overall diversity. The population is at an elevated risk of extinction based on its reduced capacity for resilience.

Population Size and Productivity

Guthrie Creek is known to have supported steelhead in numbers ranging from 15,000 to 25,000 in the 1930's (CDFG 1982) however the historic abundance of coho salmon in these streams is unknown. Along with steelhead populations, the current population is suspected to be either extirpated or on levels much lower than in past decades due to the apparent habitat degradation through these watersheds. In surveys conducted over the past 20 years in Guthrie Creek and Oil Creek, there have only been two records of coho salmon being found. Coho spawning in these watersheds is rare and likely the result of straying from either the Mattole or Eel River. 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.

As a dependent population, the population's abundance and productivity is highly influenced by nearby populations, which contribute spawners as strays. Both the Eel and Mattole River populations have been severely restricted and have low numbers of returning adults compared to historic runs, and are at high risk of extinction. The lack of productivity in these systems and the associated reduction in strays entering Guthrie, Fleener, and Oil Creek further increases this population's risk of extinction. The Guthrie Creek coho salmon population is considered to have an elevated risk of extinction given its low population size and negative population growth rate.

Extinction Risk

Not applicable because Guthrie Creek is not an independent population.

Role in SONCC Coho Salmon ESU Viability

The Guthrie Creek population is considered to be non-core "Dependent" population within the Southern Coast Diversity Stratum meaning that it has a low likelihood of persisting in isolation over a 100-year time scale, yet it receives sufficient immigration to alter its dynamics and extinction risk. The recovery target for the Guthrie Creek population is to recover the population to at least a moderate risk of extinction. 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.

There are several populations which may interact with the Guthrie Creek population. The Eel River, which is located less than 10 miles to the north of this population, historically had a robust coho salmon run and likely contributed numerous stray adult spawners to the Guthrie Creek population. Adult coho salmon from the Mattole River to the south also likely spawn in Guthrie Creek and its tributaries. Both these populations help sustain the dependent Guthrie Creek population over the long term. By providing connectivity between populations, the Guthrie Creek population helps sustain the resiliency and diversity of the SONCC ESU and of individual independent populations. Because nearby populations have seen dramatic declines in productivity, there is far less interaction between populations. The individuals that do spawn in Guthrie, Fleener, or Oil Creek are likely strays from larger populations but the recruitment rate is probably close to zero.

27.4 Plans and Assessments

Bureau of Land Management (Arcata office)

CDFG 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

Lost Coast Headlands Feasibility Study

In the process of first establishing the Lost Coast Headlands in 2001, the BLM conducted a feasibility study including potential acquisitions and management alternatives for the area. In

this study they consulted with local residents, mapped significant resources in the area, and evaluated opportunities for protecting coastal resources, preserving coastal agriculture, and providing public coastal access.

Lost Coast Headlands Biological Assessment

As part of the Lost Coast Headlands Feasibility Study, the consulting group Mad River Biologists completed a biological assessment of the area in 2000.

27.5 Stresses

Table 27-2. Severity of stresses affecting each life stage of coho salmon in Guthrie Creek. Stress rank categories and assessment methods are described in Appendix B, and the data used to assess stresses for the initial threats assessment (described in Appendix B) is presented in Appendix H.

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

[1] Key limiting factor(s) and limited life stage(s).
[2] Increased Disease/Predation/Competition is not considered a stress for this population.

Limiting Stresses, Life Stages, and Habitat

Little information exists regarding the habitat quantity and quality available in Guthrie Creek and its tributaries. The data that is available indicates that spawning and rearing habitat do exist in the watershed, but are likely limited in quality and abundance. No information exists regarding appropriate habitat for adult migration and holding, but given the small size of the stream channel, it is unlikely that there are many, if any, pools and deep areas for adult salmonids to use for holding. When spawning does occur, eggs are highly susceptible to suffocation and death due to increased sediment inputs throughout the watersheds comprising the population. Additionally, elevated turbidity levels and decreased water quality can impair the health and survivability of rearing juveniles by decreasing food resources, increasing stress levels, and

respiration rates. Excess sediment in the system is indicated as a known stress to existing habitat, and likely has played a role in filling in of the stream channel and the shallow pool depths seen throughout the watershed. All life stages are affected by this stress.

Within Guthrie, Fleener, and Oil Creek, the greatest potential refugia occurs in the middle and upper reaches where riparian cover is most extensive and the effects of sedimentation are least. Tributary streams within these reaches provide the greatest source of rearing and spawning habitat due to the lower turbidity (CDFG 1982). Guthrie Creek in particular has the greatest potential for coho salmon productivity because it is both larger than the other streams and appears to have higher quality habitat. Fleener Creek has a relatively large amount of High IP habitat for its size and should be investigated for restoration opportunities such as exclusionary fencing as done by the BLM.

Sediment Supply

Altered sediment supply has been determined as the highest stress affecting all life history phases of coho salmon, imposing a high stress on eggs, fry, and juveniles, and adults. High sediment loading, as a result of land use and geology, contributes to multiple problems including the simplification of stream habitat, increased turbidity, and increased embeddedness, which reduces emergence success. Areas along the stream near the coast are characterized by bare, unstable slopes and eroding stream banks. A CDFG stream survey of Guthrie Creek from 1982 documented, "steep and unstable" banks that were undercut and collapsing in many areas along the first 1,000 feet of the mainstem, upstream of the mouth (CDFG 1982). The mainstem was characterized by high silt content and cemented gravels for the entire length of the survey up to 3,000 feet from the mouth. The tributaries were noted to have considerably lower silt content. With subsequent reductions in grazing on lower Guthrie Creek since the time of this survey it is likely that conditions have improved somewhat as banks have stabilized and riparian areas have recovered. However, high sediment loading likely continues throughout the watershed as a result of timber harvest and grazing that occurs on private land upstream.

Impaired Water Quality

The primary impairment to water quality in Guthrie, Fleener, and Oil Creek is the high turbidity caused by sedimentation. Temperature was recorded between July and October of 2005 in Guthrie Creek and was very good (<15°C) to good (15 to 16°C) for most of that time. Only a few days did the temperature exceed 17° C. Despite cool temperatures, turbidity in these watersheds is likely very high due to the elevated erosion rates and high silt content of the soils. Although there is no direct data on turbidity, the aquatic insect EPT parameter has been measured in Fleener Creek and was rated as poor (≤12). This parameter is a measure of the number of pollution intolerant insect taxa present (Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies)). The limiting factor for these species is generally the high turbidity and fine sediment in the streambed. Turbidity primarily affects juvenile salmonids by interfering with gill function, feeding, and other normal behaviors. Impaired water quality is considered a medium to high stress to this population.

Floodplain and Channel Structure

Lack of floodplain and channel structure is a low to medium stress for coho salmon in the Guthrie Creek population. The history of logging and grazing along with bank instability in riparian areas has eliminated large legacy trees in the riparian zone along with the supply of LWD to streams. Wood is essential for the maintenance of pools through scouring and the general complexity of stream habitats. In addition, an excess of sediment has filled pools and caused the shallowing and widening of channels through aggradation. The overall simplified stream habitat no longer provides places of refuge for fish and lacks deep pools and side channels for use during high flow events or times of low water.

Riparian Forest Conditions

Riparian forests in all four watersheds in the population area have been negatively impacted by timber harvest and grazing in the area. Survey data from Guthrie Creek in 1982 (CDFG 1982) indicates that riparian cover is lacking from the mouth to about 1,000 feet upstream. Then, riparian vegetation increases to mostly alder and willow until approximately 6,000 feet from the mouth upstream of which a conifer forest canopy provides about 50 percent canopy cover for the rest of the upland channel. Although grazing has been eliminated from riparian areas in Guthrie and Fleener Creeks, lower reaches have yet to recover and riparian vegetation is still lacking. Timber harvest continues to limit riparian condition in middle and upper reaches. Overall degraded riparian condition is a medium stress to coho salmon in this population and limits the amount of cover, LWD, and rearing and spawning habitat in streams.

Impaired Estuary/Mainstem Function

The estuaries of Fleener, Guthrie, and Oil Creek are all small in size and contain little habitat for coho salmon rearing. Estuarine function has been impacted to some degree by elevated sediment aggradation which has led to decreased flows, a widened and shallowed channel, and the possible presence of fish passage barriers during low flow periods. The accumulation of driftwood, possibly due to changes in the geomorphology of the estuary in Fleener Creek, has potentially led to complete blockage of the watershed to anadromous fish (Fuller 2010). Guthrie Creek does not seem to accumulate driftwood at its mouth due to higher flows than Fleener Creek. One potential source of concern in the entire population area is the unstable headland geology, which can lead to mass wasting at the mouth of these streams. Overall, impaired estuarine function is not a significant issue for this population.

Adverse Fishery-Related Effects

NMFS has determined that federally-managed fisheries are not likely to jeopardize the continued existence of the SONCC coho salmon ESU (Appendix B). The effect of fisheries managed by the state of California on the continued existence of the SONCC coho salmon ESU has not been formally evaluated by NMFS (Appendix B).

Barriers

There may be stream crossing barriers associated with logging roads on private timber land, but the extent of this issue is unknown. There are no documented fish passage barriers on Federal or

County roads. Fish barriers pose an overall low stress to Guthrie Creek coho salmon. There are some known diversions that could act as fish passage barriers if not properly screened.

Hydrologic Function

The hydrologic function in Guthrie Creek is good. Generally, the channel's morphology is that of a deep crevice and U-shaped channel, which maintains flow and sufficient water depth to sustain fish. The overall stress associated with hydrologic function is considered low.

Adverse Hatchery-Related Effects

The effects of hatchery fish on all life stages of coho salmon are described in Chapter 3. There are no operating hatcheries in the Guthrie Creek population area. Hatchery-origin adults may stray into the population area; however, the proportion of adults that are of hatchery origin is unknown. Adverse hatchery-related effects pose a low risk to all life stages, because less than five percent of adults are presumed to be of hatchery origin and there are no hatcheries in the basin (Appendix B).

27.6 Threats

Table 27-3. Severity of threats affecting each life stage of coho salmon in Guthrie Creek. Threat rank categories and assessment methods are described in Appendix B, and the data used to assess threats for the initial threats assessment (described in Appendix B) is presented in Appendix H.

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

[1]Invasive Non-Native/Alien Species, and Mining/Gravel Extraction are not considered threats to this population.

Timber Harvest

The Guthrie Creek population area is made up of nearly 97 percent private land, much of which is used for timber production. Most land is likely on a 30 to 50 year rotation with 25 to 35 percent of a watershed being harvested based on CalFire's Forest Practices GIS data. Poor riparian conditions in Guthrie Creek and throughout the population area have been attributed to past and present timber harvest. The lack of mature riparian forest along streams and LWD in streams reflect the outcome of early harvest practices with no riparian buffers. Although some areas of the watershed have likely recovered some of their riparian structure and function, the cessation of logging in riparian areas was too recent for many areas to progress to the late seral stage. Also, because the area is already prone to erosion and high turbidity, additional sediment inputs associated with timber harvest can have major consequences for coho salmon in this population (see sediment stress section above). The overall threat associated with timber harvests is considered high for all life stages except smolts, which typically migrate to sea and beyond immediate impacts from timber harvesting.

Agricultural Practices

The coastal areas of these watersheds are frequently used for cattle grazing. Except in the lowest reaches of Guthrie and Fleener Creeks, which have managed grazing allotments with exclusionary fencing, cattle in most areas have direct access to the creek. Grazing and trampling by livestock typically causes bank destabilization, loss of riparian habitat, sedimentation, and consequent changes in benthic prey, turbidity, and loss of stream connectivity. Because this area is particularly prone to bank destabilization and erosion, grazing is especially harmful to stream habitat and coho salmon. These adverse effects are considered an overall medium threat to coho salmon. All life stages are affected.

Roads

These watersheds are predominantly private timberland and contain a network of private, unpaved logging roads. The overall density of roads in the Guthrie Creek population area is very high (>3 miles road per square mile of watershed). These roads are built on unstable soils and are prone to erosion and washouts. Of particular concern are road-stream crossings, which typically contribute the most to sediment loading. Sediment that originates from roads accretes in stream channels and leads to high levels of turbidity. The shallowing and widening of stream channels, cementation of gravels, and suspended sediment loads lead to decreased survival of eggs and decreased growth and survival of juveniles. Adults are impacted by the lack of suitable spawning habitat. The cumulative threat from roads is considered moderate.

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, NMS has not authorized future collection of coho salmon for research purposes in Guthrie Creek.

Channelization/Diking

Past and current channelization and diking on Guthrie Creek has not significantly affected the Guthrie Creek coho salmon populations. This practice currently poses a low threat to all life stages of coho salmon.

Dams/Diversions

Dams and diversions in the population area have not significantly affected the Guthrie Creek coho salmon population. There is only one documented diversion in the area, on Fleener Creek. Its impact is currently unknown but it could be affecting fish passage and flow in that creek. Based on current information, dams and diversions pose a low threat to all life stages of coho salmon in this watershed.

High Intensity Fire

Fire currently poses a low threat to all life stages of coho salmon in this watershed. During the summer months of the California fire season, cool foggy days are common in Humboldt County and therefore the overall fire hazard for the area is low. Managed livestock grazing in the area further reduces fire risk by eliminating fuel sources.

Climate Change

Climate change poses a low threat to this population due to its cooler climate, low risk of average temperature increase and precipitation change over the next 50 years (see Appendix B for modeling methods). Overall, the range and degree of variability in temperature and precipitation is likely to increase in all populations. In addition, all populations will be negatively impacted by ocean acidification and changes in ocean conditions and prey availability (see Independent Science Advisory Board 2007, Feely et al. 2008, Portner and Knust 2007).

Urban/Residential/Industrial Development

This watershed is presently not developed and is not likely to experience any urban, residential, or industrial development in the future. Although most land is privately owned, due to the rugged nature of the terrain, lack of infrastructure, and relative isolation, it will likely continue to be used for timber harvest in the future. Consequently, development poses a low threat to coho salmon in this population.

Road-Stream Crossing Barriers

There are no documented road-stream crossing barriers within the population area. The high density of roads, however, indicates the potential for barriers to exist on private timber land. Without proper upgrades to existing crossing barriers and prevention of future barriers this threat is likely to continue to increase in the future on private lands.

Hatcheries

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

27.7 Recovery Strategy

The Guthrie Creek coho salmon population is either extirpated or has very low population abundance and productivity. For the past 100 years, grazing and timber harvest have been the dominant land uses. As a result, little spawning and rearing habitat remains within these watersheds. The acquisition of the lower portions of Guthrie and Fleener Creeks by the BLM is helping to remove some of the grazing pressure on the landscape; however issues in the remaining 97 percent of the watershed need to be addressed in order to recover this population. Minimizing the impacts from grazing and timber harvest should be a priority in reducing sedimentation and turbidity. Fencing riparian corridors and supplying adequate stock watering facilities away from creeks will prevent trampling and grazing in these areas.

Careful management of timber harvest in conjunction with decommissioning, improving, and maintaining roads will reduce sediment pollution, erosion, and improve riparian conditions. The highly erodible character of the soils will probably hinder riparian rehabilitation and continue to add to sediment loads even with the absence of grazing and harvest near the stream channel.

Although ultimate recovery of this population will help provide connectivity and refugia for the important nearby populations of the Eel and Mattole rivers, there are many challenges that hinder recovery in this area. Guthrie Creek seems to have the most potential for habitat recovery of all four creeks containing IP habitat.

Table 27-4 on the following page lists the recovery actions for the Guthrie Creek population.

Table 27-4 Recovery action implementation schedule for the Guthrie Creek population.

Action ID / Step ID	Strategy	Key LF	Objective	Action Description / Step Description	Area	Priority
SONCC-GutC.8.1.3	Sediment	Yes	Reduce delivery of sediment to streams	Reduce stream bank erosion	Population wide	BR
SONCC-GutC.8.1.3.1				*Complete stream bank sediment source inventory and map unstable hillslopes. Develop a plan that prioritizes and locations for treatment*		
SONCC-GutC.8.1.3.2				*Treat priority sediment source sites, guided by the plan*		
SONCC-GutC.8.1.3.3				*Provide educational materials to land owners that describes alternative land management practices that will result in reduced erosion and impacts to riparian forests*		
SONCC-GutC.8.1.4	Sediment	Yes	Reduce delivery of sediment to streams	Minimize mass wasting	Population wide	BR
SONCC-GutC.8.1.4.1				*Assess roads and determine feasibility for relocation in priority sites*		
SONCC-GutC.8.1.4.2				*Relocate roads off of unstable land features*		
SONCC-GutC.27.2.5	Monitor	No	Track habitat condition	Track habitat indicators related to spawning, rearing, and migration	Population wide	3
SONCC-GutC.27.2.5.1				*Measure indicators for spawning and rearing habitat. Conduct a comprehensive survey*		
SONCC-GutC.27.2.5.2				*Measure indicators for spawning and rearing habitat once every 15 years, sub-sampling 10% of the original habitat surveyed*		
SONCC-GutC.27.1.6	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate juvenile spatial distribution	Population wide	3
SONCC-GutC.27.1.6.1				*Conduct presence/absence surveys for juveniles (3 years on; 3 years off)*		
SONCC-GutC.27.2.7	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Altered Sediment Supply'	All IP habitat	3
SONCC-GutC.27.2.7.1				*Measure the indicators, % sand, % fines, V Star, silt/sand surface, turbidity, embeddedness*		
SONCC-GutC.27.1.8	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Refine methods for setting population types and targets	Population wide	3
SONCC-GutC.27.1.8.1				*Develop supplemental or alternate means to set population types and targets*		

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID		***Step Description***				
SONCC-GutC.27.1.8.2		*If appropriate, modify population types and targets using revised methodology*				
SONCC-GutC.27.2.9	Monitor	No	Track habitat condition	Determine best indicators of estuarine condition	Estuary	3
SONCC-GutC.27.2.9.1		*Determine best indicators of estuarine condition*				
SONCC-GutC.7.1.1	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	Lower Guthrie Creek	BR
SONCC-GutC.7.1.1.1		*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*				
SONCC-GutC.7.1.1.2		*Develop grazing management plan to meet objective*				
SONCC-GutC.7.1.1.3		*Plant vegetation to stabilize stream bank*				
SONCC-GutC.7.1.1.4		*Fence livestock out of riparian zones*				
SONCC-GutC.7.1.1.5		*Remove instream livestock watering sources*				
SONCC-GutC.7.1.2	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase vegetation	Population wide	BR
SONCC-GutC.7.1.2.1		*Plant native riparian species in denuded areas*				