28. Bear River Population

- Southern Coastal Stratum
- Non Core-2, Potentially Independent Population
- High Extinction Risk
- Recovery criteria: 20% of IP habitat must be occupied in years following spawning of brood years with high marine survival
- 83.61 mi^2
- 48 IP km (30 mi) (27% High)
- Dominant Land Uses are Timber Harvest and Agriculture
- Principal Stresses are 'Lack of Floodplain and Channel Structure' and 'Degraded Riparian Forest Conditions'
- Principal Threats are 'Roads' and 'Timber Harvest'

28.1 History of Habitat and Land Use

Bear River is a fourth order, 30 km coastal stream draining approximately 151.5 km^2 (53,287 acres) to the Pacific Ocean (Ricker 2002b). The connection between the Bear River and the Pacific Ocean is periodically blocked by a temporary sand bar during summer low flow. The lagoon-type estuary is approximately one-quarter mile in length (Humboldt Redwood Company (HRC) 2008, Bliesner et al. 2006). The two major land uses in the basin consist of agricultural grazing and timber harvest. HRC (formerly Pacific Lumber) owns 16,537 acres of land in the upper portion of the watershed, all of which is covered by its 1999 Habitat Conservation Plan (HCP) (Wisniewski and Garinger 2006). The remaining acreage in the watershed is in private ownership (36,839 acres), and 161 acres is owned by State Parks.

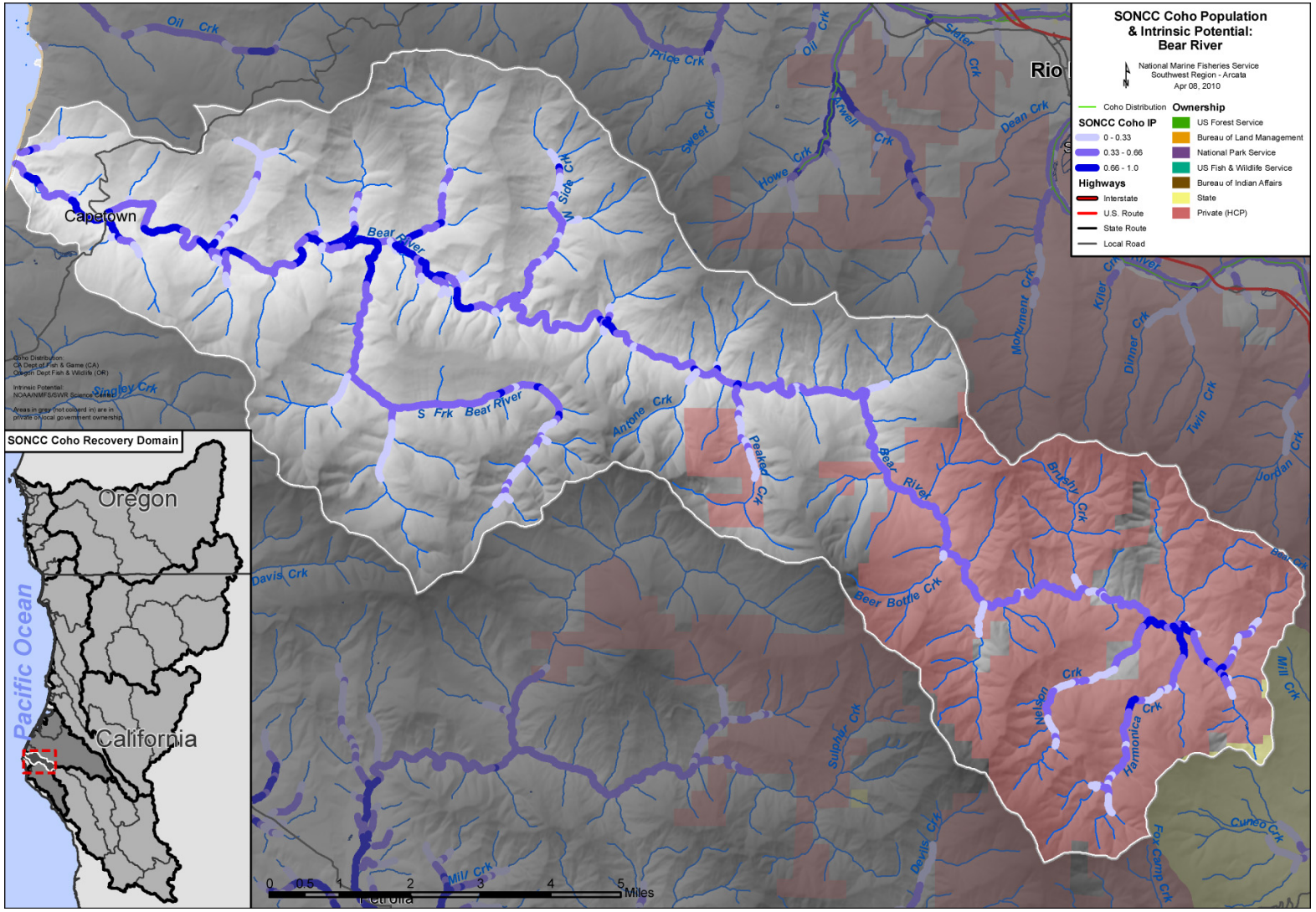

Figure 28-1. The geographic boundaries of the Bear River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (CDFG 2009a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Northern Coastal diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

The headwaters of the watershed have been managed for timber production since 1950. Early logging operations harvested trees from large tracts and burned residual slash. Most of the trees in the riparian areas were harvested. Logs were skidded downhill with tractors, often utilizing watercourses for skid trails. There was little replanting of harvested sites during the 1950's and 1960's, and site regeneration was left to natural seeding or sprouting. Consequently, much of the area harvested during this period is now comprised primarily of hardwood (e.g., tanoak) (Blair et al. 2006). The flood of 1964 altered the morphology of the lower river, transporting large amounts of sediment, removing the majority of the remaining riparian vegetation and decreasing the size and depth of the estuary (Ricker 2002b).

Land use in the lower watershed (Figure 28-2) is predominately rangeland and grazed primarily by cattle and sheep (Ricker 2002b). No dams exist in the Bear River drainage, however small water diversions exist throughout the basin for domestic use, livestock watering, irrigation, and dust abatement (road watering). None of these diversions exceed 1 cubic foot per second (Bliesner et al. 2006).

Since 1998, CDFG (through the Fisheries Restoration Grants Program-SB 271) funded ten projects in the Bear River watershed, including landowner education, roads assessment , temperature monitoring, riparian enhancement and riparian planting, log structure placement, livestock exclusionary fencing, gully and streambank stabilization.

28.2 Historic Fish Distribution and Abundance

There is no historic documentation of coho salmon presence in Bear River (Bliesner et al. 2006); and no individuals were collected in juvenile outmigrant traps in 2000 to 2001 in Bear River (Ricker 2002b). Furthermore, CDFG's North Coast California Coho Salmon Investigation (NCCSI) sampled the mainstem and south fork Bear River between 2001 and 2003 with no coho salmon detected. CDFG habitat surveys indicated suitable habitat for coho salmon in lower Bear River and portions of South Fork Bear River (CDFG 2004b), including a high degree of sinuosity, low gradient, and deep pools in the lower river (Bliesner et al. 2006). The majority of the high IP reaches in the Bear River are in the lower river, in several reaches in South Fork Bear River, and in Upper Bear River near the mouths of Harmonica and Nelson Creeks (Figure 28-1, Figure 28-2 and Table 28-1). Bear River supports populations of CC Chinook and NC steelhead, and therefore likely historically supported SONCC coho salmon.

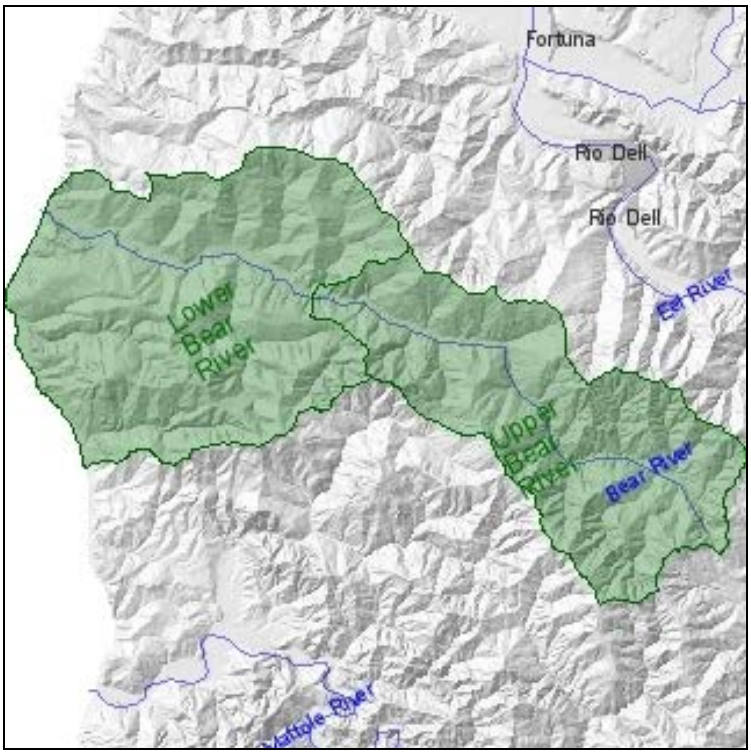

Figure 28-2. Location of lower and upper Bear River. Capetown HSA, Cape Mendocino HU.

Table 28-1. Tributaries with instances of high IP reaches (IP > 0.66). (Williams et al. 2006).

Stream Name	Stream Name
Bear River	Harmonica Creek
South Fork Bear River	Nelson Creek

28.3 Status of Bear River Coho Salmon

Spatial Structure and Diversity

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 40 coho salmon per-IP km of habitat are needed (1,900 spawners total) to approximate the historical distribution of Bear River coho salmon and habitat. Although CC Chinook salmon and NC steelhead are present, SONCC coho salmon have not been documented in Bear River. There are no documented barriers within the Bear River watershed that currently restrict the spatial structure of the population. Because no coho salmon have been documented the population may be functionally extinct and therefore lacks diversity. Bear River coho salmon population is at an elevated risk of extinction based on its extremely low numbers and reduced capacity for resilience.

Population Size and Productivity

No adult or juvenile coho salmon have been documented in Bear River.

Extinction Risk

The Bear River coho salmon population is not viable and at high risk of extinction, because the estimated average spawner abundance over the past three years has been less than the depensation threshold (Table ES-1 in Williams et al. 2008).

Role in SONCC Coho Salmon ESU Viability

The Bear River population is considered to be a non-core 2 "Potentially Independent" population within the Southern Coastal diversity stratum meaning that it has a high likelihood of persisting in isolation over a 100-year time scale, but is too strongly influenced by immigration from other populations to exhibit independent dynamics. The demographic target for recovery is juvenile occupancy. Because the Bear River population may be functionally extinct, nearby populations such as the Mattole and Eel River populations are needed to provide a source of straying individuals that could recolonize the Bear River population area.

28.4 Plans and Assessments

Humboldt Redwood Company

Pacific Lumber Habitat Conservation Plan

The Pacific Lumber Company (PALCO) Habitat Conservation Plan (HCP) was finalized in 1999 and the associated Incidental Take Permit is effective through 2049. The HCP was inherited by the Humboldt Redwood Company upon acquisition of the PALCO lands in 2008. NMFS issued a Section 10(a)(1)(B) permit authorizing incidental take of SONCC coho salmon by PALCO and determined that this taking would not appreciably reduce the likelihood of survival and recovery of the species in the wild (PALCO 1999b). Although the goal of the HCP is to maintain or achieve, over time, a properly functioning aquatic habitat condition, it acknowledges that not all essential habitat elements (e.g., large wood recruitment) will be attainable within the 50-year life of the plan (PALCO 1999a). Site-specific prescriptions, which are designed to promote a properly functioning aquatic habitat condition, are contained in the Bear River watershed analysis (HRC 2008).

In August, 2004, Section 6.33 (Control of sediment from roads and other sources) was revised to extend the time frame for completion of road assessment and associated sediment sources from 2005 to 2010. The Bear River Watershed Analysis was completed in October 2006, and the Hillslope Management and Riparian Management Prescriptions were completed in April, 2007 (PALCO 2007). The hillslope management/mass wasting avoidance strategy uses a three-step approach for the identification and avoidance or mitigation of high hazard unstable areas during the planning and implementation of forestry activities. These steps are: slope stability training; site-specific and project-specific "screening" for unstable areas; and enforceable site-specific prescriptions for road construction, re-construction, or timber harvest on unstable areas designated as "High Hazard." Also required is review and approval of a professional licensed geologist.

In general, no harvest will occur within the Channel Migration Zone, defined as the flood-prone area in stream reaches with less than 4 percent gradient, which is generally the 100-year

floodplain (PALCO 2007). In addition, all streams will have a Riparian Management Zone (RMZ). The RMZ of Class I (fish-bearing) streams is 150 feet wide, with no timber harvest permitted within the first 50 feet.

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.

28.5 Stresses

Table 28-2. Severity of stresses affecting each life stage of coho salmon in Bear River. 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	Lack of Floodplain and Channel Structure[1]	Medium	Very High	Very High[1]	Very High	Very High	Very High
2	Degraded Riparian Forest Conditions[1]	-	Very High	Very High[1]	Very High	High	Very High
3	Impaired Water Quality	Low	Very High	Very High	Very High	Low	High
4	Altered Sediment Supply	High	High	Very High	Medium	Very High	High
5	Impaired Estuary/Mainstem Function	-	Medium	High	Very High	Medium	High
6	Adverse Fishery-Related Effects	-	-	-	-	Medium	Medium
7	Altered Hydrologic Function	Low	Medium	Medium	Low	-	Low
8	Barriers	-	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

Lack of floodplain and channel structure, degraded riparian forest conditions, impaired water quality, and altered sediment supply are all stressors that affect juvenile rearing success of Bear River coho salmon. Lack of LWD due to past logging practices and increased sediment supply reduce complexity by filling in pools and reducing habitat structure, limiting juvenile rearing and holding habitat. If coho salmon were present in the Bear River, substrate embeddedness would

limit their spawning success and the lack of instream cover and pool refugia would limit rearing success.

Floodplain and Channel Structure

Floodplain and channel structure is ranked as a very high stress to nearly all life stages of coho salmon. In the high IP reaches, the pool depths in the Bear River mainstem average 3.3 ft or greater. However, in the South Fork Bear River and Nelson and Harmonica Creeks, pool depths are 2.0 ft or less, which is considered a poor condition for salmonid habitat function. Pool frequency throughout the watershed is poor, less than 35 percent by length, due to the lack of instream wood structures throughout the mainstem and certain tributaries. Delivery of large wood to the majority of Class I streams is problematic and will continue to be so for a period of least 10 to 25 years. After 25 years, an estimated 75 percent of the HCP-covered riparian forest will be of sufficient size to benefit aquatic habitat conditions. (Blair et al. 2006).

Riparian Forest Conditions

Riparian forest conditions are ranked as a high or very high stress to nearly all life stages of coho salmon, with an overall ranking of very high. The high IP habitat of lower Bear River, South Fork Bear River, as well as the upper watershed and its tributaries, generally lack canopy cover and are dominated by hardwoods, which provide poor shading and decompose faster than conifers. On HRC lands, current riparian conditions are primarily the result of intensive mid-twentieth century logging and two significant flood events of the same time period. Species composition is primarily a mixture of Douglas-fir, tanoak, red alder, willow, California bay-laurel, and big-leaf maple. Structurally, while large trees in excess of 24" diameter at breast height (dbh) occur throughout the Bear River, most stands consist of trees ranging from 12 to 24" dbh, with multiple canopy layers just beginning to develop (Blair et al. 2006).

Impaired Water Quality

Water quality is ranked as a high or very high stress to nearly all life stages of coho salmon. Seasonally warm air temperatures, at times exceeding 32° Celsius (C), emphasize the importance of maintaining over-stream shade canopy and cool riparian microclimate conditions to reduce solar heating of the water. Much of the Bear River, and the lower reaches of Harmonica Creek and Gorge Creek, have little over-stream shade canopy (Blair et al. 2006), and summertime water temperatures exceed 17°C.

Sediment Supply

Sediment supply is ranked as a high or very high stress to nearly all life stages of coho salmon. The high IP habitat of lower Bear River, South Fork Bear River, as well as the upper watershed and its tributaries, have a high degree of embeddedness that reduces survival of eggs and fry, and the production of invertebrate prey, thereby diminishing rearing for 0+ and 1+ individuals (if present). The embeddedness of substrate in riffle habitat, as well as shallow pool depths described in the *Floodplain and Channel Structure* section, is caused in part by excess fine sediment, which also increases instream turbidity. Effects to coho salmon from elevated turbidity include an impaired ability to find food, gill abrasion, food assemblage changes, smothering of eggs and filling of pools with fine sediment.

Impaired Estuary/Mainstem Function

This stress focuses on the estuary conditions in the Bear River, since this is a single population basin (see Chapter 2 for further description of this stressor). Mainstem conditions are addressed through other stressors such as floodplain and channel structure, riparian condition, hydrologic function, etc. Estuary function is important to the population because of its unique role in the life history and survival of coho salmon. The Bear River estuary is considered by Wisniewski and Garinger (2006) to be suffering from changes in sediment, water, and wood. The lack of LWD, reduced pool frequency, and lack of riparian vegetation have decreased the availability of refugia. Accretion of sediment is widespread in the estuary and reduces pool and channel complexity. Juveniles and smolts are the most affected by the loss of estuarine function due to the lost opportunity for estuarine rearing and refuge. The loss of estuarine function is a medium threat for these life stages.

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).

Hydrologic Function

Hydrologic function ranks as a low or medium threat to all life stages of coho salmon. Timber harvest practices and road construction have altered the vegetation, which ultimately changed the timing and volume of runoff. Increased water velocity and increased suspended sediment diminish habitat suitability during times of high flow. Water drafting is a component of the activities covered under the PALCO HCP and is also covered by state 1600 permits. However, no estimate of annual volume or location of water withdrawal is available.

Barriers

No fish passage barriers have been identified (CalFish 2009).

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 Bear River population area. Hatchery-origin coho salmon may stray into the population area, but the proportion of spawning 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 (Appendix B) and there are no hatcheries in the basin (Appendix B)

28.6 Threats

Table 28-3. Severity of threats affecting each life stage of coho salmon in Bear River. 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	Roads	High	Very High	Very High	Very High	Very High	Very High
2	Timber Harvest	Medium	Very High	Very High	Very High	Very High	Very High
3	Agricultural Practices	Medium	High	Very High	High	High	High
4	High Intensity Fire	Low	Medium	Medium	Medium	Medium	Medium
5	Climate Change	Low	Low	Medium	Medium	Medium	Medium
6	Fishing and Collecting	-	-	-	-	Medium	Medium
7	Channelization/Diking	Low	Low	Low	Low	Low	Low
8	Dams/Diversion	Low	Low	Low	Low	Low	Low
9	Road-Stream Crossing Barriers	-	Low	Low	Low	Low	Low
10	Mining / Gravel Extraction	-	Low	Low	Low	Low	Low
11	Hatcheries	Low	Low	Low	Low	Low	Low

[1]Urban/Residential/Industrial Development, and Invasive and Non-Native Species are not considered threats to this population.

Roads

Road density, which serves as part of the water and sediment transport system, is high (greater than 3 miles of road per square mile of watershed) throughout the majority of the watershed and ranked as a very high threat to the majority of coho life stages. Roads accelerate delivery of sediment to the riparian and aquatic habitat, and alter the stream hydrograph. The majority of the roads are associated with land managed for industrial timber and managed under the HRC HCP, and HRC required to stormproof roads on their land.

Timber Harvest

Timber harvest is ranked as a very high threat to the majority of coho life stages. Legacy effects of past harvest practices, such as accelerated sediment transport, lack of wood recruitment, and lack of riparian canopy, reduce the habitat quality in Bear River and its tributaries. Effects of industrial timber harvest may be reduced under the HCP prescriptions, but it may take many decades before the riparian and stream habitat can recover. The remaining areas within the

watershed are privately owned, and data does not exist regarding timber harvest occurring in these areas.

Agricultural Practices

Grazing in the lower watershed provides an overall high threat ranking for coho salmon, contributing to degraded riparian and aquatic habitat. Increased bank erosion and suspension of sediments increases turbidity and reduces light penetration, thereby interfering with visual feeding of juveniles (0+ and1+) and smolts. Production of prey is also limited by increased turbidity levels and elevated nutrient loading.

High Intensity Fire

Based on information in the Humboldt County General Plan (2008), a fire in the Bear River watershed would likely be severe due to climate, vegetation characteristics, and remote location. Fire is identified as a medium threat because of its potential significance if a fire were to occur.

Climate Change

Climate change poses a medium threat, primarily to juveniles, smolts, and adults. Although the current climate is generally cool, modeled regional average temperature shows a moderate increase over the next 50 years (see Appendix B for modeling methods). Average temperature could increase by up to 1^{o} C in the summer and by the same amount in the winter. Annual precipitation in this area is predicted to trend downward over the next century. Overall, the range and degree of variability in temperature and precipitation is likely to increase in all populations. The vulnerability of the estuary and coast to sea level rise is low in this population. Rearing and migratory habitat is most at risk to climate change. Increasing temperatures and changes in the amount and timing of precipitation will impact water quality and hydrologic function in the summer. As with all populations in the ESU, adults 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).

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. NMFS has authorized future collection of coho salmon for research purposes in the Bear River. NMFS has determined these collections are not likely to jeopardize the continued existence of the SONCC coho salmon ESU.

Channelization/Diking

There is little evidence of channelization or diking in the watershed.

Dams/Diversions

There are no appropriative water rights in the Bear River watershed according to the NCRWQCB, however, the extent of riparian water rights is unknown. There are no dams in the watershed.

Road-stream Crossing Barriers

No road-crossing barriers have been identified in the Bear River watershed, resulting in a low threat ranking.

Mining / Gravel Extraction

Historically, small-scale gravel mining has occurred in the Bear River, and the Humboldt County Public Works is currently permitted to extract 3,000 yards^3 per year and 10,000 yards^3 per three to five year period from their Branstetter Bar sites (RM 1.5). Due to the low level of extraction, mining/gravel extraction is believed to be a low threat to coho salmon.

Hatcheries

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

28.7 Recovery Strategy

The numbers of coho salmon in the Bear River are severely depressed, as evidenced by their apparent absence. The Bear River population is likely highly dependent on straying from the Mattole and Eel rivers for recolonization, and the majority of the high IP habitat occurs in the lower watershed, primarily west of Peaked Creek. Recovery activities in the watershed should promote increased abundance by improving the habitat function for spawning and rearing in the high IP habitat. Actions that improve spawning and rearing habitat include those that reduce sediment delivery, improve stream temperatures, improve long term prospects for large wood recruitment, and promote increased floodplain and channel structure. These actions should be a priority in the watershed, especially in the high IP reaches. Reducing sediment upstream of the high IP reaches is a priority since the sediment will be transported into the high IP reaches. Activities that accomplish these goals will have beneficial effects on the estuary as well, although the time for these effects to be observed will likely be several decades and possibly much longer.

Table 28-4 on the following page lists the recovery actions for the Bear River population.

Table 28-4. Recovery action implementation schedule for the Bear River population.

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-BeaR.2.1.1	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	High IP sub watersheds	3
SONCC-BeaR.2.1.1.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-BeaR.2.1.1.2	*Place instream structures, guided by assessment results*					
SONCC-BeaR.7.1.5	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve grazing practices	High IP sub watersheds	3
SONCC-BeaR.7.1.5.1	*Assess grazing impact on sediment delivery and riparian condition, identifying opportunities for improvement*					
SONCC-BeaR.7.1.5.2	*Develop grazing management plan to meet objective*					
SONCC-BeaR.7.1.5.3	*Plant vegetation to stabilize stream bank*					
SONCC-BeaR.7.1.5.4	*Fence livestock out of riparian zones*					
SONCC-BeaR.7.1.5.5	*Remove instream livestock watering sources*					
SONCC-BeaR.7.1.6	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Population wide	BR
SONCC-BeaR.7.1.6.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-BeaR.7.1.6.2	*Develop watershed-specific guidance for managing riparian vegetation*					
SONCC-BeaR.7.1.7	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide	3
SONCC-BeaR.7.1.7.1	*Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements specified in 14 CCR 898.2(d) prior to approval by the Director (similar to a Spotted Owl Resource Plan).*					
SONCC-BeaR.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	3

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	***Step Description***					
SONCC-BeaR.16.1.10.1	*Determine impacts of fisheries management on SONCC coho salmon in terms of VSP parameters*					
SONCC-BeaR.16.1.10.2	*Identify fishing impacts expected to be consistent with recovery*					
SONCC-BeaR.16.1.11	Fishing/Collecting	No	Manage fisheries consistent with recovery of SONCC coho salmon	Limit fishing impacts to levels consistent with recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	2
SONCC-BeaR.16.1.11.1	*Determine actual fishing impacts*					
SONCC-BeaR.16.1.11.2	*If actual fishing impacts exceed levels consistent with recovery, modify management so that levels are consistent with recovery*					
SONCC-BeaR.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	3
SONCC-BeaR.16.2.12.1	*Determine impacts of scientific collection on SONCC coho salmon in terms of VSP parameters*					
SONCC-BeaR.16.2.12.2	*Identify scientific collection impacts expected to be consistent with recovery*					
SONCC-BeaR.16.2.13	Fishing/Collecting	No	Manage scientific collection consistent with recovery of SONCC coho salmon	Limit impacts of scientific collection to levels consistent with recovery	SONCC recovery domain plus ocean; from shore to 200 miles off coasts of California and Oregon	3
SONCC-BeaR.16.2.13.1	*Determine actual impacts of scientific collection*					
SONCC-BeaR.16.2.13.2	*If actual scientific collection impacts exceed levels consistent with recovery, modify collection so that impacts are consistent with recovery*					
SONCC-BeaR.3.1.8	Hydrology	No	Improve flow timing or volume	Increase instream flows	Population wide	BR
SONCC-BeaR.3.1.8.1	*Identify alternative water sources, storage means, or seasonal withdrawal restrictions to increase streamflow during low flow periods*					
SONCC-BeaR.3.1.8.2	*Reduce diversions*					
SONCC-BeaR.3.1.9	Hydrology	No	Improve flow timing or volume	Educate stakeholders	Population wide	BR
SONCC-BeaR.3.1.9.1	*Provide education and training on conserving water while diverting*					
SONCC-BeaR.3.1.9.2	*Provide incentives to landowners to reduce water consumption during low flow periods*					
SONCC-BeaR.27.1.15	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate juvenile spatial distribution	Population wide	3

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID		***Step Description***				
SONCC-BeaR.27.1.15.1		*Conduct presence/absence surveys for juveniles (3 years on; 3 years off)*				
SONCC-BeaR.27.1.16	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Track indicators related to the stress 'Fishing and Collecting'	Population wide	2
SONCC-BeaR.27.1.16.1		*Annually estimate the commercial and recreational fisheries bycatch and mortality rate for wild SONCC coho salmon.*				
SONCC-BeaR.27.2.17	Monitor	No	Track habitat condition	Track habitat indicators related to spawning, rearing, and migration	Population wide	3
SONCC-BeaR.27.2.17.1		*Measure indicators for spawning and rearing habitat. Conduct a comprehensive survey*				
SONCC-BeaR.27.2.17.2		*Measure indicators for spawning and rearing habitat once every 10 years, sub-sampling 10% of the original habitat surveyed*				
SONCC-BeaR.27.2.18	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Lack of Floodplain and Channel Structure'	All IP habitat	3
SONCC-BeaR.27.2.18.1		*Measure the indicators, pool depth, pool frequency, D50, and LWD*				
SONCC-BeaR.27.2.19	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Degraded Riparian Forest Condition'	All IP habitat	3
SONCC-BeaR.27.2.19.1		*Measure the indicators, canopy cover, canopy type, and riparian condition*				
SONCC-BeaR.27.2.21	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Impaired Water Quality'	All IP habitat	3
SONCC-BeaR.27.2.21.1		*Measure the indicators, pH, D.O., temperature, and aquatic insects*				
SONCC-BeaR.27.2.22	Monitor	No	Track habitat condition	Monitor stream temperature	Population wide	BR
SONCC-BeaR.27.2.22.1		*Continue stream temperature monitoring at established locations*				
SONCC-BeaR.27.1.23	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Refine methods for setting population types and targets	Population wide	3
SONCC-BeaR.27.1.23.1		*Develop supplemental or alternate means to set population types and targets*				
SONCC-BeaR.27.1.23.2		*If appropriate, modify population types and targets using revised methodology*				

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID		*Step Description*				
SONCC-BeaR.27.2.24	Monitor	No	Track habitat condition	Determine best indicators of estuarine condition	Estuary	3
SONCC-BeaR.27.2.24.1		*Determine best indicators of estuarine condition*				
SONCC-BeaR.8.1.2	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	3
SONCC-BeaR.8.1.2.1		*Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective*				
SONCC-BeaR.8.1.2.2		*Decommission roads, guided by assessment*				
SONCC-BeaR.8.1.2.3		*Upgrade roads, guided by assessment*				
SONCC-BeaR.8.1.2.4		*Maintain roads, guided by assessment*				
SONCC-BeaR.8.1.3	Sediment	No	Reduce delivery of sediment to streams	Improve regulatory mechanisms	Population wide	3
SONCC-BeaR.8.1.3.1		*Develop grading ordinance for maintenance and building of private roads that minimizes the effects to coho*				
SONCC-BeaR.8.1.4	Sediment	No	Reduce delivery of sediment to streams	Reduce stream bank erosion	Population wide	BR
SONCC-BeaR.8.1.4.1		*Inventory sediment sources, and prioritize for treatment*				
SONCC-BeaR.8.1.4.2		*Treat priority sediment source sites, guided by the plan*				