9. Mussel Creek Population

- Northern Coastal Stratum
- Dependent Population
- Recovery criteria: 20% of IP habitat must be occupied in years following spawning of brood years with high marine survival
- 14 mi^2
- 6 IP km (4 mi) (50% High)
- Dominant Land Uses are Timber Harvest and Recreation
- Principal Stresses are 'Lack of Floodplain and Channel Structure' and 'Degraded Riparian Forest Conditions'
- Principal Threats are 'Timber Harvest' and 'Channelization/Diking'

9.1 History of Habitat and Land Use

Mussel Creek empties into the Pacific Ocean just south of Port Orford between Brush and Euchre Creeks. Historically, a trail likely passed through the lower basin, and became a road for automobiles in the 1920s prior to eventually becoming Highway 101 (Maguire 2001b). The roadway has caused the South Fork of Mussel Creek to be realigned, which resulted in a loss of habitat suitability for coho salmon. Tourist attractions such as the Prehistoric Gardens and the Arizona Beach campground are both located within the floodplain of lower Mussel Creek and Myrtle Creek.

Data for timber harvest on private lands are not available for the Mussel Creek basin, but aerial photos indicate timber has been harvested from most of the basin except for a small patch below Highway 101, adjacent to Prehistoric Gardens. Active timber harvest continues and road densities are high in this basin. In addition, Mussel Creek has very steep slopes, which likely facilitated sediment transport to the creeks during and after land disturbing activities. Myrtle Creek serves as an example of these channel changes; it loses surface flow in late summer and early fall possibly due to excessive fine sediment loads from steep, managed land near the headwaters. Additionally, the stream channel has been straightened and channelized to maximize space for camping and recreation. These impacts have made approximately 50 percent of the area with high intrinsic potential for coho salmon habitat currently uninhabitable and difficult to restore.

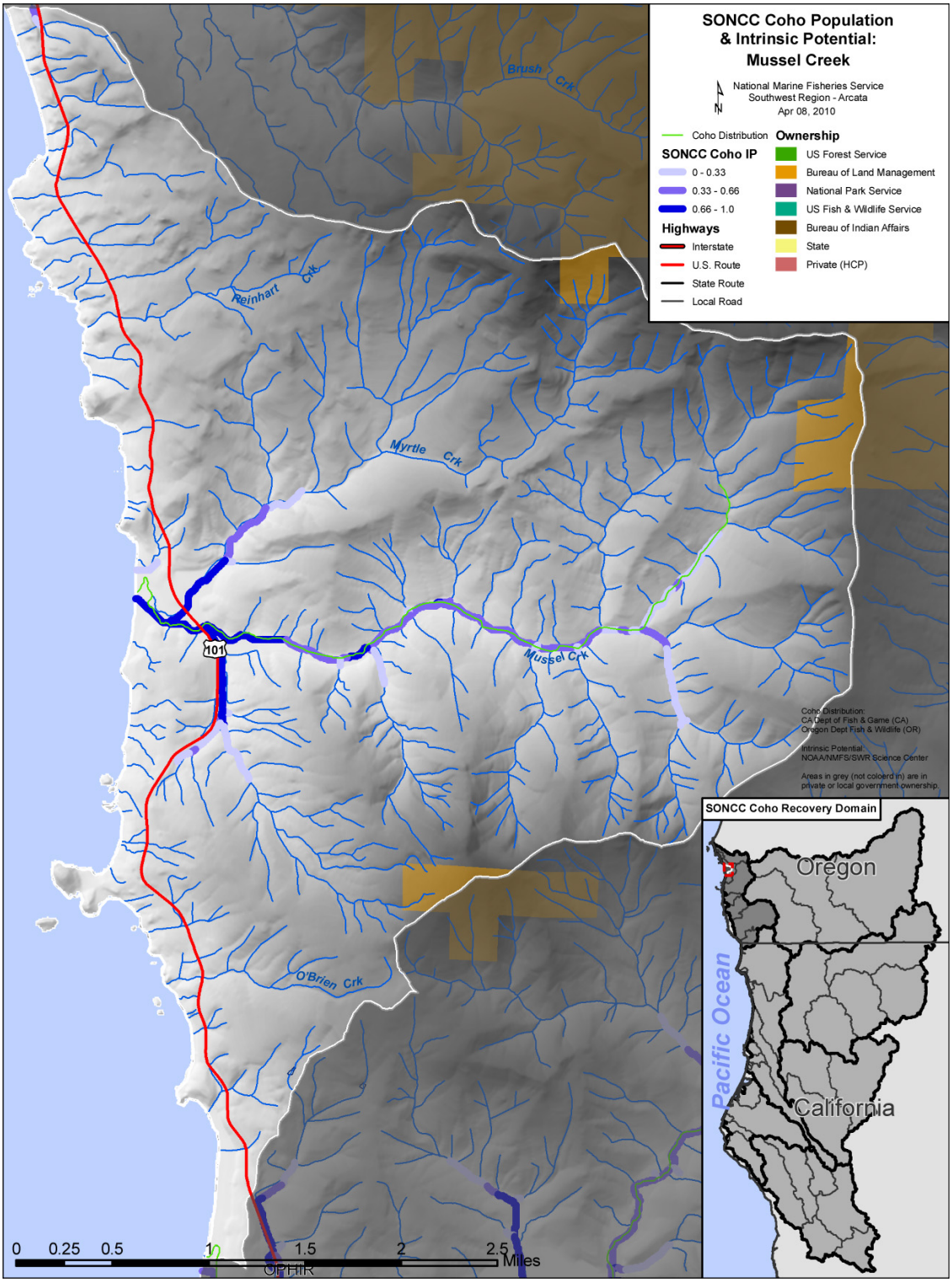

Figure 9-1. The geographic boundaries of the Mussel Creek coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams et al. 2006), land ownership, coho salmon distribution (ODFW 2010a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Rogue diversity stratum (Williams et al. 2006). Grey areas indicate private ownership.

9.2 Historic Fish Distribution and Abundance

No information is available about the historic distribution and abundance of coho salmon in Mussel Creek.

Table 9-1. Tributaries with instances of high IP reaches (IP > 0.66) (Williams et al. 2006).

Stream Name	Stream Name	Stream Name
Lower Mussel Creek	Myrtle Creek	South Fork Mussel Creek

9.3 Status of Mussel Creek Coho Salmon

Spatial Structure and Diversity

Much of the high IP coho salmon habitat in Mussel Creek is no longer suitable because the South Fork is channelized and re-routed by Highway 101. The major tributary, Myrtle Creek, is also channelized and loses surface flows during the summer and fall. Approximately 50 percent of high IP coho salmon habitat has been lost due to channelization and straightening. Additionally, mainstem Mussel Creek lacks sufficient depth and other channel features necessary to be fully functional for coho salmon rearing. Available data show coho salmon are restricted to the mainstem Mussel Creek when present, and no coho salmon were observed during recent juvenile surveys in 2002 and 2003 (Oregon Department of Fish and Wildlife (ODFW 2005a). The small population size in Mussel Creek suggests restricted genetic diversity.

Population Size and Productivity

The Mussel Creek population is presumed to be nearly extirpated based on recent juvenile surveys, impaired habitat conditions, and the lack of any other information to indicate that coho salmon currently spawn or rear in the basin. The productivity and size of this population is driven by the dynamics of the Mussel Creek population as well as those of nearby populations, which contribute spawners as strays. However, the supply of strays to Mussel Creek is not expected to be substantial or consistent in the near term because most adjacent populations in the SONCC coho salmon ESU are at low levels.

Extinction Risk

Not applicable because Mussel Creek is not an independent population.

Role in SONCC Coho Salmon ESU Viability

The Mussel Creek population is considered dependent because it does not have a high likelihood of sustaining itself over a 100-year time period in isolation and would likely receive sufficient immigration to alter its dynamics and extinction risk (Williams et al. 2006). Although such populations are not viable on their own, they do increase connectivity by allowing dispersal among independent populations and provide areas of refugia for other populations, acting as a source of colonists in some cases. Historically the Mussel Creek population would have interacted with other Northern Coastal dependent populations of coho salmon such as those in

Brush and Euchre Creeks, as well as larger independent populations such as those in the Elk and Rogue Rivers. Any restored habitat in Mussel Creek provides potential connectivity that assists metapopulation function in the ESU.

9.4 Plans and Assessments

State of Oregon

Oregon Plan for Salmon and Watersheds
http://www.oregon.gov/OPSW/about_us.shtml

The State of Oregon developed a conservation and recovery strategy for coho salmon in the SONCC and Oregon Coast ESUs (State of Oregon 1997). The Oregon Plan for coho salmon is a comprehensive plan that includes voluntary actions to address all of the threats currently facing coho salmon in these ESUs and involves all relevant state agencies. Reforms to fishery harvest and hatchery programs described in the Oregon Plan were implemented by ODFW in the late 1990s. Many habitat restoration projects have occurred across the landscape in headwater habitat, lowlands, and the estuary.

Report of the Oregon Expert Panel on Limiting Factors

ODFW (2008b) convened a panel of fisheries and watershed science experts as an initial step in their development of a recovery plan for Oregon's SONCC coho salmon populations. Deliberations of the expert panel provided ODFW with initial, strategic guidance on limiting factors and threats to recovery. Based on the input of panel members, ODFW (2008b) summarized the concerns for the Mussel Creek population as follows:

> Key concerns in Mussel Creek were primarily loss of over-winter tributary habitat complexity and floodplain connectivity for juveniles, especially in the lowlands which are naturally very limited in these systems and have been impacted by past and current urban, rural residential, and forestry development and practices. Secondary concerns were related to a loss of over-winter, lowland habitat complexity due to past and current agricultural practices. In addition, high water temperatures exist for summer parr due to a loss of riparian function and channel straightening.

Cumulative Effects of Southwest Oregon Coastal Land Use on Salmon Habitat

Oregon State University (OSU) Oak Creek Labs conducted a study funded by ODFW and the Oregon Department of Forestry (ODF) to determine relationships between forest harvest and Pacific salmon productivity (Frissell 1992). The study assessed basins along the Oregon coast extending from the Sixes River to the southern border during the period from 1986 to 1992.

South Coast Watershed Council

9.5 Stresses

Table 9-2. Severity of stresses affecting each life stage of coho salmon in Mussel 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	Lack of Floodplain and Channel Structure[1]	Low	Very High	Very High[1]	Very High	Very High	Very High
2	Degraded Riparian Forest Conditions[1]	-	Very High	Very High[1]	Very High	Very High	Very High
3	Altered Sediment Supply	High	Medium	Medium	Medium	High	Medium
4	Impaired Estuary/Mainstem Function	-	Medium	High	Medium	Medium	Medium
5	Impaired Water Quality	Low	Medium	Medium	Low	Low	Low
6	Barriers	-	Low	Low	Low	Low	Low
7	Altered Hydrologic Function	Low	Low	Low	Low	-	Low
8	Adverse Fishery-Related Effects	-	-	-	-	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

The juvenile life stage is most limited and quality winter rearing habitat, as well as summer rearing habitat, is lacking as vital habitat for the population. Winter rearing habitat is often formed by instream large wood, but is also found in estuaries and floodplain wetlands. Timber removal has decreased the source of large wood, and much of the historically available habitat in the estuary and floodplain wetlands has been altered by development, channelization, and construction of a jetty. The IP habitat in the Mussel Creek basin is concentrated in the flattest parts of the basin, near the ocean. Off-channel juvenile rearing habitat with suitable temperature is vital to coho salmon recovery in this river. These findings are consistent with those of the Oregon Expert Panel (Section 9.4).

Lack of Floodplain and Channel Structure

In many areas, the creek and its tributaries disconnected from the floodplain. Channelization of Myrtle Creek and the South Fork Mussel Creek eliminated meanders and side channels that would have provided summer and winter coho salmon rearing habitat. Coho salmon juveniles prefer pools formed by large wood, but habitat surveys show less than one key piece per 100m in the middle reach of Mussel Creek upstream of the highest IP habitat, which rates as poor

according to ODFW standards. The upper reach of Mussel Creek had 1 to 2 key pieces of large wood per 1000 feet, which rates as fair.

Figure 9-2. Photo of the Myrtle Creek channel. View is looking downstream just above its convergence with Mussel Creek. Surface flow has been lost, and the stream has been channelized. Photo taken on 9/18/2008.

Pool frequency in the upper reach of Mussel Creek was rated as (10 to 20 percent) according to ODFW standards. The good rating (20 to 35 percent) in the middle reach of Mussel Creek likely represents a substantial reduction in pool frequency from historic conditions, given the level of disturbance in the basin. Pool depth is poor (average less than 2 feet) in the entire sampled area.

Degraded Riparian Forest Conditions

Without proper riparian forests, Mussel Creek has no mechanism for recruitment of large wood, which would trap fine sediment and enhance habitat complexity (Chapter 3). Lack of riparian cover also decreases shade and thermal buffering, and reduces formation of undercut banks. Habitat surveys of riparian conditions in the middle reaches of Mussel Creek found the area to be devoid of large conifers (>36" diameter at breast height), which translates to a poor riparian condition score using the ODFW criteria (<75 large conifers per 1000' of stream). Lack of large conifers in the riparian zone of much of the lower creek is also apparent. One short reach of Mussel Creek downstream Highway 101 contains a patch of late seral forest with a mature riparian canopy (Figure 9-3).

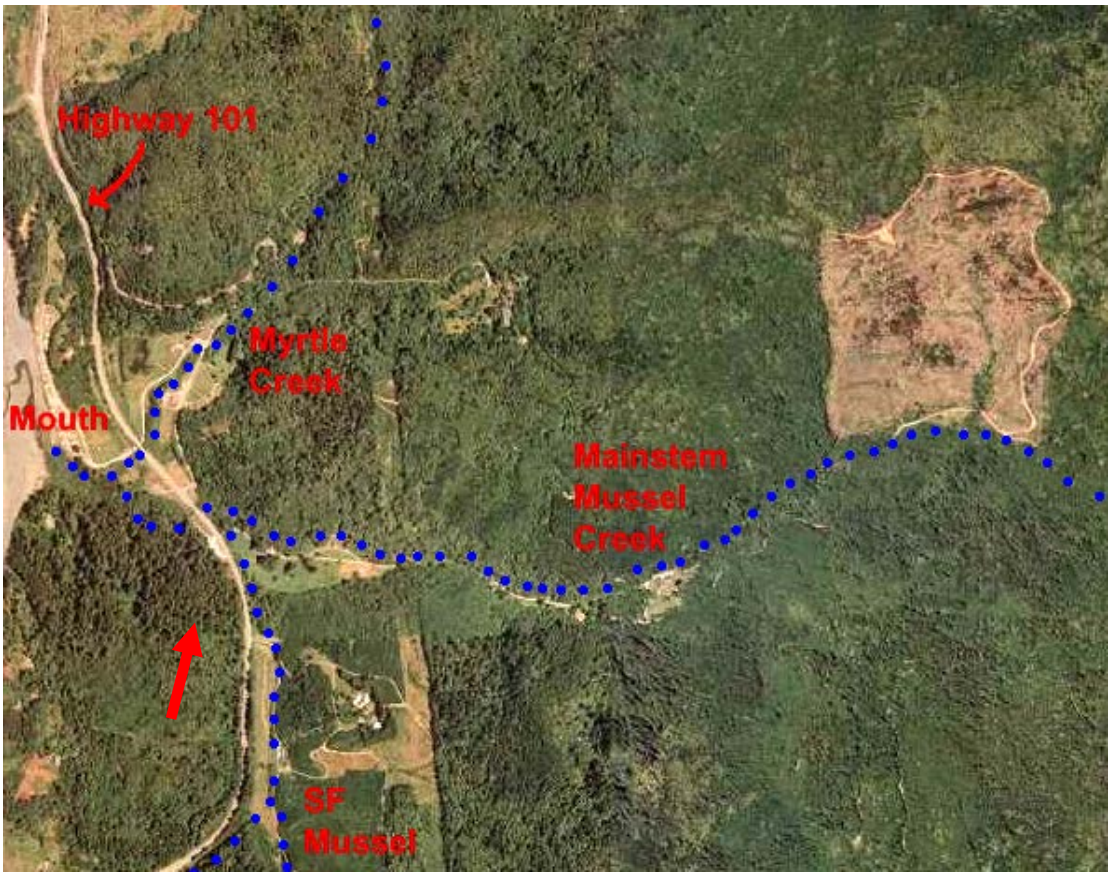

Figure 9-3. The lower reaches of Mussel, South Fork Mussel and Myrtle creeks in June 2005. Note the power line corridor in upper Myrtle riparian, Highway 101 confining South Fork, and a clearcut upper mainstem Mussel Creek. Arrow at lower-left points to patch of large trees, possibly old growth.

Altered Sediment Supply

Sediment contribution from landslides and erosion occurs naturally in the Mussel Creek basin; however, roads, timber harvest, and bank erosion following removal of riparian vegetation have elevated fine sediment input. Habitat surveys in the middle reaches of Mussel Creek found poor (>17 percent surface fines) silt/sand surface conditions, while the steeper reach further upstream rated good (<12 percent). Excess fine sediment directly impacts coho salmon egg viability and can reduce food for fry, juveniles and smolts. Poor pool frequency and depth throughout the Mussel Creek basin is likely due to elevated levels of fine sediment partially filling pools, a lack of scour-forcing obstructions such as large wood, and in some reaches diminished scour due to channel widening.

Impaired Estuary/Mainstem Function

Little is known about the historic extent of estuarine area in Mussel Creek, but it is likely that development adjacent to the current estuary has reduced habitat. Currently the estuarine portion of Mussel Creek is confined to less than 10 acres of tidal sand and mudflat, and a few acres of tidal wetland habitat west of Highway 101(Figure 9-4). Based on the natural drainage pattern and elevations in the area, it is likely that much of the historical estuarine tidal area that once existed has been diked and filled to accommodate the highway, other small roads, and residential

and agricultural development. Remaining habitat is largely degraded and provides little cover and foraging habitat.

Figure 9-4. Lagoon at the mouth of Mussel Creek. View is looking north. A sand bar blocks exchange of salt and fresh waters during periods of low flow. The lagoon is shallow, lacks cover, and likely provides limited habitat for juvenile salmonid rearing. (9/18/2008).

Impaired Water Quality

There are no water quality data available for Mussel Creek. Temperature problems are unlikely in Mussel Creek due to the proximity to the coast, topographic shading, short transit time, and likely contributions of groundwater from hollows throughout this steep basin. Turbidity is likely high during winter due to high road density and timber harvest in the basin. Potential sources of chemical water pollutants would be use of herbicides on industrial timberlands and leakage from septic systems at the campground, resorts, or the small number of rural residences in the basin.

Barriers

There are no known structural barriers to coho salmon passage in Mussel Creek. The dry reach of lower Myrtle Creek poses a potential seasonal impediment to passage.

Altered Hydrologic Function

The complex hydrology of Mussel Creek has been severely disrupted by Highway 101, debris torrents down Myrtle Creek, and development on the floodplain. Increased peak discharge is also likely in the Mussel Creek basin due to high road densities and widespread timber harvest.

Adverse Fishery-Related Effects

NMFS has determined that federally- and state-managed fisheries in Oregon are not likely to jeopardize the continued existence of the SONCC coho salmon ESU (Appendix B).

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 Mussel Creek population area. Hatchery-origin coho salmon may stray into Mussel Creek, but 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).

9.6 Threats

Table 9-3. Severity of threats affecting each life stage of coho salmon in Mussel 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	Very High	Very High	Very High	Very High	Very High
2	Channelization/Diking	High	Very High	Very High	Very High	Very High	Very High
3	Roads	High	Very High	Very High	Very High	Very High	Very High
4	Urban/Residential/Industrial	High	High	High	High	High	High
5	Agricultural Practices	Medium	Medium	Medium	Medium	Medium	Medium
6	Dams/Diversion	Low	Medium	Medium	Medium	Medium	Medium
7	Climate Change	Low	Low	Low	Low	Medium	Low
8	High Intensity Fire	Low	Low	Low	Low	Low	Low
9	Road-Stream Crossing Barriers	-	Low	Low	Low	Low	Low
10	Fishing and Collecting	-	-	-	-	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

Recent private timberland harvest data are not readily available. However, it is apparent from aerial photos that the basin has likely experienced extensive harvest in the last 50 years. As seen in Figure 9-3, active timber harvest on private lands within the Mussel Creek basin is occurring and is expected to continue.

Channelization/Diking

Highway 101 caused the relocation and straightening of most of the South Fork Mussel Creek channel, which altered more than 20 percent of the high IP habitat in the Mussel Creek basin. The highway is not likely to be relocated and is a major impediment to restoring habitat in South Fork Mussel Creek; however, there is a meadow east of creek that could potentially provide space for creation of a more complex channel. Myrtle Creek has also been channelized through the lower reach near the campground. A parking lot for beach access was constructed by rearranging deposited materials, which created a functional dike along the eastern lagoon border and reduced the lagoon area.

Roads

Road densities in the Mussel Creek basin are over thresholds recognized as contributing to increased fine sediment yield and elevated peak flows. Roads are expected to cause fine sediment delivery into Mussel Creek, because the basin is very steep and the geology is relatively unstable. The construction of Highway 101 has resulted in the channelization and realignment of the South Fork Mussel Creek, as well as parts of the mainstem Mussel Creek and Myrtle Creek. These impacts, along with excessive sedimentation from upslope activities, have altered the hydrology of these creeks and made them less suitable for coho salmon spawning and rearing. In addition, because of the small size of the Mussel Creek basin and the significant impacts of Highway 101 to high IP habitat in the basin, the highway continues to be a major threat to coho salmon in this basin.

Urban/Residential/Industrial Development

A resort (Prehistoric Gardens), a campground, and a day use recreation area (Arizona Beach) are operated in the floodplain of Mussel Creek. Additionally, an electrical power transmission line runs north-south across the South Fork and lower mainstem Mussel Creek and parallels the riparian zone of upper Myrtle Creek (Figure 9-3). Periodically, along this corridor all vegetation is removed. Other than the power lines, the existing developments are relatively small and are not expected to expand significantly. The recent acquisition and conversion of Arizona Beach from a privately operated campground facility to a state park should improve conditions in the basin.

Agricultural Practices

Cattle grazing occurs in the lower Mussel Creek floodplain adjacent to high IP habitat; however, it is not a significant activity in the basin.

Dams/Diversions

No dams are known to exist in the valley and few water diversions are presently active.

Climate Change

There is low risk of average temperature increase, or change in average precipitation, over the next 50 years (Appendix B). The risk of sea level rise is moderate (Appendix B, Thieler and

Hammer-Klose 2000). Adults may be negatively impacted by climate-related ocean acidification, changes in ocean conditions, and prey availability (see Independent Science Advisory Board 2007, Feely et al. 2008, Portner and Knust 2007).

High Intensity Fire

The proximity of the Mussel Creek basin to the coast is a strong moderating factor on fire risk.

Road-Stream Crossing Barriers

Road-stream crossing barriers are not a significant threat to coho salmon in Mussel Creek based on the lack of known barriers that exist in the basin. Given the amount of timber harvest that has occurred in the basin and the density of roads in the lower basin it is likely there are many partial or total barriers that have yet to be identified on private land. Based on the projected population growth in this area, an increase in road-stream crossings is not likely unless significant timber harvest resumes in un-roaded areas.

Fishing and Collecting

The directed recreational fishery for hatchery coho salmon in Oregon likely encounters more coho salmon than the Chinook-directed fisheries that account for much of the bycatch mortality of SONCC coho salmon. This is because coho salmon are the targeted species in the directed recreational fishery. The exploitation rates associated with this freshwater fishery and all other fisheries managed by the State of Oregon were found to be low enough to avoid jeopardizing the existence of the ESU (NMFS 1999). The standard applied to make that determination was a jeopardy standard, not a species viability standard, because recovery objectives to achieve species viability had not been established for SONCC coho salmon at that time (NMFS 1999). As of April 2011, NMS has not authorized future collection of coho salmon for research purposes in Mussel Creek.

Hatcheries

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

9.7 Recovery Strategy

Restoration efforts should be focused on lower Mussel Creek, South Fork Mussel Creek, and Myrtle Creek, which all have high IP habitat (Figure 9-1).

The Mussel Creek population is considered dependent and therefore cannot be viable on its own; however, it is necessary to restore habitat within the basin so that it can support all life stages of coho salmon and provide connectivity between other populations in the ESU. The recovery criterion for this population is that 20% of IP habitat must be occupied in years following spawning of brood years with high marine survival. The most important factor limiting recovery of coho salmon in Mussel Creek is a deficiency in the amount of suitable rearing habitat for juveniles. The processes that create and maintain such habitat must be restored by increasing

habitat complexity within the channel, re-establishing off-channel rearing areas, restoring riparian forests, increasing summer flow, and reducing threats to instream habitat.

Table 9-4 on the following page lists the recovery actions for the Mussel Creek population.

Table 9-4. Recovery action implementation schedule for the Mussel Creek population.

Action ID / Step ID	Strategy / Step Description	Key LF	Objective	Action Description	Area	Priority
SONCC-MusC.2.2.4	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Construct off channel ponds, alcoves, backwater habitat, and old stream oxbows	Lower mainstem and estuary	3
SONCC-MusC.2.2.4.1	*Identify potential sites to create refugia habitats. Prioritize sites and determine best means to create rearing habitat*					
SONCC-MusC.2.2.4.2	*Implement restoration projects that improve off channel habitats as guided by assessment results*					
SONCC-MusC.2.2.5	Floodplain and Channel Structure	Yes	Reconnect the channel to the floodplain	Increase beaver abundance	Lower Mainstem	3
SONCC-MusC.2.2.5.1	*Develop program to educate and provide incentives for landowners to keep beavers on their lands*					
SONCC-MusC.2.2.5.2	*Implement beaver program (may include reintroduction)*					
SONCC-MusC.2.1.6	Floodplain and Channel Structure	Yes	Increase channel complexity	Increase LWD, boulders, or other instream structure	State park in lower mainstem	3
SONCC-MusC.2.1.6.1	*Assess habitat to determine beneficial location and amount of instream structure needed*					
SONCC-MusC.2.1.6.2	*Place instream structures, guided by assessment results*					
SONCC-MusC.7.1.1	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve long-range planning	Lower mainstem and estuary	3
SONCC-MusC.7.1.1.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-MusC.7.1.1.2	*Develop watershed-specific guidance for managing riparian vegetation. Consider larger riparian buffers in coho occupied habitat*					
SONCC-MusC.7.1.2	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Population wide	BR
SONCC-MusC.7.1.2.1	*Determine appropriate silvicultural prescription for benefits to coho salmon habitat*					
SONCC-MusC.7.1.2.2	*Thin, or release conifers, guided by prescription*					
SONCC-MusC.7.1.2.3	*Plant conifers in the tributaries and alders and cottonwoods in the lower floodplain, guided by prescription*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MusC.7.1.3	Riparian	Yes	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide	BR
SONCC-MusC.7.1.3.2	*Revise Oregon Forest Practice Act Rules in consideration of IMST (1999) and NMFS (1998) recommendations*					
SONCC-MusC.27.2.10	Monitor	No	Track habitat condition	Track habitat indicators related to spawning, rearing, and migration	Population wide	3
SONCC-MusC.27.2.10.1	*Measure indicators for spawning and rearing habitat. Conduct a comprehensive survey*					
SONCC-MusC.27.2.10.2	*Measure indicators for spawning and rearing habitat once every 15 years, sub-sampling 10% of the original habitat surveyed*					
SONCC-MusC.27.1.12	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Estimate juvenile spatial distribution	Population wide	3
SONCC-MusC.27.1.12.1	*Conduct presence/absence surveys for juveniles (3 years on; 3 years off)*					
SONCC-MusC.27.2.13	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Lack of Floodplain and Channel Structure'	All IP habitat	3
SONCC-MusC.27.2.13.1	*Measure the indicators, pool depth, pool frequency, D50, and LWD*					
SONCC-MusC.27.2.14	Monitor	No	Track habitat condition	Track habitat indicators related to the stress 'Degraded Riparian Forest Condition'	All IP habitat	3
SONCC-MusC.27.2.14.1	*Measure the indicators, canopy cover, canopy type, and riparian condition*					
SONCC-MusC.27.1.15	Monitor	No	Track population abundance, spatial structure, productivity, or diversity	Refine methods for setting population types and targets	Population wide	3
SONCC-MusC.27.1.15.1	*Develop supplemental or alternate means to set population types and targets*					
SONCC-MusC.27.1.15.2	*If appropriate, modify population types and targets using revised methodology*					
SONCC-MusC.27.2.16	Monitor	No	Track habitat condition	Determine best indicators of estuarine condition	Estuary	3
SONCC-MusC.27.2.16.1	*Determine best indicators of estuarine condition*					

Action ID	Strategy	Key LF	Objective	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MusC.5.1.8	Passage	No	Improve access	Remove barriers	Population wide	BR
SONCC-MusC.5.1.8.1	*Use ODFW and SCWC fish passage barrier database to 5.1 based on known coho use or data identifying suitable habitat conditions above barriers*					
SONCC-MusC.8.1.11	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	BR
SONCC-MusC.8.1.11.1	*Assess and prioritize road-stream connection, and identify appropriate treatment to meet objective*					
SONCC-MusC.8.1.11.2	*Decommission roads, guided by assessment*					
SONCC-MusC.8.1.11.3	*Upgrade roads, guided by assessment*					
SONCC-MusC.8.1.11.4	*Maintain roads, guided by assessment*					
SONCC-MusC.10.2.7	Water Quality	No	Reduce pollutants	Educate stakeholders	Population wide	BR
SONCC-MusC.10.2.7.1	*Develop an educational program that teaches landowners and businesses about avoiding pollution from septic systems, backyard pesticides, fuels, and nutrients.*					