3 Southern Oregon / Northern California Coast Recovery Domain

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3.1 Southern Oregon / Northern California Coast Coho Salmon ESU

The geographic setting of the Southern Oregon/Northern California Coho Salmon Evolutionarily Significant Unit (SONCC-Coho Salmon ESU) includes coastal watersheds from the Elk River (Oregon) in the north to the Mattole River (California) in the south. The ESU is characterized by three large basins and numerous smaller basins across a diverse landscape. The Rogue River and Klamath River extend beyond the Coast Range and include the Cascade Mountains. The Eel River basin also extends well inland, including higher elevation inland streams and those that experience drier, warmer summer temperatures. The numerous smaller to medium-sized coastal basins in the ESU experience relatively wet, cool, and temperate as compared to those of the interior sub-basins of the Rogue River, Klamath River, and Eel River basins, which exhibit a range of conditions including snowmelt-driven hydrographs, hot/dry summers, and cold winters. The lower portions of these large basins are more similar to the smaller coastal basins in terms of environmental conditions than they are to their interior sub-basins.

The Technical Recovery Team (TRT) for the SONCC-Coho Salmon ESU prepared two documents intended to guide recovery planning efforts for the ESA-listed coho salmon. The first of these reports described the historical population structure of the ESU (Williams et al. 2006). In general, the historical population structure of coho salmon in the SONCC-Coho Salmon ESU was characterized by small-to-moderate-sized coastal basins where high quality habitat is in the lower portions of the basin and by three large basins where high quality habitat was located in the lower portions, middle portions of the basins provided little habitat, and the largest amount of habitat was located in the upper portions of the sub-basins. The SONCC TRT categorized populations into one of four distinct types based on its posited historical functional role in the ESU:

> *Functionally independent populations*: populations with a high likelihood of persisting over 100-year time scales and that conform to the definition of independent "viable salmonid populations" offered by McElhany et al. (2000).
>
> *Potentially independent populations*: populations with a high likelihood of persisting over 100-year time scales, but that were too strongly influenced by immigration from other populations to be demographically independent.
>
> *Dependent populations*: populations believed to have had a low likelihood of sustaining themselves over a 100-year time period in isolation and that received sufficient immigration to alter their dynamics and extinction risk.
>
> *Ephemeral populations*: populations that were both small enough and isolated enough that they were only intermittently present.

In addition to categorizing individual populations, the population structure report also placed populations into diversity strata, which are groups of populations that likely exhibit genotypic and phenotypic similarity due to exposure to similar environmental conditions or common evolutionary history (Williams et al. 2006). This effort was a prerequisite for development of viability criteria that consider processes and risks operating at spatial scales larger than those of individual populations.

The second TRT report developed a framework for assessing viability of coho populations in the SONCC-Coho Salmon ESU (Williams et al. 2008). This report established biological viability criteria, from which delisting criteria were developed by a federal recovery planning team (NMFS 2014a). These criteria consist of both population-level viability criteria and ESU-level criteria. Application of these criteria requires time series of adult spawner abundance spanning a minimum of four generations for independent populations.

The population viability criteria represent an extension of an approach developed by Allendorf et al. (1997) and include criteria related to population abundance (effective population size), population decline, catastrophic decline, spawner density, and hatchery influence (Table 3.1). In general, the spawner density low-risk criterion, which seeks to ensure a population's viability in terms its ability to fulfill its historical functional role within the ESU, is the most conservative. The ESU-level criteria are intended to ensure representation of the diversity within an ESU across much of its historical range, to buffer the ESU against potential catastrophic risks, and to provide sufficient connectivity among populations to maintain long-term demographic and genetic processes. These criteria are summarized in Table 3.2.

Since the TRT developed viability criteria for the SONCC-Coho Salmon ESU, a NMFS recovery planning team has completed the federal recovery plan for SONCC-Coho Salmon (NMFS 2014a). This plan includes establishment of population-level and ESU-level recovery criteria for independent populations of SONCC-Coho Salmon. These recovery criteria generally follow the viability criteria developed by the TRT, but may deviate slightly for certain populations based on additional analysis.

Application of recovery and viability criteria requires population-level estimates of adult spawner abundance spanning a minimum of four generations for independent populations (Williams et al. 2008). In reality, for most of the coho salmon populations in this ESU, estimates meeting these criteria are lacking. However, since the mid-2000s, implementation of the Coastal Monitoring Plan[4] (CMP) has greatly expanded, and shorter time series of adult spawner abundance are now available for many populations. In a few other areas composite estimates of several populations, or estimates representing only a portion of a population, constitute the best available data. If data collection has occurred in a consistent manner, these shorter time series, composite estimates, or partial population estimates are presented despite the shortcomings, as they provide the only basis for evaluating current viability. However, the reader is cautioned that short-term trends in abundance or abundance indices can be highly misleading given natural variation in environmental conditions in both the freshwater and marine environments.

[4] For information on the California Coastal Monitoring Program: http://www.calfish.org/ProgramsData/ConservationandManagement/CaliforniaCoastalMonitoring.aspx

Table 3.1. Viability criteria for assessing extinction risk for populations of coho salmon (*O. kisutch*) in the Southern Oregon/Northern California Coast Coho Salmon ESU. For a given population, the highest risk score for any category determines the population's overall extinction risk (Williams et al. 2008).

Criterion	Extinction risk: High	Moderate	Low
	- any One of -	- any One of -	- all of -
Effective population size[a]	$N_e \leq 50$	$50 < N_e < 500$	$N_e \geq 500$
- or -	*- or -*	*- or -*	*- or -*
Population size per generation	$N_g \leq 250$	$250 < N_g < 2500$	$N_g \geq 2500$
Population decline	Precipitous decline[b]	Chronic decline or depression[c]	No decline apparent or probable
Catastrophic decline	Order of magnitude decline within one generation	Smaller but significant decline[d]	Not apparent
Spawner density (adults/IP km)	N_a / *IPkm*[e] ≤ 1	1 < N_a / *IPkm* < MRD[f]	N_a /*IPkm* ≥ MRD[f]
Hatchery Influence			Hatchery fraction <5% *- in addition to above -*
Extinction risk from PVA	≥ 20 % within 20 yrs	≥ 5% within 100 yrs but < 20 % within 20 yrs	< 5 % within 100 yrs[g]

a – The effective population size (N_e) is the number of breeding individuals in an idealized population that would give rise to the same variance in gene frequency under random genetic drift or the same rate of inbreeding as the population under consideration (Wright 1931); total number of spawners per generation (N_g), for SONCC coho salmon the generation time is approximately three years therefore $N_g = 3\ N_a$.
b – Population has declined within the last two generations or is projected to decline within the next two generations (if current trends continue) to annual run size of $N_a \leq 500$ spawners (historically small but stable populations not included) **or** $N_a > 500$ but declining at a rate of ≥10% per year over the last two-to-four generations.
c – Annual spawner abundance (N_a) has declined to ≤ 500 spawners, but now stable **or** number of adult spawners (N_a) > 500 but continued downward trend is evident.
d – Annual spawner abundance decline in one generation < 90% but biologically significant (e.g., loss of year class).
e – *IPkm* = the estimated aggregate intrinsic habitat potential for a population inhabiting a particular watershed (i.e., total accessible km weighted by reach-level estimates of intrinsic potential; see Bjorkstedt et al. [2005] for greater elaboration).
f – Minimum required spawner density (MRD) is dependent on the amount of potential habitat available. Figure 5 of Williams et al. (2008) summarizes the relationship between spawner density and IP km.
g – For population to be considered at low-risk of extinction, all criteria must be satisfied (i.e., not just a PVA). A population viability analysis (PVA) can be also included for consideration, but must estimate an extinction risk <5% within 100 years *and* all other criteria must be met. If discrepancies exist between PVA results and other criteria, results need to be thoroughly examined and potential limitations of either approach should be carefully identified and examined.

Table 3.2. Summary of ESU viability criteria for the Southern Oregon/Northern California Coast Coho Salmon ESU.

ESU viability characteristic	Criteria
Representation	1. All diversity strata should be represented by viable populations.
Redundancy and connectivity	2.a. At least 50% of historically independent populations in each diversity stratum should be demonstrated to be at low risk of extinction according to the population viability criteria. For strata with three or fewer independent populations, at least two populations must be viable. AND 2.b. Total aggregate abundance of the populations selected to satisfy 2a must meet or exceed 50% of the aggregate viable population abundance predicted for the stratum based on the spawner density.
	3. All dependent and independent populations not expected to meet low-risk threshold within a stratum should exhibit occupancy indicating sufficient immigration is occurring from the “core populations”.
	4. The distribution of extant populations, both dependent and independent, needs to maintain connectivity across the stratum as well as with adjacent strata.

ESU Boundary Delineation

The SONCC-Coho Salmon ESU currently includes populations spawning from the Elk River (Oregon) in the north to the Mattole River (California) in the south, inclusive. New genetic data are available from collections in 2003 from populations in California (Gilbert-Horvath et al. in press). These recent genetic data do not suggest the need for a re-examination of the boundaries between the Central California Coast Coho Salmon ESU and the SONCC-Coho Salmon ESU. These data show clear separation between populations north and south of Punta Gorda, the current southern boundary of the ESU. The Biological Review Team for the Oregon Coast Coho Salmon ESU reviewed genetic data and concluded that a reconsideration of the ESU boundary the between the SONCC-Coho Salmon ESU and Oregon Coast Coho Salmon ESU was not necessary (Stout et al. 2010). In 2015, a new sampling effort was conducted to resample all sites sampled in 2003 California-wide survey (Gilbert-Horvath et al. in press) and included samples from populations located in the Oregon portion of the SONCC-Coho Salmon ESU. These corresponding analyses are currently underway and therefore are not available for consideration at this time.

Summary of Previous Assessments

Status reviews by Weitkamp et al. (1995) and Good et al. (2005) concluded that the SONCC-Coho Salmon ESU was likely to become endangered. Risk factors identified in these early status reviews included severe declines from historical run sizes, the apparent frequency of local extinctions, long-term trends that were clearly downward, and degraded freshwater habitat and associated reduction in carrying capacity.

In the most recent viability assessment, Williams et al. (2011) reported that although long-term data on coho salmon abundances in the SONCC-Coho Salmon ESU were scarce, all available evidence from shorter-term research and monitoring efforts indicated that conditions had worsened for populations in this ESU since review by Good et al. (2005). Williams et al. (2011) concluded that the SONCC-Coho Salmon ESU was likely to become endangered. The apparent negative trends across the ESU were of great concern as was the lack of information to determine if there had been improvement in freshwater habitat and survival. However, the negative trends were considered in the context of the apparent low marine survival during the period that likely contributed to the observed declines.

New Data and Updated Analyses

Abundance and Trends

Quantitative population-level estimates of adult spawner abundance spanning more than 9–12 years are scarce for independent or dependent populations of coho salmon in the SONCC ESU, although monitoring in California has improved considerably since the 2010 viability assessment as a result of the implementation of the CMP across the California portion of the ESU. The CMP framework provides population abundance estimates at the appropriate spatial scale (i.e., population unit) based on redd counts from surveys of stream reaches selected according to a Generalized Randomized Tessellation Survey (GRTS) design. Redd counts are then expanded to adult estimates based on spawner:redd ratios determined at a network of life-cycle monitoring stations (LCMs). Although only estimates of redds are presented in this assessment of the SONCC-Coho Salmon ESU, these estimates still provide a better basis for assessing viability compared with previous reviews and will increase greatly in value as these time series become longer and we gain a better understanding of the relationship between spawner:redd ratios among populations and among years within a population. Although only one of the time series of abundance meet the requisite four generations called for by the TRT for application of viability criteria, all still provide a substantially better basis for assessing viability compared with previous reviews and will increase greatly in value as these time series become longer. In addition, ongoing weir-based estimates are available for population units in the Klamath Basin (Scott and Shasta rivers), our longest time series sets for this ESU.

Unfortunately, the few estimates available at the population unit spatial scale from the Oregon portion of the ESU for the 2010 assessment are no longer collected and therefore no estimates at the population spatial scale are available for Oregon populations (Sounhein et al. 2014). The estimate of Rogue River coho salmon, that is a composite of several population units, continues to be collected and is extremely valuable.

In California, there are seven independent populations currently monitored at the "population unit" scale, although only the video weir count from the Shasta River is of the duration to satisfy viability criteria (12 years) and is a direct count of fish passing the weir, and not an estimate of adult escapement into the Shasta River (Table 3. 3, Figure 3.1). Of great concern is the extremely low numbers of fish "estimated" to have passed the weir in 2014 (46 coho salmon) and that only four of those fish were considered to be 3-year olds (Chesney and Knechtle 2015). The adult counts from the Scott (Knechtle and Chesney 2014) and Shasta (Chesney and Knechtle 2015) rivers emphasize the current precarious situation in the Klamath. In particular, the Shasta River count is now 14 years in duration (4+ generations) and from this time series a slight decline is apparent, although the slope of the decline is not significantly different from zero (Figure 3.2). In addition, the number of adult coho salmon counted at the Shasta River weir is less than the depensation threshold of 531 adults (Williams et al. 2008).

The Shasta River and Scott River adult counts represent the longest term population-unit spatial scale monitoring currently underway in the SONCC-Coho Salmon ESU, although with implementation of the CMP, five population units are now being monitored and are providing appropriate data to assess population viability (Table 3.3). There are now four years of data (estimated number of redds) for the Smith River, Redwood Creek, Humboldt Bay, and South Fork Eel River population units, although only the first two years of data were available for the Smith River at the time of this assessment. The Mattole River population has a time series of two years and has the lowest estimated number of redds (47) of any of the five new time series available.

Trends in abundance were only calculated for those populations where at least six years of data were available (Table 3.3). The slope of the trend line for both the Shasta River and Scott River did not differ from zero. For the next assessment in 2020, the Scott River will have more than 12 years of data. In addition, the time series information for the Smith River, Redwood Creek, Humboldt Bay, South Fork Eel River, and Mattole River will all be at least two generations in length (six years) and there will be more information on trends in abundance available for other California populations.

Besides the population-unit spatial scale estimate that are required to appropriately assess population viability, there are two other data sets that provide insight into the condition of coho salmon in the ESU, although at spatial scales that do not allow for assessing population viability.

An estimate of spawners over the past 13 years in Freshwater Creek, a Humboldt Bay tributary, includes estimates from 2002–2003 to 2013–2014 with a trend that is not significantly different than zero ($p > 0.07$) over the 13-year period (Figures 3.3 and 3.4; Table 3.4). The Freshwater Creek monitoring site is of particular interest because of the presence of a LCM operated as outlined in the CMP (Ricker and Anderson 2014). This LCM provides critical data to understand the relationships between redds counts and estimated adult escapement – a critical relationship to understand as CMP efforts currently focus on redd counts for many practical reasons. In addition, this and other

Table 3.3. Viability metrics for independent populations of coho salmon (*O. kisutch*) in the SONCC-Coho Salmon ESU. NA indicates not available or applicable; dash (-) indicates no estimate of appropriate spatial scale or sampling design for viability analysis. Trends are shown only for populations where time series is at least six years; **bold** indicates significant trend.

Stratum/population	Yrs	$\overline{N}_{a(arith)}$	$\overline{N}_{a(geom)}$	$\overline{N}_{g(harm)}$	$\hat{C}$	$\hat{T}$ (95% CI)
Northern Coastal Basins						
Elk River						
Lower Rogue River						
Chetco River						
Winchuck River						
Central Coastal Basins						
Smith River[a,b] *(redd estimate)*	2	355	331	NA	NA	-
Lower Klamath River						
Redwood Creek[b,c] *(redd estimate)*	4	529	516	NA	NA	-
Maple Creek/Big Lagoon[d]						
Little River						
Mad River						
Southern Coastal Basins						
Humboldt Bay tributaries[b,e] *(redd estimate)*	4	1038	919	NA	NA	-
Low. Eel/Van Duzen rivers						
Bear River						
Mattole River[b,f] *(redd estimate)*	2	47	46	NA	NA	-
Interior – Rogue						
Illinois River						
Mid. Rogue/Applegate rivers						
Upper Rogue River						
Interior – Klamath						
Middle Klamath River						
Upper Klamath River						
Salmon River						
Scott River[g] *(video weir – adults)*	8	810	404	1713	NA	0.145 (-0.389, 0.678)
Shasta River[h] *(video weir – adults)*	14	127	84	261	0.81	-0.094 (-0.231, 0.044)
Interior – Trinity						
South Fork Trinity River						
Lower Trinity River						
Upper Trinity River						

Table 3.3. continued.

Stratum/population	Yrs	$\overline{N}_{a(arith)}$	$\overline{N}_{a(geom)}$	$\overline{N}_{g(harm)}$	$\hat{C}$	$\hat{T}$ (95% CI)
Interior – Eel						
South Fork Eel River[b,i] *(redd estimate)*	4	1347	1310	NA	NA	-
Mainstem Eel River						
North Fork Eel River[d]						
Middle Fork Eel River[d]						
Middle Mainstem Eel River						
Upper Mainstem Eel River[d]						

a – Data from Garwood and Larson (2014). Data available for 2011 and 2012, data for 2013 and 2014 not available at time of analysis.
b – Redd estimate, not adult escapement estimate.
c – Data from Ricker et al. (2014a, 2014b, 2014c, and 2014d); data from 2010 to 2013.
d – Population unit designated by Williams et al. (2006 and 2008), not included in NMFS (2014a).
e – Data from Ricker et al. (2015e, 2015f, 2015g, and 2015h); data from 2010 to 2013.
f – Data from Ricker and Lindke (2014) and Ricker et al. (2014e); data for 2011 and 2012.
g – Data from Knechtle (2015), data from 2007 to 2014.
h – Data from Knechtle (2015), data from 2001 to 2014.
i – Data from Ricker et al. (2015a, 2015b, 2015c, and 2015d); data from 2010 to 2013.

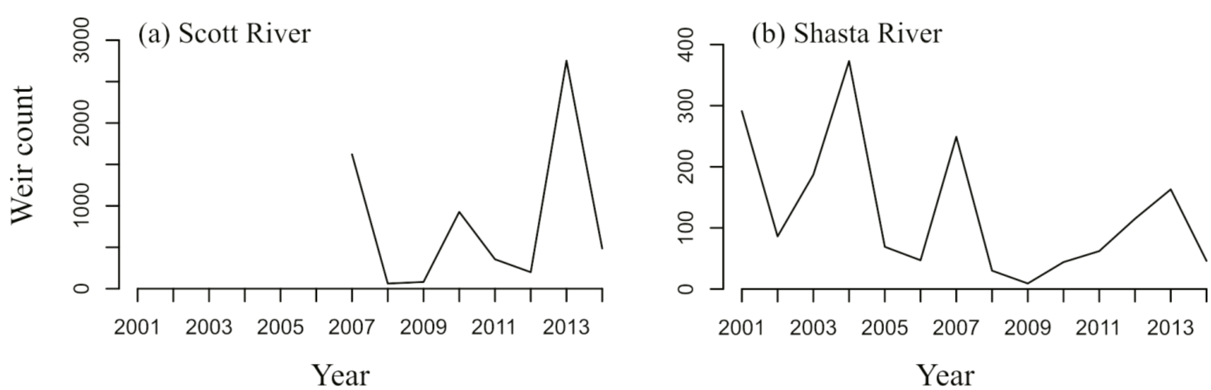

Figure 3.1. Video weir counts of adult coho salmon in a) Scott River for 2007 to 2014 and b) Shasta River for 2001 to 2014 (Knechtle 2015).

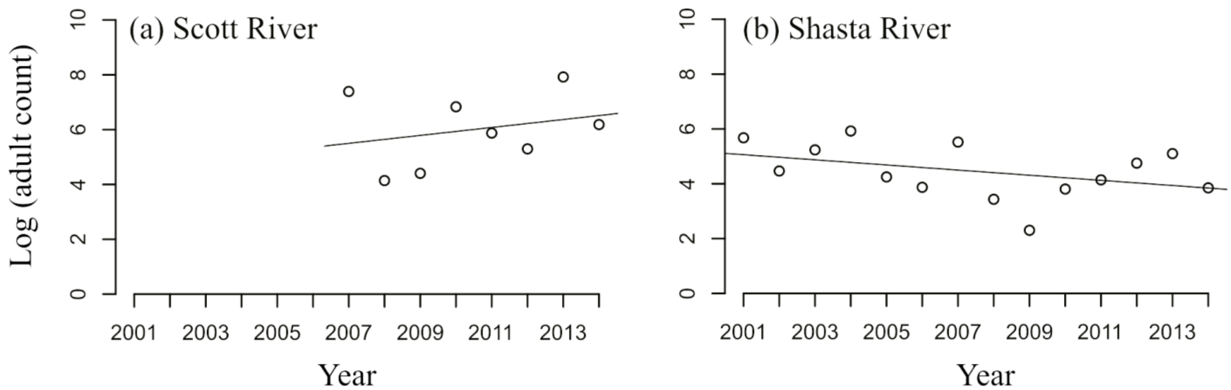

Figure 3.2. Trends (log adult counts at video weir) for independent coho salmon populations in a) Scott River from 2007 to 2014 and b) Shasta River from 2001 to 2014 (Knechtle 2015).

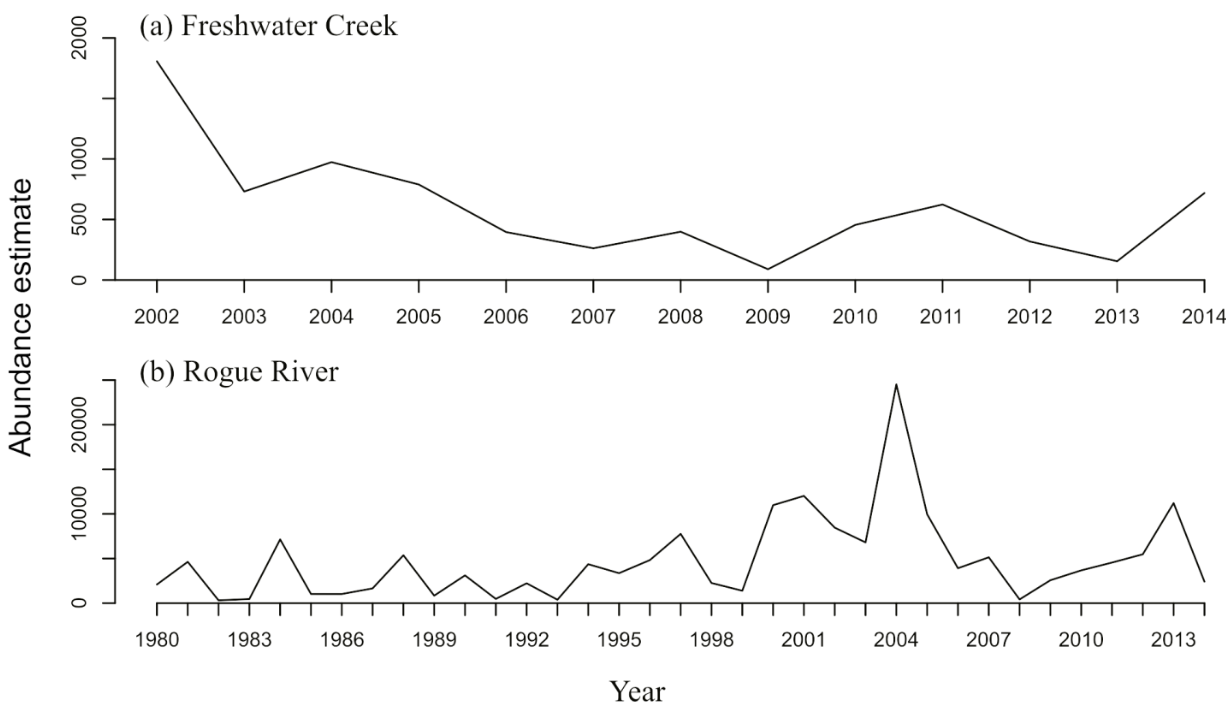

Figure 3.3. Estimated adult coho salmon in a) Freshwater Creek for 2002 to 2014 and b) Rogue River for 1980 to 2014 (Freshwater Creek data from Ricker 2015, Rogue River data from Confer (2015).

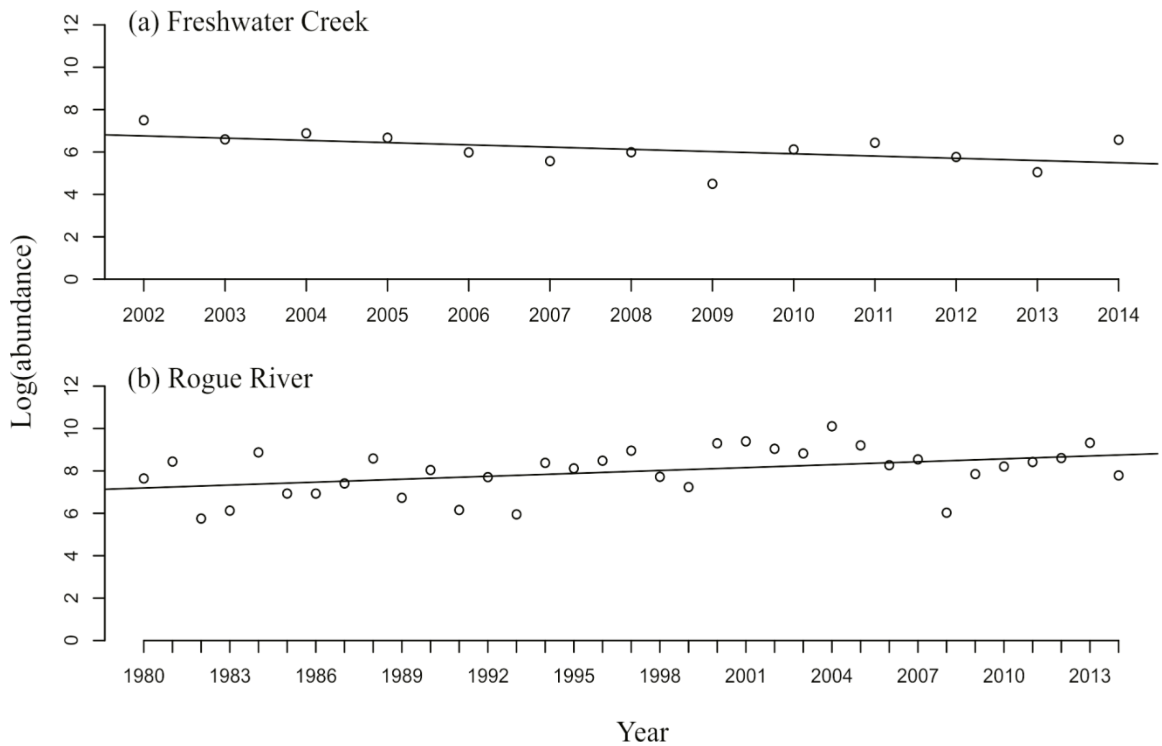

Figure 3.4. Trends (log abundance) of coho salmon in a) Freshwater Creek for 2002 to 2014 and b) Rogue River for 1980 to 2014 (Freshwater Creek data from Ricker 2015, Rogue River data from Confer (2015).

LCMs will provide estimates of marine survival that will provide context when evaluating trends in abundance and effectiveness of restoration activities (Figure 3.5).

The only estimate available to assess the viability of coho salmon in the Oregon portion of the SONCC-Coho Salmon ESU is from the Rogue River. These estimates are derived from mark-recapture estimates based on returns to Cole Rivers Hatchery expanded by the mark rate observed at Huntley Park. (Confer 2015). The Huntly Park seine estimates provide the best overall assessment of coho salmon spawner abundance in the basin (Good et al. 2005). Four independent populations contribute to this count (Lower Rogue River, Illinois River, Middle Rogue and Applegate rivers, and Upper Rogue River), which has had a significant positive trend ($p = 0.01$) over the past 35 years and a non-significant negative trend ($p > 0.05$) over the past 12 years or four generations (Table 3.4; Figures 3.3 and 3.4).

No extensive and systematic survey of presence of coho salmon has been conducted in the SONCC-Coho Salmon ESU in the past 10 years. Garwood (2012) developed a criteria to develop a list of historical and recent occurrence of coho salmon in the California portion of the SONCC-Coho Salmon ESU, although brood years evaluated were almost exclusively from 1979 to 2004 and therefore did not include field observations for the most recent three generations. No comparable survey data are available for the period from 2005 to 2014.

Table 3.4. Short- and long-term trends in SONCC-Coho Salmon ESU population abundance based on partial or composite population estimates and population indices. Trends in **bold** are significantly different from 0 ($\alpha = 0.05$).

Spawning tributary (Population)	Years	Data type	Mean (range)	$\hat{T}$ (95% CI)	Data sources
Rogue Basin[a]	12	Composite, mark-recapture	6717 (414 – 24509)	-0.074 (-0.262, 0.150)	Confer 2015
	35		4764 (314 – 24509)	**0.046** (0.011, 0.115)	
Freshwater Creek[b] (Humboldt Bay)	12	Partial pop., weir-carcass mark-recapture	493 (89 – 974)	-0.070 (-0.200, 0.060)	Ricker 2015
	13		594 (89 – 1807)	-0.105 (-0.222, 0.013)	Ricker 2015

a – These estimates are derived from mark-recapture estimates based on returns to Cole Rivers Hatchery expanded by the mark rate observed at Huntley Park. The Oregon Department of Fish and Wildlife staff advises that these data provide a more precise estimate of coho salmon escapement in the Rogue Basin compared to Huntly expansion method used previously (and in 2010 review). Data from Confer (2015).
b – Maximum live/dead counts do not distinguish between natural and hatchery-origin spawners. Counts may include both, particularly in the early part of the time series.

There are three hatcheries in the SONCC Coho Salmon ESU and all three are included in the ESA-listed ESU. The hatcheries include Cole Rivers Hatchery on the Rogue River, Iron Gate Hatchery on the Klamath River, and Trinity River Hatchery on the Trinity River. One key development since the previous assessment in 2010 is the completion of the Hatchery Genetic Management Plan (HGMP) for the Iron Gate Hatchery that moves the operation of this hatchery from a mitigation hatchery to one now operated to protect and conserve the genetic resources of the Upper Klamath population unit of the SONCC-Coho Salmon ESU. Included in the HGMP are defined monitoring and evaluation activities to evaluate effects of the hatchery activities on the abundance, productivity, spatial structure, and diversity, and the magnitude or relative impact of the hatchery program on other actions that influence the SONCC-Coho Salmon ESU. The implementation of the HGMP is considered a positive step towards meeting viability targets for the Upper Klamath population unit, the diversity stratum, and the ESU. A HGMP is being developed for the Trinity River Hatchery and is not in place at this time. Cole Rivers Hatchery is operated as a harvest program (ODFW 2015) used for augmentation of fishing and harvest opportunities, and mitigation for the loss of habitat resulting from dam construction in the Rogue and Applegate rivers. A HGMP was completed in 1999. The hatchery stock is managed as an integrated stock. Approximately 75,000 smolts are released on-site, all fish are fin-clipped and 25,000 are coded-wire tagged (ODFW 2015). The coho salmon program at Cole Rivers Hatchery does provide monitoring opportunities related to ocean distribution and harvest. Future development of a HGMP for Trinity River Hatchery will help insure that hatchery operations for coho

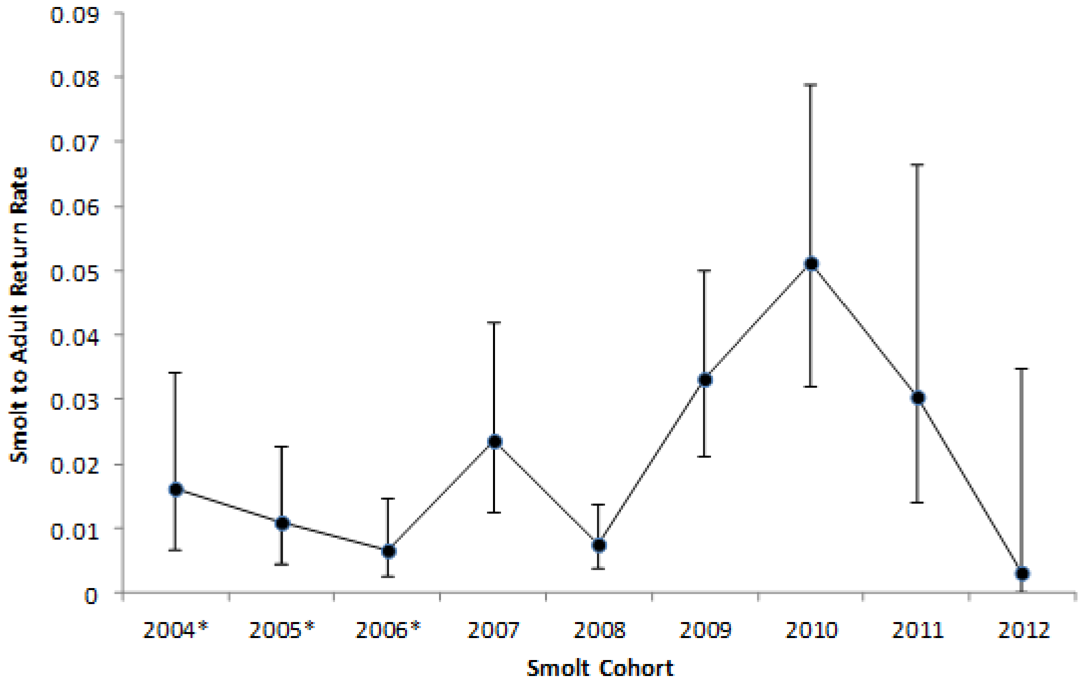

Figure 3.5. Smolt to adult return rates and 95% confidence levels for Freshwater Creek coho salmon smolt cohorts 2004 to 2012 from Ricker and Anderson (2014). Estimates for cohorts 2004-2006 based on smolts trapped at different location than estimates for cohorts 2005-2012 (see Ricker and Anderson 2014).

salmon are focused on aspects that protect and conserve the genetic resources of the local population units of the SONCC-Coho Salmon ESU and include defined monitoring and evaluation activities to evaluate effects of the hatchery activities on the abundance, productivity, spatial structure, and diversity, and the magnitude or relative impact of the hatchery program on other actions that influence coho salmon in this ESU.

Harvest Impacts[5]

Coho salmon from this ESU are primarily distributed off the coast of California and southern Oregon. Because coho salmon-directed fisheries and coho salmon retention have been prohibited off the coast of California since 1996, the ocean exploitation rate of SONCC-Coho Salmon is generally low and attributable to non-retention impacts in California and Oregon Chinook salmon-directed fisheries, impacts in Oregon mark-selective coho salmon fisheries (primarily non-retention), and impacts in Oregon non-mark selective fisheries.

[5] Harvest impacts section prepared by Michael O'Farrell.

Natural-origin Rogue/Klamath basin coho salmon ocean exploitation rates have been estimated for years 1986–2014 using backward runs of the Fishery Regulation Assessment Model (FRAM) (L. LaVoy and R. Kope, NMFS, personal communication). These estimates are the best available measure of the SONCC-Coho Salmon ESU ocean exploitation rate (Figure 3.6). This rate has been low and relatively stable since the early 1990s (average of 5.3% for years 1994–2014), which contrasts sharply with the much higher rates estimated for the 1980s and early 1990s (average of 50.8% between 1986 and 1993).

Freshwater recreational fishery impacts on SONCC-Coho Salmon are likely relatively low given California's statewide prohibition of coho salmon retention, and normally only mark-selective coho salmon retention in the Oregon portion of this ESU. Klamath basin tribes (Yurok, Hoopa, and Karuk) currently harvest a relatively small number of coho salmon for subsistence and ceremonial purposes (CDFG 2002). The Yurok fishery estimated harvest rate averaged 3.4% for the 1994–2014 period, and 2.3% for the 2011–2014 period (Williams 2015). The harvest rates reported in Williams (2015) are likely biased high because little escapement and harvest monitoring occur in the Klamath Basin, precluding a complete estimate of run size. Harvest rate estimates for the other two tribal fisheries are not available.

In summary, the available information indicates that the level of SONCC-Coho Salmon ESU fishery impacts has not changed appreciably since the 2010 salmon and steelhead assessment (Williams et al. 2011).

Summary and Conclusions

Although long-term data on coho salmon abundance in the SONCC-Coho Salmon ESU are scarce, all available evidence from available trends since 2011 assessment (Williams et al. 2011) indicate little change since the 2011 assessment. The two population-unit scale time series for the ESU both have a trend slope not different than zero. The composite estimate for the Rogue Basin populations was not significantly different from zero ($p > 0.05$) over the past 12 years and significantly positive over the 35 years of the data set ($p = 0.01$). The continued lack of appropriate data remains a concern, although the implementation of the CMP for California populations is an extremely positive step in the correct direction in terms of providing the types of information required to adequately assess and evaluate population and ESU viability. The lack of population spatial scale monitoring sites in Oregon is of great concern and increases the uncertainty when assessing viability. Additionally, it is evident that many independent populations are well below low-risk abundance targets, and several are likely below the high-risk depensation thresholds specified by the TRT and the Recovery Plan (NMFS 2014a). Though population-level estimates of abundance for most independent populations are lacking, it does not appear that any of the seven diversity strata currently supports a single viable population as defined by the TRT's viability criteria, although all diversity strata are occupied.

In addition to the implementation of population monitoring in California through the CMP, the implementation of Life-Cycle Monitoring stations is also an extremely positive development and will greatly contribute to estimating freshwater and marine survival,

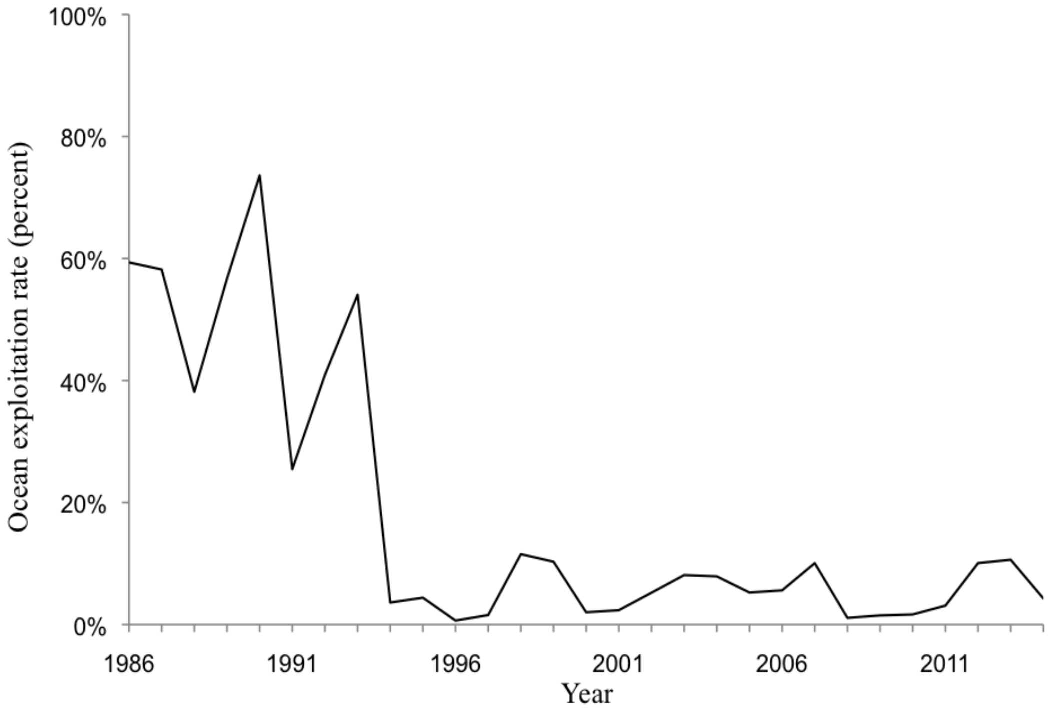

Figure 3.6. Natural-origin Rogue/Klamath coho salmon ocean exploitation rate estimates for years 1986 – 2014 (L. LaVoy and R. Kope, NMFS, personal communication). calibrating various sampling methods, and providing platforms for needed research to further develop appropriate conservation and recovery efforts.

The SONCC-Coho Salmon ESU is currently considered likely to become endangered. Of particular concern is the low number of adults counted entering the Shasta River in 2014–2015. The lack of increasing abundance trends across the ESU for the populations with adequate data are of concern. Moreover, the loss of population spatial scale estimates from coastal Oregon populations is of great concern. The new information available since Williams et al. (2011) while cause for concern, does not appear to suggest a change in extinction risk at this time.

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VIABILITY ASSESSMENT FOR PACIFIC SALMON AND STEELHEAD LISTED UNDER THE ENDANGERED SPECIES ACT: SOUTHWEST

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Individual sections (Recovery Domains) should be cited as follows:

Spence, B.C. 2016. North-Central California Coast Recovery Domain. Pages 32–82 *in* T.H. Williams, B.C. Spence, D.A. Boughton, R.C. Johnson, L.G. Crozier, N.J. Mantua, M.R. O'Farrell, and S.T. Lindley. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.