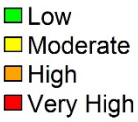
Oregon Coast coho

Overall vulnerability—Moderate (60% Moderate, 40% High)
Biological sensitivity—Moderate (58% Moderate, 42% High)
Climate exposure—High (6% Moderate, 94% High)
Adaptive capacity—Moderate (2.0)
Data quality—89% of scores ≥ 2

Oregon Coast Coho		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Early life history	1.8	2.8	
	Juvenile freshwater stage	3.1	2.8	
	Estuary stage	2.3	2.8	
	Marine stage	3	2.3	
	Adult freshwater stage	1.6	3	
	Cumulative life-cycle effects	2.1	2.3	
	Hatchery influence	1.3	2.8	
	Other stressors	2.6	2.8	
	Population viability	2.2	3	
	Ocean acidification sensitivity	1.9	1	
	Sensitivity Score	High		
Exposure variables	Stream temperature	3.2	2.8	
	Summer water deficit	2.7	2	
	Flooding	1.6	2	
	Hydrologic regime	1.3	3	
	Sea level rise	2	2	
	Sea surface temperature	2.8	2.5	
	Ocean acidification exposure	3.9	3	
	Upwelling	1.7	2	
	Ocean currents	1.9	1	
	Exposure Score	High		
Overall Vulnerability Rank		High		



Life History Synopsis

Oregon Coast coho salmon displays an ocean-maturing phenotype, with adults generally returning to spawn in freshwater tributaries from late September through January. This late run timing is especially characteristic of populations inhabiting large coastal lakes in the central coast (Ford et al. 2004). Fish tend to enter larger rivers earlier and may delay migration into smaller tributaries until precipitation and stream discharge is sufficient (Clark et al. 2014). Information on age at reproduction is summarized by Weitkamp et al. (1995). Females return predominately at age 3, whereas males may return at age 3 or ~age 2, after only 6 months at sea.

Eggs of Oregon Coast coho salmon incubate from October through March, and juveniles emerge throughout late winter and spring. Like other coho salmon in this region, most juveniles enter the ocean at age 1 (Weitkamp et al. 1995). Juveniles have been shown to make extensive use of estuary habitats when they are available (Wainwright and Weitkamp 2013). Females typically spend about 16 months at sea (Sandercock 1991), while male ocean residence time varies as indicated above.

Oregon coast coho salmon are widely distributed in marine waters. During the first summer, some individuals remain in local waters off the Oregon and Washington coasts, while others move rapidly northward along the continental shelf to Alaska (Morris et al. 2007, Van Doornik et al. 2007, Beamish et al. 2018). As maturing adults, fish from this DPS are caught in coastal fisheries from Vancouver Island to Monterrey Bay (Weitkamp and Neely 2002).

Climate Effects on Abundance and Distribution

In September, early returning adults may encounter seasonally warm temperatures or low flows that delay entry into spawning tributaries. However, Oregon Coast coho adults will typically hold in estuaries or larger rivers and rapidly ascend tributaries to spawn when conditions become suitable (Clark et al. 2014). Autumnal drops in stream temperature and increases in stream discharge improve conditions for adult migration as well as egg incubation. Thus, incubating eggs are unlikely to be exposed to excessively warm temperatures or desiccation.

Because juveniles typically spend at least one year in fresh water, they can be exposed to warm summer conditions or stress from low flows (Ebersole et al. 2009). In winter, exposure to floods may displace juveniles or reduce egg survival (Nickelson et al. 1992). Change in flood exposure is expected to be somewhat less for this DPS than for more southerly populations, which were projected to face larger changes in atmospheric rivers. ***High*** ranks for sensitivity in the *juvenile freshwater stage* and exposure to *stream temperature* made this a ***highly vulnerable life stage***. Exposures may vary significantly among major freshwater habitats where coho juveniles rear, including coastal dune lakes, coastal tributaries, and the Umpqua River—the only stream in this DPS that includes the Cascade Mountains within its catchment (Wainwright and Weitkamp 2013). The former two habitats frequently warm to levels that pose physiological or survival challenges to coho salmon, and also support a large contingent of nonnative warmwater fishes, which may have negative ecological effects (Sanderson et al. 2009). Declines in snowpack could have negative consequences for coho salmon in inland tributaries of the Umpqua River.

Though the quality of information is mixed regarding potential sensitivity of Oregon Coast coho salmon to climate change, it is certain that exposure to changing marine conditions will occur, for example, with high levels of *ocean acidification*. The importance of marine conditions to productivity (number and size of returning adults) was stressed by Wainwright and Weitkamp (2013), and scored ***high*** in this assessment However, data quality for these threats was limited.

Extrinsic Factors

Although production hatcheries were once more prevalent in this DPS, hatchery propagation has been significantly reduced to only three facilities (NMFS 2011). Accordingly, sensitivity to *hatchery influence* was ranked ***low***. Sensitivity to *other stressors* was ranked ***moderate***. Oregon Coast coho salmon is listed as threatened under the U.S. Endangered Species Act. However, it is considered to be at lower risk of extinction than other coho DPSs, and was scored ***low*** for *population viability*.

Adaptive Capacity

Adaptive capacity was ranked ***moderate*** for this DPS. It likely has a similar amount of flexibility in the juvenile rearing period as other coho. Adults are less constrained in freshwater entry timing than California coho, and thus could potentially respond temporally to changing environmental conditions.

Literature Cited

Much of the information here is summarized from a recent review of climate effects on Oregon Coast coho salmon by Wainwright and Weitkamp (Wainwright and Weitkamp 2013).

Beamish, R. J., L. A. Weitkamp, L. D. Shaul, and V. I. Radchenko. 2018. Ocean ecology of Coho Salmon. Pages 391-554 *in* R. J. Beamish, editor. The ocean ecology of Pacific salmon and trout. American Fisheries Society, Bethesda, MD.

Clark, S. M., J. B. Dunham, J. R. McEnroe, and S. W. Lightcap. 2014. Breeding site selection by coho salmon (*Oncorhynchus kisutch*) in relation to large wood additions and factors that influence reproductive success. Can J Fish Aquat Sci **71**:1498-1507.

Ebersole, J. L., M. E. Colvin, P. J. Wigington Jr, S. W. Lightcap, J. P. Baker, M. R. Church, J. E. Compton, and M. A. Cairns. 2009. Hierarchical modeling of late summer weight and summer abundance of juvenile coho salmon across a stream network. Trans Am Fish Soc **138**:1138-1156.

Ford, M. J., D. Teel, D. M. Van Doornik, and P. W. Lawson. 2004. Genetic population structure of central Oregon Coast coho salmon (*Oncorhynchus kisutch*). Conserv Genet **5**:797–812.

Morris, J. F. T., M. Trudel, M. E. Thiess, R. M. Seeting, J. Fisher, S. A. Hinton, E. Ferguson, J. A. Orsi, E. Farley, and D. W. Welch. 2007. Stock-specific migrations of juvenile Coho salmon derived from coded-wire tag recoveries on the continental shelf of western North America. Am Fish Soc Symp **57**:81–104.

Nickelson, T. E. R., J.D., S. L. Johnson, and M. F. Solazzi. 1992. Seasonal changes in habitat use by juvenile coho salmon (*Oncorhynchus kisutch*) in Oregon coastal streams. Can J Fish Aquat Sci **49**:783-789.

NMFS, National Marine Fisheries Service. 2011. Listing endangered and threatened species: threatened status for the Oregon Coast coho salmon evolutionarily significant unit. U.S. Department of Commerce Federal Register 50 CFR Part 223 Docket No. 110531311–1310–02, Silver Spring, MD.

Sandercock, F. K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*).*in* C. Groot and L. Margolis, editors. Pacific Salmon Life Histories. UBC, Press, Vancouver, BC, Canada.

Sanderson, B. L., K. A. Barnas, and A. M. W. Rub. 2009. Nonindigenous species of the Pacific Northwest: an overlooked risk to endangered salmon? BioScience **59**:245-256.

Van Doornik, D. M., D. J. Teel, D. R. Kuligowski, C. A. Morgan, and E. Casillas. 2007. Genetic analyses provide insight into the early ocean stock distribution and survival of juvenile Coho salmon off the coasts of Washington and Oregon. N Am J Fish Manage **27**:220-237.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of climate change on Oregon coast Coho salmon: Habitat and life-cycle interactions. Northwest Sci **87**:219-242.

Weitkamp, L., and K. Neely. 2002. Coho salmon (*Oncorhynchus kisutch*) ocean migration patterns: insight from marine coded-wire tag recoveries. Can J Fish Aquat Sci **59**:1100-1115.

Weitkamp, L. A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U.S. Dep Commerce NOAA Tech Memo NMFS NWFSC 24, Seattle, WA.