Coho salmon − *Oncorhynchus kisutch*

Overall Vulnerability Rank = Low

Biological Sensitivity = High

Climate Exposure = Low

Sensitivity Data Quality = 75% of scores ≥ 2

Exposure Data Quality = 64% of scores ≥ 2

| | *Oncorhynchus kisutch* | Expert Scores | Data Quality | Expert Scores Plots (Portion by Category) |
|---|---|---|---|---|
| Sensitivity attributes | Habitat Specificity | 2.8 | 2.5 | |
| | Prey Specificity | 1.6 | 2.8 | |
| | Adult Mobility | 1.2 | 2.5 | |
| | Dispersal of Early Life Stages | 3.8 | 2.5 | |
| | Early Life History Survival and Settlement Requirements | 3.0 | 2.0 | |
| | Complexity in Reproductive Strategy | 3.2 | 2.5 | |
| | Spawning Cycle | 4.0 | 2.8 | |
| | Sensitivity to Temperature | 2.1 | 2.2 | |
| | Sensitivity to Ocean Acidification | 2.0 | 1.8 | |
| | Population Growth Rate | 1.8 | 2.2 | |
| | Stock Size/Status | 2.2 | 1.8 | |
| | Other Stressors | 2.1 | 1.8 | |
| | Sensitivity Score | High | | |
| Exposure factors | Sea Surface Temperature | 1.9 | 2.5 | |
| | Sea Surface Temperature (variance) | 1.3 | 2.5 | |
| | Bottom Temperature | 2.0 | 2.5 | |
| | Bottom Temperature (variance) | 1.4 | 2.5 | |
| | Salinity | 1.4 | 2.0 | |
| | Salinity (variance) | 2.3 | 2.0 | |
| | Ocean Acidification | 4.0 | 2.5 | |
| | Ocean Acidification (variance) | 1.4 | 2.5 | |
| | Phytoplankton Biomass | 1.6 | 1.2 | |
| | Phytoplankton Biomass (variance) | 1.8 | 1.2 | |
| | Plankton Bloom Timing | 1.3 | 1.0 | |
| | Plankton Bloom Timing (variance) | 1.9 | 1.0 | |
| | Large Zooplankton Biomass | 1.5 | 1.0 | |
| | Large Zooplanton Biomass (variance) | 1.8 | 1.0 | |
| | Mixed Layer Depth | 1.4 | 1.0 | |
| | Mixed Layer Depth (variance) | 1.7 | 1.0 | |
| | Currents | NA | NA | |
| | Currents (variance) | NA | NA | |
| | Air Temperature | 1.9 | 2.5 | |
| | Air Temperature (variance) | 1.1 | 2.5 | |
| | Precipitation | 1.7 | 2.0 | |
| | Precipitation (variance) | 1.3 | 2.0 | |
| | Sea Surface Height | 1.3 | 2.5 | |
| | Sea Surface Height (variance) | 1.3 | 2.5 | |
| | Exposure Score | Low | | |
| | Overall Vulnerability Rank | Low | | |

Low
Moderate
High
Very High

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**Coho salmon (*Oncorhynchus kisutch*)**

Overall Climate Vulnerability Rank: **Low**. (86% certainty from bootstrap analysis).

Climate Exposure: **Low**. With the exception of ocean acidification (4.0), all exposure factors had scores less than 2.5.

Biological Sensitivity: **High**. Spawning cycle (4.0) and dispersal of early life stages (3.9) were ranked as "very high" sensitivity, and complexity in reproductive strategy (3.3) and early life history survival (3.1) were ranked as "high" sensitivity.

Potential for Distribution Change: **Low** (97% certainty from bootstrap analysis). Adult mobility indicated a very high potential for distribution change, whereas the remaining three distribution attributes indicated low potential for distribution change.

Directional Effect in the Eastern Bering Sea: Projected climate change in the eastern Bering Sea is expected to have a neutral effect on coho salmon, with a 92% certainty in expert scores.

Data Quality: 75% of the sensitivity attributes and 64% of the exposure factors had average data quality scores of 2 or greater (indicating at least "moderate" data quality).

Climate Effects on Abundance and Distribution:

Little is known on the environmental influences on stock productivity of western Alaska coho salmon.

Diets of juvenile coho salmon included more euphausiids in 2006, a cold year, and more pollock during warm years (2004-205) in the eastern Bering Sea (Farley et al. 2009). The quantity of eggs produced increased with body size of coho salmon (Salo and Bayliff 1958).

Timing of spawning migration of coho salmon to the Chignik River on the Alaska Peninsula was earlier with warmer sea temperatures (increased strength of the Pacific Decadal Oscillation index) (Walsworth and Schindler 2015). Upstream spawning migration normally occurs at water temperatures in the range of 7.2 - 15.6 °C, but also as low as 0.8 °C (Reiser and Bjornn 1979, Gribanov 1948).

Emergence from the gravel is a function of development rate, variation in activity, and environmental conditions (temperature, flow, oxygen) experienced by the egg and alevin (Quinn 2005). Alevins reside interspersed within the gravel of stream beds and prefer 2-10 cm substrate with < 15% fines (< 3.3 mm, optimum < 5% fines). Dissolved oxygen levels < 2 mg/l is lethal (optimum > 8 mg/l) (NPFMC 2010). Optimum freshwater temperature is 4.4-13.3 °C. Emergence is after 150 days at optimum temperatures.

The range of temperature tolerance (8.8° – 14.9°C) for juvenile coho salmon is also one of the highest and narrowest for Pacific salmon (Echave et al. 2012). The range of tolerance of salinity (20-32.2 ppt) was the broadest for Pacific salmon species. Maturing coho salmon prefer similar warmer temperatures (8.2° – 14.9°C) as juvenile coho salmon (Echave et al. 2012).

Life History Synopsis:

Coastal spawning populations of coho salmon in North America ranges from the San Lorenza River, California (37 ºN), to Norton Sound, Alaska (64 ºN) (Sandercock 1991). The eastern Bering Sea is used as a rearing habitat for juvenile and maturing coho salmon migrate and feed in the eastern Bering Sea on their way back to fresh water to spawn (Farley et al. 2009).

Coho salmon is a short-lived, anadromous, and semelparous species. Adult salmon spawn and incubate eggs in fresh water. After fry emerge from the gravel in spring, western Alaska coho salmon typically remain in fresh water for one winter. During their first year at sea, juvenile coho salmon rear in nearshore waters until late summer and then move south during the fall but return to the eastern Bering Sea the following year to their natal stream to spawn (Farley et al. 2009).

The peak seasonal spawning in Bristol Bay is August and September (July-November) and October (September-November) for Arctic-Yukon-Kuskokwim stocks. http://www.adfg.alaska.gov/index.cfm?adfg=fishingsportfishinginforuntiming.main .

Age at maturity is from 2 to 4 years for coho salmon, but they commonly mature after 3 years in western Alaska rivers (INPFC 1962).

Coho salmon are managed in-season at local area levels by the Alaska Department of Fish and Game. http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByArea.main&_ga=2.207693394.172348407.1523379747-1353484536.1523379747.

Commercial harvest of coho salmon in Norton Sound increased and was then relatively stable for the Bristol Bay and Kuskokwim regions from 1996 to 2015 (ADFG 2017, Poetter and Tiernan 2017). Total commercial harvest of coho salmon to western Alaska river systems was relatively stable from 1996 to 2015.

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