Hood Canal summer-run chum

Overall vulnerability—High (31% Moderate, 69% High)
Biological sensitivity—High (27% Moderate, 73% High)
Climate exposure—High (5% Moderate, 95% High)
Adaptive capacity—Moderate (1.7)
Data quality—84% of scores ≥ 2

Life History Synopsis

Adult migration begins in late summer for Hood Canal summer-run chum, with a relatively short migration to spawning grounds (<1-60 km). Adults spawn in both large and small river systems, and therefore have access to a broad array of habitats that support spawning. Chum salmon typically spawn in the lower reaches of rivers and in side channels and riffles. Eggs incubate in late summer and fall, when temperatures may approach stressful thresholds. High fall river flows increase bed load sediment, which may lead to scouring of redds. Juveniles enter the ocean during their first spring as fry or subyearlings, spending up to one month in fresh water. The short period of freshwater rearing occurs during winter months when temperature variation is low. In late winter, juvenile chum can spend up to one month in estuarine shallow waters (all salinity zones) before moving to the ocean. After leaving estuaries, juveniles may
exhibit extended residency within Puget Sound before migrating, and may even overwinter in the sound (Salo 1991, Johnson et al. 1997). Juveniles in the ocean move northward along nearshore areas to Alaska.

Chum salmon eat a wider variety of prey than other Pacific salmon species (Davis et al. 2009), which might confer greater resiliency on this species in confronting impending ecosystem transitions. Chum salmon are micronectivores, zooplanktivores, and piscivores. In general, North American chum undergo extensive ocean migrations into the Gulf of Alaska and subarctic North Pacific Ocean (Urawa et al. 2018), with an absolute thermal range of 0-15.6°C for all seasons, and frequently observed ranges of 1-13°C during spring to fall and 1.5-10°C during winter (Abdul-Aziz et al. 2011). Due to lack of extensive marking efforts, less is known of Hood Canal summer chum salmon ocean distribution.

Age at maturity is highly variable (typically 3, 4, and 5 years). Adults may aggregate in estuaries near river mouths for up to one month prior to upstream migration, and warm temperatures or hypoxia at this time may be stressful.

**Climate Effects on Abundance and Distribution**

A relatively small number of studies have examined the effect of climate factors on the abundance, distribution, or productivity of West Coast chum salmon. Eaton and Scheller (1996) found a maximum weekly average upper thermal tolerance for chum salmon of 21°C. Early marine climate signals such as coastal sea surface temperature and PDO explain a small proportion of the variation in total productivity variations for Washington and West Coast Vancouver Island chum salmon. Increased productivity is associated with warmer coastal SSTs (and positive PDO) a few months prior to and during the early marine period (Mueter et al. 2005). Accordingly, sensitivity in the marine stage was ranked low.

Mantua et al. (2010) suggested that the unique life history of Hood Canal Summer chum makes this DPS especially vulnerable to the climate change impacts because they spawn in small shallow streams in late summer, eggs incubate in the fall and early winter, and fry migrate to sea in late winter. Sensitivity during the adult freshwater stage and the early life history was ranked moderate. Predicted climate change effects for the low-elevation Hood Canal streams historically used by summer chum salmon include multiple negative impacts stemming from warmer water temperatures and reduced streamflow in summer, and the potential for increased redd-scouring from peak flow magnitudes in fall and winter. Exposure for stream temperature and summer water deficit were both ranked high, largely due to effects on returning adults and hatched fry. Likewise, sensitivity to cumulative life-cycle effects was ranked high.

Abdul-Aziz et al. (2011) developed spatially explicit representations for open ocean thermal habitat for chum salmon, finding that under a multimodel ensemble average of climate model outputs using the A1B emissions scenario, summer habitat area for chum salmon declined by 29% for the 2080s, with the largest habitat losses in the eastern half of the Gulf of Alaska. Wintertime habitat area losses were 19%, with reductions at the southern end of the historical
range offset somewhat by habitat area gains in the southern Bering Sea. Whether a general northward and westward displacement of the most frequently observed thermal open ocean habitat will have substantial impacts on the life-cycle productivity or spawning distribution of chum salmon is unknown. However, it seems likely that West Coast chum salmon populations are vulnerable to the projected displacement of high seas thermal habitat. Sensitivity in the marine stage was ranked low, but exposure to mean sea surface temperature was ranked moderate.

Juvenile chum consume crustaceans, including amphipods and copepods, which may be impacted by ocean acidification. However, chum is known to consume jellyfish (Arai et al. 2003), which might be more resilient to OA than crustaceans. Jellyfish become more abundant in warmer years and may offer food sources to juvenile chum that are not taken advantage of by other species. Puget Sound chum salmon appear to compete with pink salmon, so climate effects on pink will indirectly affect chum (Ruggerone and Nielsen 2004, Greene et al. 2015).

**Extrinsic Factors**

Hood Canal summer-run chum salmon is listed as threatened under the U.S. Endangered Species Act, and a 2011 status review update suggested further declines in some populations (Ford et al. 2011). Sensitivity for population viability was ranked high. Hatchery influence and other stressors were ranked low.

**Adaptive Capacity**

Adaptive capacity for Summer run Hood Canal chum salmon ranked moderate.

**Literature Cited**


