Migratory behavior and distribution of Pacific halibut

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PURPOSE

To provide the RAB with a description of the studies designed to improve our knowledge on distribution and migration of Pacific halibut in the northeast Pacific Ocean and eastern Bering Sea.

BACKGROUND

The IPHC is currently investigating Pacific halibut distribution and migration at early and juvenile life-stages.

Unlike juvenile Pacific halibut which are demersal, larvae are pelagic for approximately the first six months of life and are distributed largely based on where they originated (i.e. where they were spawned) and where the currents carry them during their pelagic life stage. Of interest to the IPHC Secretariat is the connectivity of larvae to nursery areas, particularly for larvae spawned in the Gulf of Alaska that settle in the Bering Sea, as well between the eastern and western sides of each basin, and the environmental drivers that may affect the magnitude of this connectivity. Also of interest are the geographic differences in larval dispersal and distribution of settled Pacific halibut related to environmental conditions. For example, it has been established that the counter-clockwise Alaska Coastal Current in the Gulf of Alaska flows into the Bering Sea via Aleutian Island passes, primarily Unimak Pass. The IPHC does not conduct larval surveys, but National Oceanic and Atmospheric Administration (NOAA) icthyoplankton (larval) surveys are conducted annually, and IPHC teamed with NOAA to examine these data spanning from 1972 to 2015 and model possible dispersal pathways, both at the larval and early demersal stages.

DISCUSSION

The research project investigating larval and juvenile connectivity between the Gulf of Alaska (GOA) and Bering Sea (BS), in cooperation with NOAA EcoFOCI, used two recently developed modeling approaches to estimate dispersal and migration pathways of larval and young juvenile Pacific halibut in order to better understand the connectivity of populations between the GOA and BS and within each of these two ocean basins. The first of these two models was a combination physical oceanography and larval recruitment model and the second model was a spatio-temporal model. Results from the larval recruitment model indicate that the Aleutian Islands constrain connectivity between GOA and BS, but that large island passes serve as pathways between these ecosystems. The degree of connectivity between GOA and BS is influenced by spawning location such that up to 50-60% of simulated larvae from the westernmost GOA spawning location arrive in the BS with progressively fewer larvae arriving proportional to distance from spawning grounds further east. There is also a large degree of connectivity between eastern and western GOA and between eastern and western BS. Spatial modeling of 2-6 year old fish shows ontogenetic migration from the inshore settlement areas of

eastern BS towards Unimak Pass and GOA by age 4. The pattern of larval dispersal from GOA to BS, and subsequent post-settlement migrations back from BS toward GOA, provides evidence of circular, multiple life-stage, connectivity between these ecosystems, regardless of temperature stanza or year class strength. The study showed annual variations in dispersal, but there was no clear signal between warm and cold stanza years identified. The results of these studies will improve estimates of productivity by contributing to the generation of potential recruitment covariates and by informing minimum spawning biomass targets by Biological Region. In addition, these results will assist in the biological parameterization and validation of movement estimates in the MSE Operating Model (Appendix I). The results of this study have been published in the journal *Fisheries Oceanography* (Sadorus et al., 2021).

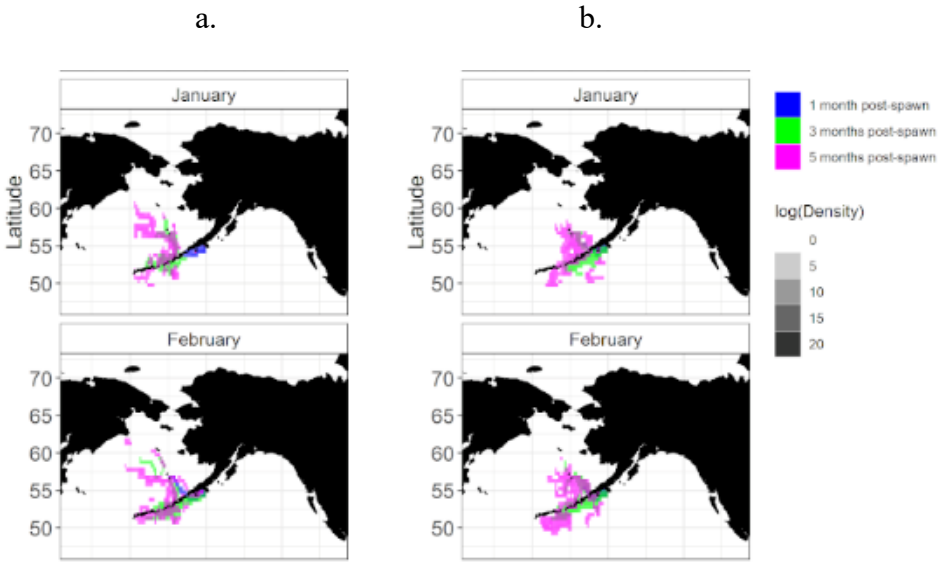

Figure 1. A sample of larval advection modelling results for Pacific halibut spawned in January (top) or February (bottom) in the western Gulf of Alaska during a) 2005 (a warm year) and b) 2009 (a cold year).

RECOMMENDATION

That the RAB:

1) **NOTE** paper IPHC-2021-RAB022-09, which described studies designed to improve our knowledge on Pacific halibut connectivity at early and juvenile stages.