Tues 10:00

Winter phytoplankton isoscapes in the Gulf of Alaska: decoding Pacific salmon ecosystems on the high seas

Moronke K. Harris[1], Anna Vazhova[2], Mark Saunders[1], Vladimir Radchenko[1], Evgeny A. Pakhomov[3], and Brian P. V. Hunt[3]

[1]North Pacific Anadromous Fish Commission, 502-889 West Pender Street, Vancouver, BC V6C 3B2, Canada (Email: mharris@npafc.org; Tel: 647-523-3170)
[2]Pacific Branch of the Russian Federal Research Institute of Fisheries and Oceanography (TINRO), Shevchenko 4, Vladivostok, 690950, Russia
[3]University of British Columbia, Institute for the Oceans and Fisheries, 2202 Main Mall, Vancouver, BC V6T 1Z4, Canada (Email: b.hunt@oceans.ubc.ca; Tel: 778-230-4776)

Approximately 55 million Pacific salmon inhabit the Gulf of Alaska (GoA) during winter. Despite the importance of this region, the high seas phase of salmon life history remains poorly understood. The current lack of baseline data on the environmental conditions experienced by overwintering salmonids adds uncertainty to the already challenging task of determining potential implications of climate impacts on ocean productivity for salmon condition and reproductive success in a changing Pacific ecosystem. Plankton stable isotopes (SI; δ13C and δ15N), influenced by nutrients, community composition and physical oceanographic variables, can be used to determine the linkages between bottom-up changes in the abundance and composition of primary producers and consumers that cascade through ecosystems. Isocapes, geographic distributions of SI, have recently been developed for the northeast Pacific based on the relationship between zooplankton isotopes from Continuous Plankton Recorder samples and satellite data. These models demonstrate a strong relationship between isotope values and ocean temperature and productivity, offering a valuable tool for predicting the food web productivity experienced by salmon on the high seas. However, the isoscape models have yet to be evaluated against in situ measurements. As the first comprehensive winter expedition examining factors affecting Pacific salmon in the GoA, the 2019 International GoA Expedition successfully established a baseline of environmental and ecosystem-level measurements for future comparisons. Here, we used carbon and nitrogen SI from phytoplankton collected during the 2019 Expedition to reconstruct aspects of the marine environment experienced by Pacific salmon during the overwintering period of their life cycle within the high seas. Filtered Niskin rosette water samples were collected from the sea surface (~2 m depth) at every grid station (n = 56) to: (i) provide a GoA isotope baseline for application in ocean productivity and trophic studies, (ii) identify spatial variation in isotope signatures that can be used to trace salmon foraging locations and migration and (iii) validate existing predictive models for GoA isoscapes. These high spatial resolution phytoplankton measurements are able to be directly compared to salmon isotope values also collected in situ. Salmon abundance is affected by the abundance and species composition of lower tropic levels. Thus, understanding drivers of lower trophic level variation is essential for understanding cascading changes throughout the high seas ecosystem.