Nearshore Fish Community Composition Along a Gradient of Glacial Influence in Southeast and Southcentral Alaska

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Introduction

Alaska is on the front lines of climate-driven ecological change. Climate models predict increased temperature and precipitation for the Southeast and Southcentral regions of Alaska (Kunkel et al. 2017), which may impact important ecosystems like estuaries downstream of glaciers. By examining the nearshore fish community composition of estuaries that fall along a gradient of glacial watersheds, from 0% glaciated to 60% glaciated, we may be able to draw conclusions about the future impacts of climate change on Alaska's fisheries and ecosystems. The objectives of this study were to:

1) Describe and compare nearshore fish community composition across a gradient of glacial influence in two regions of the Gulf of Alaska (Southeast and Southcentral), and
2) Evaluate seasonal trends in fish diversity and abundance in Lynn Canal and Kachemak Bay.

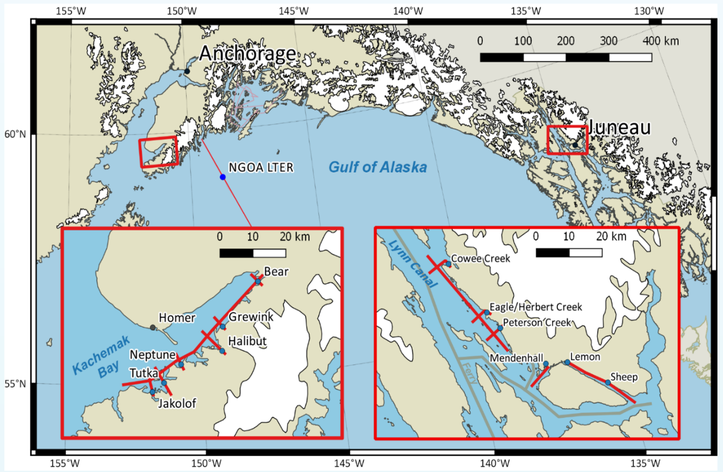

Figure 1: Study regions and sites. Red boxes are (l to r) Kachemak Bay and Lynn Canal. Red lines are routes for airborne data collection, blue dots are ground sampling sites in estuaries. Map courtesy of the Fire and Ice leadership team.

Methods

- Community data were collected during the negative low tide April-September 2019 at ten sites: five estuaries in Lynn Canal and five estuaries in Kachemak Bay (Figure 1).
- Fish were captured using a 50ft x 8ft beach seine (mesh size 0.5 in).
- Fish were identified, measured, and released. Juvenile coho salmon were retained for gut content analysis.
- Water sensors were deployed and collected each month to continuously measure temperature, salinity, dissolved oxygen, light, and depth.
- Community composition was analyzed using non-metric multidimensional scaling with the R package vegan (Oksanen et al. 2019).

Results

- Fish community composition showed the greatest variation between regions
- Sites within Kachemak Bay had greater differences in community composition than sites within Lynn Canal.
- Catch-per-unit-effort (CPUE) was largest in both regions in the middle of the summer and tapered at the beginning and end of the sampling season.

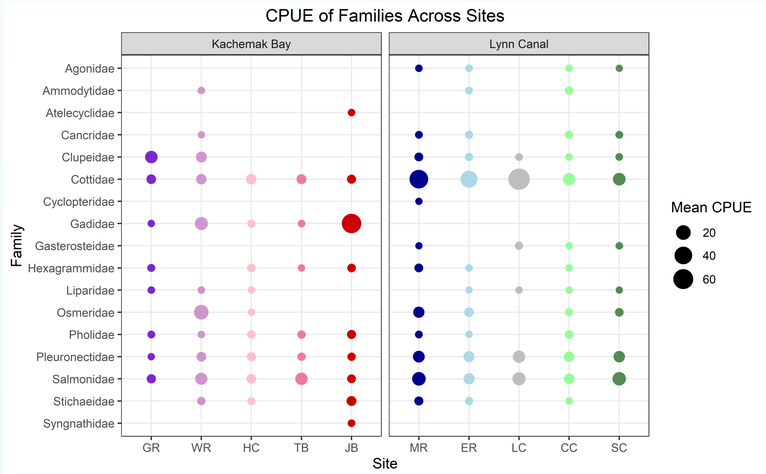

Figure 2: Mean CPUE (fish/minute) for entire sampling season of families across sites.

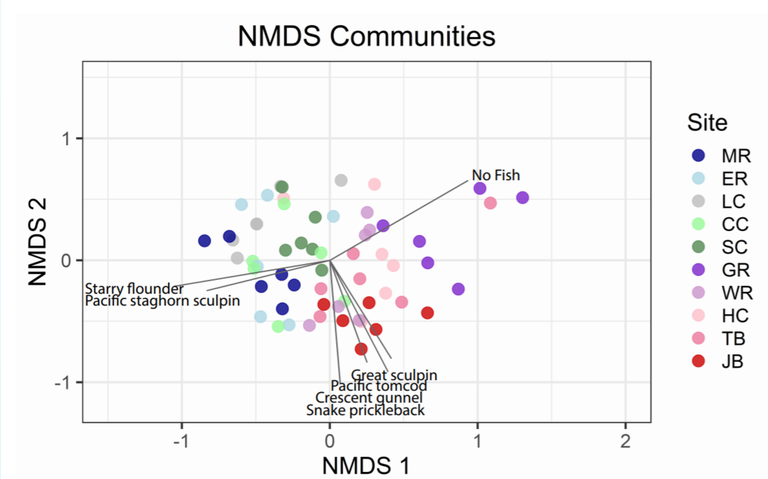

Figure 3: NMDS for communities based on entire sampling season. Warm colors correspond with Kachemak Bay sites and cool colors correspond with Lynn Canal sites.

References

Stewart, B., K. Kunkel, S. Champion, R. Frankson, L. Stevens, and G. Wendler, 2017: Alaska State Climate Summary. *NOAA Technical Report NESDIS 149-AK*, 4 pp..
Oksanen, A. J., Blanchet, F. G., Friendly, M., Kindt, R., Legendre, P., Mcglinn, D., … Szoecs, E. (2019). Package ' vegan .'

Conclusion and Next Steps

The primary sources of variation in community composition from Year 1 are regional differences in fish species and differences in habitat type. With analysis of the water quality data we will be able to detect seasonal and site-based trends in water chemistry that may be drivers of fish community composition within regions. Year 2 sampling will begin in April 2020.

This study is part of the Alaska EPSCoR Fire and Ice project that is investigating climate-driven ecological change in Alaska's boreal forest and nearshore coastal ecosystems. A central goal of the coastal research efforts is to quantify how physical and chemical properties of glaciated watersheds influence ecological community structure in the nearshore marine environment.


Photo Credit: Maggie Chan


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