Spatio-temporal variation in the nearshore forage fish community in the Strait of Juan de Fuca

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Spatio-temporal variation in the nearshore forage fish community in the Strait of Juan de Fuca

Kinsey Frick¹, Anna Kagley¹, Kurt Fresh¹, Larry Ward², Jameal Samhouri¹, A. Ole Shelton¹

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Elwha River dam removals
Goals

Assess monthly, inter-annual, and spatial variability in forage fish abundance and community composition.

Examine the effects of habitat change on nearshore fish following removal of the Elwha River dams.
Methods

Beach seine at 23 sites April – September (6 months)

Identify and count all fish, measure 20 of each species
Forage Fish dominate Elwha, Port Angeles, Green Point, and Sequim.
Regional Size Class Contributions

**Surf Smelt**
- Sequim
- Green Point
- Port Angeles
- Elwha

**Pacific Sand Lance**
- Sequim
- Green Point
- Port Angeles
- Elwha

**Pacific Herring**
- Sequim
- Green Point
- Port Angeles
- Elwha

Legend:
- Adult >120
- Juvenile 50-120
- Post-larval <50
Separating Signal from Noise
Build a Model

• Bayesian hierarchical modeling framework
  – Explore effects of temporal and spatial variability on forage fish abundance and community composition
  – Model includes: year, month, site, status relative to dam removal
Annual and seasonal variability in probability of occurrence

Species
- Pacific herring
- Pacific sand lance
- Surf smelt

- Logit probability of occurrence
- Year: 2006 to 2016
- Month: April to September
Predicted Occurrence Before and After Removal of the Elwha Dam
Results/Conclusions

• We catch a LOT of fish. Catch is highly variable.
  – 45-55 species/year, 23-93K individuals
  – Forage fish dominate: >82% of individuals caught
    • Big 3 species: Surf Smelt, Pacific Sand Lance, Pacific Herring
    • More prevalence of other FF species when these decline

• Following dam removal:
  – Surf smelt abundance increased, particularly adults, but surf smelt increased everywhere
  – Moderate increases in occurrence for other species in Elwha region only
    • sample-limited with this modeling approach
Next Steps

• Develop a model that will better accommodate missing/patchy data so we can analyze effects on more species.
  – Apply to salmonids using this model

• Incorporate environmental variables into more sophisticated model.

• Expand to explore forage fish populations in the Salish Sea. Collaborate with others to examine the relatedness of individuals caught in different places using:
  – Genetics
  – Stable isotope analyses
It takes an army.

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