Variation in abundance and condition of juvenile chum salmon (*Oncorhynchus keta*) in response to marine factors in Southeast Alaska

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Background

- Chum salmon returns are highly variable in Southeast Alaska. As an important commercial fishery, further explanation of mechanisms affecting chum salmon survival is needed.
- Juvenile chum salmon experience high mortality rates during early marine residency when migrating offshore.
- Marine factors that juvenile salmon encounter during offshore migrations may influence condition and marine survival.

Objectives

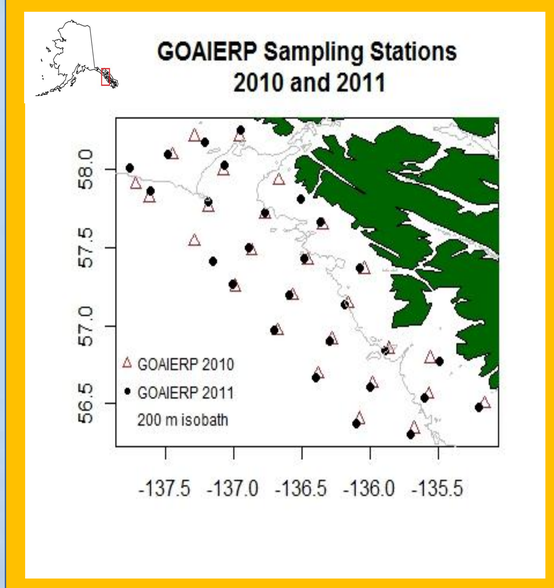
- Evaluate stock-of-origin differences in juvenile chum salmon abundance and condition.
- Evaluate inter-annual differences in juvenile chum salmon condition.
- Describe the relationship between juvenile chum salmon abundance and condition and environmental variables.
- Identify environmental correlates that will help develop hypotheses regarding stock-specific juvenile chum salmon abundance and condition.

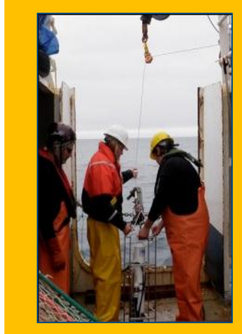
Methods

- The Gulf of Alaska Integrated Research Project (GOAIERP) sampled stations offshore in the Eastern Gulf of Alaska (EGOA) in 2010 and 2011 collecting juvenile chum salmon and biophysical data.

- Fish were collected using a surface trawl targeting top 20 meters of water for 30 minutes at each station.

- Vertical profiles of water properties to within 10 m from the bottom were collected using a Seabird 911*Plus* CTD.

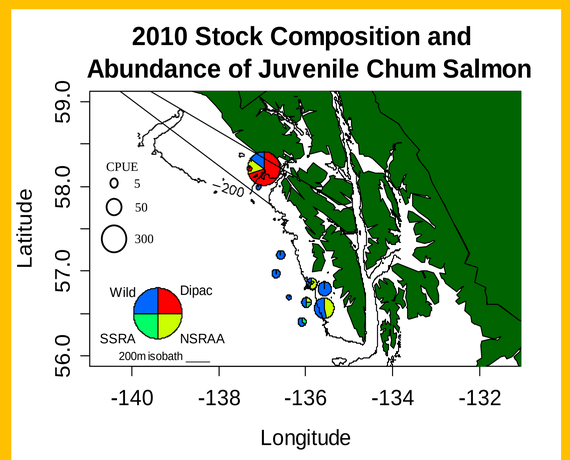


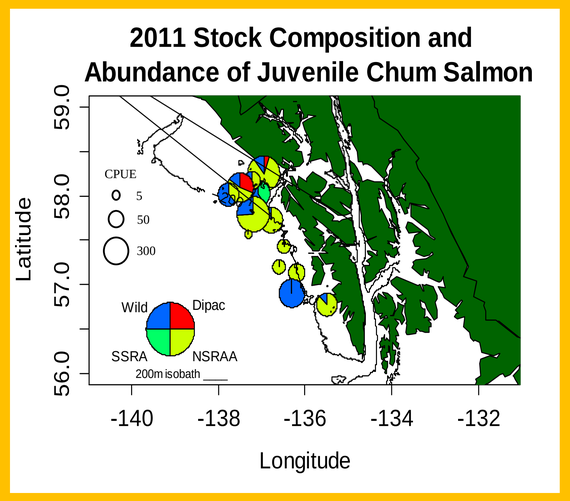


Distribution and Abundance

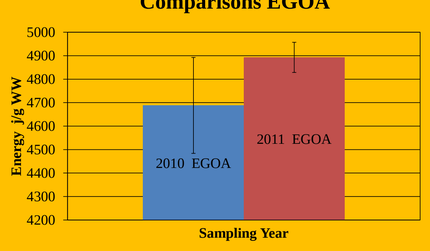
During the 2010 survey, juvenile chum salmon were distributed across the shelf near areas of outmigration from Southeast. The 2011 survey found juvenile chum mostly in the northern stations. **In both sampling years juvenile chum salmon were more abundant at stations sampled later in July.**

Overall abundance (CPUE) in 2011 was less than 2010 after accounting for differences in trawl sampling effort**.** Hatchery populations (DIPAC, NSRAA and SSRAA) were more abundant in 2011 than the wild stocks. The only population that was not more abundant in 2011, was the hatchery stock, DIPAC. Possible stock-specific abundance differences could be due to the temporal differences in the 2010 and 2011 surveys.



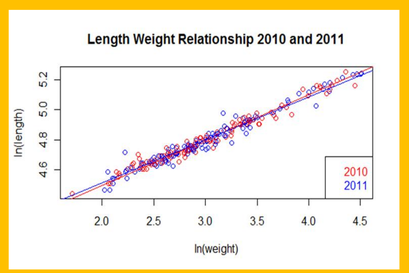


Condition



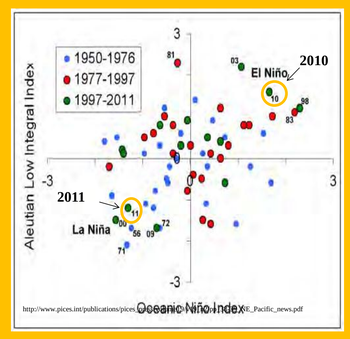
There is an inter-annual difference in juvenile chum salmon energy values in the EGOA. In 2011, juvenile chum salmon have better overall condition based on energy content values. There was greater variability in energy values in 2010 than in 2011.

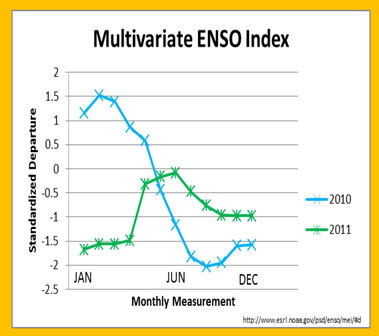
On average, juvenile chum salmon were longer in 2011 (mean FL=124.09, SE=2.26) than 2010 (mean FL=121.6, SE=2.03). However, there is not a clear indication that there is an inter-annual difference in the overall size of juvenile chum salmon when considering the length weight relationship.



Factors Affecting Condition

The Aleutian Low Integral Index, measuring the Aleutian Low pressure system, characterized 2010 as a weak El Nino and 2011, which had an anomalously cold winter, a weak La Nina. This corresponds to the multivariate ENSO index (MEI), a basin scale variable that integrates El Nino and La Nina events with variables associated in the coupled ocean-atmosphere system. The winter of 2010 was warm dropping drastically through the summer to a cold fall. While in 2011, the winter was anomalously cold but the temperature quickly increased in the summer.





Sea surface temperatures were measured in the EGOA in July of 2010 and 2011. Average sea surface temperatures were significantly different between 2010 (11.70°C; SD=0.39) and 2011 (12.59 °C ; SD=1.25) with the **summer of 2011 being warmer than 2010**.

Summary

The abundance and condition varied greatly as did the thermal regime in 2010 and 2011. Juvenile chum salmon had higher energy content and were larger in 2011 when the preceding winter was anomalously cold, but decreased abundance (CPUE) compared to 2010. These observations suggest that biological and physical mechanisms affect the response of juvenile chum salmon condition and abundance in northern Southeast Alaska. Future work will use regression models to examine the relationship between environmental variables and juvenile chum salmon condition in the nearshore environment using a time series (1997 – 2011) from northern Southeast Alaska.

Implications

Findings from this study may provide a better understanding of the relationship between environmental variation and the early marine residency of juvenile chum salmon in Southeast Alaska. Identifying the early marine mechanisms that affect growth and eventual recruitment will provide a local ecosystem metric in order to improve management actions for hatchery and wild chum salmon and in effect be a critical management tool for salmon fisheries of Southeast Alaska.

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