Introduction:

- A series of replicate (spring/summer/fall) acoustic surveys was conducted in 10 bays on the outer coast of Southeast Alaska and the Kodiak Island/Kenai Peninsula area as part of the Gulf of Alaska Integrated Ecosystem Research Program (GOAIERP).
- The goals of this ongoing work were to establish seasonal patterns of habitat use by forage fishes in inshore areas, make regional comparisons, and establish habitat associations.

Methods:

- An acoustic survey was conducted in each bay using a 38/120 kHz echosounder deployed on a tow body from a 50-70' chartered vessel.
- Efforts were made to identify acoustic scatters using jigs, a camera, a gillnet, and a small midwater trawl.
- A dual-frequency technique was applied to classify backscatter as consistent with that from fish and zooplankton.

Acoustic classification:

Backscatter from fish with swim bladders can be distinguished from zooplankton backscatter using a dual-frequency technique. Backscatter in a 50kHz range on 120kHz was assigned to plankton.

Examples of fish backscatter

Fish backscatter varied substantially among bays, with higher observations in deeper parts of the bays. Jigging proved to be the most effective method for capturing fish, as the vessels could not tow a trawl fast enough. Aggregations of herring, pollock, and rockfish were identified, but much of the backscatter could not be identified to species.

Backscatter varies by bay and season

Mean backscatter consistent with fish (upper panel) and zooplankton (lower panel) at each site. The sites (see map above) are displayed in increasing longitude (i.e. from EGOA to CGOA). Observations from a 2010 pilot study in the EGOA are included.

Backscatter increases with seafloor depth

Box plots of the distribution of vertically integrated backscatter consistent with fish (left) and zooplankton (right) as a function of seafloor depth. The box plots show the median, interquartile range, and the extreme observations. Although some of the highest observations of fish backscatter were observed in relatively shallow water (dense herring schools resulted in very high values > 100 m), median acoustic abundance of fish and zooplankton increased 10 fold (i.e. 1.5 orders of magnitude) between 20 and 200 m.

A dense aggregation of age-0 capelin was observed in fall 2010 in the Barren Islands

An extensive aggregation of juvenile capelin was observed acoustically and sampled with trawls between Kodiak and the Kenai Peninsula (Barren Islands) during a pilot study in fall 2010.

Water depth is more predictive of fish and zooplankton backscatter than season, bay, or region

Approach: We fit the generalized additive model

\[ \log(abundance) = f(depth) + f(season) + f(site) + \text{error} \]

Effects on fish abundance

Additive effects of covariates on acoustic backscatter from fitting a preliminary generalized additive model on fish (upper panel) and zooplankton (lower panel) backscatter. Effects of seafloor depth, season, and study site are shown. The units of the y axis are the additive effect on \( \log(abundance) \) i.e., a 1 unit change represents a 10 fold change in acoustic backscatter. The increase in abundance with depth appears to have the largest effect on mean abundance.

Effects on zooplankton abundance

Preliminary observations:

- There is a strong gradient in fish and zooplankton abundance in inshore bays in the GOA, with higher abundance in deeper water.
- A large aggregation of juvenile capelin was observed in the Barren Islands between Kodiak and the Kenai Peninsula.
- Water depth is more predictive of fish and zooplankton backscatter than season, bay, or region (EGOA vs. CGOA).
- Zooplankton backscatter tends to be higher in the spring than later in the year.

What’s next?

- Surveys in summer/spring/fall of 2013 with more fishing effort and camera drops to identify acoustic scatters.
- Comparison with acoustics from offshore GOAIERP cruises.
- Examination of fish abundance in relation to bottom type.

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This page contains information that was not directly published and contains descriptions of the observations to explore the relative importance of depth, season, and site on acoustic abundance.