Occurrence of Arctic and saffron cod in the diet of ringed seals at Shishmaref, 1975–2016

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Overview

A warming climate is expected to alter the marine food web by favoring species of fish that prefer warmer water to the detriment of those that favor cooler water. We used diet data from a long-term study of ringed seals (*Pusa hispida*) to investigate trends in the occurrence and size of the two most common fish found in their stomachs in Alaskan waters, Arctic cod (*Boreogadus saida*) and saffron cod (*Eleginus gracilis*). Arctic cod are strongly associated with sea ice and cooler waters, and may be displaced by saffron cod, which prefer warmer water and may become more prominent in ringed seal diet.

Methods

- Stomachs from 127 ringed seals collected by subsistence hunters at Shishmaref, Alaska between 2013–2016 were examined for diet. Canine teeth were collected and aged. Seals were separated by age class as pups (<1 yr. old) and non-pups (>1 yr. old).
- Stomach contents were rinsed, and prey items were identified to the lowest taxonomic level.

- Fish were identified by their species-unique otolith shape.
- Each fish has two otoliths, one on the right and one of the left side of its head. Otoliths were separated by side.

- For each fish species, the side with the greatest number of otoliths was counted, photographed, and measured (from rostrum to postrostrum) using a Leica M125 stereo microscope and MU1000 AmScope.

Arctic cod

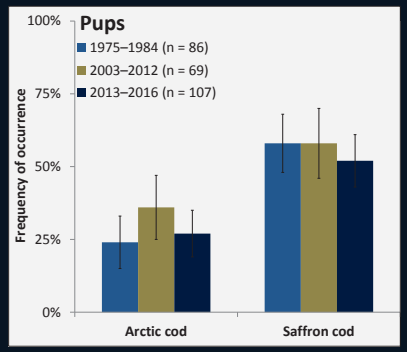
Arctic cod left otolith 10X

Saffron cod

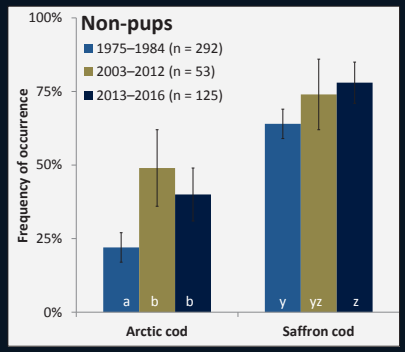
Saffron cod left otolith 10X

Frequency of occurrence

Frequency of occurrence (FO) was calculated by dividing the number of stomachs containing each cod species, by the number of stomachs containing any prey item. Frequencies during 2013–2016 were compared to frequencies during 1975–1984 and 2003–2012 (Crawford et al. 2015).



The FO of Arctic and saffron cod remained relatively constant over time for pups.



The FO of Arctic and saffron cod increased over time for non-pups. Significant differences within fish species are indicated on graph with different letter labels ($p<0.05$).

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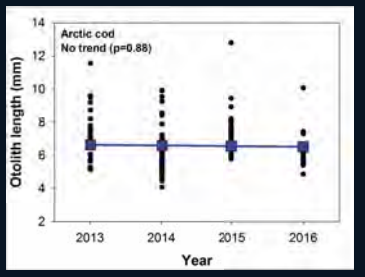
References

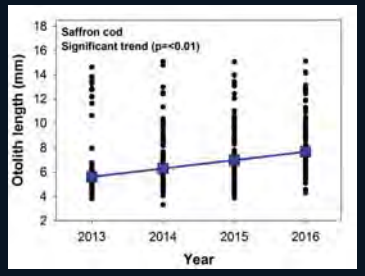
Crawford JA, Quakenbush LT, Citta JJ. 2015. A comparison of ringed and bearded seal diet condition and productivity between historical (1975-1984) and recent (2003-2012) periods in the Alaskan Bering and Chukchi seas. Progress in Oceanography 136: 133-150.

Otolith length

Otolith lengths were compared by age of seal and year of harvest. No difference in otolith length was found by seal age; therefore, we pooled ages.



Average length of Arctic cod otoliths did not change over time.



Average length of saffron cod otoliths increased significantly over time.

Conclusion

- The occurrence of Arctic cod in the diet of non-pups was lower during 1975–1984 than during either of the two more recent time periods.
- The trend towards more and larger saffron cod in seal stomachs may indicate environmental conditions are improving for saffron cod.
- Continued monitoring is needed to detect changes in the occurrence and size of prey species.

Next steps

❖ Examine ringed seal stomachs from 2018 for the presence of Arctic cod. Fish surveys from 2018 indicate lower presence of Arctic cod and we want to see if that is reflected in the diet.

❖ Collect fish of size classes that are consumed by seals. Use these to develop length regressions that more accurately represent the size of fish consumed by seals.