Comparing the diets of three abundant fishes across the Chukchi and Beaufort seas

Gray, B. P., and Norcross, B. L., University of Alaska Fairbanks, School of Fisheries and Ocean Sciences

Introduction

- Arctic cod (Boreogadus saida), Arctic staghorn sculpin (Gymnocanthus tricuspid), and shorthorn sculpin (Myoxocephalus scorpius) are abundant fishes in the Arctic.
- Each species is important to the higher trophic levels (marine mammals, sea birds, and other fishes).
- In the past 15 years, little information has been published regarding the diets of these three species.
- No information has been published comparing the diets of these species across the Chukchi and Beaufort Seas.
- Furthermore, no research has been conducted on shorthorn sculpin diet in either of these seas.
- Without documenting the present relationships between these three species and their prey over large spatial scales, it will be impossible to fully account for the effects of climate change on trophic interactions in arctic marine food webs.
- The objective of this research was to compare the diets of each species across the Chukchi and Beaufort seas over a panel of years (2010–2012) to determine if similar species from either sea showed different patterns in prey selection.

Fish collections

- Fishes for stomach contents analysis were collected August–September of 2010–2012 across stations in the Chukchi and Beaufort seas.
- Chukchi cruises included: AKCH10-11 and Arctic EIS12. Beaufort11 was the only Beaufort cruise.
- Fishes were collected using a plumb staff beam trawl and an otter trawl.

Laboratory methods

- Stomachs are excised and placed in a small petri dish.
- Prey are examined using a dissection microscope.
- Prey are identified to the lowest taxonomic level.

Diet Analysis

- Diets were analyzed using percent weight (%W), percent occurrence (%O), and prey-specific abundance (Ψ).

\[
\begin{align*}
\%W_i &= \frac{W_i}{\sum W_i} \times 100 \\
\%O_i &= \frac{O_i}{\sum O_i} \times 100 \\
\Psi_i &= \frac{N_i}{S_i} \times 100
\end{align*}
\]

- W_i = Weight of prey i
- O_i = Occurrence of prey i
- N_i = Sum of all non-empty stomachs
- S_i = Sum of all prey weights in only stomachs containing prey i

Results: Prey-specific abundance

- Figures 1–6: %W figures for each species over both seas by 10 mm size bins.
- Figure 7: Schematic showing how to interpret the prey-specific abundance figures.
- Figures 8–13: Prey-specific abundance figures for each population of species over both seas.

Conclusions

- Diets of these fishes differed by species and size class across the Chukchi and Beaufort seas.
- However, when looking at populations as a whole, fish species consumed many of the same prey groups over both seas but in differing amounts.
- Calanoid copepods (mainly Calanus sp.) dominated the diets of Arctic cod in both seas. Also, a decline in copepod consumption was noticed across both seas as body size increased.
- Gammarid amphipods dominated the diets of Arctic staghorn sculpins in the Chukchi Sea, while a more generalized diet, mainly composed of gammarids and polychaetes, was noticed in the Beaufort Sea.
- Hyperid amphipods (mostly Themisto sp.) were the dominant prey of shorthorn sculpin in the Beaufort Sea while diets in the Chukchi Sea were more generalized.
- Documentation of these present relationships will allow for monitoring the effects of climate change on Arctic marine food webs.

Literature cited