Cook Inlet Beluga Whale Diet Using Stable Isotope Analysis

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Introduction

Determining whether changes have occurred in the diet of endangered Cook Inlet beluga whales (*Delphinapterus leucas*) is important for understanding whether diet was a factor in the population decline or is currently a factor in its recovery. Using bone from the skulls of Cook Inlet beluga whales, we determined the $\delta^{15}N$ and $\delta^{13}C$ isotope signatures for 23 belugas collected between 1965 and 2007. We also determined the isotope signatures of prey species found in stranded beluga stomachs, sport caught salmon from Cook Inlet, and from recent literature to determine possible important prey items.

Methods

Cook Inlet belugas

We sampled bone from Cook Inlet beluga skulls in the University of Alaska Fairbanks, Museum of the North collection.

Bone samples were cleaned, treated with hydrochloric acid to isolate the collagen, and then freeze dried.

The dried samples were analyzed using a mass spectrometer for carbon and nitrogen isotope values.

Prey

Samples of fish bones were taken from the stomachs of Cook Inlet belugas, and processed in the same manner as the skulls. Muscle was taken from sport caught salmon, freeze dried, and then analyzed with the mass spectrometer. King, chum, and sockeye values from the North Pacific were found in recent literature.

Results

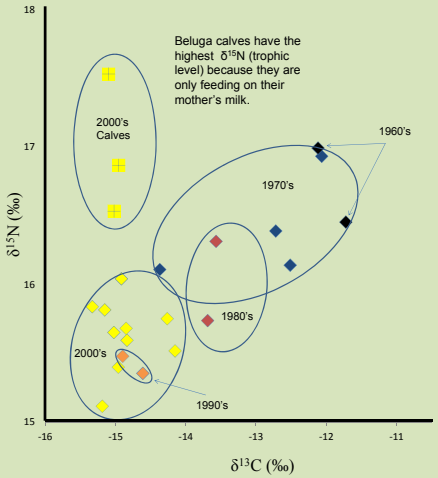

Figure 1. Scatter plot of collagen $\delta^{13}C$ and $\delta^{15}N$ stable isotope ratios for 23 Cook Inlet beluga collected between 1964 and 2007.

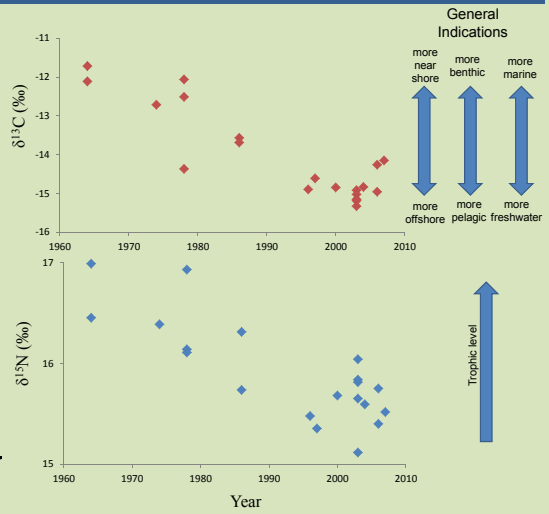

Figure 2. Scatter plot of collagen $\delta^{13}C$ and $\delta^{15}N$ stable isotope ratios plotted against the year they died. Only data from adults are shown in this figure.

The results of 19 adult Cook Inlet beluga skulls show a decrease in $\delta^{13}C$ and $\delta^{15}N$ from the 1960's to present.

Results

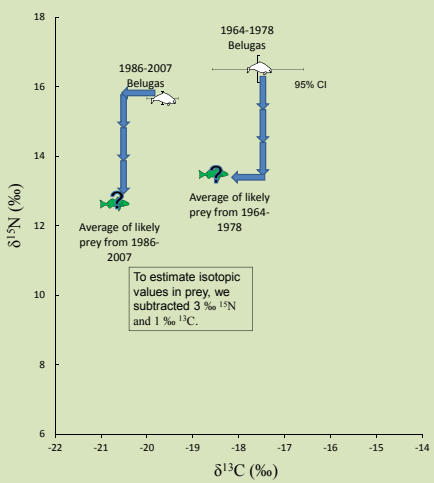

Figure 3. Adult beluga isotope values and extrapolated prey values for two time periods, 1964-1978 and 1986-2007.

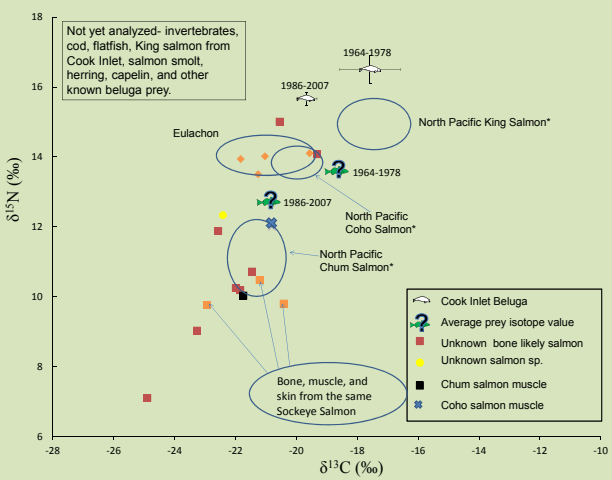

Figure 4. Values of adult belugas, extrapolated prey, and potential prey items in Cook Inlet. * Values for North Pacific salmon from *F.R. Satterfield IV and B.P. Finney. Progress in Oceanography 53 (2002) 231–246*

We determined the isotope signature of potential beluga prey in Fig. 3., then compared that to prey items we found in the stomachs of stranded beluga whales, sport caught salmon from cook inlet, and North Pacific salmon values in recent literature (Fig. 4). Fig. 4 is missing many potential prey items.

Conclusion, Discussion, and Next Step

Has Cook Inlet Beluga Whale Diet changed?

Yes. Based on our sample of 19 skulls, Cook Inlet beluga whales have a different isotope signature in recent years (1986–2007; n=13) then they did in the past (1964–1978; n=6).

What does the change in $\delta^{15}N$ mean?

The change in $\delta^{15}N$ indicates that belugas are feeding lower on the food chain now then in the past. Further studies are needed to determine how their diet has changed.

What does the change in $\delta^{13}C$ mean?

The change in $\delta^{13}C$ indicates a change in the food source. This could be caused by:

1) A switch from prey that feed near shore to prey that feed offshore
2) A switch from eating marine species to eating freshwater species
3) A switch from eating benthic species to eating pelagic species.

Again, further study is necessary to understand how the diet has changed.

What is next?

Next we will analyze more potential prey items from Cook Inlet, then apply prey mixing models to determine what proportion of each potential prey item makes up the diet now and in the past.

Acknowledgments: This project is funded by NOAA Fisheries, Alaska Region. We would like to thank Dr. Link Olson and Brandy Jacobsen at the University of Alaska Museum of the North for providing access to beluga skulls in their collection (UAM #s 86886, 11642, 11643, 16008, 16009, 16014, 16013, 16010, 16006, 91731, 91771, 87332, 48680, 97401, 91769, 94549, 92570, 83805, 87979, 92569, 48678, 91772, 91770, 91732). We would also like to thank Dr. Matthew Wooller, Timothy Howe, and Norma Haubenstock from the Alaska Stable Isotope Facility at the Water and Environmental Research Center, University of Alaska for assistance in processing, analyzing and interpreting the samples. Beluga samples used in this research were collected and archived under various NOAA permits maintained by NMFS, Alaska Region and the University of Alaska Museum of the North from 1973 to present.