Variation in stable isotopes reflect differences in the foraging ecology of fin whales (*Balaenoptera physalus*) between the North Atlantic and Mediterranean Sea

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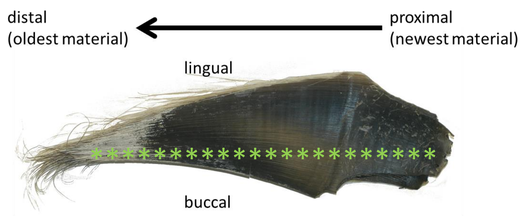
We investigated differences in foraging strategies between two populations of fin whales with some limited gene flow, the western North Atlantic (WNA) population and Mediterranean Sea (MS) population [1]. We examined trophic level, isotopic niche width, and temporal patterns using stable isotope analysis.

Baleen plates of fin whales were collected from the WNA and analyzed for $\delta^{13}C$ and $\delta^{15}N$ at ~1 cm intervals along the growth axis. We compared these data to previously sampled baleen plates collected from the MS [2].



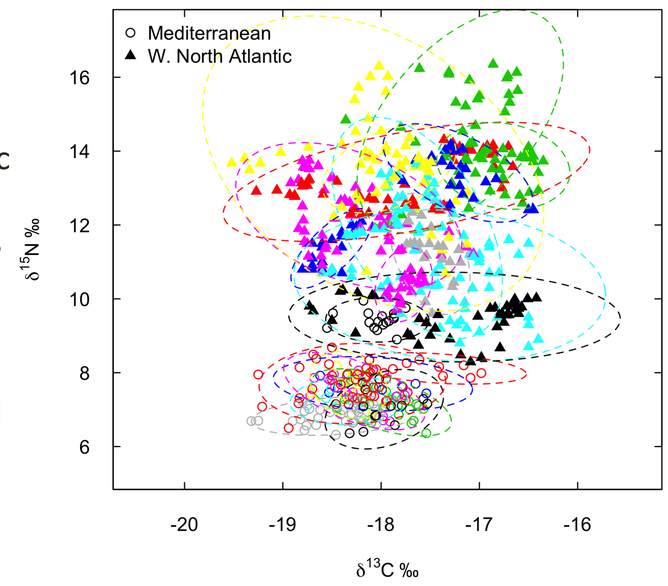
Baleen grows continuously from the upper gum and represents several years of an animal's life. Green stars = typical sampling locations.

id	year	id	year
MS01	1975	WNA01	1873
MS02	1980	WNA02	1875
MS03	1989	WNA03	1899
MS04	1989	WNA04	1914
MS05	1990	WNA05	1952
MS06	1992	WNA06	1961
MS07	1993	WNA07	1975
MS08	1996	WNA08	1975
MS09	2000	WNA09	1977
MS10	2002	WNA10	1992
		WNA11	1994
		WNA12	1995
		WNA13	2010

Trophic level is consistently higher in the WNA.

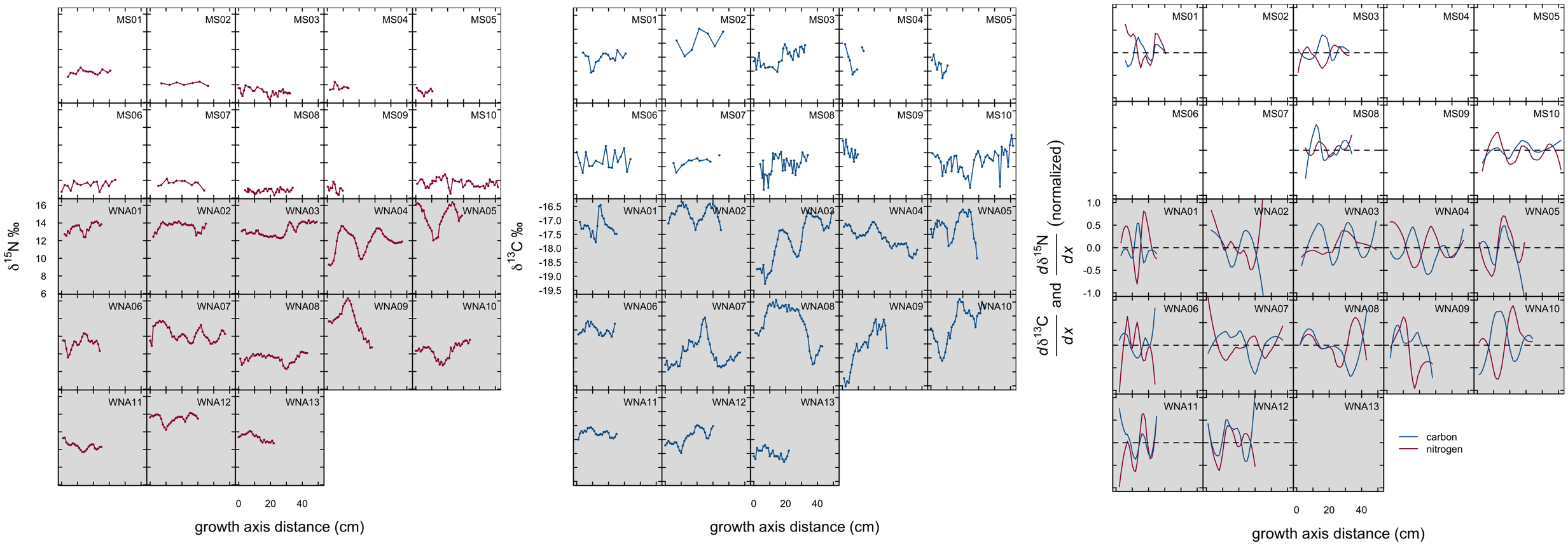
$\delta^{15}N$ values were higher in the WNA except for MS01 (black open circles). Mean difference was 4.6 ‰ or more than a trophic level consistent with feeding on primarily crustaceans (krill) in MS and diets including more forage fish in WNA.

$\delta^{13}C$ varied more in the WNA and was higher (Wilcoxon test, p = 0.02), but direct comparisons are difficult due to potential anthropogenic changes in $\delta^{13}C$ over the longer time period sampled in the WNA [3].

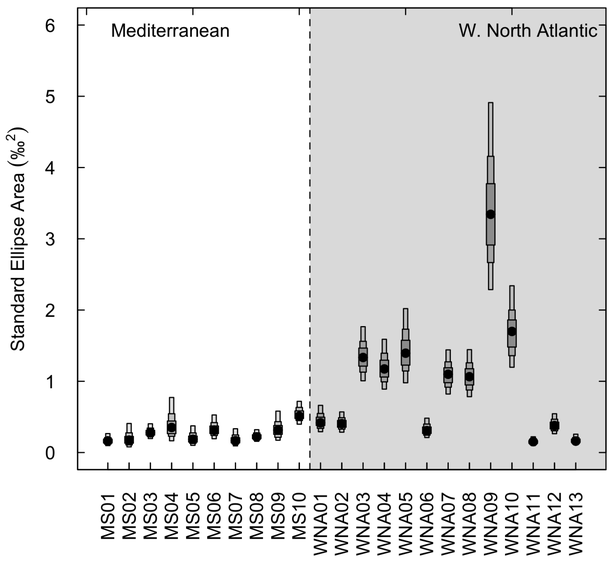


Above: isotope values plotted in carbon-nitrogen space. Each color represents an individual animal.

WNA samples show more variation than MS samples and evidence for fasting and prey switching.



Isotopic niche width is greater in the WNA



Isotopic niche width (INW) as measured by standard ellipse area [4] is greater for WNA fin whales given in general larger within individual variation in $\delta^{13}C$ and $\delta^{15}N$.

We also noted larger between individual variation in INW for the WNA animals.

These differences likely suggest more variation in prey in the WNA and possible foraging specializations

WNA fin whales showed larger cyclic patterns in $\delta^{13}C$ and $\delta^{15}N$. Increasing $\delta^{15}N$ with concurrent decreasing $\delta^{13}C$ is consistent with fasting perhaps associated with extended migrations (e.g., WNA04, WNA10), but see [5]. Simultaneous increase or decrease in $\delta^{13}C$ and $\delta^{15}N$ (e.g., WNA05) or change in only one isotope (e.g., WNA02) might indicate prey switching or movement to new feeding grounds.

Next steps

Use compound specific isotope analysis to help confirm the cause of cyclic patterns in isotope values.

Narrow the temporal mismatch between the WNA and MS samples to facilitate investigations of changes over time.

Incorporate sex or other demographic factors, such as pregnancy [6], into analysis.

Acknowledgements and References

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Museum Specimens: National Museum of Natural History – A16045 (WNA01), A15296 (WNA02), 86411 (WNA03), 288229 (WNA06), 504258 (WNA07), 504243 (WNA08), 504733 (WNA09); Museum of Comparative Zoology, Harvard – 11448 (WNA04), 62051 (WNA11), 52053 (WNA12); North Carolina Science Museum – 7121 (WNA05); North Carolina Maritime Museum – 6-2-92-CCC-W (WNA10) , WAM645 (WNA13); See [2] for details on MS samples. MS01-10 correspond to Bp1-10 in text.