# Using Stable Isotope Ratios to Identify Habitats of Common Bottlenose Dolphins in the Northern Gulf of Mexico

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## Challenge – how to determine whether a stranded dolphin originated from estuarine or coastal stocks?

### Background

Stable isotopes serve as biochemical markers reflecting the assimilation of the various elemental isotopes into tissues. The isotopes exist due to a difference in the number of neutrons in the nucleus (e.g., Carbon 12 or Carbon 13). A stable isotope ratio refers to the ratio of the heavier isotope to the lighter isotope and using the annotation $\delta^{13}C$.

Stable isotope ratios have typically been used to identify trophic interactions (see review by Newsome et al. 2010):

- Carbon isotopes indicate the source of primary productivity - Salt-marsh plants use C4 photosynthetic pathway with average δ13C composition of -12 ‰ (Schlesinger, 1997); the range is from -17 ‰ to -9 ‰ while C3 plants have a range of δ13C signature of -34 ‰ to -23 ‰ (Chmura and Aharon, 1995) (Fig. 1)
- Nitrogen isotopes reveal position in food webs (Fig. 2) and anthropogenic inputs into ecosystems

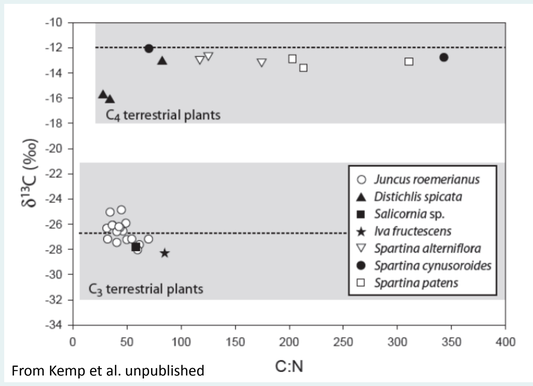
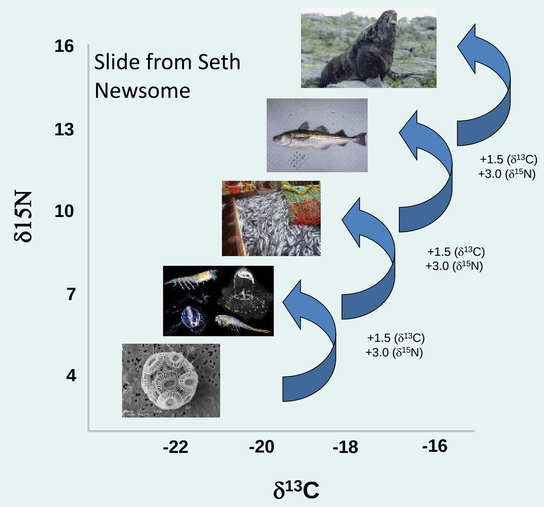



**Fig. 1**

**Fig. 2**




### Uses of Stable Isotope Ratios to Indicate Habitat or Movements

However, stable isotope ratios also identify habitat and movements:

- Sulfur isotopes in the open ocean are relatively stable and uniform at +21 ‰, decreasing with fresh-water influences
  - Example - fish from Barataria Bay, LA - resident species showed $\delta^{34}S$ increasing in marine plankton feeding species relative to estuarine benthic-feeding species (Fry and Chumchal 2011) (Fig. 3)

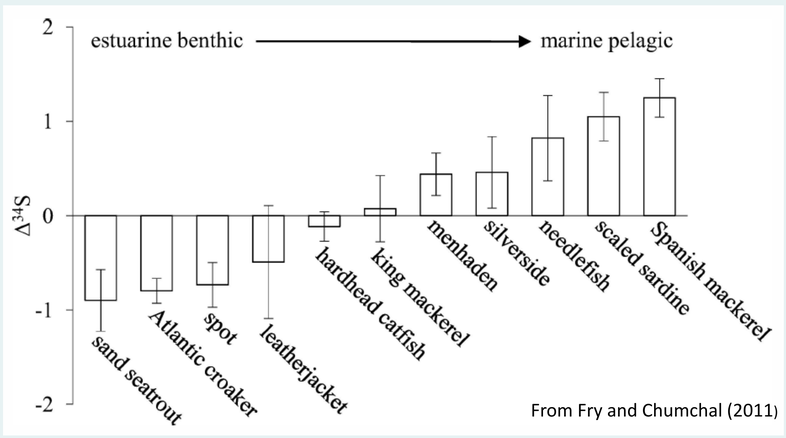



**Fig. 3**

Analyses using all one or more stable isotope ratios can help identify whether bottlenose dolphins inhabit primarily estuarine or coastal waters and fine-scale habitat preferences

- Example – bottlenose dolphins feeding primarily in seagrass areas have different isotopic signatures than feeing infrequently in seagrass beds (Fig. 4) (Rossman et al. 2013)
- Example - bottlenose dolphins from waters near Sarasota, FL, have different isotopic signatures (Barros et al. 2010) (Fig. 5)
- Example - bottlenose dolphins from waters of North Carolina have different isotopic signatures (Fig. 6) (Hohn et al. unpub data)

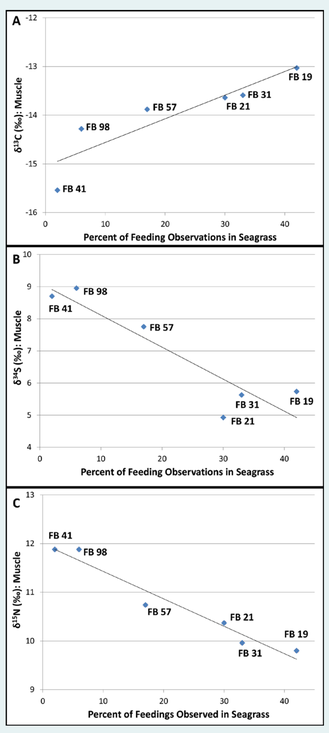



**Fig. 4**

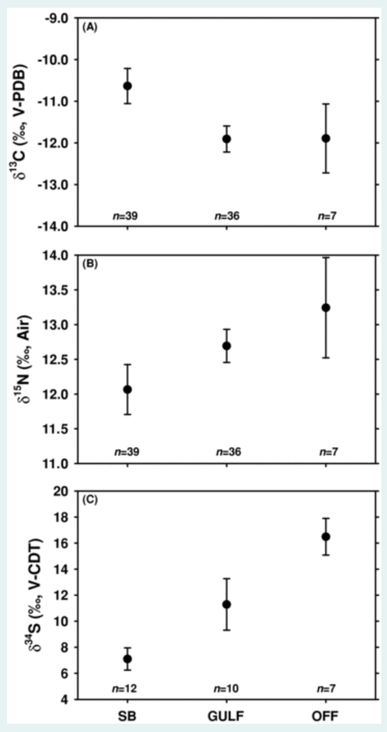



**Fig. 5**

Stable Isotope Ratios from skin biopsies of *Tursiops* collected in North Carolina waters

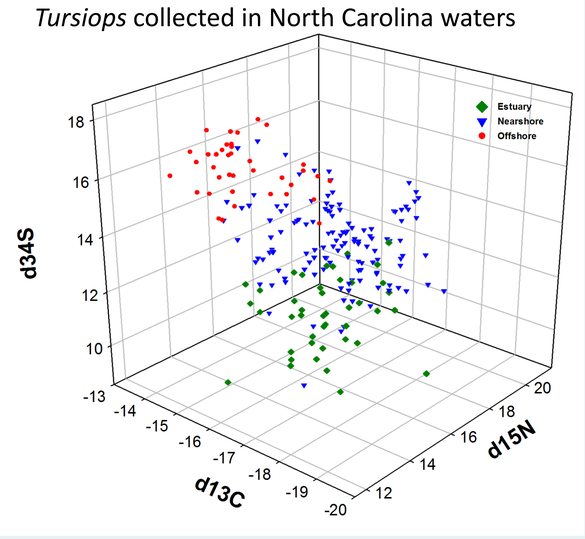



**Fig. 6**

### Future Plans

Stable isotope ratios are being investigated to help assign stranded along the northern Gulf of Mexico coast to stock. Collaborators include:
Len Thomas, The Centre for Research into Ecological and Environmental Modeling, St Andrews, UK; Todd Speakman and Eric Zolman, NOAA, NOS, NCCOS, Hollings Marine La
Jenny Litz, NOAA, NMFS, SEFSC, Miami Laboratory; Carrie Sinclair, NOAA, NMFS, SEFSC, Mississippi Laboratories; Representatives from the Gulf Stranding Networks

Literature Cited

Barros, N., P.H. Ostrom, C.A. Stricker, and R.S. Wells. 2010. Stable isotopes differentiate bottlenose dolphins off west-central Florida. Marine Mammal Science 26(2): 324-336.

Chmura, G.L., P. Aharon, R.A. Socki and R. Abernethy. 1987. An inventory of 13C abundances in coastal wetlands of Louisiana, USA: vegetation and sediments. Oecologia 74: 264-271.

Fry and Chumchal. 2011. Sulfur stable isotope indicators of residency in estuarine fish. Limnol. Oceanogr. 56(5): 1263-1576.

Newsome et al. 2010. Using stable isotope biogeochemistry to study marine mammal ecology. Marine Mammal Science 26(3): 509-572.

Rossman, Sam, Nélio B. Barros, Peggy H. Ostrom, Craig A. Stricker, Aleta A. Hohn, Hasand Gandhi, Randall S. Wells. 2013. Retrospective analysis of bottlenose dolphin foraging: a legacy of anthropogenic ecosystem disturbance. Marine Mammal Science 29(4):705-718. October. DOI: 10.1111

Schlesinger, W.H. 1997. Biogeochemistry: An analysis of global change. Academic Press.