Diet Composition and Isotopic Signatures of Sentinel Species as Indicators of Climate Change

Robert Suryan
Amanda Gladics

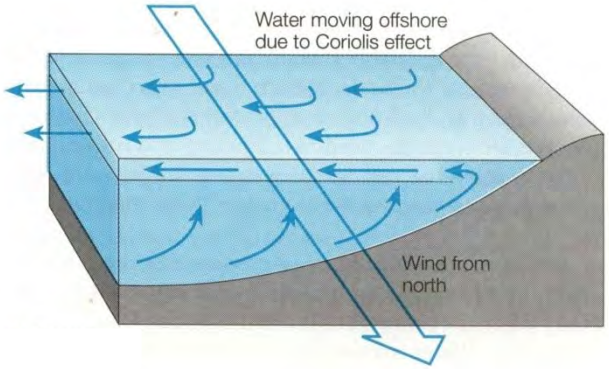
Oregon State University OSU Hatfield Marine Science Center

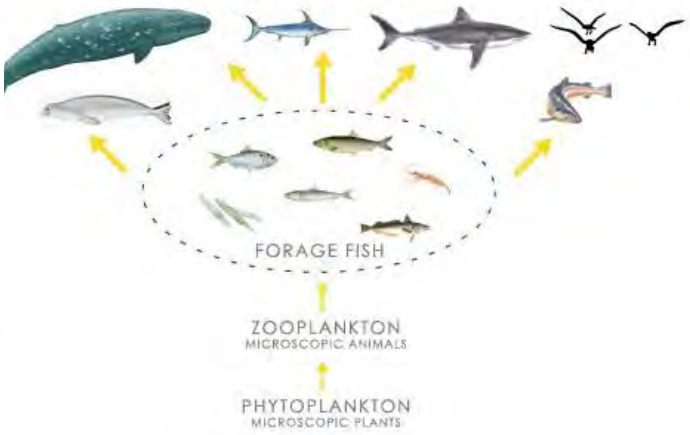
Julia Parrish

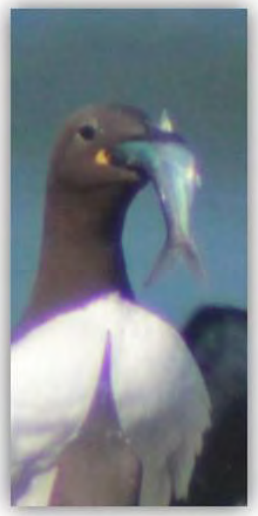
UNIVERSITY of WASHINGTON

Elizabeth Daly
Bill Peterson

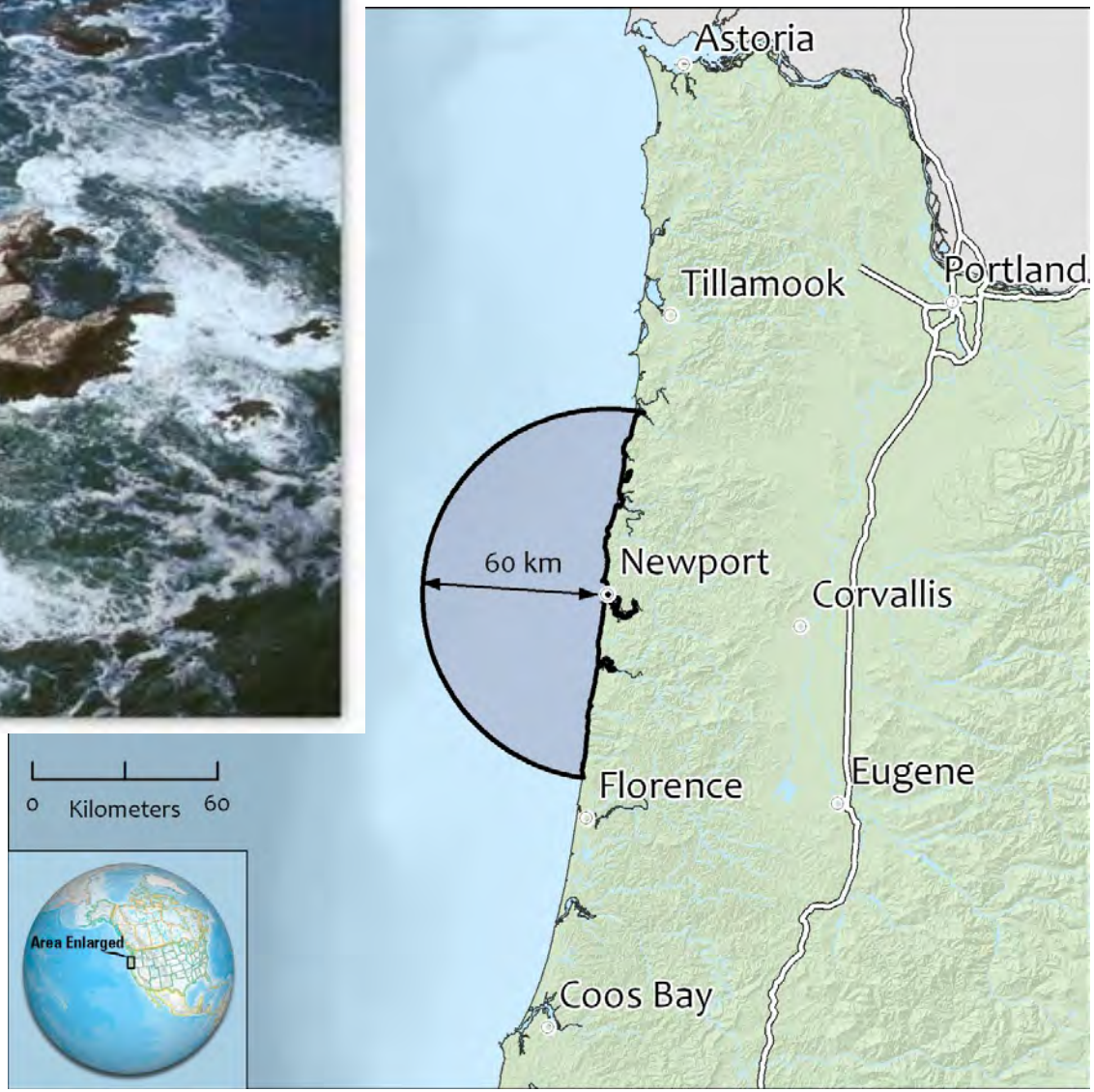
NOAA CIMRS





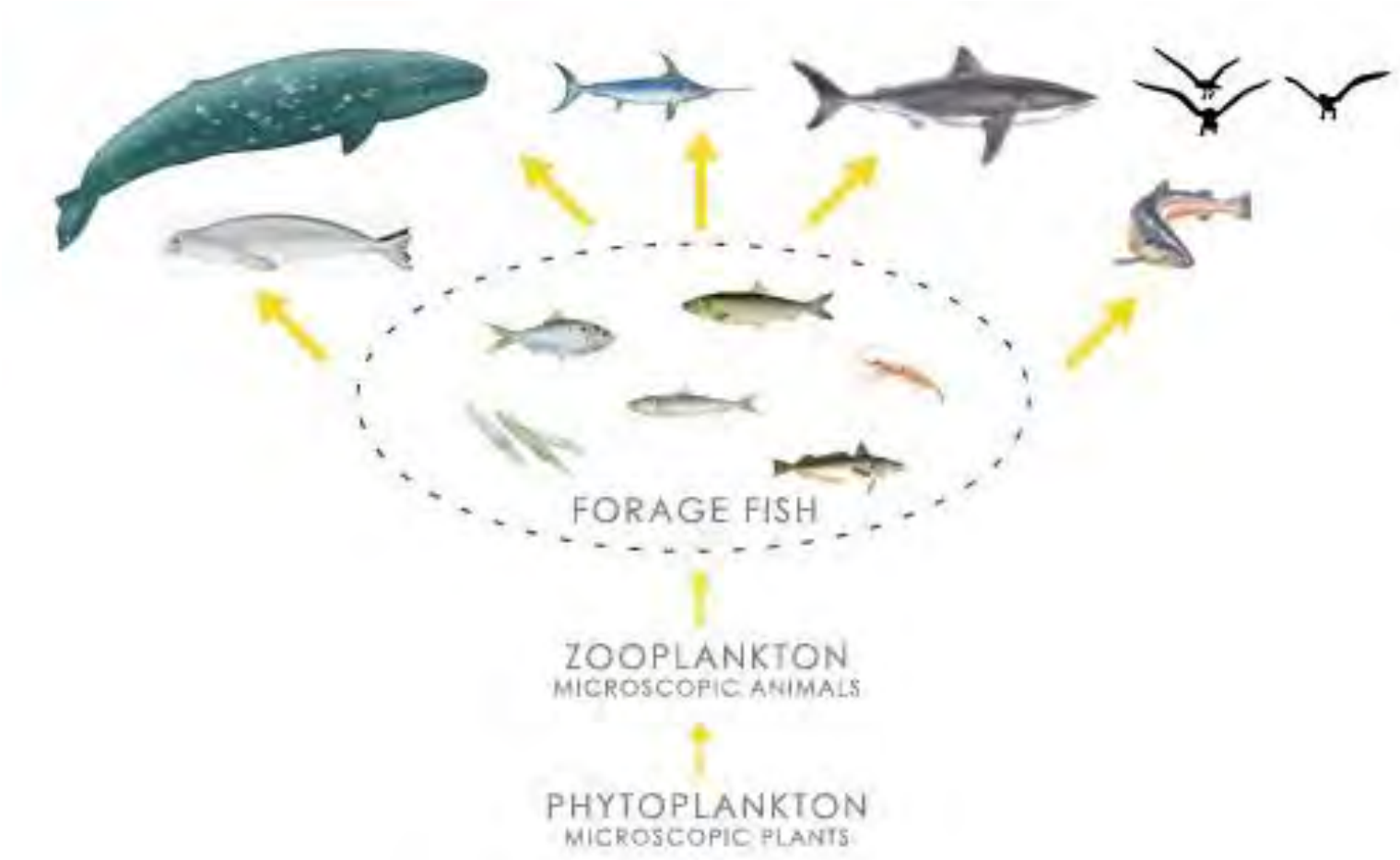



Roy Lowe USFWS


Astoria
Portland
Tillamook
60 km
Newport
Corvallis
Florence
Eugene
Coos Bay
0 Kilometers 60
Area Enlarged

Bottom-up Effects

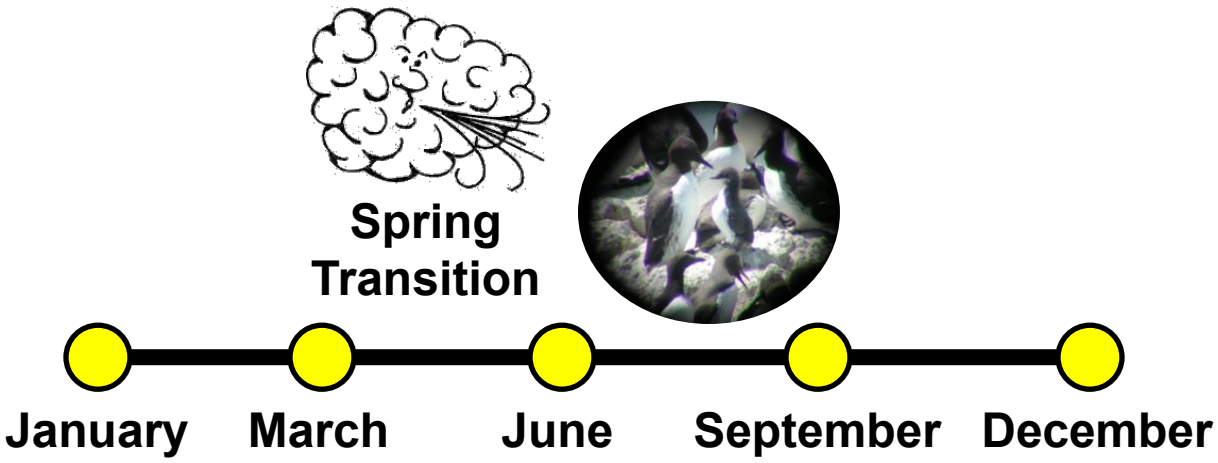
("Ecological Equivalents")



Top-Down Effects

Common Murre (*Uria aalge*)

- Chiefly piscivorous
- Dive up to 150 m
- Produce ≤ 1 chick per year



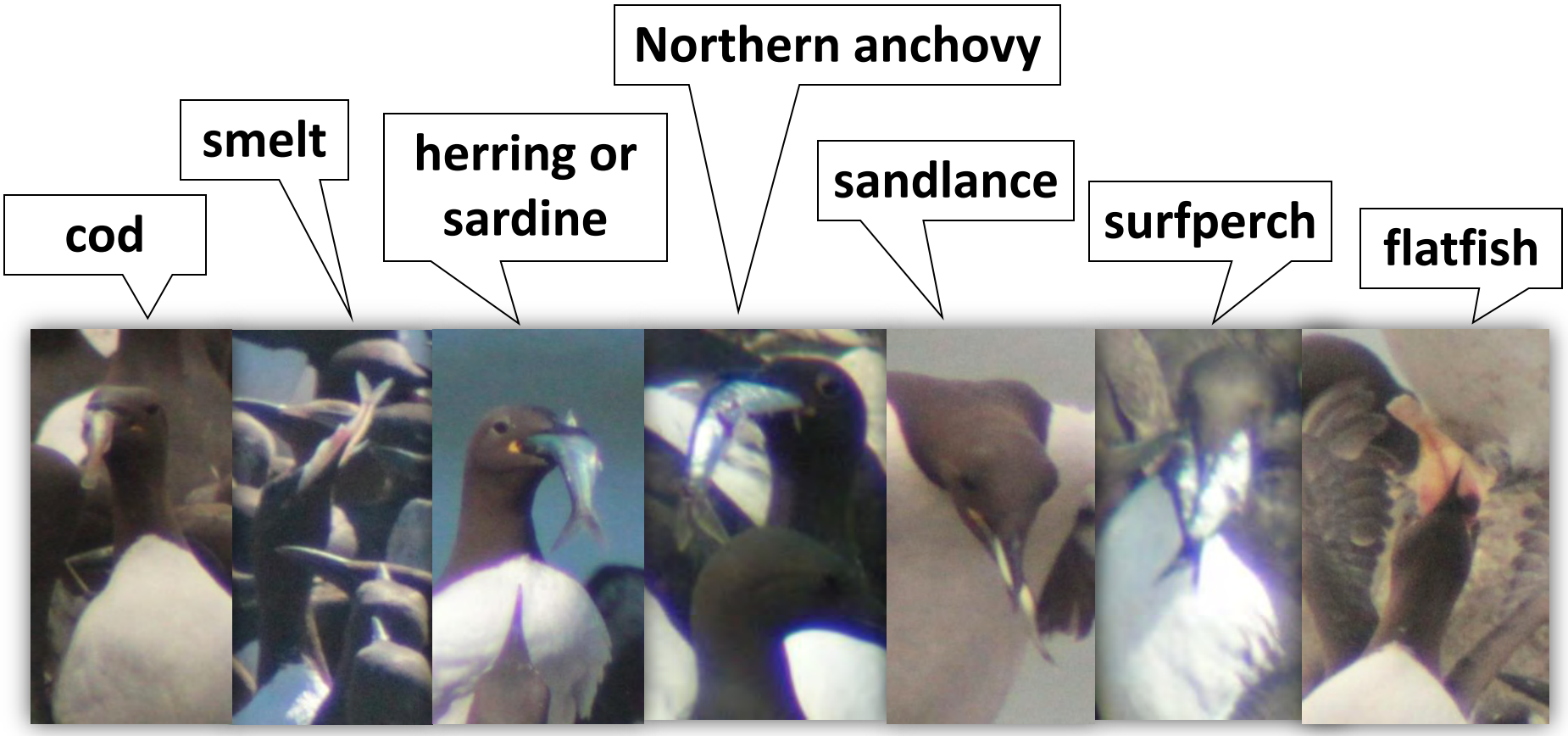
Objectives

- Determine whether variation in diets and isotopic signatures reflect local- or basin-scale physical variability.
- Decipher mechanisms by which physical forcing and biological production affects upper trophic level consumers

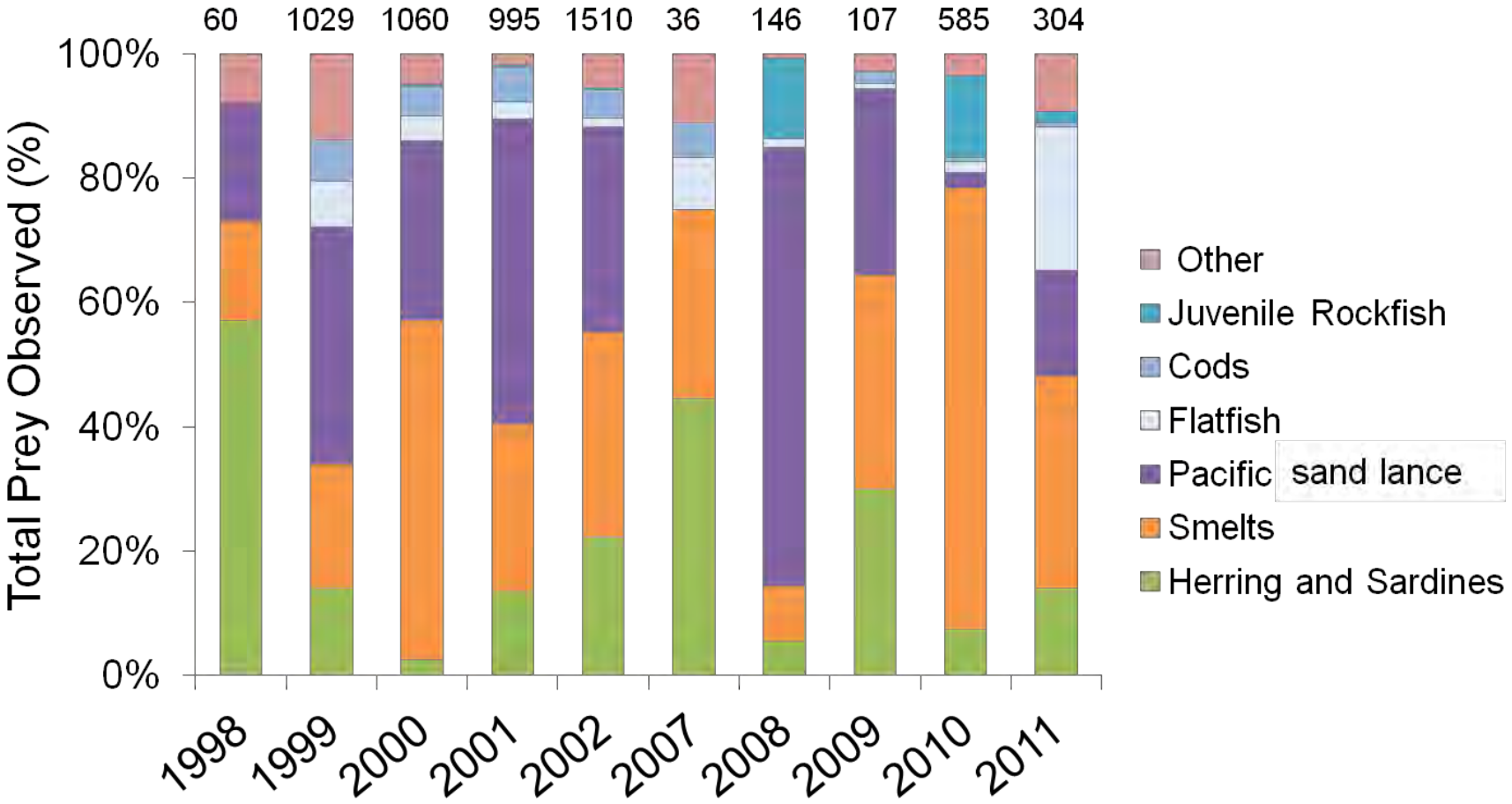
Murre Diets: digital photographs

2007-2011

Murre diets: digital photographs



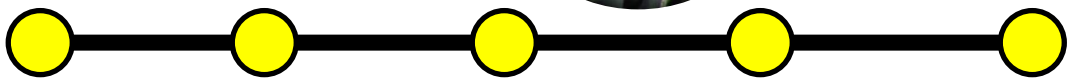
Murre Chick Diets



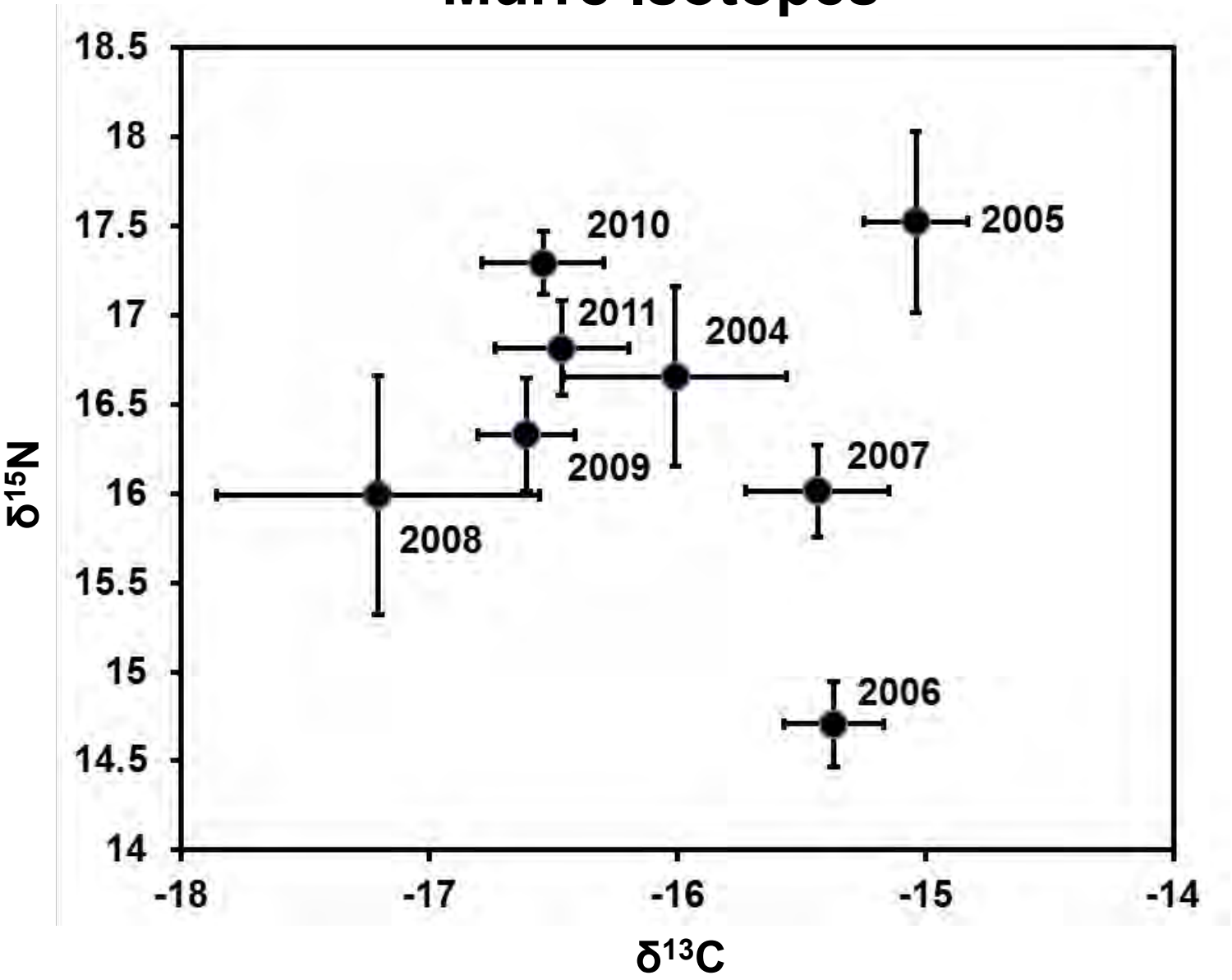
Gladics et al. 2013, In Review J. Mar. Sys.

Murre Diets: stable isotope analysis

2004-2011



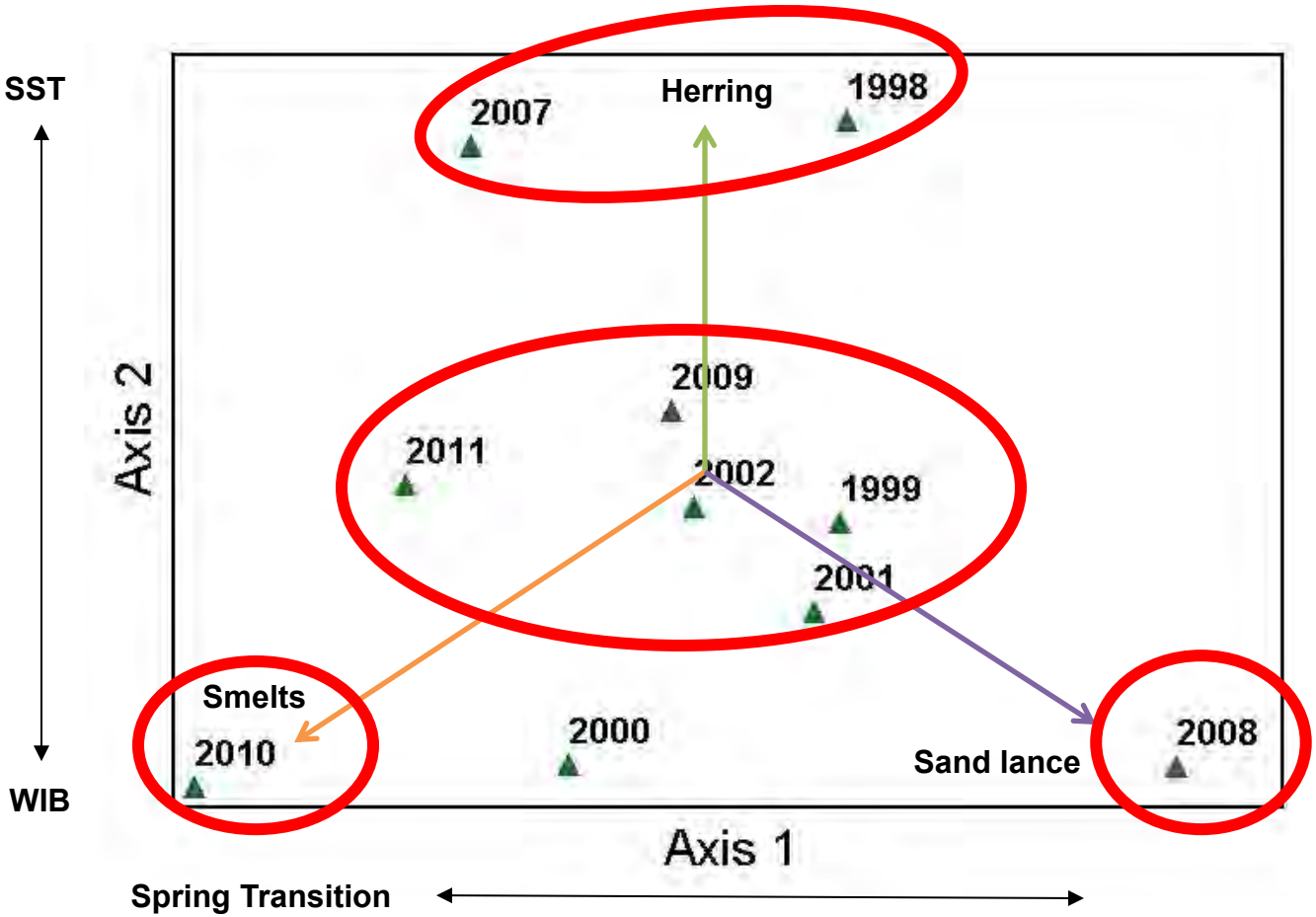
Murre Isotopes



Local-Scale Drivers

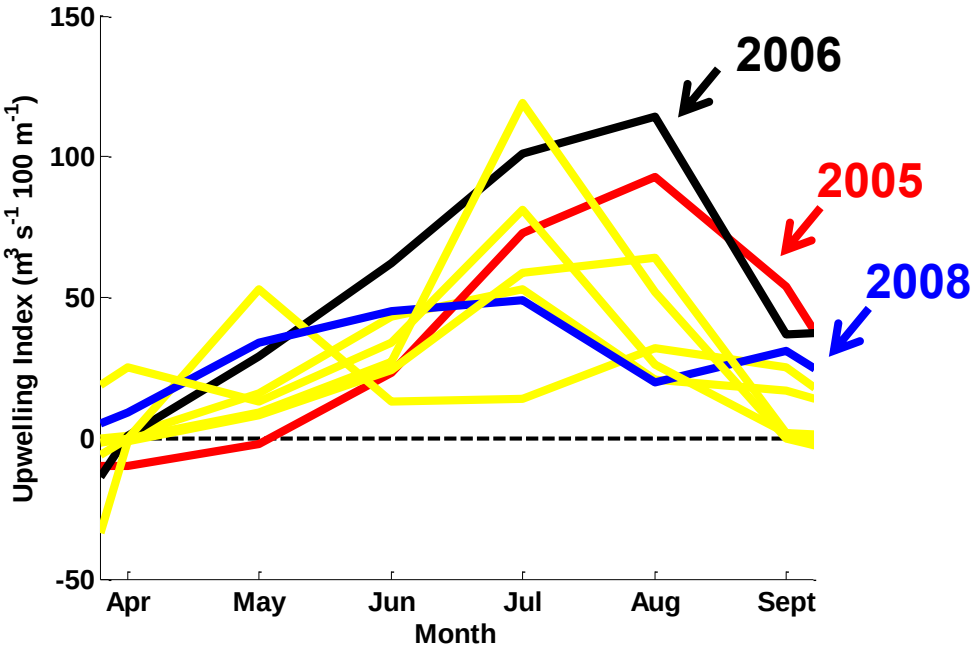
1. Wind Stress
2. Upwelling Index
3. Water Temperature (upper water column)
4. Zooplankton Species Comp/Biomass (CCI & NCI)
5. Ichthyoplankton Species Comp/Biomass (WIC & WIB)
6. Spring Transition

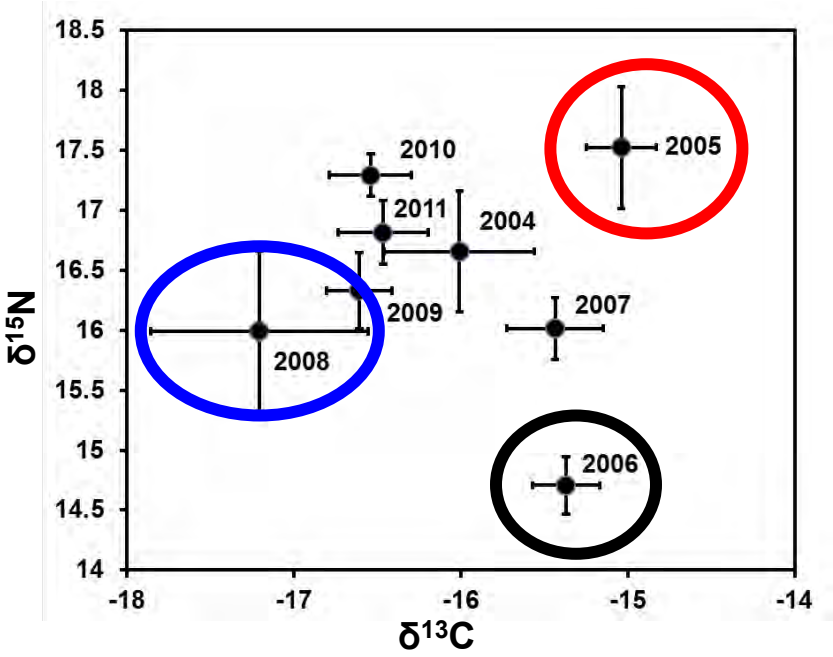
Prey & Local-Scale Drivers



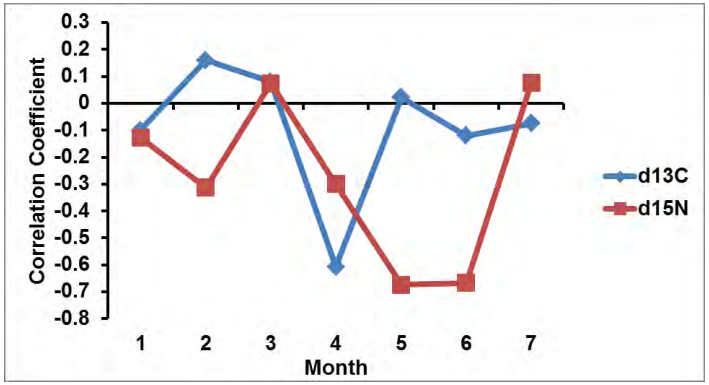
Gladics et al. 2013, In Review J. Mar. Sys.

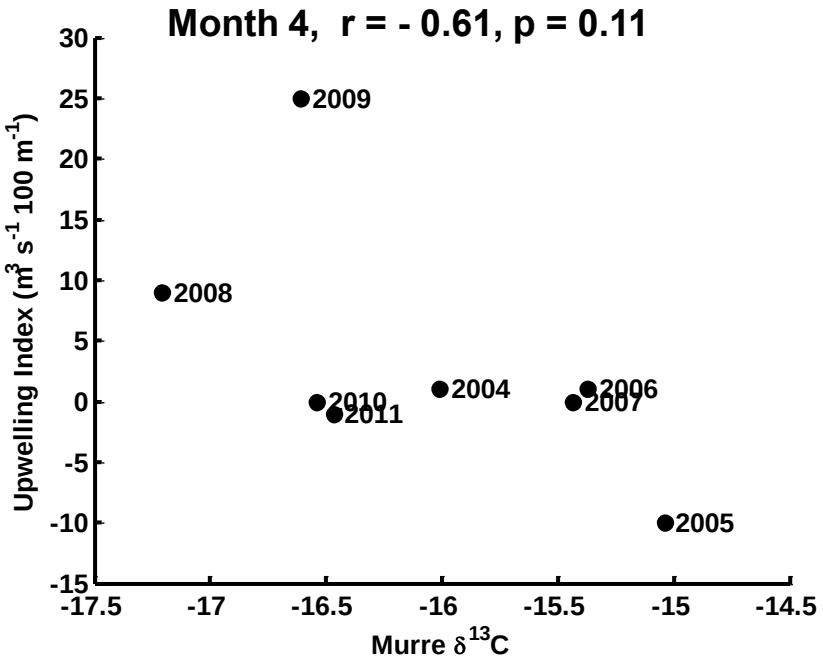
Upwelling Index (45º N)
2004 - 2011

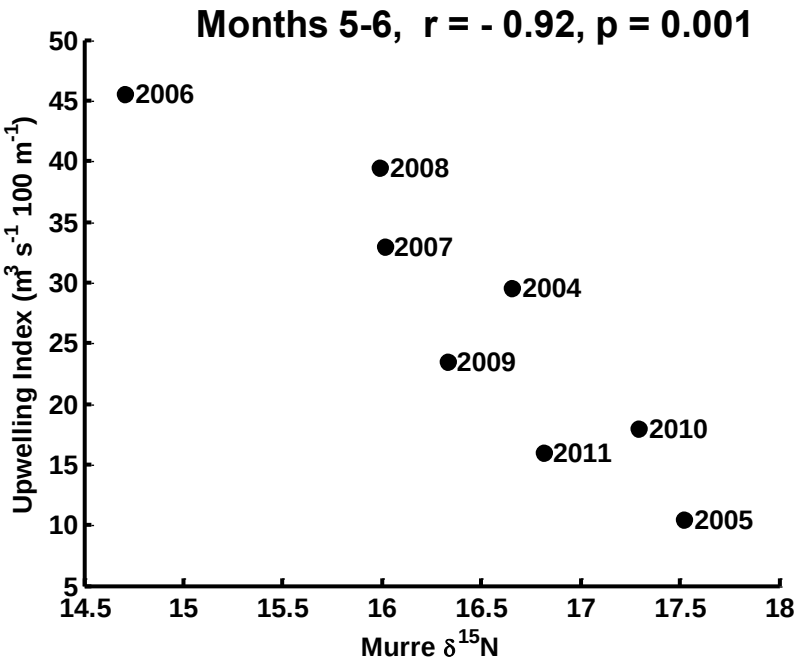




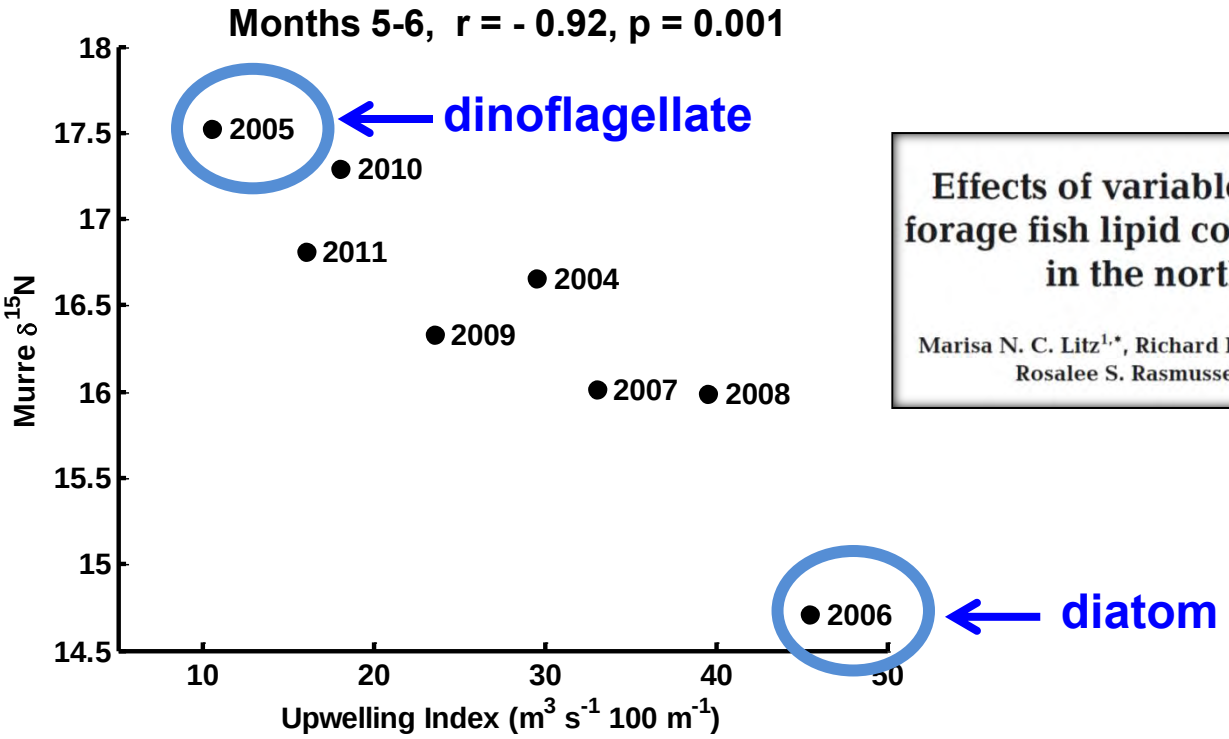
Isotopes vs. Upwelling Index







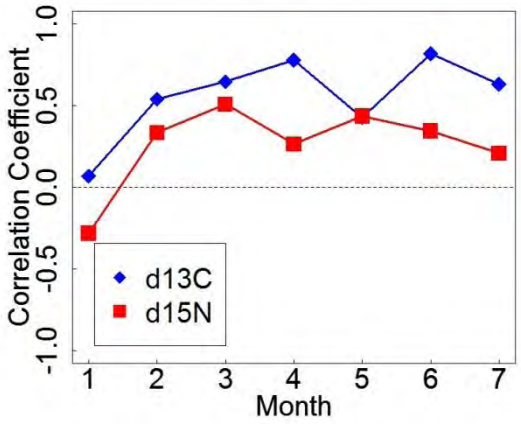
Does Upwelling Affect Length of Food Chain?



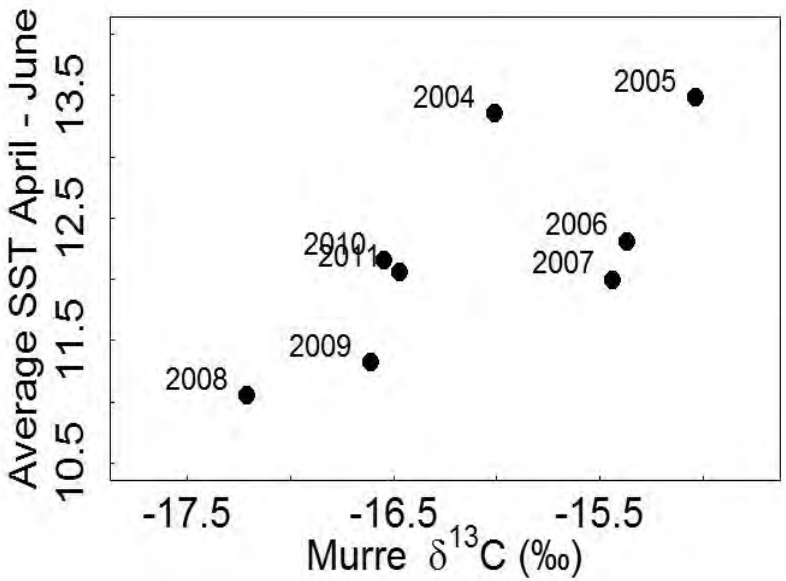
Effects of variable oceanographic conditions on forage fish lipid content and fatty acid composition in the northern California Current

Marisa N. C. Litz[1,*], Richard D. Brodeur[2], Robert L. Emmett[2], Selina S. Heppell[3], Rosalee S. Rasmussen[4], Linda O'Higgins[1], Matthew S. Morris[5]

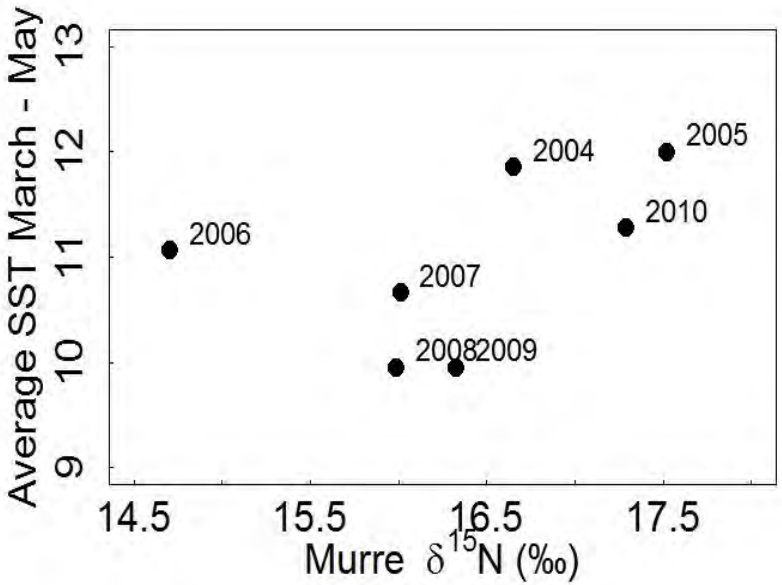
Isotopes vs. SST



Month 4-6, r = 0.71 , p = 0.047



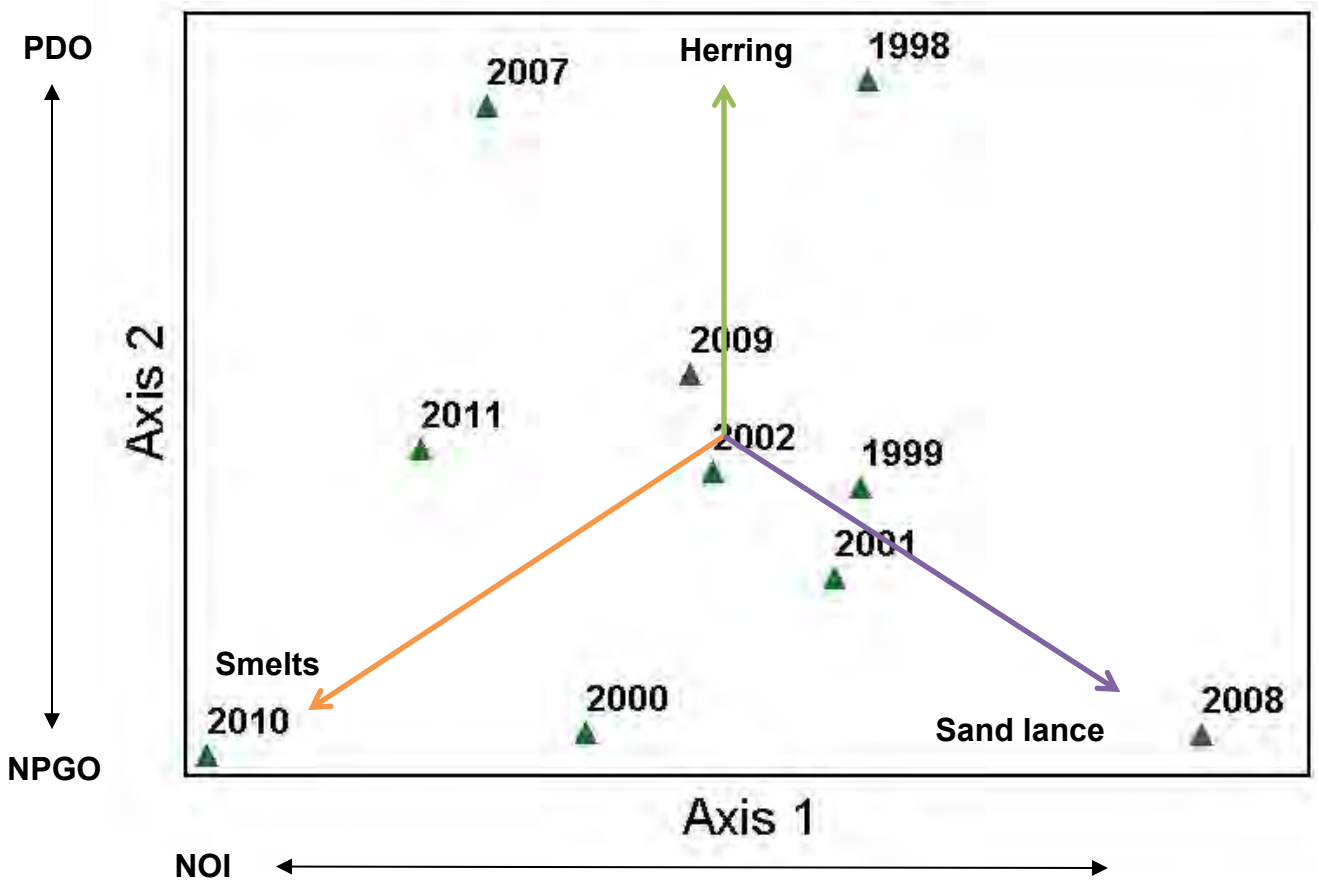
Month 3-5, r = 0.45 , p = 0.308



Basin-Scale Drivers

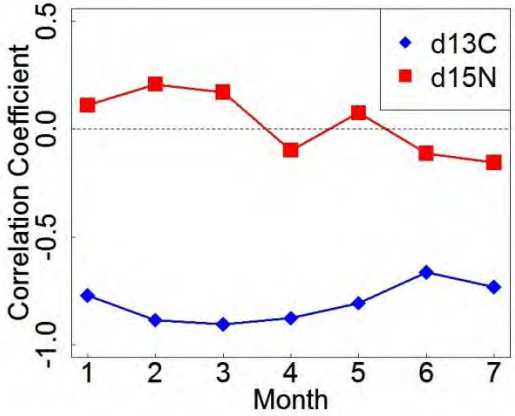
1. Pacific Decadal Oscillation
2. Multivariate ENSO Index
3. Northern Oscillation Index
4. North Pacific Gyre Oscillation

Prey & Basin-Scale Drivers

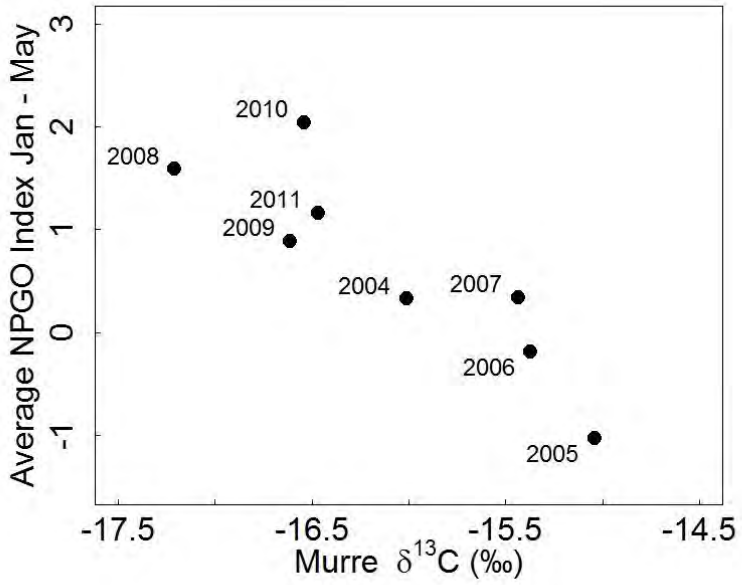


Gladics et al. 2013, In Review J. Mar. Sys.

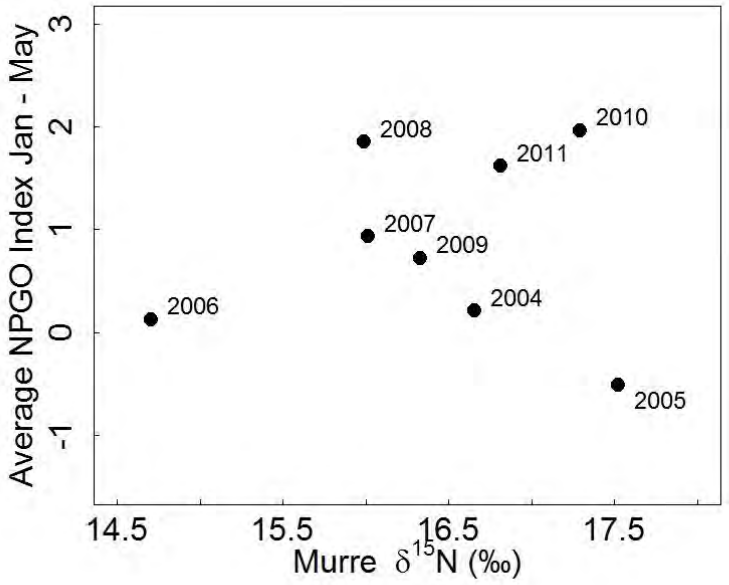
Isotopes vs. NPGO



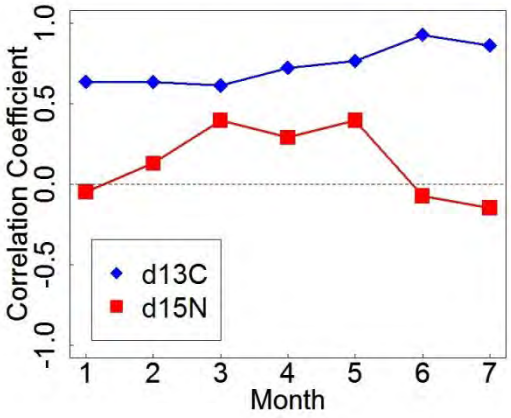
Month 1-5, r = - 0.89, p = 0.0035



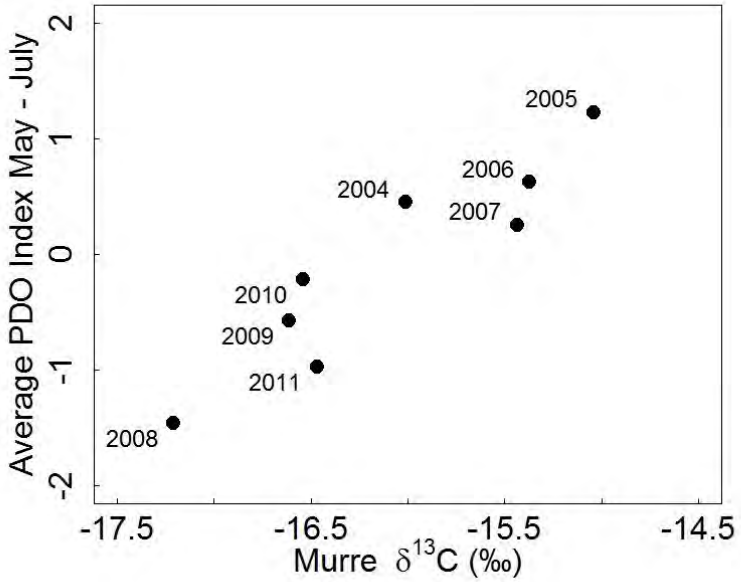
Month 1-5, r = 0.1, p = 0.8083



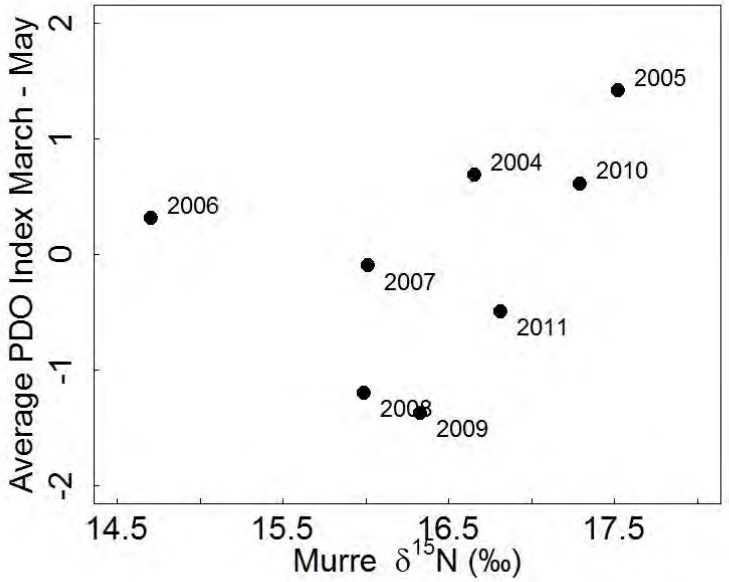
Isotopes vs. PDO



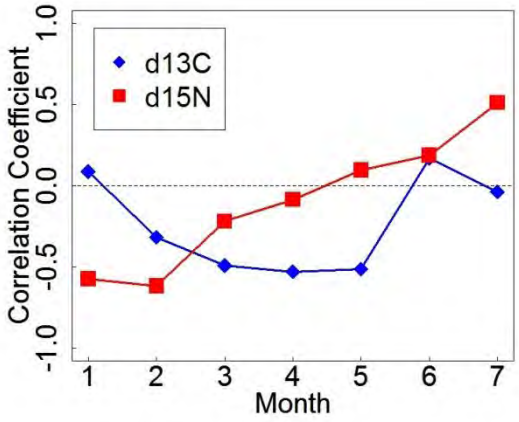
Month 5-7, r = 0.93 , p < 0.001



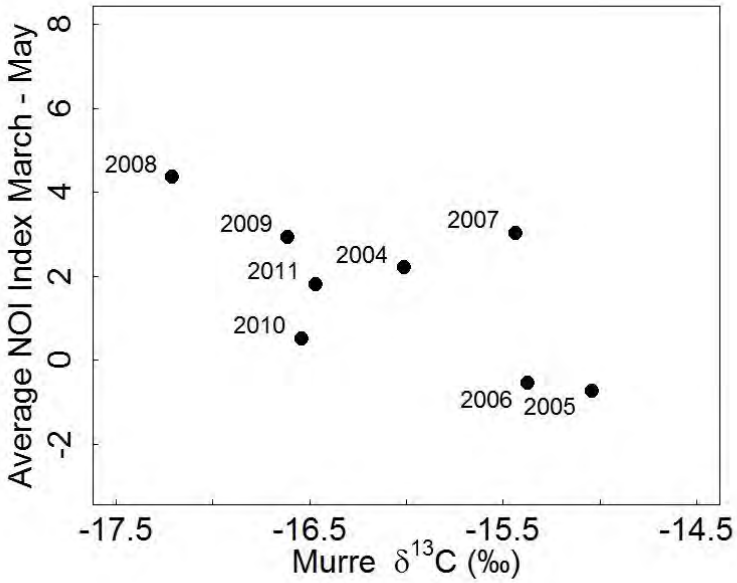
Month 3-5, r = 0.51 , p = 0.24



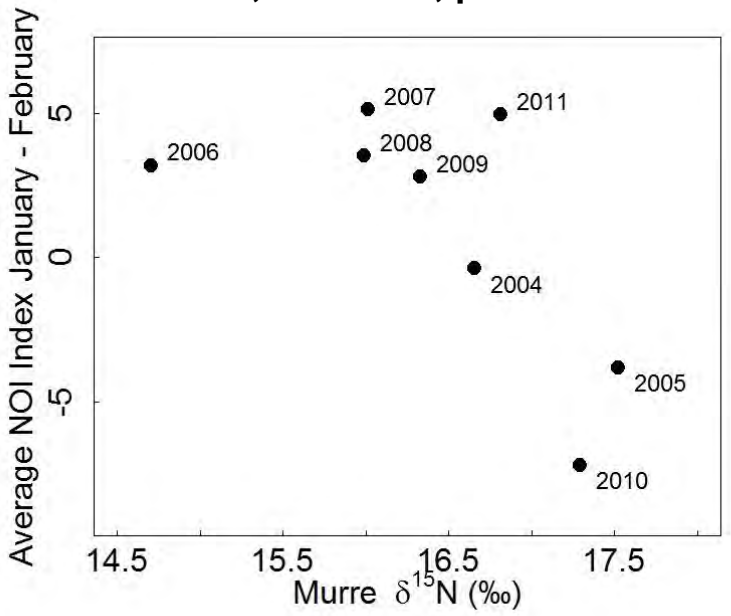
Isotopes vs. NOI



Month 5-7, r = -0.67 , p = 0.0674



Month 1-2, r = -0.65 , p = 0.082



Conclusions

- Murre diets reflected changes in local- and basin-scale biophysical drivers
- Murre $\delta^{15}N$ may reflect upwelling driven changes in energy pathways in coastal food webs
- Murre $\delta^{13}C$ appears to most strongly reflect variability in source water transport

Conclusions

Signals reflecting physical forcing and biological production regimes that propagate through the food web are measurable within a major, upper trophic level consumer on the Central Oregon Coast

Thanks!

Joe Ashor (BLM)
Timothy Fisher (BLM)
Dawn Harris (FWS)
Roy Lowe (FWS)
Shawn Stephensen (FWS)

Yaquina Head Field Crews!

Funding:
Bureau of Land Management
U.S. Fish and Wildlife Service
National Science Foundation