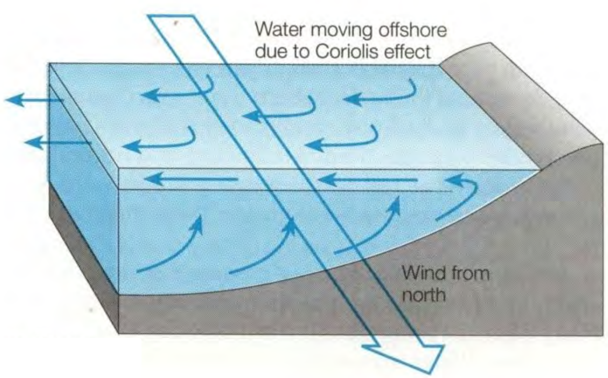
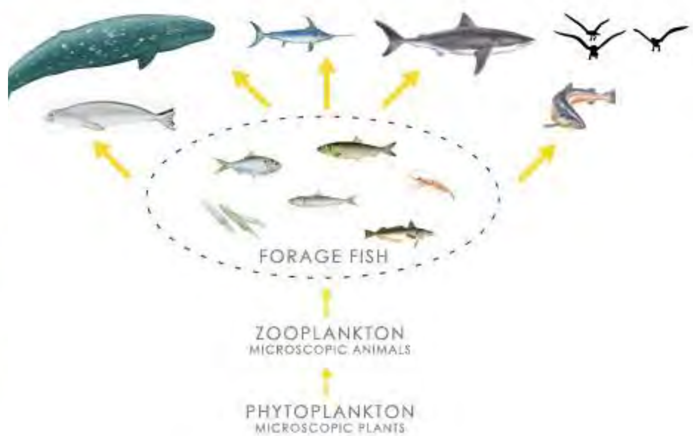
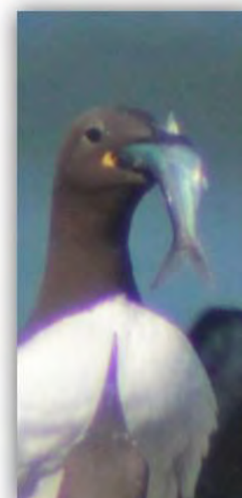
Effect of environmental variation on diets and stable isotope signatures of a piscivorous seabird in a coastal upwelling system

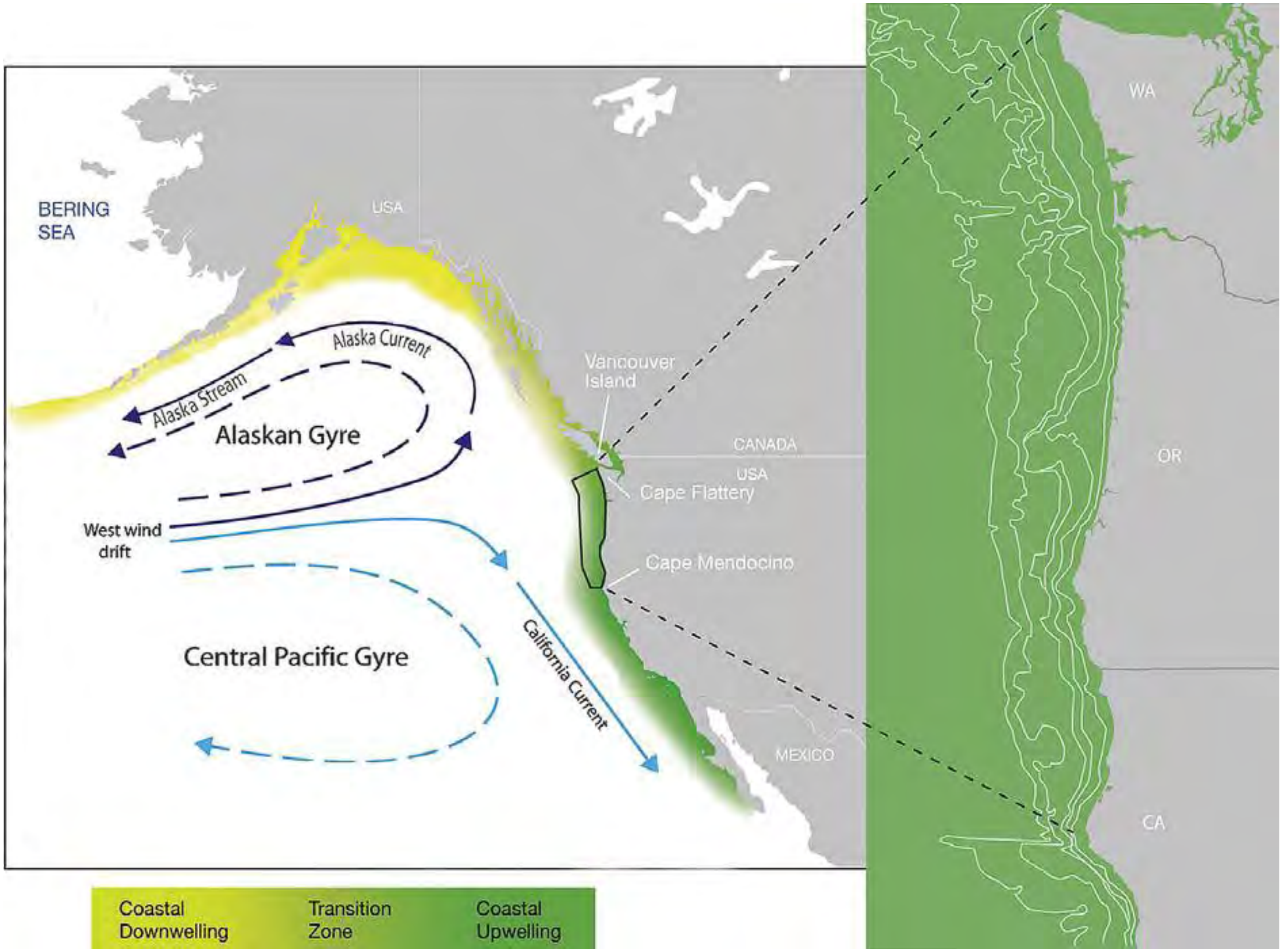
Robert M. Suryan, Amanda J. Gladics







Northern California Current



(Schwing *et al*. 2006)

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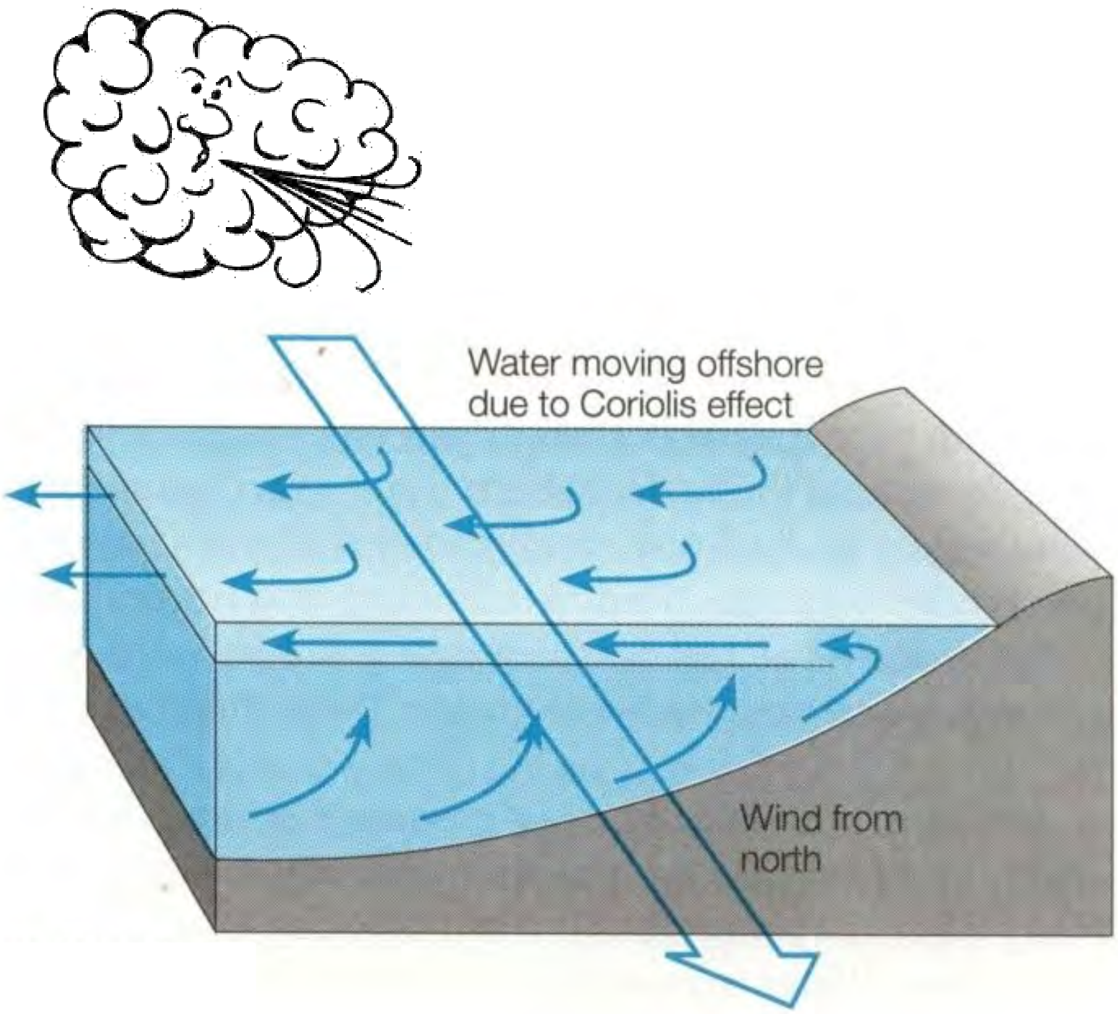
Coastal Upwelling



Marine Food Web

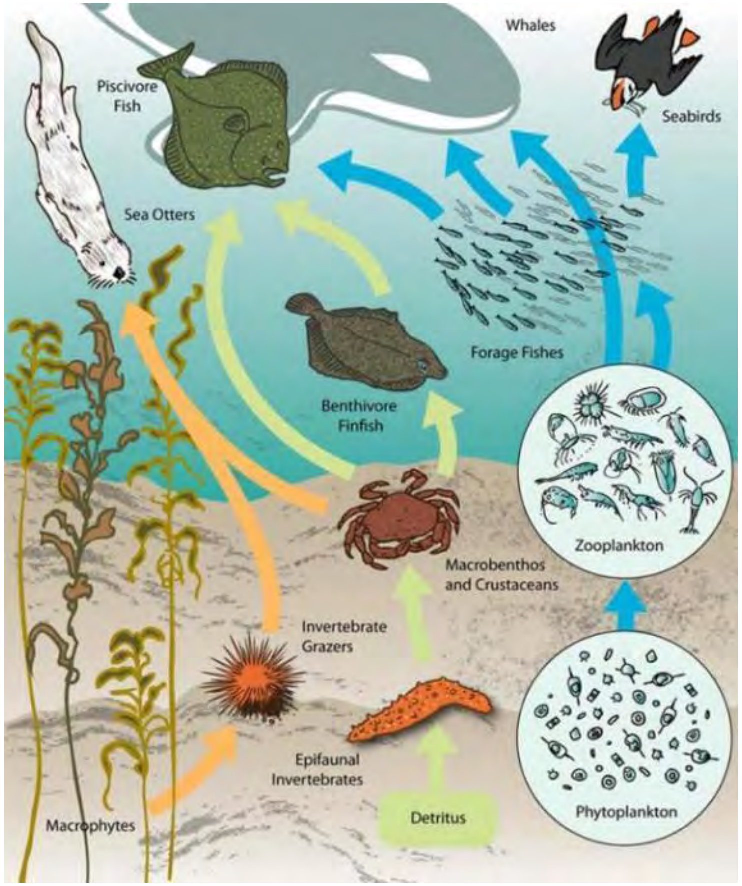


Illustration by Soren Henrich
http://www.pncimamatters.ca

Emergence of Anoxia in the California Current Large Marine Ecosystem

F. Chan,[1]* J. A. Barth,[2] J. Lubchenco,[1] A. Kirincich,[2] H. Weeks,[3] W. T. Peterson,[4] B. A. Menge[1]

Delayed upwelling alters nearshore coastal ocean ecosystems in the northern California current

John A. Barth*†, Bruce A. Menge‡, Jane Lubchenco†‡, Francis Chan‡, John M. Bane§, Anthony R. Kirincich*, Margaret A. McManus¶, Karina J. Nielsen|, Stephen D. Pierce*, and Libe Washburn**

A new climate regime in northeast pacific ecosystems

William T. Peterson[1] and Franklin B. Schwing[2]

Planktivorous auklet *Ptychoramphus aleuticus* responses to ocean climate, 2005: Unusual atmospheric blocking?

William J. Sydeman,[1] Russell W. Bradley,[1] Pete Warzybok,[1] Christine L. Abraham,[1] Jaime Jahncke,[1] K. David Hyrenbach,[2] Vernon Kousky,[3] J. Mark Hipfner,[4] and Mark D. Ohman[5]

Anomalous pelagic nekton abundance, distribution, and apparent recruitment in the northern California Current in 2004 and 2005

Richard D. Brodeur,[1] Stephen Ralston,[2] Robert L. Emmett,[1] Marc Trudel,[3] Toby D. Auth,[4] and A. Jason Phillips[4]

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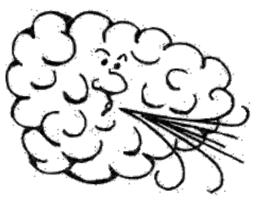
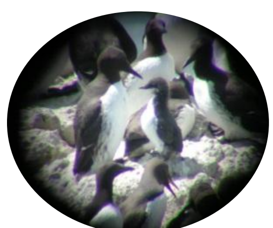
Common Murre (*Uria aalge*)

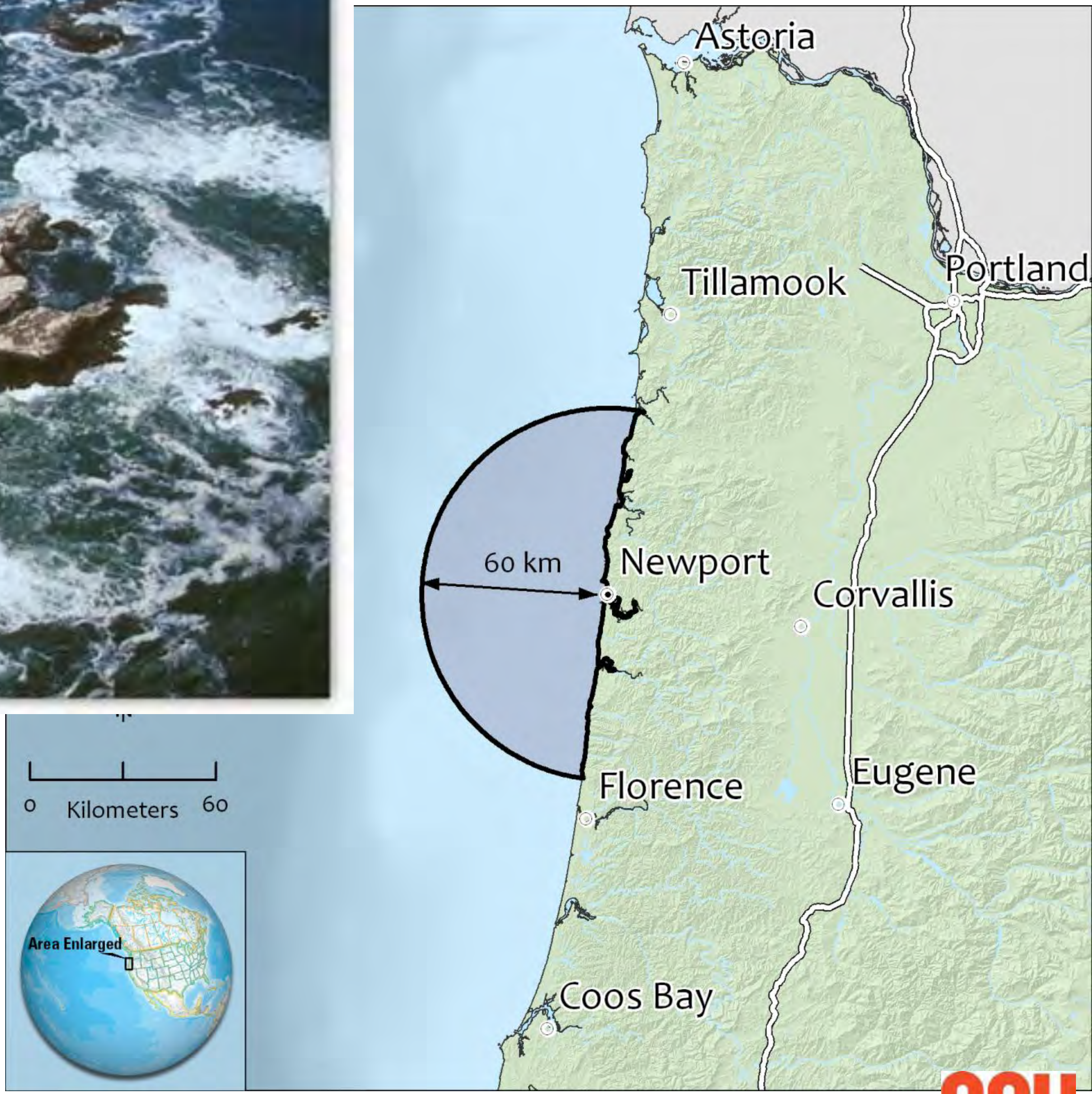
- Chiefly piscivorous
- Dive up to 150 m
- Produce ≤ 1 chick per year



Spring Transition



January — March — June — September — December



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Objectives

- ➢**Determine whether variation in isotopic signatures of common murres reflect variation in coastal upwelling conditions and summer diet**
- ➢**Decipher mechanisms by which physical forcing and biological production affects upper trophic level consumers**

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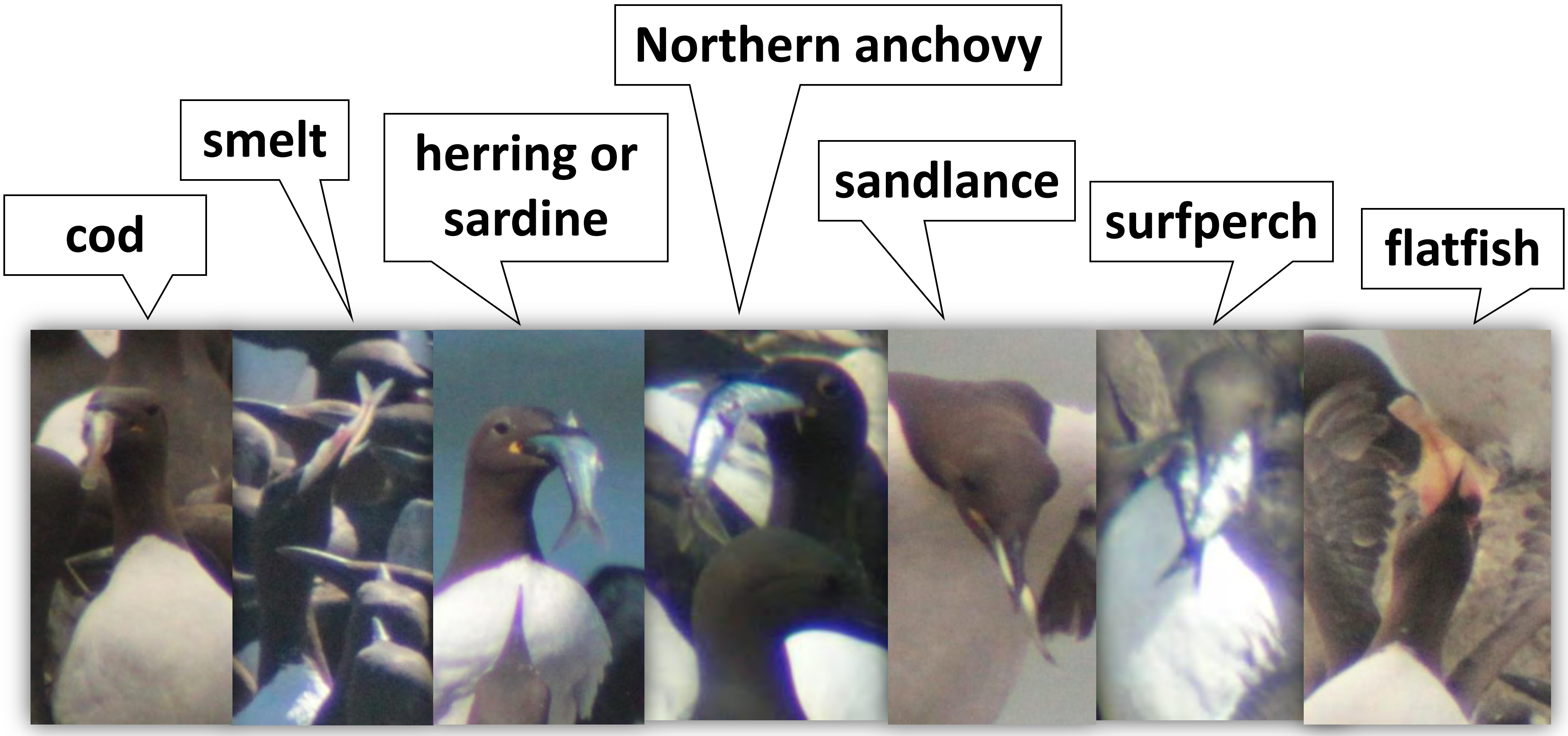
Murre Diets: stable isotope analysis

2004-2011

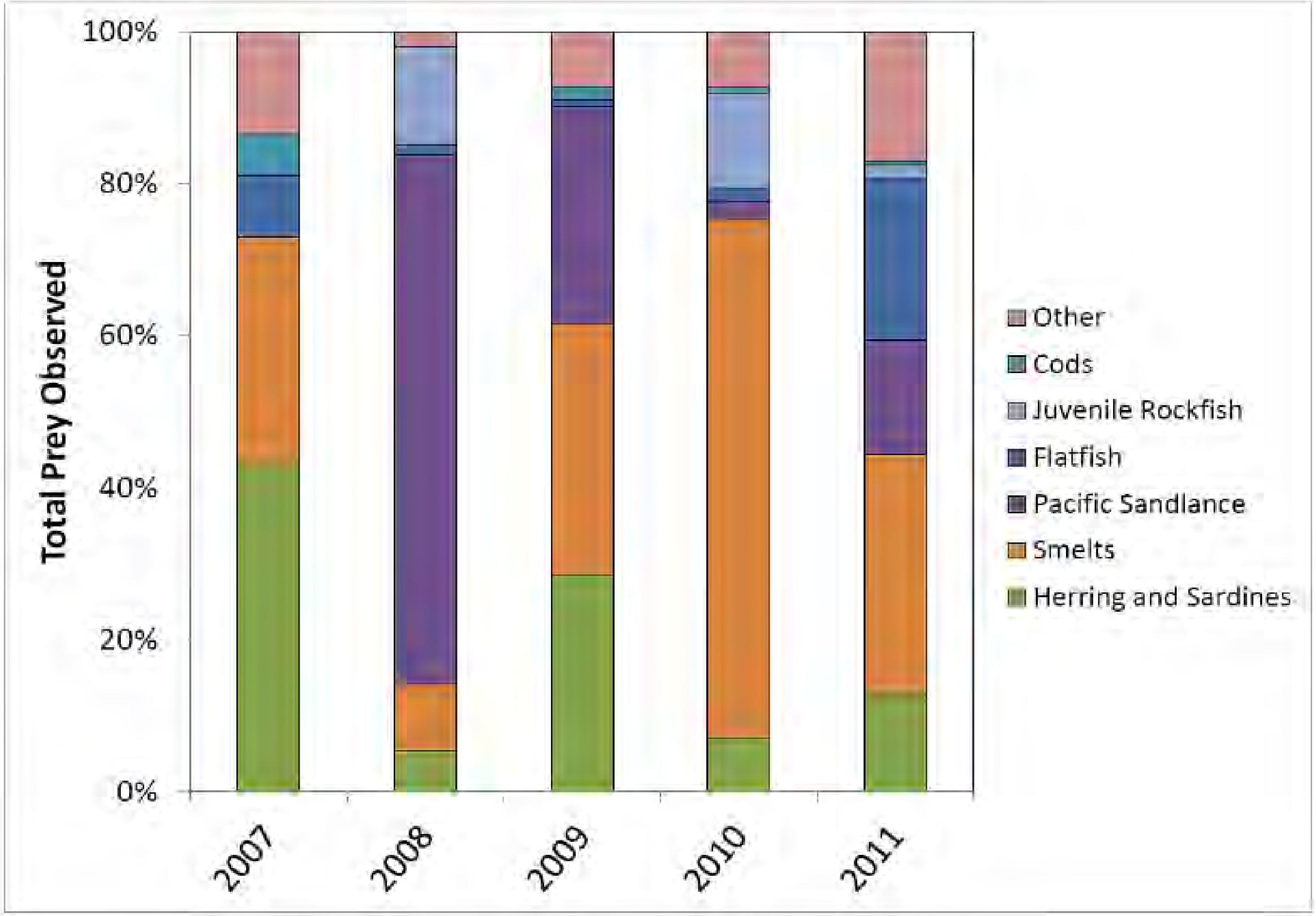
January — March — June — September — December

Murre Diets: digital photographs
2007-2011

Murre diets: digital photographs



Murre Chick Diets



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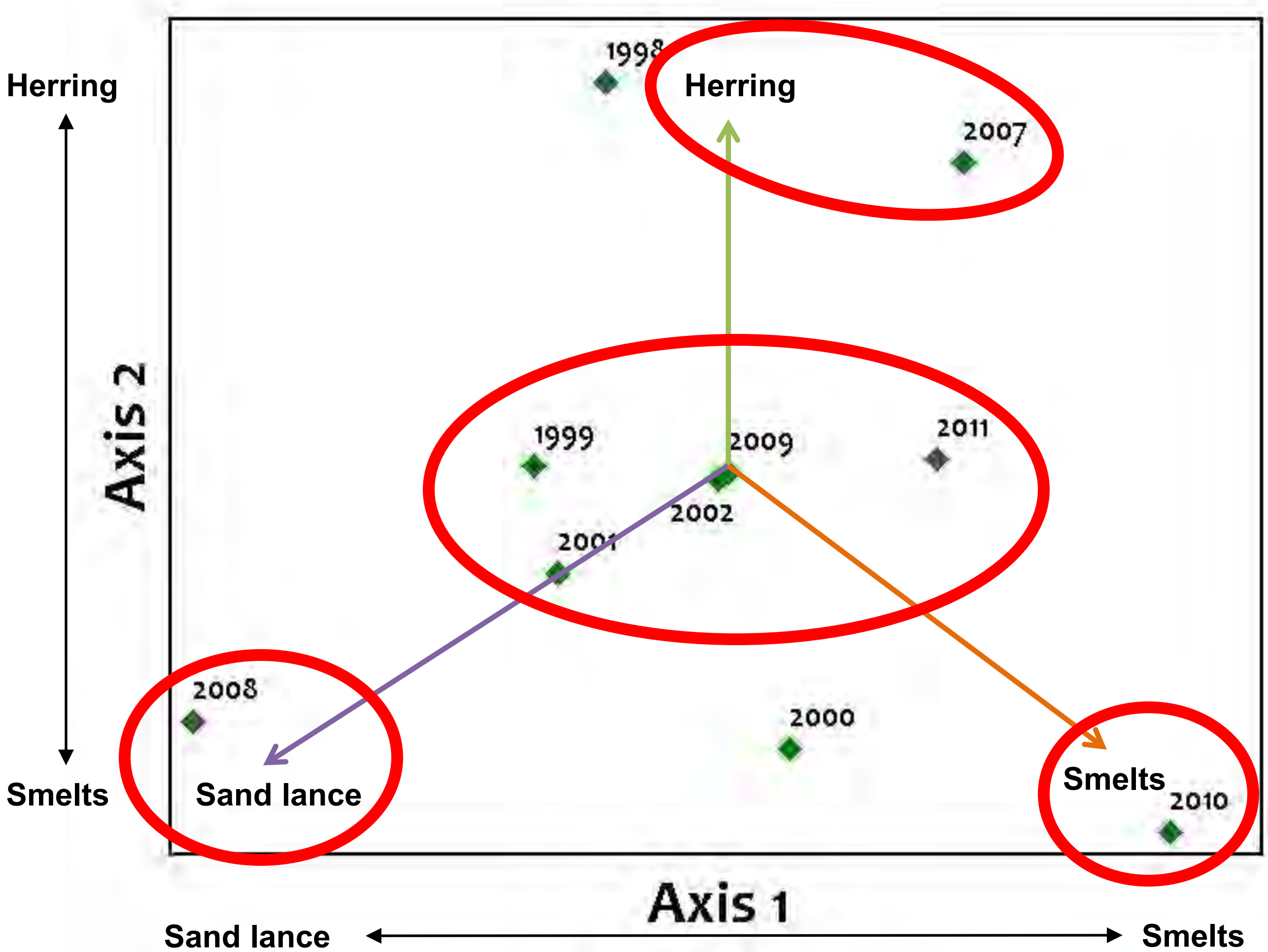
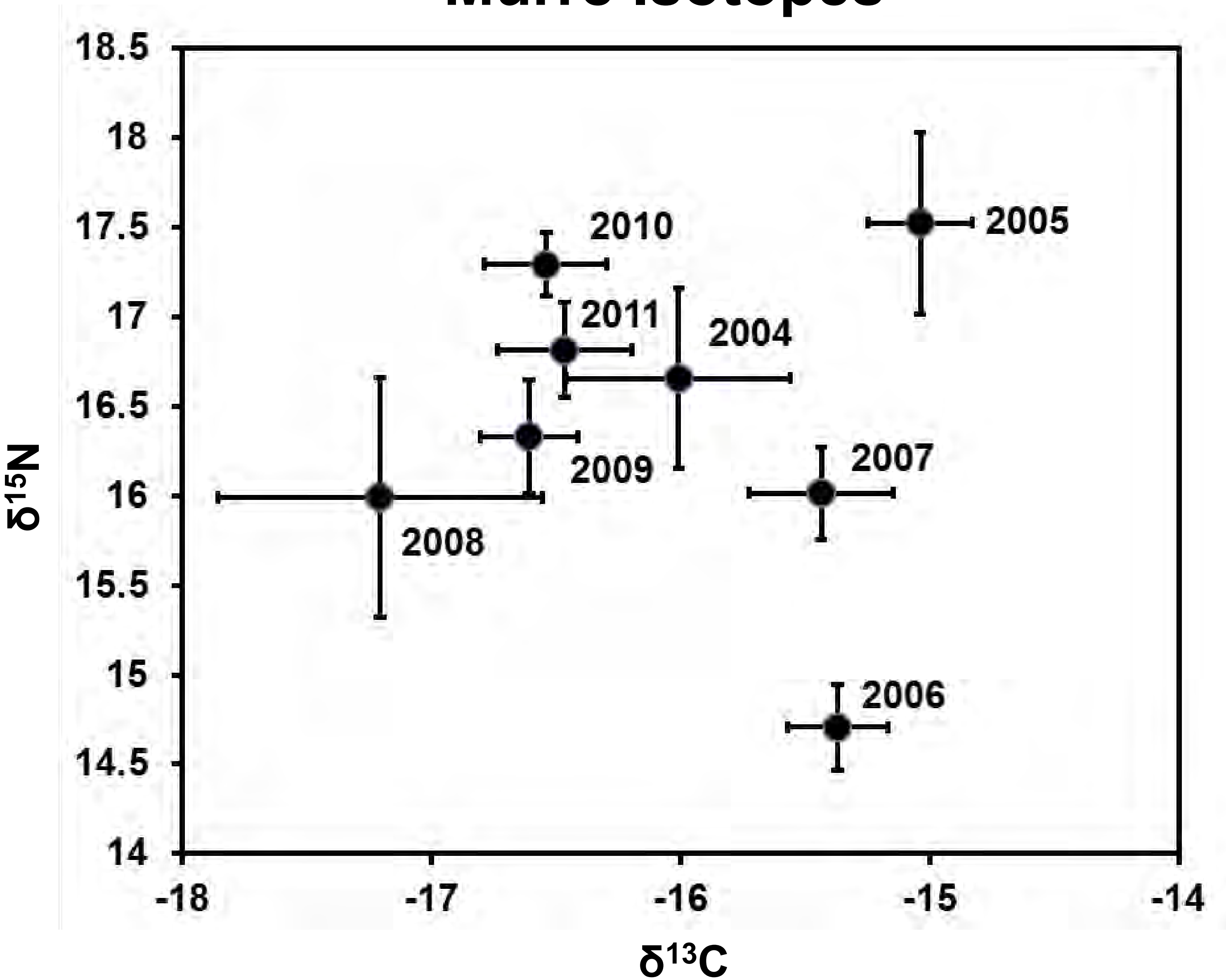
Prey Gradients



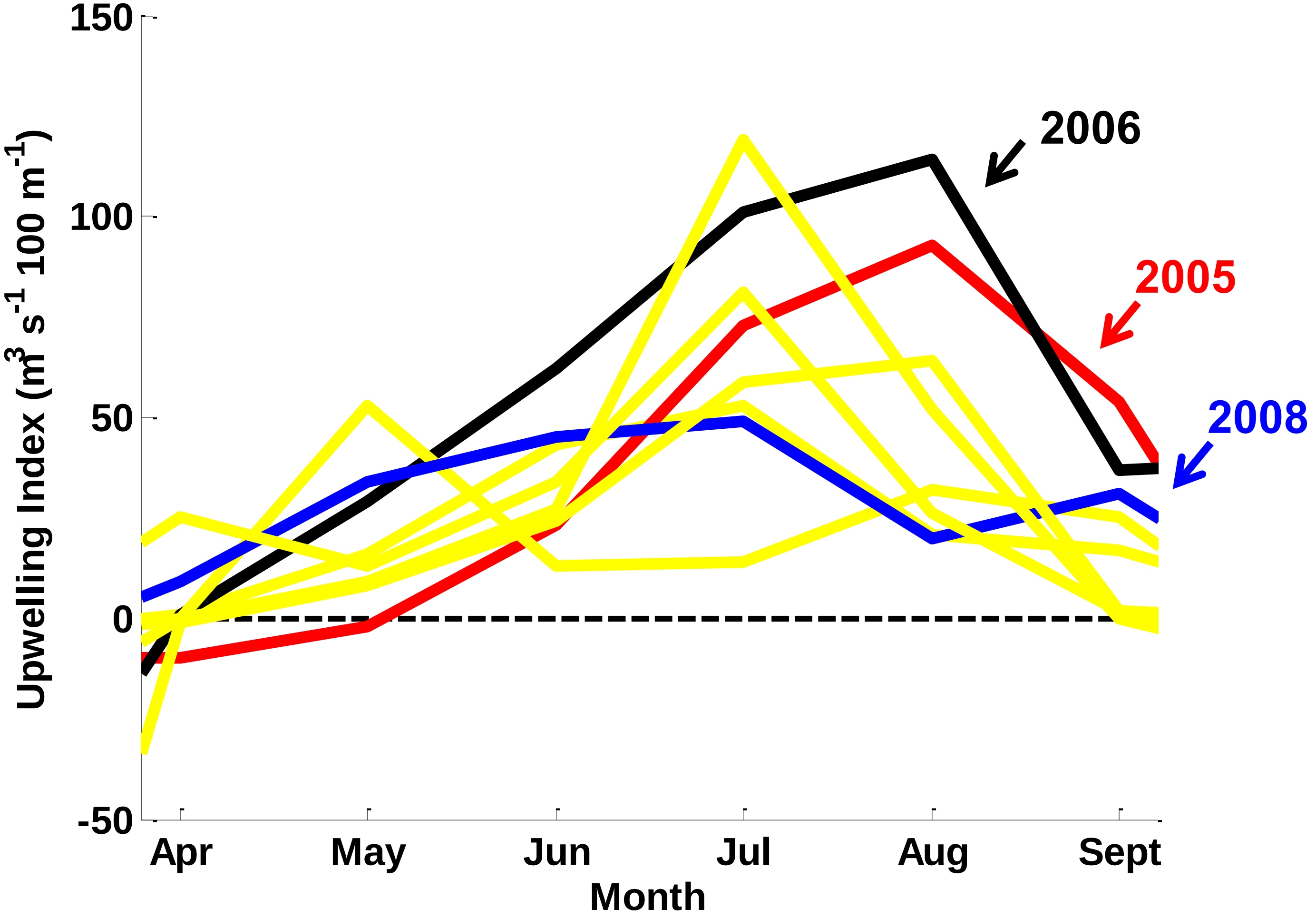
Gladics et al. 2012, ms

Herring in warmer years (+ SST, + PDO)
Sandlance in years with weaker N Pacific High (- NOI)
Smelts in years with a stronger N Pacific High (+ NOI)

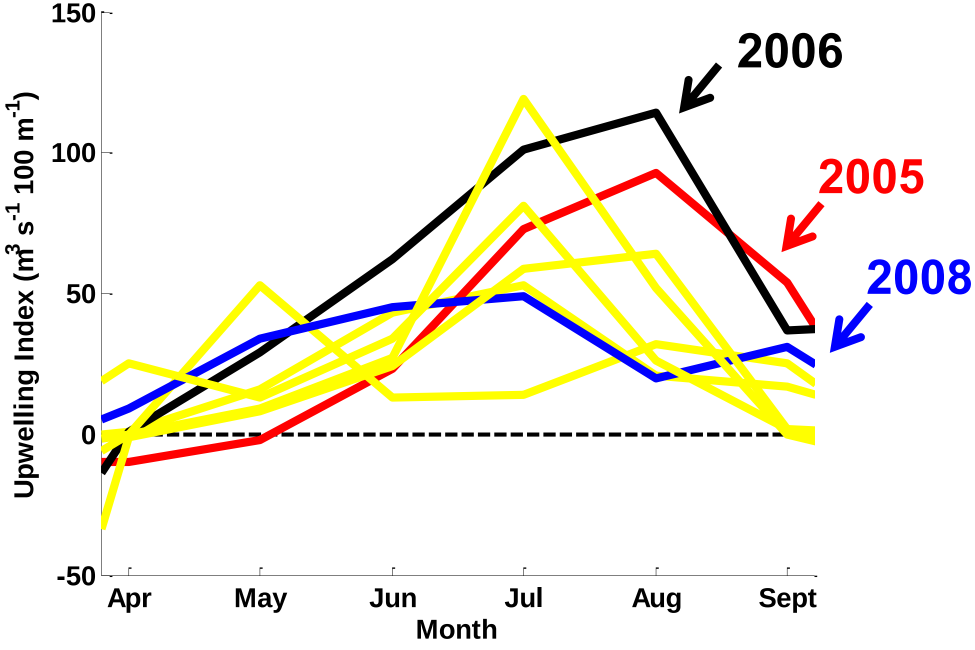
Murre Isotopes

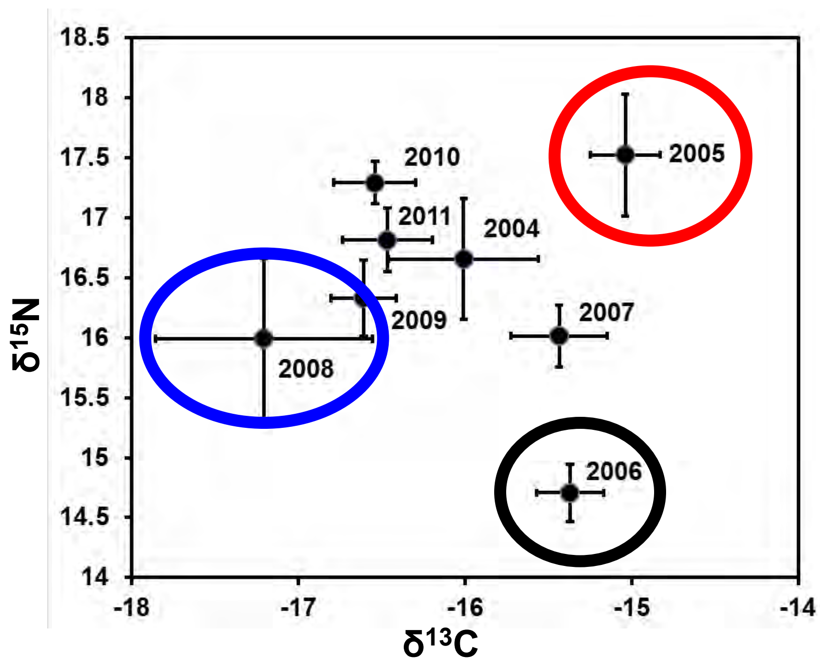


Upwelling Index (45º N)
2004 - 2011

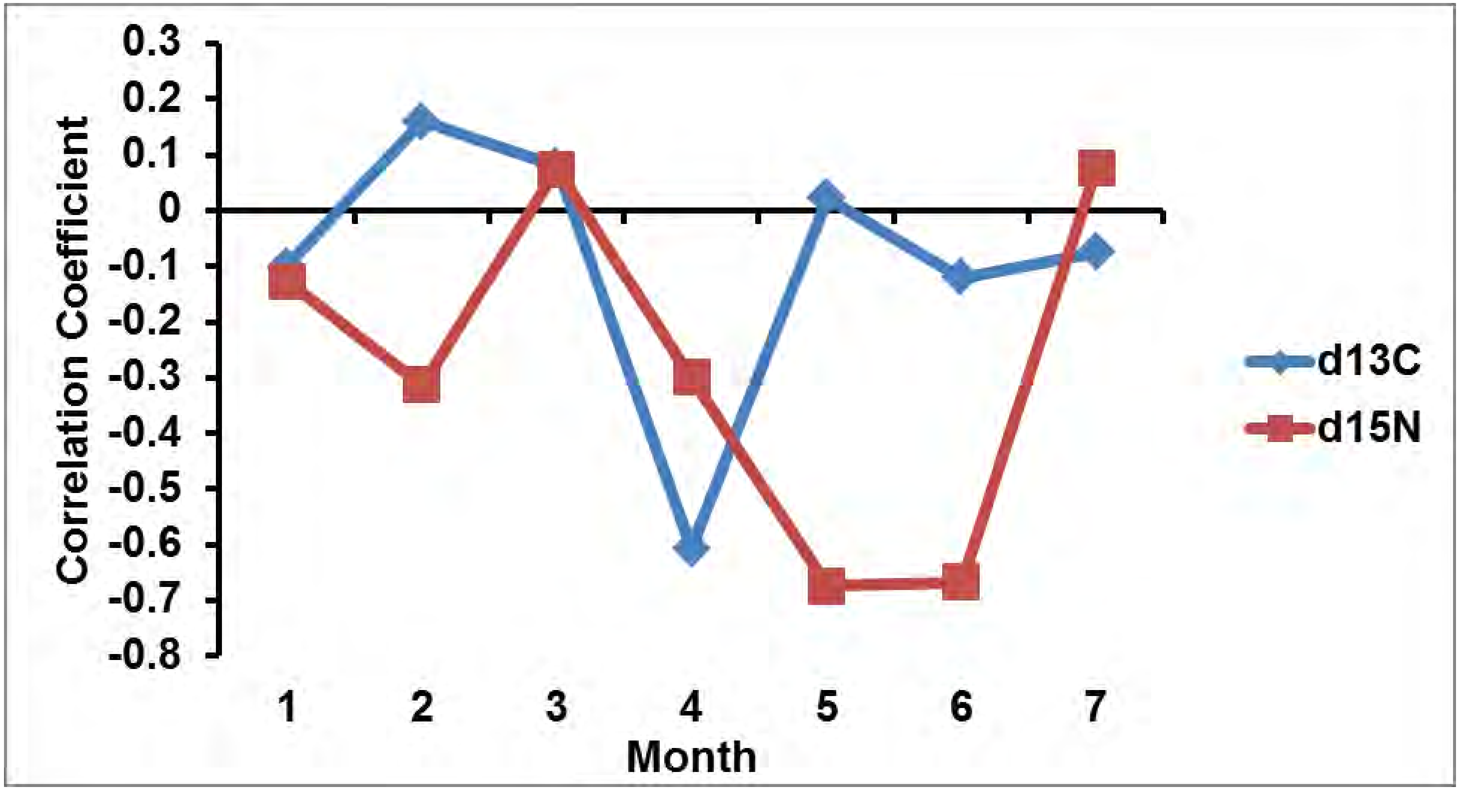


Upwelling Index (45º N)
2004 - 2011





Murre Isotopes vs. Upwelling Index



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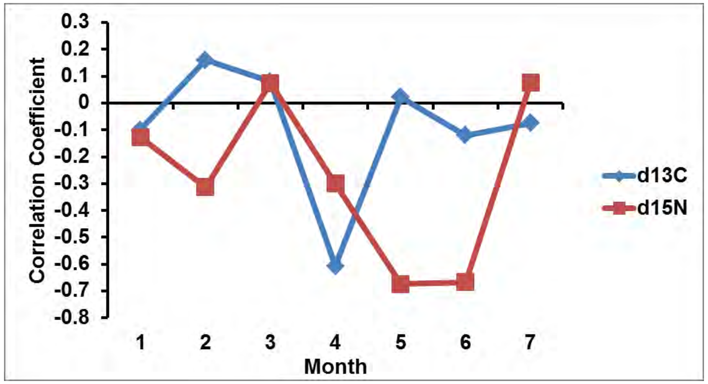
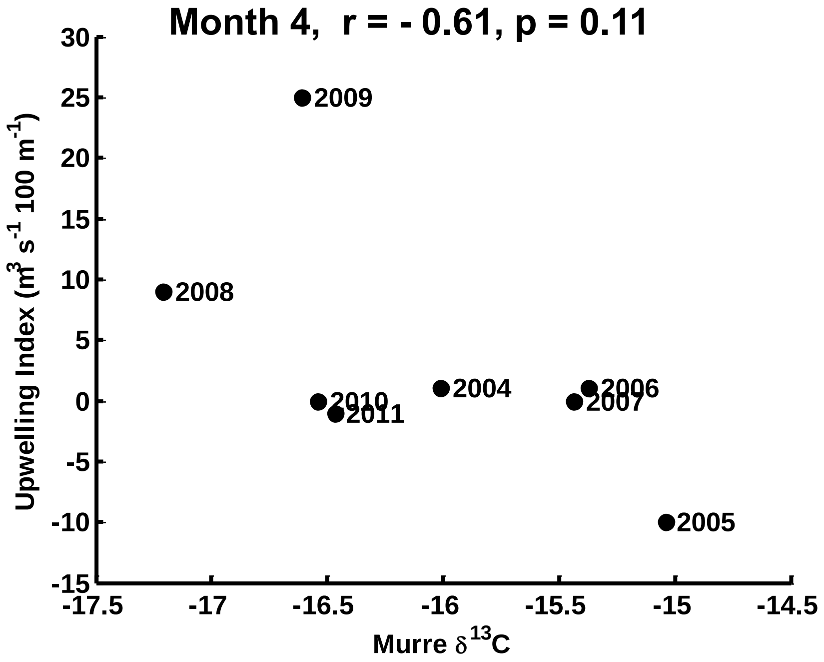
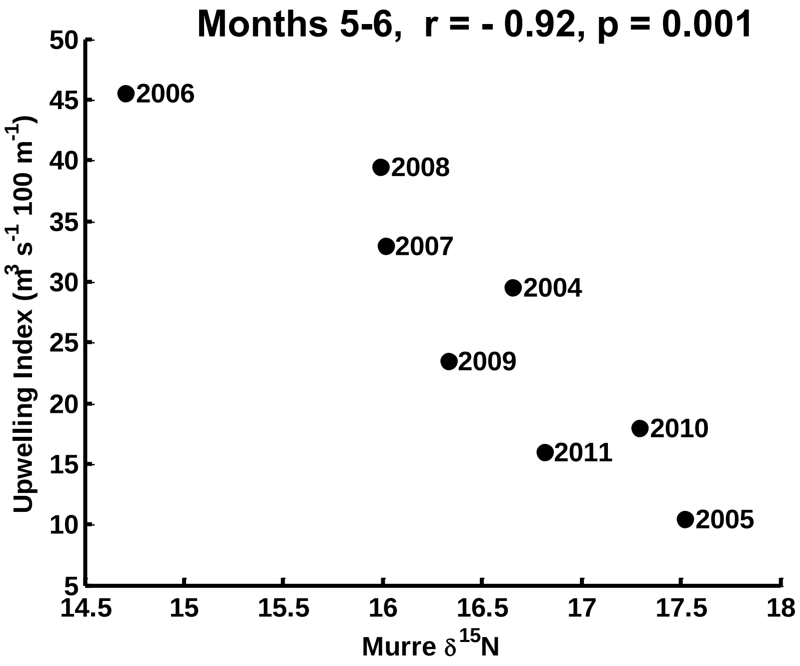
Isotopes vs. Upwelling Index







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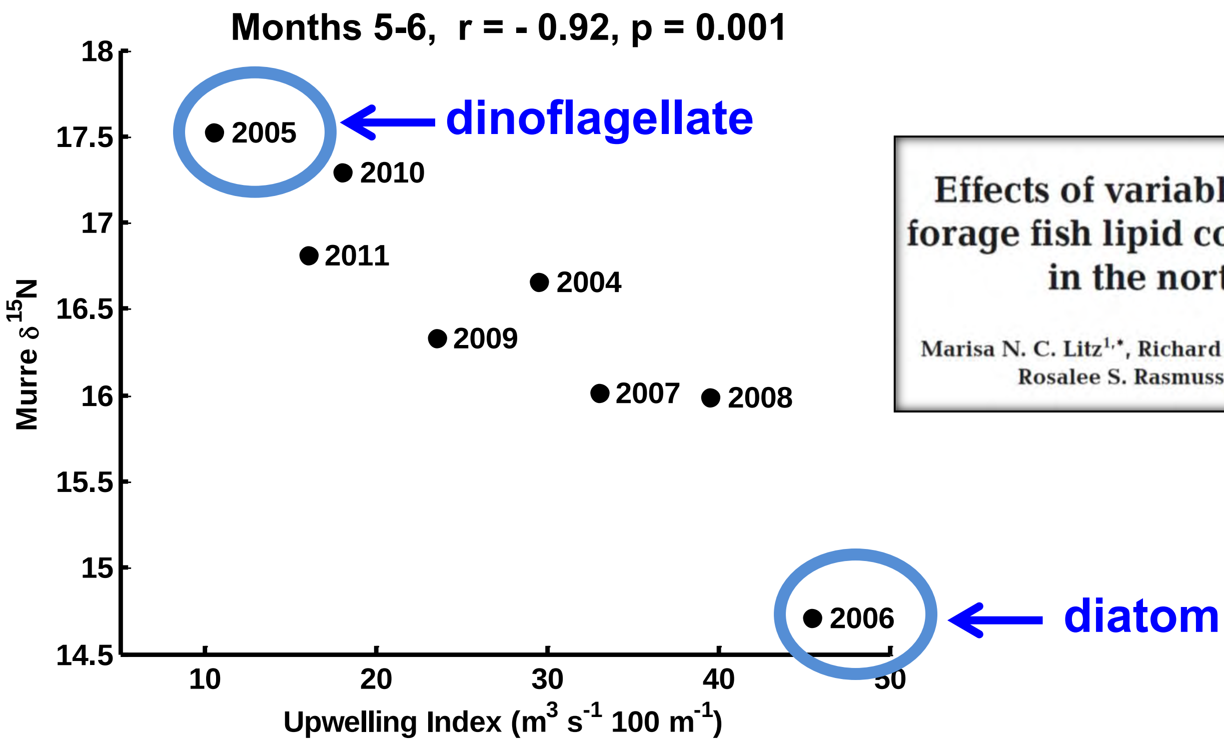
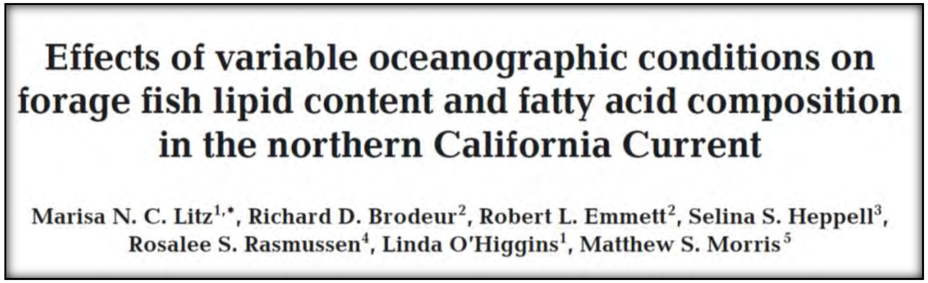
Isotopes vs. Upwelling Index





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]

Ecosystem Impacts

RESEARCH ARTICLES

Biological and Chemical Response of the Equatorial Pacific Ocean to the 1997–98 El Niño

F. P. Chavez,[1*] P. G. Strutton,[1] G. E. Friederich,[1] R. A. Feely,[2]
G. C. Feldman,[3] D. G. Foley,[4] M. J. McPhaden[2]

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PROGRESS IN OCEANOGRAPHY

Environmental forcing on life history strategies: Evidence for multi-trophic level responses at ocean basin scales

Robert M. Suryan[a,*], Vincent S. Saba[b], Bryan P. Wallace[c], Scott A. Hatch[d], Morten Frederiksen[e], Sarah Wanless[f]

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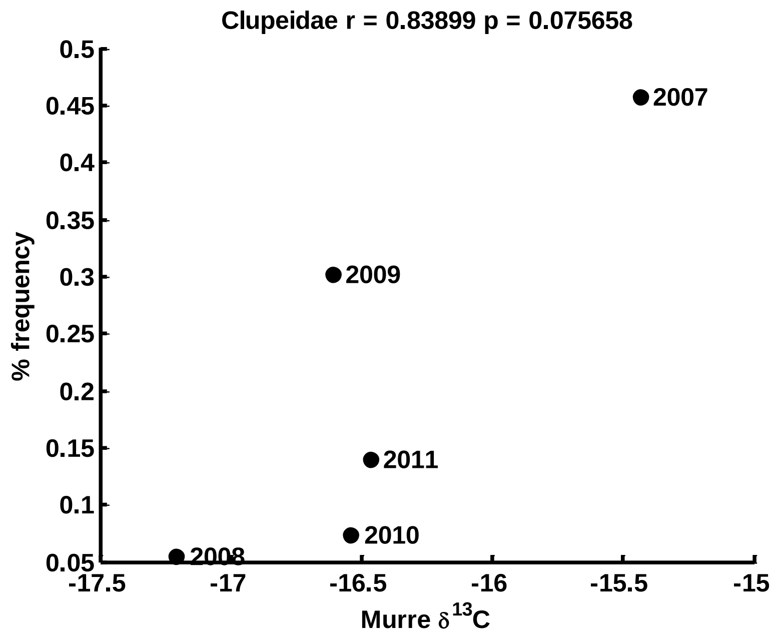
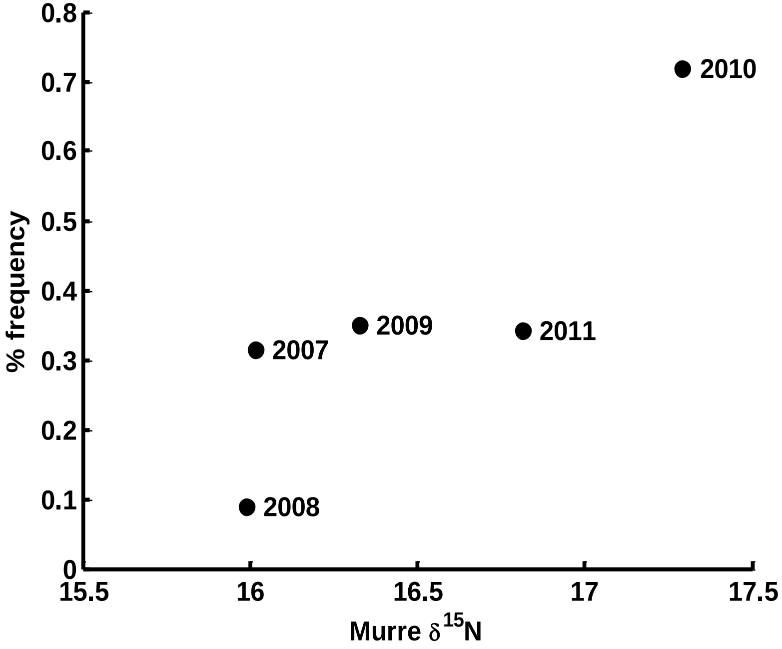
Prey Species vs. Stable Isotopes

Clupeidae (herring/sardines) r = 0.87, p = 0.05



Osmeridae (smelts) r = 0.87, p = 0.05



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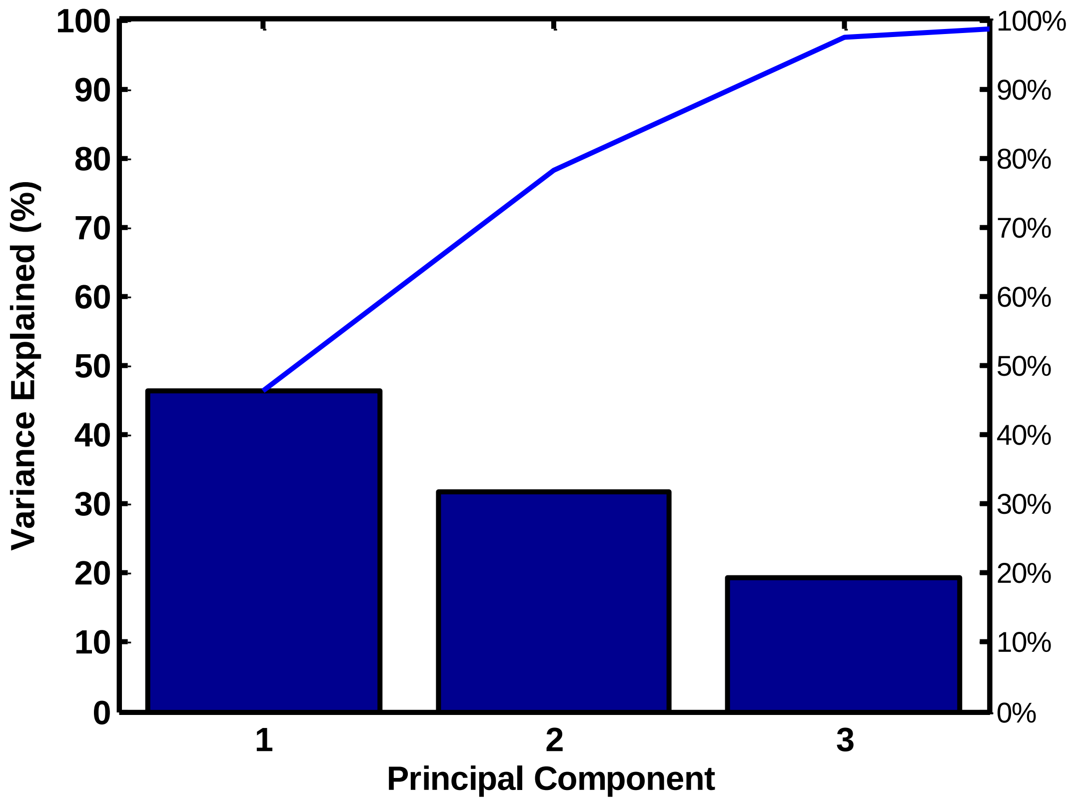
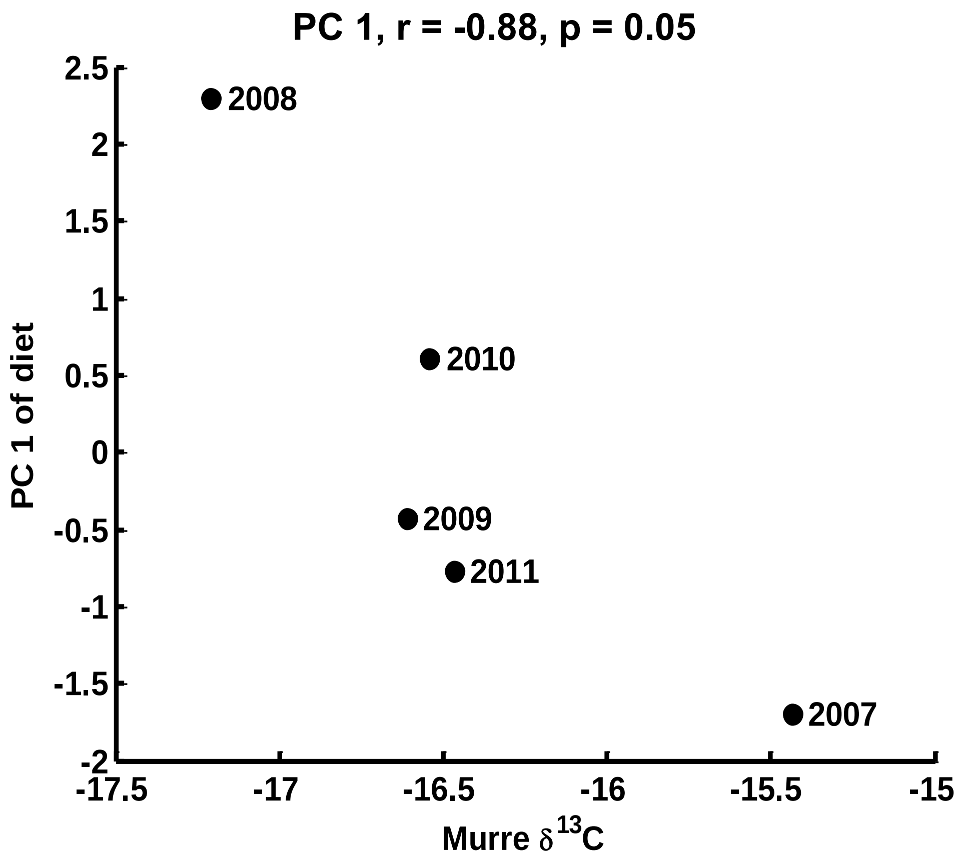
Prey Species PCA

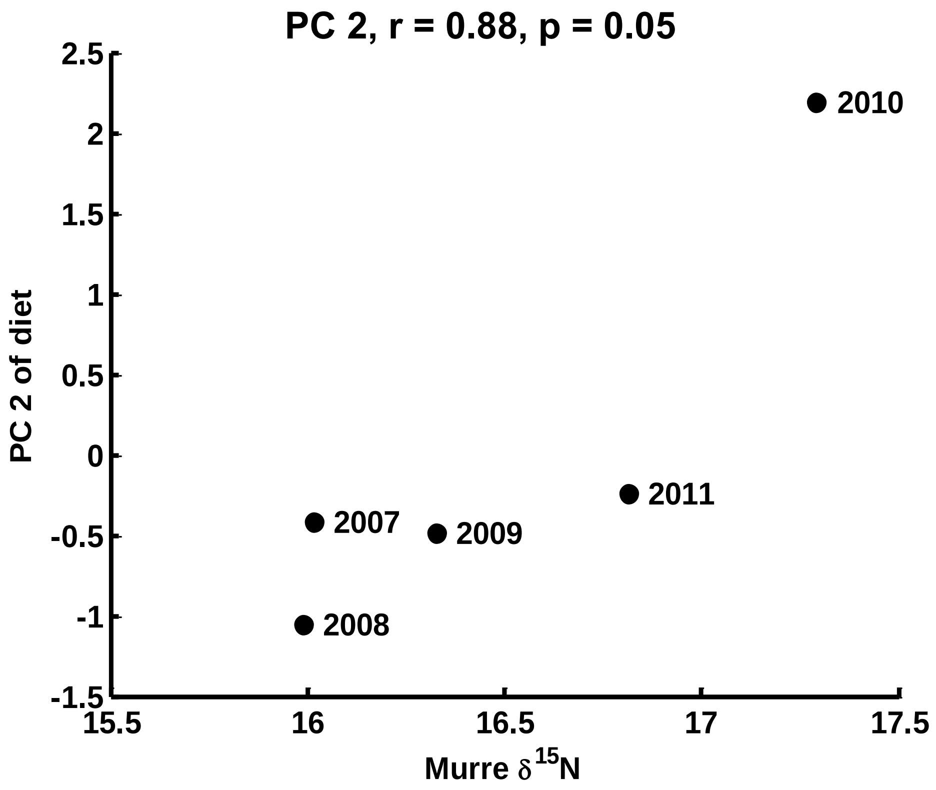


Prey Species vs. Stable Isotopes



PC1 vs. $\delta^{15}N$
r = -0.009, p = 0.989

Prey Species vs. Stable Isotopes



PC2 of diet vs. $\delta^{13}C$
r = 0.082, p = 0.896

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Stable Isotopes vs. Reproductive Success

$\delta^{15}N$ vs. Repro. Succ: $r = -0.256$, $p = 0.678$

$\delta^{13}C$ vs. Repro. Succ: $r = -0.460$, $p = 0.436$

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Stable Isotopes vs. Reproductive Success

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Conclusions

- Variation in upwelling and diet affects the isotopic signature of murre diets during the summer breeding season

- Murre $\delta^{15}N$ values can vary by 1 trophic level among years, even though their diet is strictly forage fishes

- $\delta^{15}N$ correlated most strongly with physical forcing (upwelling)

- $\delta^{13}C$ correlated most strongly with prey species consumed (spatial and source water variability?)

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

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Thanks!

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