Using Stable Isotope Analysis to Study Zooplankton Trophic Ecology in San Francisco Estuary

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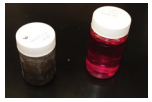
1 Introduction and Objectives

Zooplankton are an important food source for fish, like the endangered delta smelt. We use stable isotope analysis to improve our knowledge of the planktonic food web in the San Francisco Estuary and gain insights into its development over the past 4 decades.

3 main objectives:

Objective 1: Analyze effect of preservation method on zooplankton stable isotope composition.

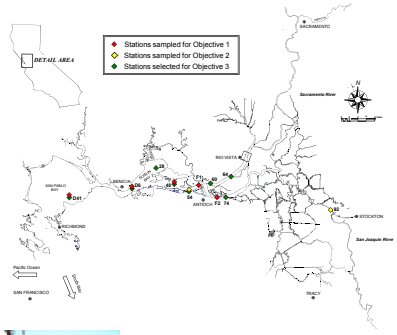


Objective 2: Use Historical zooplankton samples to characterize trends in their trophic ecology.*

Objective 3: Determine current primary organic matter sources and trophic level.*

*Results for these studies are not yet available

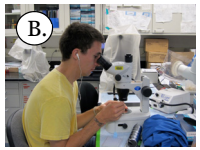
2 Sample Strategy and Methods



A. Zooplankton sampling + water filtration to measure environmental parameters ([SPM], [POC], [PON], [Chla], POC/Chla ratio, C/N ratio, salinity, temperature, turbidity...)

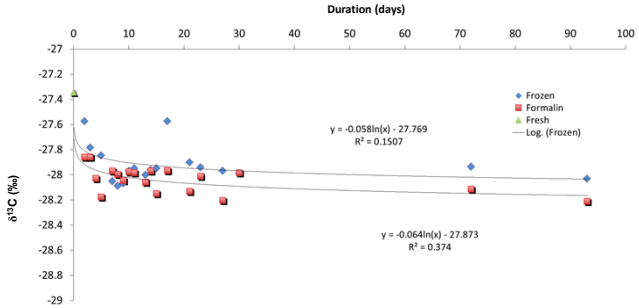
B. Zooplankton species identification, sorting and picking up (from 60 to 400 individuals/ sample depending on species)

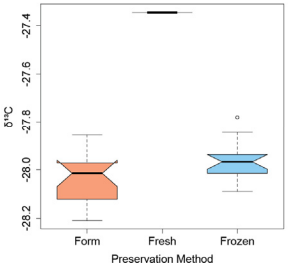
C. Stable Isotope Analysis by EA-IRMS (Elemental Analyzer- isotopic ratio mass spectrometer)

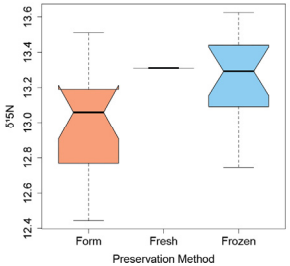


3 Impact of Preservation Methods and Duration: *e.g.. Acartiella sinensis*

- Very small effect of preservation on sample stable isotope composition
- Both formalin and freezing cause a slight initial ^{13}C-depletion, then $\delta^{13}C$ values remained relatively constant

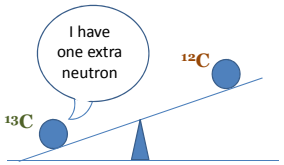




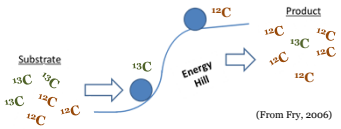


Stable Isotope Analysis

What are Stable Isotopes?

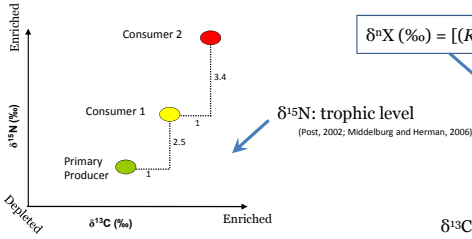


It is harder to push the heavier Carbon 13 up the "energy hill" in some chemical reactions, which means less of the heavier isotope in the product.



(From Fry, 2006)

What are Stable Isotopes Useful for in Ecology?



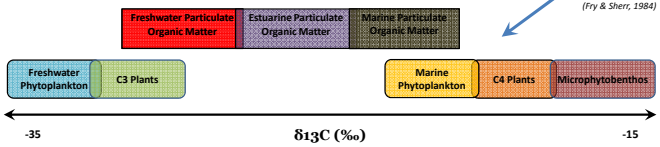
$$\delta^{n}X\ (‰) = [(R_{sample}/R_{standard})-1] \times 10^{3}$$

(Peterson & Fry, 1987)

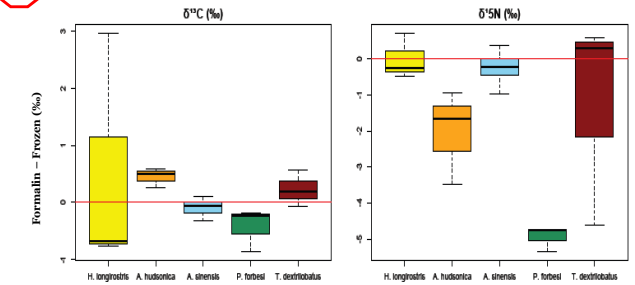
The δ value is related to the proportion of the heavier isotope over the light one in the sample

$\delta^{15}N$: trophic level (Post, 2002; Middelburg and Herman, 2006)

$\delta^{13}C$: origin of organic matter (Fry & Sherr, 1984)



4 Impact of Preservation Methods by Species



Mean differences between formalin-preserved and frozen samples (Formalin - Frozen)

(Except for *A. sinensis*, samples were analyzed after 1 day, 1 week, 1 month and 3 months of preservation)

5 Conclusion & Perspectives

- Small differences in the $\delta^{13}C$ of frozen and formalin preserved samples for all species
- Nitrogen results not as clear but taxon-specific correction factors could be applied to historical samples
- Results for objective 2 & 3 are still pending but we could expect to detect trends toward more negative $\delta^{13}C$ and more positive $\delta^{15}N$ values in recent years as a result of increasing reliance on terrestrially or freshwater derived organic matter sources and increasing degree of carnivory

This material is based upon work supported by the S.D. Bechtel, Jr. Foundation and by the National Science Foundation under Grant No. 0952013. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the S.D. Bechtel, Jr. Foundation or the National Science Foundation. This project has also been made possible with support of the National Marine Sanctuary Foundation. The STAR program is administered by the Cal Poly Center for Excellence in Science and Mathematics Education (CESAME) on behalf of the California State University (CSU). Steven Westbrook Robert Noyce Scholarship grant number 0833358.

Grant No. 0952013

Acknowledgements/References

A huge thank you to all the scientists in the Kimmerer lab for all their help and for a fun summer! Thanks to Department of Fish and Game and the Interagency Ecological Program for providing us with their samples as well as the UC Davis Stable Isotope Facility for analysing our samples. Thanks to David Bell and David Morgan of the Questuary for their help with sampling.

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