



CALFed Progress Questionnaire  
California Sea Grant College Program

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ProjectYear\_2A 1st Year ProjectNo\_2C R/SF-26  
TypeQuestionnaire\_2B Interim Questionnaire

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**Project Information**

ProjectNo\_2C R/SF-26 StartDate\_3a 9/1/2007 EndDate\_3b 8/31/2010  
ProjectTitle\_4 Investigating the Lower Trophic Levels of Suisun Bay Food Web: A Biomarker-Specific Isotope Approach

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**Additional Research Mentors and Community Mentors**

**Additional Research Mentors\_8**

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**Additional Community Mentors\_9**

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**Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.**

**ProjectObjectives\_10**

Simultaneous declines of multiple pelagic organisms in the upper San Francisco Bay suggests a possible trophic linkage and that a decline in food resources is an important factor in the decline of juvenile fish. Juvenile fish and the Delta Smelt rely predominantly on zooplankton as their food source, but the species of zooplankton that is most abundant changes temporally for multiple reasons. Because zooplankton species have different feeding strategies and because river flow directly and/or indirectly controls the magnitude and quality of organic matter available, there is a need to directly relate water management strategies to shifts in food sources available to the zooplankton community.

Our research goal is to obtain a coarse time-series of food sources being utilized by the dominant zooplankton inhabiting the upper SFB estuary (Suisun Bay). Based on this series of snapshots, we hope to further assess the impact of particular water management strategies on zooplankton community dynamics. We focus on Suisun Bay as it is a critical habitat and likely to be strongly affected by proposed changes to the San Joaquin River.

Our specific objectives are: (1) To determine what sources of organic matter support the dominant zooplankton population within Suisun Bay at different time points of the year and (2) To determine if changes in water management practices modify the type and magnitude of food sources available to support zooplankton production.

**Summary of progress in meeting each of these goals and objectives**

**ProgressSummary\_11**

Our approach is to use biomarker-specific isotopes to obtain a snapshot of the primary food sources of zooplankton. While the traditional approach of using stable carbon ( $^{13}\text{C}$ ) and nitrogen ( $^{15}\text{N}$ ) isotopes to distinguish organic matter inputs is difficult in the San Francisco Bay estuary because of the number of potential sources and their overlapping isotopic signatures (Canuel et al., 1995; Cloern et al., 2002), the use of biomarkers and multiple isotope tracers can help overcome some of these limitations. Specifically, our goal is to analyze the carbon isotopes of lipid biomarkers to determine carbon inputs of specific sources; the nitrogen isotopes of amino acids to determine sources of nitrogen and trophic-level interactions; and both radiocarbon and sulfur isotopes of bulk biomass to trace estuarine-marine vs. terrestrial organic inputs.

Our goal in the first year was to complete two sampling cruises (Spring, Summer) during which the entire suite of measurements would be analyzed. Once the baseline isotopic composition of all potential organic matter inputs to zooplankton was determined, we would then focus on those analyses that provided the most information.

In April and July of this past year, a full suite of samples was collected from Suisun Bay and its inputs/outputs: Benicia, Suisun Slough, San Joaquin River and Sacramento River. The bulk stable carbon and nitrogen isotope signatures of all fractions of these samples have been measured. In addition, a method for quantitative extraction of lipids from these samples has been tested; a current focus is to test if both lipids and amino acids can be isolated from the same zooplankton sample quantitatively and without isotopic fractionation.

The amino acid composition for this suite of samples has also been determined as a first-step to measuring the nitrogen isotopes of individual amino acids. This analysis also provides information on the concentration of D/L amino acids (a tracer of bacterial input) and of non-protein amino acids (a tracer of organic matter freshness). We are also currently culturing zooplankton isolated from Suisun Bay to directly test the trophic relationship in amino acid isotope signatures (between food source and zooplankton) within the species found in the relevant estuarine environment.

Initially we proposed to identify the isotopic signature of primary producers in Suisun Bay through size fractionation. This approach had the potential pitfall of co-isolating detritus or bacteria. Instead, a method to determine the carbon and nitrogen isotopes of chlorophyll a has been developed which will allow the stable isotopes of primary producers in Suisun Bay to be determined directly.

**PROJECT MODIFICATIONS:** Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

**Modifications\_12**

No substantial modifications in research plans have been made at this time. A minor methodological change, described in the above paragraph, has been made.





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**COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.**

**CoopOrganiz\_15**

The USGS and Dr. James Cloern have generously provided berth space on the R/V Polaris during monthly cruises through the San Francisco Bay and immediate access to critical data such as chlorophyll concentrations and water salinity. We hope to pursue further collaborations with USGS scientists. For instance, USGS scientist Dr. Carol Kendall is monitoring the sulfur isotopes of sulfate, which will directly complement our own measurements of sulfur isotopes in zooplankton.

The Department of Water Resources has generously provided access to several of their water monitoring stations on the Sacramento and San Joaquin River.

**AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.**

**Awards\_16**

n/a

**KEYWORDS: List keywords that will be useful in indexing your project.**

**Keywords\_17**

Zooplankton, organic matter, trophic levels, food webs, Suisun Bay, compound-specific isotopes





