



## Unraveling Sources of Food Web Support in the Sacramento-San Joaquin Delta's Marsh Ecosystem

Emily Howe, Delta Science Fellow

### BACKGROUND

A century of human intervention has changed the physical, biological and chemical environment of the Sacramento-San Joaquin Delta. The area, which was historically characterized by marshes, rivers, and high turbidity, is now defined by a shrinking marsh habitat, contaminants and minimal flow.

Within the last fifty years, the delta experienced a 95% reduction in freshwater tidal marsh and brackish wetland ecosystems. Many attribute food limitation (diminishing detritus-based organic matter and decreased phytoplankton productivity) to the recent pelagic organism decline in the region.

The relative importance of non-phytoplankton detrital material in the food web is not well understood.

### PROJECT

As wetlands and their marsh plants have been destroyed, the primary source of carbon (energy) at the base of the Delta food web has shifted from plant detritus to phytoplankton. As a result, the food chain has become structured around pelagic food web dynamics and is yet one more symptom of ecosystem degradation. However, this project seeks to test the hypothesis that despite a phytoplankton-based food web, invertebrates key to fish diets are still well adapted to take advantage of marsh-produced detritus when it is available.

To investigate these ideas, the Fellow used stable isotope and fatty acid biomarkers to: (1) identify the origin, transport and fate of organic debris in the delta and Suisun Bay, and (2) investigate the role of this debris in supporting key invertebrate prey organisms in tidal marshes and other shallow-water ecosystems.

“One way to protect, restore, and enhance the Delta ecosystem is to support the base of the food web, which requires identifying which sources of organic matter are important to different primary consumers.”

- Emily Howe, Delta Science Fellow



Preliminary analysis showed that amphipods, mysid shrimp (shown here, right), insect larvae, and dragonfly nymphs received approximately half their diet from plant detritus. PHOTO: NOAA

Fellow Emily Howe, far right, samples organic matter in Suisun Marsh. PHOTO: Maria Karm

## RESULTS

The Fellow and collaborators have collected samples of primary producers, suspended particulate organic matter, sediment cores and consumer organisms from the Delta and Suisun Marsh.

The sampling occurred primarily in densely vegetated marsh in various salinity gradients and vegetation areas. The ongoing California drought prohibited sampling of varied flow periods.

Fatty acid and stable isotope analysis was conducted on consumer organisms to allow the Fellow to track trophic linkages between species.

Preliminary analysis showed that the sources of organic matter were highly distinguishable using both fatty acid and stable isotope analysis. This allowed the Fellow to conclude that invertebrates eat a variety of organic matter sources, indicating that both open water and heavily vegetated areas are important sources of food for the lower trophic levels. Specifically, although zooplankton were closely aligned with phytoplankton consumption, amphipods, mysid shrimp, insect larvae, and dragonfly nymphs received approximately half their diet from plant detritus.

## MANAGEMENT APPLICATIONS

This project will inform ecosystem restoration actions to support the base of the food web. By identifying that plant detritus remains an important food source to primary consumers, restoration planners can include vegetated areas in plans to bolster the food webs.

## PRESENTATIONS & POSTERS

Howe, E., C.A. Simenstad, M. Young. (2014) Unraveling sources of food web support in the Sacramento-San Joaquin Delta's marsh ecosystem using fatty acid biomarkers and multiple stable isotopes. 8th Bay-Delta Science Conference, Sacramento, Calif.

Young, M., K. Berridge, & E. Howe. (2014) Fishes of the North Delta: Trophic Pathways & Habitat Use. 8th Bay-Delta Science Conference, Sacramento, Calif.

Howe, E. and Simenstad, C.A. (2013). Unraveling sources of food web support in the Sacramento-San Joaquin Delta's marsh ecosystems using fatty acid biomarkers and multiple stable isotopes. Coastal and Estuarine Research Federation, San Diego, Calif.



Sherman Island Tule Marsh was one of the project study sites.  
PHOTO: E. Howe

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