Sea Grant California

Understanding Food Webs in Shallow Nearshore Waters of the Delta

Matthew Young, Delta Science Fellow

BACKGROUND

During the past decade, populations of native species in the Sacramento-San Joaquin Delta have been shrinking. Though not yet listed as endangered, existing information suggests that Sacramento blackfish (*Orthodon microlepidotus*), hitch (*Lavinia exilicauda*), tule perch (*Hysterocarpus traski*), Sacramento pikeminnow (*Ptychocheilus grandis*), and Sacramento sucker (*Catostomus occidentalis*) are in steep decline.

Nonnative species are increasingly common throughout the delta. Little is known about the relative roles of native and nonnative species in Delta food webs, especially in the near shore environment and areas where native species persist. Noticeable changes in fish community composition in littoral habitats have led to the theory that nonnative fishes may have taken over the roles of native fishes.

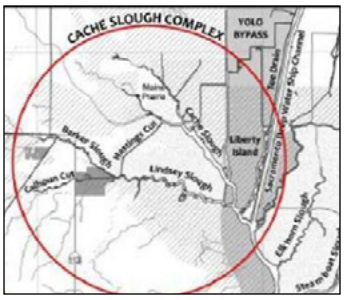
PROJECT

This project evaluates the ecological roles of native and nonnative species and the potential for resource competition by examining the trophic structure of littoral food webs in three Delta regions (Suisun Marsh, the Sacramento-San Joaquin Confluence, and the Cache Slough Complex) that are home to high densities of native fish.

The goal is to better understand how native and nonnative fishes might respond to various restoration options and the degree to which declines in native, resident fish species might be due to competition with invasive species for food and habitat. This project also considers how nonnative species with no native analogues, such as the red swamp crawfish (*Procambarus clarkii*), fit into the food webs.

The first year of the project was spent collecting samples, identifying trends in fish populations, and analyzing the effects of nonnative species on predator-prey relationships, food availability, and habitat quality.

The following year, the researcher used two methods to evaluate the trophic pathways and analyze the short-term and long-term food web dynamics. Short-term understanding was obtained by a rigorous diet-content analysis, identifying gut contents down to the lowest possible taxonomic level. Long-term understanding was obtained through stable-isotope analysis of muscle tissue, specifically looking at carbon, nitrogen and sulfur isotopes, which can identify long-term nutrient sources and resource overlap when compared between fish species.



The Cache Slough Complex, *top right*, was one of three Delta regions that was studied, due to the high density of native fish in the area. *IMAGE: M. Young*

Matt Young, *right*, collects sample fish using electrofishing equipment. *Courtesy photo*

RESULTS

The Fellow used existing literature to categorize native and nonnative fish species based on what is known about their ecological role in the Delta or, barring accurate information on Delta-specific ecology, their native range. Preliminary analysis for 10 of these groups showed strong evidence of resource segregation by some native and nonnative species, while others have higher incidences of resource overlap.

Field results revealed that, in areas where submerged aquatic vegetation (SAV) is low and not as important a contributor in the food web, there appears to be more resource segregation. A pair of superficially similar minnows, golden shiner (nonnative) & hitch (native), show evidence for segregation of resources in low SAV areas, while in high SAV areas there is much more resource overlap. Other fish pairs show this same pattern, including bluegill sunfish (nonnative) and tule perch (native).

However, other species groups don't show the same pattern. Omnivorous & detritus-consuming benthic fishes (e.g. nonnative common carp and native Sacramento sucker) have high resource overlap across all habitats. Additionally, the native Delta smelt show distinct evidence of utilizing different resource pathways than other nonnative pelagic species, including threadfin shad & Mississippi silverside, across all habitat types.

MANAGEMENT APPLICATIONS

This study will help improve understanding of Delta food webs in a rapidly changing ecosystem and provide guidance for restorative actions. By identifying which factors are limiting the abundance and distribution of native fish, findings will provide greater insight about how to rebuild or sustain native resident fish. Resource managers will be better able to predict native and nonnative fish interactions based on the resources available.

Though not yet listed as endangered, the tule perch (shown above) are in steep decline in the Sacramento-San Joaquin Delta. *PHOTO: M. Young*

> "It is critical to understand the result of restoration actions on both native and nonnative species in order to maximize the benefit of scarce resources and to avoid future listings of additional species."
>
> - Matthew Young, Delta Science Fellow

PRESENTATIONS & POSTERS

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., 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.

Durand, J., T. O'Rear, M. Young, & P. Moyle. (2013) Cache Slough and the Northern Ark of Native Fishes. State of the San Francisco Estuary Conference, Oakland, Calif.

RESEARCH MENTOR

Peter Moyle, Wildlife, Fish and Conservation Biology and Center for Watershed Sciences, UC Davis

COMMUNITY MENTOR

Fred Feyrer, Bay-Delta Office, US Bureau of Reclamation, Sacramento

CONTACT

Matthew Young
Graduate Student
Center for Watershed Science
University of California, Davis
559-936-7242
mjyoung@ucdavis.edu

Delta Stewardship Council | Sea Grant California

This publication is sponsored by a grant from the Delta Science Program, part of the Delta Stewardship Council, and is based on research findings from project R/SF-58. The views expressed herein are those of the authors and do not necessarily reflect the views of the Delta Stewardship Council or any of its sub-programs. This document is available in PDF on the California Sea Grant website: www.csgc.ucsd.edu. California Sea Grant, Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, Dept. 0232, La Jolla, CA 92093-0232 Phone: 858-534-4440; Email: casgcomms@ucsd.edu / Printed 2014