

DELTA SCIENCE FELLOW 2017



Michelle Jungbluth

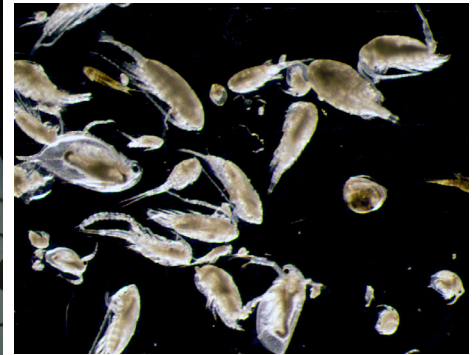
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WHY THIS RESEARCH MATTERS

Longfin smelt are a threatened species in the San Francisco Estuary. Previous research suggests that the decline in this population in the estuary has been driven partly by a food shortage. Research to date has identified prey species using traditional methods of diet assessment, which identify partially digested organisms and possibly miss important soft-bodied prey.

Using molecular methods, researchers can more carefully identify important prey in the diet and whether they differ across habitats within the estuary. Without a better picture of the longfin smelt diet, it will be hard to set management strategies that encourage this species' recovery.

Revealing the invisible contributors to the diets of larval longfin smelt and striped bass in the San Francisco Estuary



Genetic analysis elucidates the diets of delta fishes. Left: Microscope image of mixed larval fishes from a water sample. Right: Microscope image showing a subsample of the zooplankton present in the water, possible prey available to the larval fishes. – M. Jungbluth

PROJECT

To better understand why the longfin smelt is threatened, the project compared the diet of larval longfin smelt to a thriving fish with overlapping natal habitat and of similar size and morphology— the Pacific herring. Using new genetic analysis methods, the project aimed to elucidate species composition of fish diets in greater detail than has been done before and to measure differences in composition and frequency of prey across habitats. In particular, the project aimed to identify prey items that were not previously seen using traditional diet analysis methods and assess whether any prey are indicative of natal habitats.

RESULTS

The research suggests that the diets of longfin smelt and Pacific herring larvae overlap in some ways while also containing unique prey not consumed frequently by the other species. For example, the study found that delta smelt feed on more insects in the termite and cockroach family, while herring consumed more insects in the wasp, bee, and ant family. The study also found evidence of aquatic plants in the guts of longfin smelt that are not common in the Pacific herring. In addition, the study found differences in composition and frequency of different types of prey across habitats.

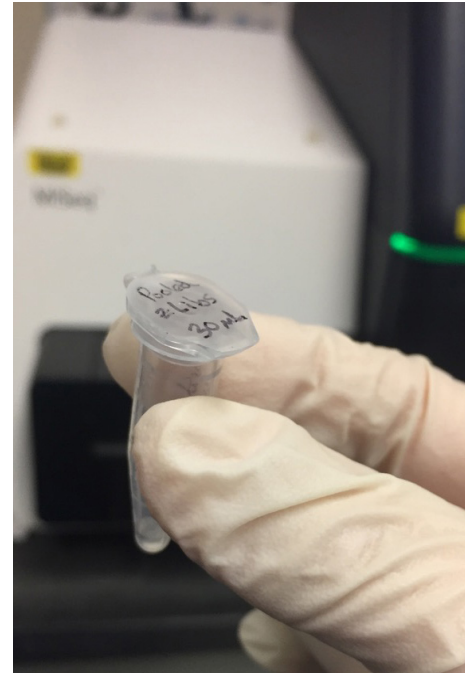
The study provides a wealth of DNA metabarcoding data on larval fish diets. It also identified the need for further genetic analysis of common species. Many common organisms in the delta have not had their DNA sequenced, which meant that they could not yet be identified with confidence.

MANAGEMENT APPLICATIONS

This research provides a more complete picture of the prey assemblage that is important to the larval diets of two important delta fish species: the threatened, native longfin smelt and an abundant co-occurring species, Pacific herring.

This information will help inform management actions meant to develop and implement plans to restore food webs throughout the delta. Managers can use these results to maximize the utility of existing programs monitoring the prey community, such as the California Department of Fish and Wildlife Zooplankton Study, to identify habitats that provide food web support to the larval fishes.

Furthermore, the study results can provide information on the importance of native vs. introduced prey species in the diets of the fishes, inform captive-rearing efforts in progress at the UC Davis Fish Conservation and Culture Laboratory, and may be mined to look for species that indicate the specific location in which the fishes were feeding.



In the end it all comes down to DNA in a tube. The liquid in this tube was processed with DNA sequencing technology to recover millions of DNA sequences that can be traced back to the diets of the larval fishes in this study. - M. Jungbluth

SELECT PUBLICATIONS AND PRESENTATIONS

Jungbluth MJ, and Kimmerer W. Feeding Habits and Novel Prey of Larval Fishes in the San Francisco Estuary are Revealed by High-Throughput DNA Sequencing. In prep.

Jungbluth, M. (2019). Molecular Insights into Aquatic Foodweb Ecology in the San Francisco Estuary and Beyond. Seminar Presentation, Rosenberg Institute Seminar Series, Estuary & Ocean Science Center, San Francisco State University, April 3, 2019.

Jungbluth, M. (2019). Composition of Larval Fish Diets: Comparing High-Throughput DNA Sequencing with Morphological Methods. Oral Presentation, Interagency Ecological Program Workshop, Folsom, CA, March 7, 2019

Jungbluth, M. (2018) Habitat Variation in the Diets of Young Longfin Smelt, Enhanced with DNA Metabarcoding. Oral Presentation, Bay Delta Science Conference, Sacramento CA, September 6, 2018

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