Fishes of tidal wetlands of the northern San Francisco Estuary: Preliminary results from the Integrated Regional Wetland Monitoring (IRWM) project

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Abstract

The Integrated Regional Wetland Monitoring project is supported by CALFED to establish a rigorous comprehensive monitoring program to evaluate how (or if) wetland restoration sites in the North Bay and Delta are changing over time, and which ecological functions are (or are not) returning to "normal". The central hypothesis of the Fish, Invertebrate and Food Web Team is that food web structure, habitat supplementation and nekton use change from allochthonous to autochthonous with increasing development of restoring wetlands. We have sampled each of six tidal marshes – Sherman Lake, Brown's Island, Bull Island, Coon Island, Pond 2a, and Carl's Marsh – approximately quarterly since October 2003. We deployed a fyke net (3.1-mm mesh) at the mouth of each of 3 channels per marsh during moderate spring tides, set during high tide and recovered at low tide. October 2003, February 2004 and June 2004 samples (52 fyke net sets) yielded 4,704 specimens representing 18 taxa, dominated by inland silverside *(Menida beryllina)*, Western mosquitofish (*Gambusia affinis*), rainwater killifish (*Lucania* parva) and three-spine stickleback (*Gasterosteus aculeatus*). Abundances of total fishes decreased markedly from October 2003 through June 2004. Composition and abundance of fishes varied geographically (e.g., Suisun/Delta dominated by Western mosquitofish and Napa/Petaluma dominated by inland silversides). Ordination analyses confirmed both geographic and seasonal separation of fish assemblages, yielding significant relationships between ordination axis scores. Additional IRWM sampling for distribution and abundance of fishes will continue through at least summer 2005, with ongoing and future analyses to include trophic dynamics (e.g., food-web structure and function; see companion poster by Simenstad et al.).

Introduction

Our overall goal is to identify and quantify metrics for monitoring the ecological contribution of emergent marshes to the broader SFE ecosystem, particularly those related to fish and motile macroinvertebrate assemblages. Our specific objectives:

1. Document the occurrence, abundance and population structure of fishes.
2. Determine the net exchange in abundance and biomass of fish and motile macroinvertebrates between open and marsh waters.
3. Evaluate the consumption of wetland prey resources by transient fishes.

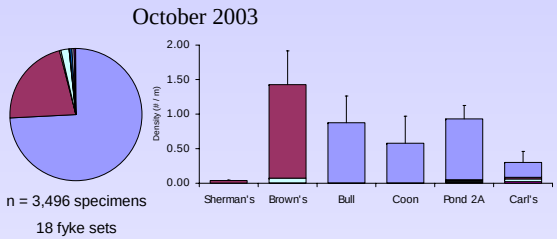
Here we present data specific to objective #1 only.

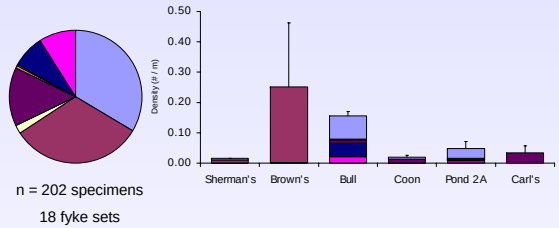
Fig. 1. We have sampled each of six tidal marshes – Sherman Lake, Brown's Island, Bull Island, Coon Island, Pond 2a, and Carl's Marsh

Materials and Methods

Marsh channels were sampled using a Fyke net positioned across the entire channel during moderate spring tides. Fish were collected periodically throughout the ebb tide then identified, measured, weighed and returned to the channel.

Results





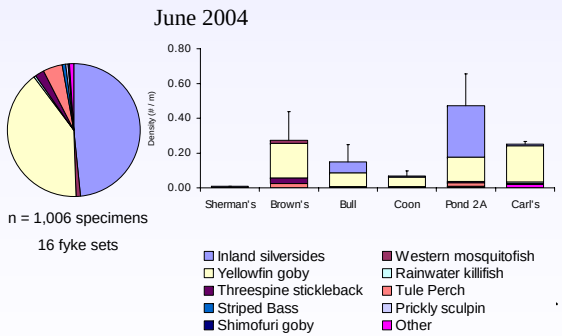


Figure 2. Composition and mean (+-SE) abundance (# / m^2) of the dominant fishes.

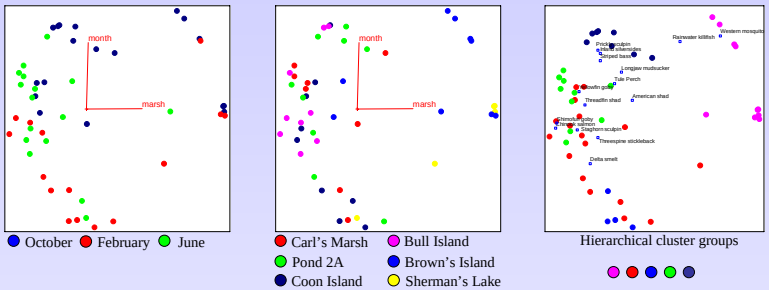


Figure 3. To explore spatial patterns in community assemblages of fish, a species x sample matrix of log transformed species abundance data was analyzed using nonmetric multidimensional scaling (NMS). Only species that occurred in >5% of the samples were included in the analyses (n= 15). Environmental variables were correlated with axis scores to help elucidate underlying environmental gradients. Two variables, marsh and month, correlated significantly with axis scores, and combined explained 55% of the variation. The correlation values are represented by red vector arrows.

Indicator species analysis (ISA) (Dufrêne and Legendre 1997) assisted in identifying species responsible for the differences among five groups determined by hierarchical clustering. For multivariate analysis we used the program PC-ORD v4.26 (McCune and Mefford 1999).

Summary and Conclusions

- All sample collections have been "successful" and sample processing has been completed for fish and is underway for invertebrates.
- 52 fyke net sets yielded 4,704 specimens, dominated by inland silversides, Western mosquitofish, Yellowfin goby and rainwater killifish.
- Composition and abundance of fishes varied both geographically and seasonally (e.g., Suisun dominated by Western mosquitofish and Napa/Petaluma dominated by inland silversides).
- Ordination axis scores were strongly correlated with month and region.
- Hierarchical clustering revealed four clusters (out of five) with one or more significant indicator species:
  - i) High abundance of Inland silversides in October in Napa.
  - ii) High abundance of Western mosquitofish in October in Suisun.
  - iii) High abundance of Yellowfin gobies in June in Napa.
  - iv) High abundance of Threespine stickleback in February.

  A fifth cluster, without significant indicator species, included notable catches of Chinook salmon and Shimofuri goby.
- Ongoing and future analyses, to include trophic dynamics (e.g., food web structure and function), determination of net exchanges (fluxes), and relation of fishes to geomorphic metrics.

Acknowledgements

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