Modeling Habitat Suitability for Fishes and Macroinvertebrates in marshes of the San Francisco Estuary

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We conducted otter trawls and sampled water quality in wetlands in north and south SFE

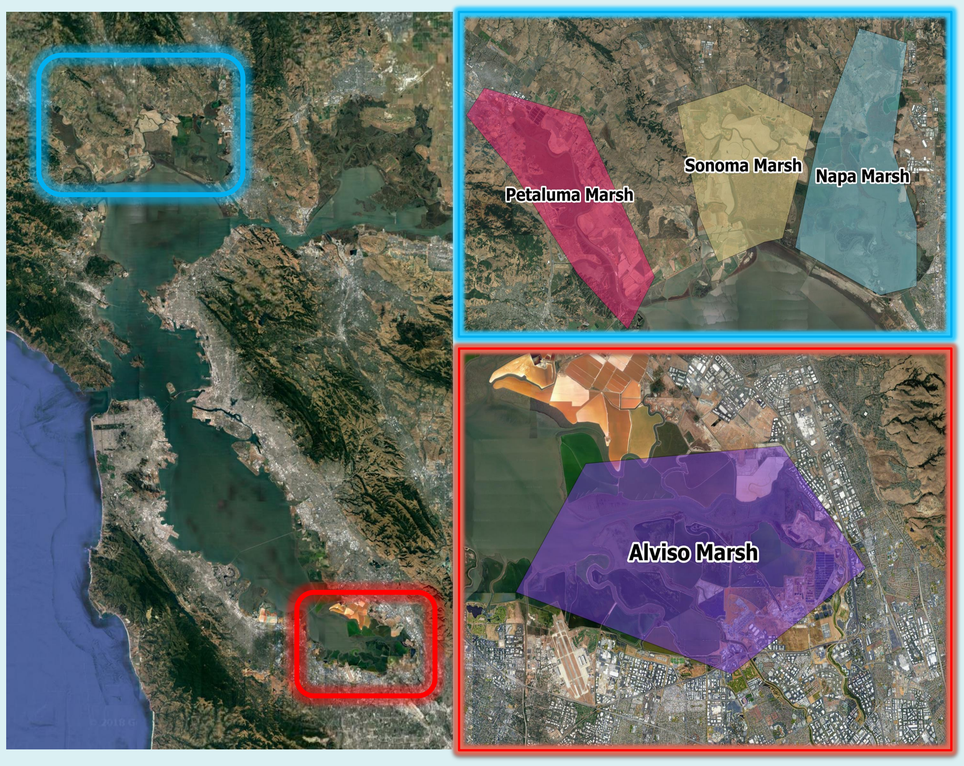


Figure 1: Map of study sites. Otter trawls were conducted monthly from 2016-2019 in Petaluma, Sonoma, and Napa marshes in the north SFE, and Alviso Marsh in the south SFE. Catch of fish and macroinvertebrate species was recorded for each tow. Tows were generally 10 minutes (duration was recorded for each tow).

Dissolved oxygen, salinity, and temperature varied across years and seasons

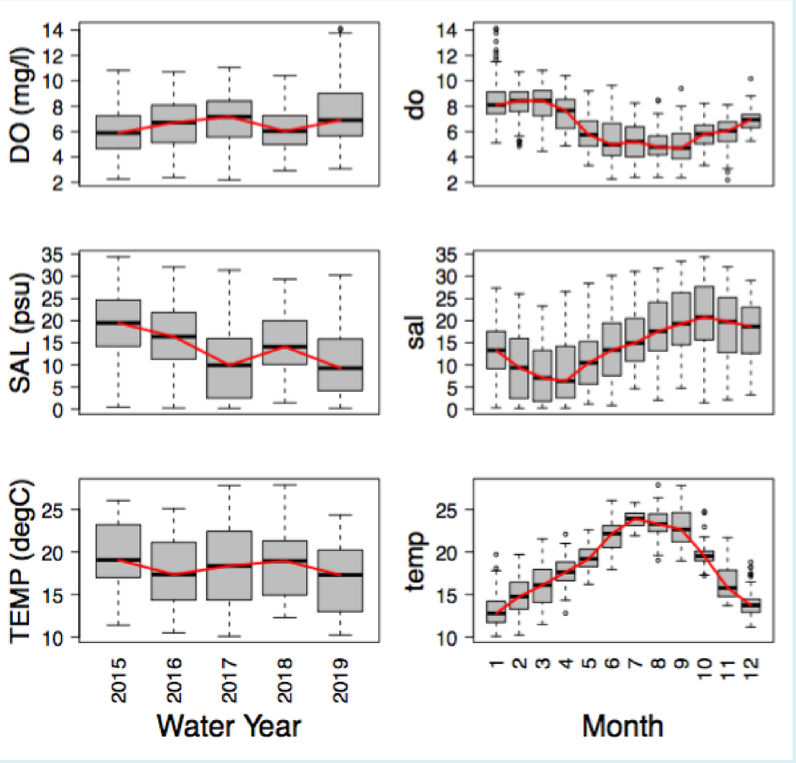
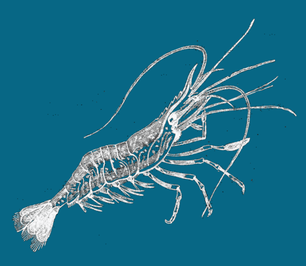
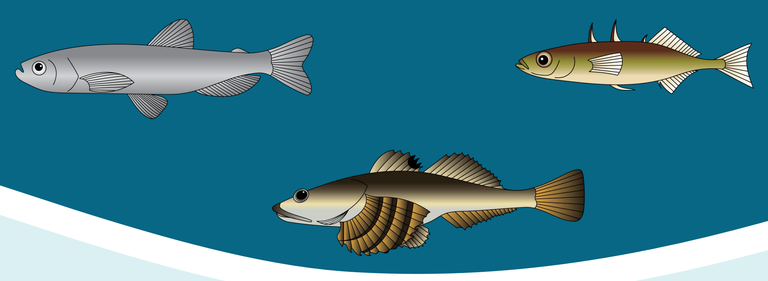


Figure 2: Water quality (dissolved oxygen, salinity, and temperature) across years and months within the study period. Red lines represent median values through time. Water quality was measured for every tow using a sonde.

Fishes and shrimps in tidal wetlands of the SFE exhibit diverse responses to water quality





We used relative catch curves to visualize relationships between environmental variables and catch per unit effort of abundant species

Here's how they work:

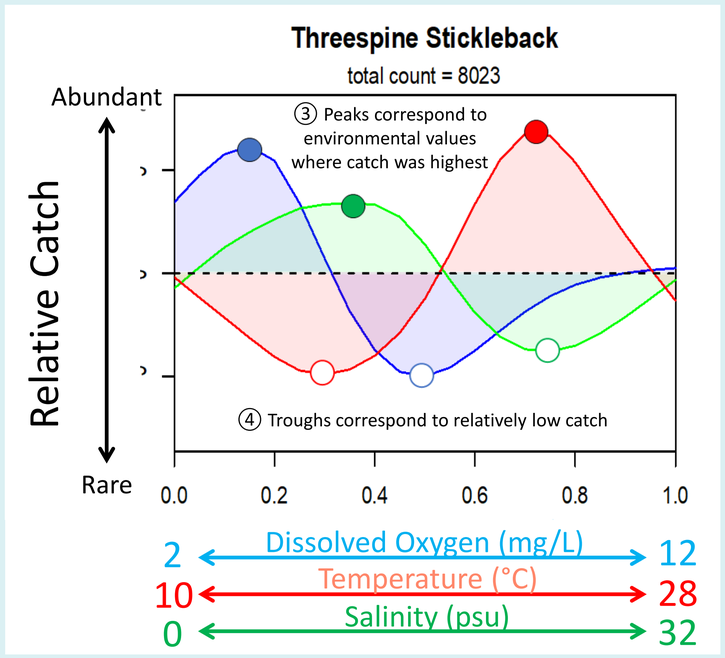


Figure 3 (above): Example of a relative catch curve for Threespine Stickleback.

Peaks and troughs occurred in very different places for each species, demonstrating a wide diversity of responses to water quality

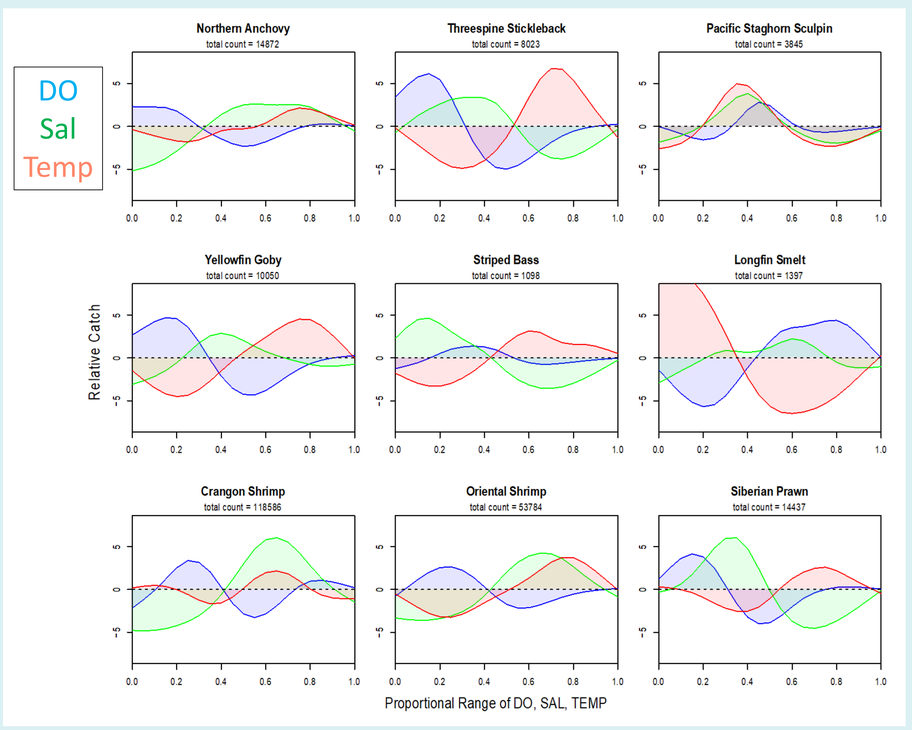


Figure 4 (right): Relative catch curves for the most abundant (highest overall catch) fish and macroinvertebrate species caught in otter trawls. Dissolved oxygen (mg/L) in blue, salinity (psu) in green, and temperature (°C) in red.

Bottom line: species of fish and shrimp respond to water quality uniquely, so management must be targeted to be effective

Introduction

Tidal salt marshes in the San Francisco Estuary (SFE) provide habitat for a diverse assemblage of fishes and invertebrates. Environmental conditions in estuarine systems are highly variable. >90% of SFE wetlands are developed, and the remaining marshes are highly impacted. Understanding the relationships between water quality and habitat use by key species is crucial for effective management.

Methods

In order to explore these relationships, bottom trawls were conducted from 2016-2019 in creeks and sloughs adjacent to restored marshes at the southern and northern ends of the SFE (fig. 1), with water quality measurements taken simultaneously. Relative catch curves were used to visualize trends in the relationship between catch per unit effort (CPUE) and environmental variables.

Results/Discussion

CPUE exhibited highly diverse responses to water quality among different species. The majority of the most abundant species were caught disproportionately at low dissolved oxygen and high temperature, though the opposite was true for some species. Responses to salinity were variable. Relative catch curves are a useful way to visualize relationships between catch and multiple water quality parameters.

Implications/Future Work

Managers must take species-specific responses to water quality into account to manage communities effectively. Future research will use these data to quantify and forecast habitat suitability for estuarine communities throughout the SFE.

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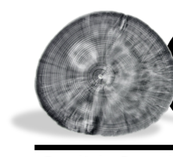

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