CALFED Progress Report
California Sea Grant College Program

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ProjectNo_2C: R/SF-33

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Project Information

ProjectNo_2C: R/SF-33 StartDate_3a: 8/1/2009 EndDate_3b: 7/31/2011
ProjectTitle_4: Effects of Freshwater Flow and Population Connectivity on Benthic Community Dynamics in the San Francisco Estuary

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8:

Additional Community Mentors_9:

Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.

ProjectObjectives_10

Climate change and water diversions have greatly modified freshwater outflow into the San Francisco Estuary, changing the Estuary's salinity regime. These climate- and water diversion-driven changes in salinities may have a wide range of impacts on important components of the San Francisco Estuary including the distribution of threatened/endangered species, the success of habitat restoration and the management of invasive species. I proposed to examine two important, closely-linked questions with direct implications for restoration efforts of the native oyster Ostrea lurida and the management of invasive species in the Estuary, including the mussel Mytilus galloprovincialis: (1) How are local populations of these species connected to each other in the San Francisco Estuary? (2) How does low salinity exposure from climate change-driven winter storms affect the fitness and reproductive output of these species?

I proposed to first establish long-term survey sites to track the abundance of these focal species in the Bay, then use trace elemental fingerprinting methods to determine the natal origin and fate of larvae of these taxa, and also conduct salinity stress tests to determine low salinity tolerances and examine effects of low salinity stress on reproductive output.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

In the first year of the project, we made significant progress to completing objective (1), an assessment of population connectivity in the Estuary for populations of Ostrea and Mytilus. We established long-term survey sites and completed population surveys of Ostrea and Mytilus at 12 locations throughout in the San Francisco Estuary in the winter of 2009, spring of 2010, and summer of 2010 to estimate the abundance of these species and examine the contribution of recruitment to existing populations and assess growth and survival over time. We determined that the trace elemental fingerprints recorded in larval shells of both Ostrea and Mytilus from different areas of the Estuary differ significantly enough to be useful in tracking larval movement between different regions. We collected brooded Ostrea larvae and recruits from numerous sites around the Estuary in fall 2009 and spring and summer of 2010. In addition, we also completed larval field outplants of Mytilus and collected Mytilus recruits in the Fall of 2009 and Spring of 2010 to estimate Mytilus population connectivity during these time periods. We have analyzed trace elemental compositions and completed preliminary analyses of Ostrea population connectivity in the Estuary from Fall 2009. We have begun experiments to assess objective (2), although equipment failures have hindered progress somewhat.

PROJECT MODIFICATIONS: Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

Modifications_12

The project has proceeded largely as planned without substantial modification to research plans, despite uncertain funding. Although some failures in the equipment responsible for maintaining Ostrea and Mytilus for experiments on salinity tolerances have hindered progress, we do not anticipate further difficulties in completing these experiments.

We are examining the possibility of genetic analysis of Ostrea samples to complement trace elemental fingerprinting approaches for estimating population connectivity.

BENEFITS AND APPLICATIONS: Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. CALFED is looking for "management cue" (see http://science.calwater.ca.gov/pdf/soemgmtcues.pdf).

BenefitsApplic_13

Preliminary results suggest that trace elemental fingerprinting is a viable technique to use for assessing the population connectivity of bivalve larvae in the San Francisco Estuary, at least on a regional scale. Determination of whether populations in south San Francisco Bay and northern San Francisco Bay (and locations within these regions) are isolated from each other is important to targeting restoration efforts in these areas and predicting the possible spread pattern of non-native species introduced to a given area. Assessments of population sizes of Ostrea and Mytilus aid our understanding of how these populations are maintained in the Estuary and indicate that populations in different areas may face different stresses. Northern San Francisco Bay populations of Ostrea are very dense in some areas, with a "band" of recruitment that seems to occur in somewhat more brackish areas, moving up and down the estuary depending on freshwater outflow levels. Restoration efforts could target these areas to acquire high density sets of Ostrea. Southern San Francisco Bay populations of Ostrea also begin recruiting earlier in the year as temperatures there were higher. Overwinter survival of existing populations in the north Bay was lower than in the south Bay, possibly due to lowered salinity from freshwater runoff in winter and spring.

PUBLICATIONS: List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and CALFED Science Conference during the duration of the fellowship.

Publications_14

Chang AL (2010) Storms and droughts: why and how history matters to communities. Invited seminar, San Francisco State University.

Chang AL, Malm P, Attoe S, Fisher JL, Morgan SG (2010) Going with the flow or staying close to home? Population connectivity, freshwater flow, and native oyster restoration in San Francisco Bay. CALFED Bay-Delta Science Conference, Oakland, CA. 29 Sept 2010.

COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

Smithsonian Environmental Research Center (Marine Invasions Research Lab): Logistical, financial and technical support to postdoctoral fellow during the California state budget crisis.

NOAA Fisheries: Technical support

UC Davis - Bodega Marine Laboratory: Logistical and technical support

AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

Awards_16

N/A

KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

freshwater flow, population connectivity, Ostrea lurida, Olympia oyster, Mytilus galloprovincialis, restoration, San Francisco Bay, estuary, salinity

PATENTS: List any patents associated with your project.

Patents_18

N/A

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Additions: Additional information can be added here. Please begin the text with the number of the question you are adding to.

Additions_19