

**Preparer Information**

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**Project Information**

ProjectNo\_2C R/SF-9 StartDate\_3a 9-1-2005 EndDate\_3b 8-31-2008  
ProjectTitle\_4 The Application of Otolith Geochemistry to Determine Stock Structure, Survival and the Relative Impact of Water Exports on the Threatened Delta Smelt

**CALFed Fellow contact information**

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**Additional Research Mentors and Community Mentors**

**Additional Research Mentors\_8**

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**Additional Community Mentors\_9**


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

**ProjectObjectives\_10**

Objectives
1. Determine the cohort structure (spatial/temporal) of the adult population.
-Otolith geochemical signatures of natal habitats
-Otolith hatchdate distribution from ages
2. Compare growth rates of adults to growth rates of juveniles.
-Otolith size-at-age backcalculations
3. Quantify the cohort structure (spatial/temporal) of juveniles salvaged at CVP and SWP.
-Otolith geochemistry and hatchdates
4. Integrate data from first three objectives in relation to water temperatures.
-examine hatchdate distribution in relation to temperature
-examine growth rates of aged cohorts in relation to temperature
-examine cohort structure in relation to temperature
-examine cohort structure of salvaged fishes in relation to temperature

**Summary of progress in meeting each of these goals and objectives**

**ProgressSummary\_11**

Approximately 100-150 individuals from 1999-2006 have been completed for age analysis. Otolith geochemistry on 50 individuals from 1999-2006 has been completed. Current status: I am in the final stages of QA/QC and data analysis.

2. Compare growth rates of adults to growth rates of juveniles.

Back-calculations have been completed and statistical analysis are to be completed following the final QA/QC stated in 1.

3. Quantify the cohort structure (spatial/temporal) of juveniles salvaged at CVP and SWP.

Age and otolith geochemistry for 2000-2001 samples has been completed and is in final QA/QC stage.

4. Integrate data from first three objectives in relation to water temperatures.

Completion of final analysis and integration is pending the QA/QC of otolith age and geochemistry data.

**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 initial proposal was for age and chemistry data on 100 individual fish from 1999-2001 year classes. I have decided to reduce the sample size from 1999-2001 to include individuals from 2002-2006, giving me 7 consecutive year classes.

Ancillary research topics:

The application of strontium isotope geochemistry to understanding how freshwater flows in the Delta. Strontium isotope ratios (Sr87/Sr86) in freshwater systems are derived from the type and age of the underlying bedrock of a water

shed. When waters from different watersheds mixes the result can be easily predicted based on the proportion of waters from each source, the strontium concentration of each source and the strontium isotope ratio of each source. Many of these variable have been measured in other studies of SF Bay and I have collected water samples as well to catalog the sources of freshwaters entering the Delta and greater SF Bay. DWR's DAYFLOW model predicts the proportion of waters diverted in the delta and thus strontium isotopes can be used to validate the DAYFLOW model, by using the predicted proportions in a model of strontium isotope mixing. Testing the model output can be accomplished by testing the waters. I have collected water samples to do so.

**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**

My results presented at the CALFED Science Conference have had direct impact on management of freshwater resources. My findings suggest that a majority of recruiting delta smelt originate in the North and Central West Delta while few recruit from the South Delta where freshwater exports reside. In addition freshwater exports tend to selectively "harvest" cohorts of fish born in the early spring (March-April). My finding also suggest that dry condition during the summer have an influence on where delta smelt reside during the juvenile stage. When conditions are dry (hi X2) the delta smelt reside in freshwaters, primarily the West Delta/Confluence area, while during wetter(low X2) conditions the juvenile smelt use primarily low-salinity habitats in Suisun Bay. Previous research by myself and Dr. Bill Bennett have documented the differing habitat values of Suisun Bay and the confluence concluding that low-salinity habitats in Suisun Bay act as critical nursery areas and that concentrating fish at the confluence may result in poor recruitment.

**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**

Hobbs, J.A., J.E. Burton and W.A. Bennett  
Classification of larval and adult delta smelt to nursery areas using trace elemental fingerprinting. Transactions of the American Fisheries Society 2007. 136:2. 518-527

Presentations

Hobbs, J.A. and W.A. Bennett  
The Application of Otolith Geochemistry to determine the natal origin and population structure of delta smelt during the POD. CALFED Science Conference, Sacramento CA. Oct 2006.

Hobbs J.A.  
Looking Back to Go Forward. Stock structure dynamics revealed with otolith geochemistry for an endangered estuarine fish. California Estuarine Research Society Conference, Bodega Bay. March 2007.

I missed the deadline for the State of of the Estuary Meeting in 2007 but will make arrangements to present a poster.



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**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**

Dr. William Bennett. I have been collaborating with Bill Bennett to determine the factors associated with poor recruitment of delta smelt during the recent POD. He has been integrating my results with his population and individual based models, and has presented results and informed management at several CALFED related meetings.

Center for Inductively Coupled Plasma Mass Spectrometry at UC Davis. Chip Lesher and Michelle Gras have been instrumental in accomplishing the geochemistry portion of this work, providing technical and administrative support.

California Department of Fish and Game. Randy Baxter has been facilitating to collection and delivery of delta smelt samples to myself and Dr. Bennett.

**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**

No awards

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

**Keywords\_17**

delta smelt, otoliths, geochemistry, water resource management, LA-MC-ICP-MS, estuary, San Francisco Bay,

**PATENTS:** List any patents associated with your project.



