



CALFED Progress Report
California Sea Grant College Program

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TypeQuestionnaire_2B Completion Questionnaire

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Project Information

ProjectNo_2C R/SF-7 **StartDate_3a** 1-Sep-05 **EndDate_3b** 31-Aug-08
ProjectTitle_4 Development of a Simulation Model of Juvenile Salmon Movement in the Sacramento-San Joaquin Delta

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

Steven Railsback, Lang Railsback and Associates, Arcata
 California

Additional Community Mentors_9

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

ProjectObjectives_10

The goal of this research was to develop and test a model of juvenile salmon movement through the Delta. The objectives to achieve this goal are to 1) Assemble and review available observations of juvenile salmon movement in the Delta; 2) identify different types of fish behavior that could be important; 3) add these behaviors to an existing particle tracking model of the Delta; and 4) use the model test alternative models of fish behavior.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

Experiments conducted in the Delta on juvenile salmon movement are Coded Wire Tag Releases (multiple agencies), Radio Telemetry Studies (D. Vogel) and Fixed Receiver Studies (USGS and FWS). I have assembled and conducted multiple analyses of this data for the purpose of developing measures that can be used for model development and testing. It is important that these measures be not only realistic but simple enough so that they can be used to compare the results of multiple model runs. I developed two measures that can be used with CWT data and tested these with model simulations of passive particles in the North Delta to ascertain important behaviors that are lacking in the model. A major result of this analysis is that fish "hang out" in the North Delta much longer (on the order of days) than particles. Thus, there is a definite holding/rearing behavior that must be incorporated into the model. Further, I am using these same measures to compare particle simulations to the results of Radio Telemetry Studies in the North Delta. This process has been very non-trivial. It has involved combining all the available observations of individual fish at multiple stations and multiple times AS WELL AS writing software to "mine" similar results from simulations. Each simulation results in thousands of observations of particle number, location, time, and distance. I have had to work closely with a programmer to assist me in developing analysis software to summarize the simulation results into the same measures used for each set of observed data. This has also involved a trial and error process to determine WHAT measures can be used for comparison. It has also been complicated by the fact that particles can travel both upstream and downstream, long distances, due to tidal action. I am currently working on comparing simulation results with the results of the Radio Telemetry Studies. This has involved "sampling" from the Radio Telemetry Data at fixed locations that model results can be compared to. I am writing a paper to disseminate these results. The purpose of the paper is to provide insight into how EXISTING data on juvenile salmon movement in the north delta can be used for model testing and development. This includes the presentation of examples of how each set of observations (CWT, Radio Telemetry, Fixed Receiver) can be used, how model results (of passive particles compare), as well as assumptions of key behaviors that particles lack.

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 purpose of this project was to use existing observations of fish movement in the Delta to develop and test a model of juvenile salmon movement in the Delta that can be used to assist managers with determining the effects of management actions in the Delta. The field observations available, although numerous, have turned out to be very sparse in space and time making it difficult to develop measures that can be used to test a model. For example, even though hundreds of thousands of salmon have been released in the north delta for CWT release studies, so few have been captured at downstream locations that the results cannot be assumed to be representative of the entire population of released fish. Therefore, it has been very challenging to develop measures of the results that can be used for model development. However, the results are important. The CWT release results can be used to test extent of movement and timing throughout the Delta. Similar challenges exist for other sets of observations (Radio Telemetry, Fixed Receiver). It has also been very time consuming developing ways to summarize the results of simulations (which result in thousands of data points for each simulation) that can be compared to observations. As a result, the main focus of this research to date has been the process of analyzing observation data results and simulation data results and the most effective way of comparing the two.

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

The major benefit to CALFED is the ability to use the results of the numerous experiments that have been conducted in the Delta for the purpose of understanding Juvenile salmon movement. This is an extremely non-trivial task due to the complex nature of the Delta. A major accomplishment of this project is the development of the individual measures from each set of observations that can be compared directly to model results.

other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

USFWS and DFG - provided results of fixed receiver releases of juvenile salmon.....
USGS - provided results of fixed receiver releases in the north delta and assisted in gaining access to RMA-Sim.....
Resource Management Associates - provided particle tracking model and support.....
Department of Water Resources - provided support with DSM2-PTM.....
Humboldt State University - provided software and support.....
Lang, Railsback and Associates - provided modeling support and document review and expert advise/comments.....
Steve Jackson - provided programming support.....
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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.....
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KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

simulation model, fish movement, salmon movement, particle tracking, model development.....
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PATENTS: List any patents associated with your project.

Patents_18

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