CALFed Progress Questionnaire
California Sea Grant College Program

ConfirmationNumber 20071030085446

Printed: 5/12/2008 12:29:52 PM

ProjectYear_2A 2nd Year **ProjectNo_2C** R/SF-7

TypeQuestionnaire_2B Interim Questionnaire

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Project Information

ProjectNo_2C R/SF-7 **StartDate_3a** 9/1/05 **EndDate_3b** 8/31/07
ProjectTitle_4 Development of a Simulation Model of Juvenile Salmon Movement in the Sacramento-San Joaquin Delta

CALFed Fellow contact information

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RMPositionTitle_6N

Community Mentor (for additional please see #9)

CMTitle_7A **CMLastName_7B** **CMFirstNamt_7C** **CMInit_7D**
CMInstitution_7E

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CMStreetAddr_7G
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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

N/A

Additional Community Mentors_9

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

ProjectObjectives_10

The project goal is to develop a way to predict how management actions affect movement of juvenile salmon in the Sacramento-San Joaquin Delta. I am attempting to address this goal via the following objectives:

1) Assemble and review all available observations of juvenile salmon movement in Delta including observations from a wide variety of spatial and temporal scales and from as many life history states (from fry to smolt) as possible.

2) Identify the different types of fish behavior that could be important, and alternative models of those behaviors from the literature and previous models.

3) Build a simulation model from an existing hydrodynamic and particle tracking model, adding the effects of behavior to particle tracking.

4) Using the simulation model, test the alternative models of fish behavior (including no behavior, i.e., particle tracking only) to see which are necessary and sufficient to reproduce the field observations.

5) Publication and dissemination. Study results will be published, and the model transferred to CALFED scientists and managers.

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Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

As of my last status report, I performed a detailed analysis of the existing data (prior to December 2006) which included Coded Wire Tag capture and release data (CWT) as well as Radio Telemetry Data (RTD) of juvenile salmon released in the Delta. Working with this data available at the time (prior to Fall 2006) and the DSM2-PTM it became apparent that it would be very difficult to use the CWT and RTD for model testing purposes. The catch size with respect to the CWT data is too small for statistical significance and you cannot determine travel paths from either the CWT or RTD. In addition, the RTD data is based on the results of fish locations observed in a moveable reference (mobile boat to find fish) whereas the PTM is fixed. I presented my concerns in a talk titled ìChallenges in Using Field Data to Validate Models of Juvenile Salmon Movement Through the Deltaî at the 2006 CALFED conference. At this conference I became aware that fixed receiver studies about to start. In December 2006 and January 2007 twenty separate ultrasonic tag releases of about 400 juvenile Chinook salmon were performed in the north Delta by the USFWS and USGS while the Delta Cross Channel was both open and closed (released near Old Town). The results of studies using fixed receivers are much more conducive to testing a model, like the PTM, that uses fixed nodes. I have obtained the raw data which I have synthesized and have created animations using USGS animation software to assist in ascertaining any possible behavior. I have been using the RMA Particle Tracking Model to run multiple simulations to make comparisons with what was observed during the ultrasonic tag releases and to estimate particle residence time in each channel of the North Delta. I recently presented results at the 2007 State of the Estuary Conference in a poster titled ìJuvenile Salmon Movement in the Sacramento-San Joaquin Delta Comparison of Ultrasonic Tag Releases with Passive Particle Simulationsî. In comparing simulated results with observations it is clear that the fish do not behave as the ìsimulatedî passive particles and mortality alone is not enough to explain the difference. It appears that the major difference is how decisions are made at the junctions. For example, observations and the model results agree for fraction of fish that reach Main Sacramento River. However, the routes taken differ. The model greatly under predicts the fraction that pass Ryde; especially when the DCC is open. The model over predicts the fraction through Sutter, Steamboat and Miner Sloughs.

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

I have changed the tools I am using to satisfy that goal (as discussed in my first status report). My community mentor has been changed to Jon Burau at the USGS whose research goal is similar to mine. I have also changed simulation models. I am now using the model developed by Resource Modeling Associates, RmaSim. RMA is actively updating bathymetry and recalibrating the RmaSim to better represent the flows in the Delta and the results are outstanding. They have also programmed the ability deploy

ìsimulatedî fixed receivers at the same locations they were placed in the field. In this way, comparisons between observations of ultrasonic tag releases and simulation results can be made. Also, to develop a better understanding of exposure in each channel in the Delta, I have been performing multiple simulations under a variety of Sacramento River Flows and Delta Cross Channel Gate operations and a 19-year mean tide to estimate average time particles spend in each channel. At the same time I have been working with the RMA folks to test the programming of the receivers. This has resulted in multiple iterations back-and-forth until the code was ready for multiple simulations with multiple receivers. I have also had to use some of my funds set aside for a programmer to program an analysis code that summarizes the RMA output to determine average travel time in a segment, overall distance traveled in a segment, number of particles traveled through the segment, and paths.

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

This will be used as a tool to assist management in making decisions with respect to water diversion.

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

2006 Resource Modeling Conference Poster Presentation: Juvenile Salmon Movement in the Sacramento-San Joaquin Delta Challenges in Using Field Data to Validate Models

2006 CALFED CONFERENCE Oral Presentation: Challenges in Using Field Data to Validate Models of Juvenile Salmon Movement Through the Delta. Abstract: Existing field studies that can be used to evaluate juvenile salmon movement at both small and large scales include radio telemetry studies and the results of coded wire tag releases. The Deltaís intricate channel network and the influence of tides, combined with the relatively low observation frequency in these studies, make it difficult to determine exact routes of observed fish. As a result, various metrics are required to compare model results to field data. Metrics that can be evaluated with these field data and used to test a movement model include which direction a fish goes at a junction, the minimum distance traveled in a specific time between two points, and the probability a fish passes a specific point at a certain time. Passive particle simulations are compared to radio telemetry data to evaluate different metrics for model testing and validation.

2007 State of the Estuary Conference Poster Presentation: Juvenile Salmon Movement in the Sacramento-San Joaquin Delta Comparison of Ultrasonic Tag Releases with Passive Particle Simulations. Abstract: In December 2006 and January 2007 twenty ultrasonic tag releases of juvenile Chinook salmon were performed in the north Delta. During each release multiple receivers were placed throughout the north Delta to monitor fish paths. The results of these studies can be used to determine routes of observed fish and therefore used to evaluate juvenile salmon movement in the Delta. The results of these releases are compared to each other as well as results of passive particle simulations to evaluate fish movement is affected by the flow.

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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

USGS, USFWS

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

simulation model, fish movement, salmon movement

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PATENTS: List any patents associated with your project.

Patents_18

does not apply

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

Additions_19

n/a