

Draft Individual Review Form

Proposal number: 2001-K217-1

Short Proposal Title: Juvenile Salmon Migratory Behavior Study

1a) Are the objectives and hypotheses clearly stated?

The proposal identifies general objectives and four specific hypotheses. The objectives and hypotheses focus primarily on providing descriptive information regarding the response of juvenile Chinook salmon to hydrologic conditions occurring within various channels of the Delta. The proposal does not provide explicit information on how specific data collected as part of the investigations will be used to test or evaluate individual hypotheses. Given the complexities variability in Delta hydrologic conditions it is not clear from the proposal how the data will be analyzed to evaluate the behavioral response of juvenile salmon. Although the investigation would provide useful information, the linkage between specific data collected under the existing hydrologic conditions during tests and its applicability to various management actions is not explicitly identified within the proposal.

The proposal does not address several important management issues, which would include (1) the behavioral response to juvenile salmon emigrating from the Sacramento River and the effects of Delta Cross-channel gate operations on behavioral patterns and migration route, (2) a comparative evaluation of changes in salmon distribution and migration patterns under conditions of high and low export rates and E:I ratios, (3) whether juvenile salmon migrate in proportion to a flow split, and (4) a comparative evaluation of juvenile salmon migration under conditions of positive and negative QWEST.

1b1) Does the conceptual model clearly explain the underlying basis for the proposed work?

The proposal contains a conceptual model of factors affecting fish migration within the Delta. The conceptual model, however, is relatively generic in identifying various factors affecting migration behavior within Delta channels and at flow splits. The proposed investigations do not provide an explicit linkage between the conceptual model, the hypotheses to be tested, and the behavioral and hydrologic data to be developed through these investigations. Given the number of factors identified in the conceptual model, for which data will not be collected as part of this investigation, and the complexity among interacting factors, the experimental design may not provide quantitative and definitive data that will address the key hypotheses.

1b2) Is the approach well designed and appropriate for meeting the objectives of the project?

The experimental design represents the most technically feasible method currently available for collecting detailed information on juvenile salmon migration. As discussed in Section 3, concerns exist regarding the minimum size requirement of fish to be used in this test, and whether or not data from yearling or older salmon is representative of the migration patterns and the behavioral response of smaller salmon smolts emigrating during the spring. Concerns also exist regarding the complexity of channel and hydrologic conditions expected to occur during these investigations, and the ability of the experimental design to effectively support analysis of the behavioral response of juvenile salmon under a variety of hydrologic conditions and other influences. Although the experimental design will provide important descriptive data on migration, it is difficult to assess the ability to interpret the resulting information with regard to various hydrologic conditions for use as a basis in developing and evaluating alternative management strategies for flows, exports, and channel conditions within the Delta. The relatively short duration (four day) period of observation of individual tags, and the inherent variability in evaluating fish behavior under field conditions, also influence the ability of the experimental design to address the project objectives and specific hypotheses.

1c1) Has the applicant justified the selection of research, pilot or demonstration project, or a full-scale implementation project?

The investigation is appropriately characterized as research. The project has been phased to include three separate reaches within the Delta for research investigations, which would appropriately facilitate implementation of the project.

1c2) Is the project likely to generate information that can be used to inform future decision-making?

The project will provide useful descriptive information regarding the general migration patterns of juvenile salmonids within various reaches of the Delta. Much of this information is currently lacking and would complement coded-wire tag salmon smolt survival investigations such as those being conducted under VAMP and as part of the AFRP salmon survival studies. The resulting information would be beneficial to decision-making, however because of the limited scope it is unlikely that these results will provide definitive information sufficient to base either detailed management decisions regarding biological benefits resulting from various alternative project operational scenarios, specific changes to Delta hydrologic conditions, nor specific habitat restoration program actions. Subsequent radio tagging and other research may be needed to address these broader objectives.

2a) Are the monitoring and information assessment plans adequate to assess the outcome of the project?

Tracking of radio tag salmon migration through various regions of the Delta will provide valuable information. As described elsewhere in this review, I am concerned about the ability to analyze and interpret information from the radio tagging on the location and route of salmon migration, and the cause-effect relationships with both channel conditions and hydrologic cues.

2b) Are data collection, data management, data analysis, and reporting plans well-described, scientifically sound and adequate to meet the proposed objectives?

Data collection, data management, data analysis, and reporting plans are generally described in the proposal, however explicit details regarding these elements of the program are not presented. The proposal identifies the development of a monitoring plan and protocol, however the scope and process for developing the protocol, the process for involving IEP and other agencies in the development of the protocol, and peer review of the proposed experimental design are not described in detail. Information on data collection regarding the location of individual radio-tagged observations is presented in the proposal, however information on specific hydrologic information that will be collected through coordination with USGS and DWR and the analysis of information on fish behavior relative to the hydrologic information is not described. The methods to be used for data analysis that will integrate the biology and hydrologic information with other relevant information regarding channel features to address the specific hypotheses and objectives of the investigation are not presented in the proposal. Although the proposal includes information on general reporting, including presentations at scientific meetings, which I support, the scope and content of the technical report are not described.

3) Is the proposed work likely to be technically feasible?

The radio tagging investigations outlined in the proposal are technically feasible. Several concerns regarding the interpretation of the results, however, exist. The use of radio tag technology requires that yearling or older salmon be used for testing. Fall-run salmon reared in the Mokelumne River Hatchery for use in radio tagging during the spring VAMP period would be approximately 18 months of age, and therefore would (1) be substantially larger than fall-run Chinook salmon smolts emigrating from either the Sacramento or San Joaquin rivers (which are the target of VAMP investigations), and would not be representative of the size distribution of salmon emigrating through the Delta during the spring, (2) may not be physiologically undergoing peak smolting conditions at the time of release, and (3) may respond behaviorally to hydrologic and other environmental conditions in a manner that is not representative of fingerling-sized salmon smolts. A second factor affecting the technical feasibility of the study is the limited battery life of radio tags. As noted in the proposal, the battery life of the radio tags is approximately four days, which, although providing a substantial amount of data on fish movement and location, may not be sufficient to allow monitoring of individual fish as they move throughout broader regions of the Delta. The addition of both mobile and fixed monitoring locations benefits the feasibility of the study, as does the proposal to have multiple releases over a period of time within a geographic region. Multiple releases of radio tagged salmon also provides the opportunity, as noted in the proposal, to test migration behavior under various tidal conditions (e.g., spring and neap tidal stages). I am concerned, however, about the technical feasibility of evaluating and interpreting results of the radio tag observations with respect to specific channel and hydrologic conditions encountered during migration, and the anticipated level of variability in these conditions that would affect the interpretation of results from this investigation.

4) Is the proposed project team qualified to efficiently and effectively implement the proposed project?

The proposed project team has extensive experience in conducting fisheries investigations within the Sacramento River, San Joaquin River system, and Delta. The team has experience in conducting radio tag investigations using juvenile salmon. The team has clearly demonstrated their scientific expertise and ability to conduct radio tag investigations of salmon migration. The team has the necessary experience and scientific credibility to efficiently and effectively design, conduct, analyze, and report on the results of the proposed investigation.

Miscellaneous comments

Although I have a number of technical comments regarding the proposal, I support proposed research to further evaluate migratory behavior of juvenile salmon within the Delta and studies to determine the relationship between migration patterns and pathways and Delta hydrologic conditions. The proposed research would contribute to the overall understanding of key aspects of salmon migration and would complement other ongoing research activities including salmon smolt survival studies (e.g., VAMP) and would contribute to the technical and scientific foundation available for the Data Assessment Team (DAT) and CALFED OPS to consider additional information on key aspects of salmon migration when evaluating alternative management decisions.

**Overall Evaluation
Summary Rating**

- Excellent
- X Very Good
- Good
- Fair
- Poor

Provide a brief explanation of your summary rating

The proposed research investigation would contribute to the scientific information used to evaluate salmon migration patterns within the Delta. Information would be relevant to developing a better understanding of the effectiveness of various types of management actions designed to enhance and protect salmonids. The proposed research would produce largely descriptive results regarding salmon migration over a relatively limited range of environmental conditions, and therefore may need to be expanded and refined in future years to provide more quantitative and comparative information to better evaluate the effects of specific management actions on salmon migration patterns.