Proposal number: 2001-K216-2 **Short Proposal Title:** Evaluation of rearing habitat within the Cosumnes River

1a) Are the objectives and hypotheses clearly stated?

Yes, the authors clearly convey the project's objectives and hypotheses. The overall goal of the research, namely to determine the relative value of the mainstem river, floodplain, secondary channel and non-natal tributary habitats, is important to the management of chinook salmon in this and other Central Valley rivers. The stated objectives are consistent with this goal, and will contribute strongly to the progress to reach this goal.

The research hypotheses are clearly stated in the proposal and provide testable statements that are consistent with the project's goals and objectives. Further, the use of directional, *a priori* hypotheses will allow the investigators to use more powerful one-sided statistical tests.

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

The conceptual underpinnings of the project are clearly described, and provide a sound motivation for undertaking the proposed research.

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

The overall approach outlined in the proposal is generally well designed to achieve the stated objectives, although some of the individual methods may need further consideration. Further discussion on each task is provided below:

Task 1. Site selection - The number of sites in each habitat (6) should be adequate to provide sufficient statistical power to distinguish among the habitat types. The use of contingency sites, however, may prove to be somewhat problematic in the analysis. Since these sites will only be sampled during unusual events, the results they provide are also likely to be "unusual" or atypical. As such, they may not really add to the rigor of the analysis. I suggest trying to sample these contingency sites during the normal course of events (even at an irregular time interval) to establish how representative these sites truly are.

Task 2. Densities and fitness – although the sampling gears identified in the proposal all can be effective means of capturing juvenile chinook salmon, they do not provide comparable measures of density. The sampling needs to be standardized among all sites and habitats, and careful consideration should be given to the relative efficiency of each gear type among habitat types. For example, seining may not be efficient in floodplain habitats if vegetation is abundant at those sites. Erroneous conclusions regarding the relative density may thus be reached if gear efficiency varies systematically among habitats. In my experience, backpack or tote barge shocking is generally the sampling method with the least variation among habitats. As such, one approach would be to only use backpack shocking at all sites. An alternative, that will likely generate better estimates, would be to consistently use one gear at all sites, and use a second gear at some subsample of sites. This approach would allow a calibration curve to be developed between gears (which would be a useful contribution in and of itself), and would improve the estimates for each habitat type.

The method outlined for estimating growth rate (i.e., computing changes in the mean or modal size over time) suffers from a couple of problems. Foremost is the fact that fish may move in and out of habitats in a size-dependent way. As a hypothetical example consider if larger individuals move from floodplain habitats to the mainstem river to outmigrate. The mean size of fish in the floodplains would thus be underrepresented (thus lowering the estimate of growth rate), and the mean size of fish in the mainstem would be overrepresented (thus increasing the estimate of growth rate). The accuracy of growth rate estimates may be improved in several ways. One suggestion would be to examine otoliths to determine daily growth rate. I believe this method has been successfully applied to juvenile chinook salmon. This method, however, would

not completely alleviate the problem of movement among habitat types. Another suggestion would be to mark fish on each sampling occasion with a site-specific mark (e.g., fin clip, Panjet dye mark, etc) to allow the identification of fish that have stayed in the habitat between subsequent sampling events. Marks allowing the identification of individual fish would be preferable, but I am not aware of any marking system that allows the easy marking and identification of individual salmon of the size range likely to be encountered, that is non lethal (note that coded wire tags would be suitable except for the need to sacrifice the fish to determine tag number).

The use of length-weight relationships to represent the relative well-being of fish (i.e., the "condition" of the fish) is appropriate, however I would object to the use of such data to represent "fitness". The use of the term fitness generally applies to an evolutionary/life history concept that length-weight relationships alone do not adequately represent.

Task 2. Stranding – The approach outlined here appears reasonable.

Task 3. Predation - Determining the relative abundance of predators using the methods identified above will be reasonable. Examination of stomach contents will likewise provide direct evidence of predation, although a lack of identifiable juvenile salmon may not indicate the true level of predation if predation events occur sporadically, or if young salmon are quickly digested to an unrecognizable state. The tethering studies may be useful, but the sample size (three groups of five individuals) seems inadequate to give anything but the coarsest of comparisons among habitats. I would recommend dropping this component, or using it only as a pilot project. I feel that strong comparisons among habitats would likely require sample sizes on the order of 100-500 tethered fish per habitat.

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

The work outlined clearly falls into the research project category based on the nature of the study proposed (i.e., data collection and analysis).

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

This project has a high likelihood of generating important information for making management decisions. Fishery managers are very likely to have to decide how to spend limited funds for habitat improvement among the four study habitats. This project will help greatly in making those difficult choices, and will hopefully avert the expenditure of funds toward projects where the habitats provide little or no benefits to chinook salmon in the Cosumnes River.

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

The work proposed is largely monitoring and assessment, and as such provides an adequate plan for these activities.

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

The data collection techniques are well described, and are discussed in detail above. The data management process is not very well described. I would strongly encourage the investigators to develop a relational database to maintain data integrity and facilitate reporting. The data reporting plan is likewise not clearly described.

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

The field work proposed is feasible, as are the methods for data analysis (even though they are not clearly identified in the proposal).

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

The project team appears well qualified to conduct all aspects of this project.

Miscellaneous comments

Prior work by T. Moore and P. Petrusso in the Upper Sacramento River system may be very useful as a basis for comparison with the Consumnes River. Ms. Moore examined juvenile chinook salmon in tributary habitats whereas Ms. Petrusso examined mainstem habitats. Citations for their work to date are:

Moore, T.L. 1997. Condition and feeding of juvenile chinook salmon in selected intermittent tributaries of the Upper Sacramento River. M.S. Thesis, California State University, Chico, CA. 66 p.

Petrusso, P. A. 1998. Feeding habits and condition of juvenile chinook salmon in the Upper Sacrament River, California. M.S. Thesis, Michigan State University, East Lansing, MI. 94 p.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
☐ Excellent X Very Good ☐ Good ☐ Fair ☐ Poor	The goals and objectives of this project are of high scientific and management importance, and are very achievable. My criticism of the proposed methods are intended to be constructive; I feel that the investigators have generally developed a sound plan of attack for addressing this important problem.