

CALFED Bay-Delta 2002 ERP Directed Actions -- Selection Panel Review

Proposal Number: 203DA

Applicant Organization: University of California, Davis

Proposal Title: Improved Fish Screen Design and Operation for Native Sacramento-San Joaquin Watershed Fishes

Recommendation: Continue to consider for potential Directed Action –

Provide a brief explanation of your rating:

The Selection Panel deliberated about the revised proposal and concurred that the proposed studies may be useful contributions relative to improving the design and function of fish screens for the Central Valley. Nevertheless there continue to be a number of concerns regarding the proposal as it stands.

The Panel continues to see a need to further clarify the utility of the proposed studies given recent and significant questions raised about the future and size of major screening proposals for fish protection. It is critical that studies applicable to fish screen design and development be coordinated and focused on the appropriate issues. Additional coordination between the fish treadmill research team, the Anadromous Fish Screen Program Technical Team, and the Central Valley Fish Facility Review Team is needed. That coordination should be documented through a combined meeting to review the proposed research and prioritize study elements to address ranked critical needs for screening design and application/installation. The revised proposal should include the evidence that those participating in the meeting concur that the proposed project meets their fish screen research needs.

The Panel recognizes that running a program of this scope is expensive. Nevertheless, the budget continued to be inadequately justified as noted in past and current reviews. The proposed costs for this research appear to be higher than was required to support similar CALFED and CVPIA funded projects in the past. For example, does this project really require a full time fish collection team of 3-4 people (CDFG personnel) to provide fish when many of the fish are coming from culture work at hatcheries (salmon) and other CALFED funded projects (Delta smelt)? Further, it may not be necessary to test every species under every set of conditions to derive a good understanding of fish behavior for each species.

The Panel recommends that because of the potential importance of this research for application to fish screening and reduced take at the pumps that comments in the current and past reviews be carefully considered and the proposal be revised accordingly.

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Research and Restoration External Review Form
CALFED Ecosystem Restoration Program 2002 Proposal Solicitation Package

Proposal Title: Improved Fish Screen Design and Operation for Native Sacramento-San Joaquin Watershed Fishes

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The goals, objectives and hypotheses are clearly stated and internally consistent. However, the title is somewhat misleading. This project is a research project directed at discovering appropriate flow conditions for Delta fishes encountering a screen facility. The title implies that the project is testing a specific screen design. This does not detract from the timelines and importance of the type of research being proposed. For agencies, water users and individuals attempting to design fish screening facilities there is minimal research available on appropriate flow conditions and design criteria for even salmonid species let alone other important Delta non-game fishes.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

This study is justified relative to the existing knowledge on fish screen flow conditions. Especially for species other than salmonids there is very little knowledge about what types of flow conditions will safely pass individual fish past a water diversion project. As the fish treadmill project has shown in previous studies, it is imperative to study the behavior of each fish species that are to be protected at water diversions, not just sustained and burst speed capabilities of the species since behavior of the species when encountering a screen can be very different for each species regardless of swimming abilities of the species. This research is justified in that those attempting to design fish protection facilities currently need the knowledge that this project will produce.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

As the applicants have shown in previous work, the approach is appropriate and well designed for meeting the objectives of the project. This work will provide highly needed basic behavioral information for Delta fishes that is currently needed by decision-makers. This facility is currently the only facility that can provide this type of information, and it currently exists and therefor would not need to incur substantial development costs.

It is not clear however from the proposal as to how the project determined what parameters to test. As I have stated, there is a critical need for design criteria for fish screening structures, especially related to fish species other than salmonids. Hence, there needs to be a link between the applicants and the fisheries agencies that are responsible for determining what criteria a screening facility will need to comply with. This communication is probably taking place, but is not readily apparent in the proposal.

There are fish screen parameters missing with this approach however. While this study produces important information it is apparently not able to test fish screen variables such as screen mesh type (profile bar, punch plate, woven mesh), mesh open area, mesh opening size, or different types of screen cleaning systems. All of these variables affect the ability of fish to avoid the screen. This facility should look for methods to allow changing of the screen type.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

I believe that the approach is fully documented and technically feasible as has been shown by this facility previously. . The scale of the project is consistent with the objectives. This is a very large laboratory experiment and the best test facility anywhere for conducting this type of research. The applicants have assembled the needed equipment and personnel to conduct this research and have proven their effectiveness in measuring these type of fish behavior parameters in past work.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

The project is very specific on the parameters that it intends to test, and as indicated previously the project has the performance history to show that there is a high degree of likelihood that it will be able to successfully meet the goals and objectives as outlined in the proposal.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

The products of this project are the information developed and the reports generated that summarize this information. The project has done a good job in the past at reporting their findings in report and presentation form. This information is very important outside the Northern California area as well, and while outside the scope of the CalFed Program it is a benefit that this information is being shared widely.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The applicants have a proven track record of performing this type of research as indicated by the appendices that are attached to the proposal. They have put together a highly qualified team of experts to perform this research. The infrastructure (the treadmill) has been constructed, and successfully used on this type of research previously. The fact that the infrastructure has already been constructed is what makes this project feasible.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

If I have a problem with any aspect of the proposal it is the high cost of the project. While the research being performed by the project is very important and needed to construct fish friendly screening structures, it is difficult to justify some of the costs of the project. While the very high (48.5%) University indirect costs are probably not something that this project has any control over, it is unsettling.. Another area of concern is the graduate student tuition remissions. This is not something that the CalFed Program should be providing. If hiring assistants to perform the work involved in the project requires that the project pays salaries and provides student fee remissions then possibly the project should be hiring outside assistants.

Miscellaneous comments:

The applicants of this proposal have improved their overall proposal and have added additional information. This resubmitted proposal does not significantly change my impression of the overall project. This project will provide very important information to fisheries agencies and water users wishing to design fish protection facilities at area water diversions. This is the only facility of its kind doing this type of research and it is important for this work to continue. I would like to see this type of research extended for other types of screen facilities, especially horizontal plate screens. The

information obtained by this work will be very applicable to current work being undertaken to screen irrigation diversions in the Delta and Sacramento and San Joaquin Rivers.

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
- Excellent X	I would rate this project as excellent. I have some concerns about some of the costs associated with the project, however, this project provides basic, highly important information needed by those individuals trying to build screens that provide protection for ESA listed fish species while at the same time providing needed water for irrigation, industrial and municipal uses. Nowhere else in the realm of fisheries restoration work do you find the win-win situation better than the construction of fish screening facilities, and this project provides some of the basic information needed to carry on that work.
- Good	
- Poor	

Research and Restoration External Review Form
CALFED Ecosystem Restoration Program 2002 Proposal Solicitation Package

Proposal Title: Improved Fish Screen Design and Operation for Native Sacramento-San Joaquin Watershed

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The proposal identifies two sets of studies, the first to facilitate passage using high sweeping velocities, fish friendly crowding devices, and visual stimuli, and the second to determine the effects of debris loading. Earlier reviews identified several deficiencies and the applicant has attempted to respond to those issues. Issues raised were “explanation of goals, objectives and hypotheses” (External Scientific # 1), “hypotheses not explicitly stated” (Research and Restoration Technical Panel Review), and “make full use of the opportunity to provide a proposal that meets the Solicitation Package’s proposal guidelines”(Final Selection Panel Review). In response, the applicant added additional information under the A1 Problem section to explain the problem and stated nine specific hypotheses related to the two sets of studies. *Unfortunately the applicant did not take this opportunity to explicitly state a set of goals and objectives.*

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

During the first round of technical reviews the conceptual model was not readily available due to a format problem, “diminishing my ability to evaluate the conceptual model shown on that page”(External Scientific #1). The applicant corrected an earlier problem and made the conceptual model available to this reviewer. Unfortunately the applicant did not take this opportunity to improve the weak justification section. This lack of response by the applicant is surprising since the Research and Restoration Technical Panel Review comments stated “The panel did not consider continuation of ongoing treadmill studies an adequate justification. The brief summarization of the results for delta smelt, Chinook salmon, and splittail is described in Table 1, but no specific velocities supporting the justification were added. The differences in sweeping velocities apparently already tested as described in Table 1 and the “very high sweeping velocities” proposed in Table 2, (the experimental variables used in fish treadmill experiments) were not described specifically in the justification. This lack of specificity was an opportunity lost for the applicant. Furthermore, no specific information is provided to support the use of fish friendly crowding devices, visual stimuli, or the effects of debris. Much of the information provided in the justification is a not a justification but a presentation of results (e.g., “Results collected thus far”; “These results show”; “These early Fish Treadmill results have been reported”). The proposal was described as “a sloppy and unpersuasive document” by an earlier review (External Scientific Reviewer #1) and this reviewer believes the justification would meet the “sloppy and unpersuasive” standard.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

The Approach section of this proposal is one of the great strengths of this proposal. Few alternatives to the Fish Treadmill approach seem to be immediately available to provide fish screen criteria and design information. This reviewer believes experiments on full or partial scale test screens (e.g., Tracy Test Facility), would yield more valuable information for design of screens and passage devices. However, few alternative approaches seem to be available. Therefore, this approach seems the most prudent and timely to obtain the desired information prior to construction.

In the approach section the applicant added a paragraph describing the Fish Treadmill and hypotheses for the passage and debris loading experiments. These additions address earlier comments on the proposal.

The approach does not address the possible behavioral differences associated with season and origin (hatchery or wild) of experimental fish. The behavioral disposition of fish used in the experiments is an important aspect and should be more carefully controlled than the plans indicated by the general comments made in section A8 (Work Schedule). For example, “the schedule of experiments for each species is determined by seasonal availability”. The seasonal changes in the physiology, behavior, and swimming performance of juvenile salmonids has been identified by many other investigators. The differences between hatchery and wild origin fish is also described using many different measures (Chilcote et al. 1986; Mazur and Iwama 1993; Salonijs and Iwama 1993; Berejikian 1995; McMichael et al. 1999; Johnsson et al. 2000). Furthermore, the use of hatchery reared delta smelt with a history of high mortality may lead to further suspect results. Inasmuch as only the most general guidelines on fish origin, quality, and attributes are provided this reviewer recommends great caution in the selection of experimental fish. Neglect of this aspect could lead to serious restriction of the inferences that could be drawn, confounded the results, or actually lead the well meaning user of the data to make design mistakes that will cost millions and result in years of retrofitting screens.

The proposal is a little vague concerning the species that will be tested. For example, in section 3 Approach white and green sturgeon are listed and the green sturgeon source is identified, “YOY hatched and reared at UC Davis, fertilized eggs provided by Yurok Tribe”. In Table 2. “Experimental variables and monitoring parameters used in the Fish Treadmill experiments” sturgeon are listed with the comment “green, if available”. Does that mean the applicant does or does not propose to do experiments on white sturgeon and will green sturgeon be available? In Table AI-1 American shad are listed as 17% complete as of September 2002. Will continued funding be used to pay for remaining American shad experiments?

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

The approach is documented and technically feasible. The applicant and collaborating scientists have an excellent record and provide a high likelihood of the proposed experiments being successfully completed. Based on the past conduct of similar experiments, the scale of the proposal is ambitious but consistent with the objectives. This matter of scale is also related to the relatively high budget.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

The applicant provides a narrative describing past performance primarily through technical reports, peer reviewed publications, and presentations. Section 7. “Expected Products and Outcomes” indicates quarterly reports, annual reports and a final technical report will be provided. Also in that section, the applicant describes the effort to communicate the findings through presentations at regional meetings. This is a very desirable approach to providing the research products to the user groups and a valuable performance measure.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project reviewed publications, and presentations.

Inasmuch as this is a research project the products identified are appropriate for the project. However, whether the peer reviewed scientific publications reach the correct audience may be a more important issue. This reviewer is not alone in expressing that concern. In section three of this review the question was posed

“Will the information ultimately be useful to decision-makers? Several earlier reviews indicated some concern about communicating the research to the engineering community and decision makers. For example, the Final Selection Panel Review “Consult and coordinate with CALFED’s Science and Ecosystem Restoration Programs and include a proposal briefing to clarify concerns and relate the need and relationship of the proposal to the Tracy Fish Test Facility.” Specifically, it looks like this recommendation for the rewritten proposal was ignored. This concern was also identified in the External Scientific Review # 2 “Hence , there needs to be a link between the applicants and the fisheries agencies that are responsible for determining what criteria a screening facility will need to comply with. This communication is probably taking place, but is not readily apparent in the proposal.” I recommend requiring participation or sponsorship in a workshop for agency staff and engineers to communicate the results. Such a workshop would be more timely than most reports and the audience could be more targeted than a scientific meeting.

- 7 **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Based primarily on peer reviewed publications and participation in regional and national meetings the track record of the applicant is excellent. The project team is eminently qualified to implement the proposed project. The Fish Treadmill is unique and the supporting infrastructure for the Treadmill is currently available.

- 8 **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

The cost of the proposal is apparently reduced by about 7% and approximately \$100k per year. Cost was noted in earlier reviews by the Final Selection Panel Review “Justify the funding and staffing levels”: External Scientific #1, “Hugely expensive”; and External Scientific #2 “if I have a problem with any aspect of the proposal it is the high cost of the project”. It is an expensive project for a laboratory based project. However, to reduce cost some tough choices have to be made. Does a reviewer recommend shortening the species list of test animals? This reviewer can not identify one of the species that would not be of concern at a screening facility. Another alternative would be to cut one of the sets of tests. Would we recommend omitting experiments on high sweeping velocities, crowding devices, or debris? The proposed experiments are the continuation of years of research experience and unless the region is ready to move to larger scale test facilities that seems a poor alternative.

Miscellaneous comments:

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
- Excellent	This proposal, in its rewritten form differs very little from the earlier submission.
-X Good	Earlier reviewers comments ranged from terming the document “sloppy and

- Poor	unpersuasive” to “Excellent” with minor concerns. Both of the same comments are still applicable because the applicant changed the proposal very little and was often unresponsive to comments including those by the Final Selection Panel Review and the External Scientific Reviewers. This reviewer finds deficiencies primarily in the Justification section. I believe the Justification is deficient because it just does not meet the standards expected for a research proposal, does not provide an example of use of previous results in fish screen design, and because the Justification is a general presentation of results of previous research. This proposal is probably the lesser of several evils. What are the alternatives: 1) do nothing, not very prudent; 2) conduct experiments at other facilities, not very timely. Not funding the project pretty much guarantees that the region will not have the information in the near future, can we afford that?
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Research and Restoration External Review Form
CALFED Ecosystem Restoration Program 2002 Proposal Solicitation Package

Proposal Title: *Improved Fish Screen Design and Operation for Native Sacramento-San Joaquin Watershed Fishes*

Review:

This proposal requests two years of funding to continue the fish screen research investigations that UC Davis has been conducting. This proposal will test fish species in the same “fish Treadmill” apparatus as in previous investigations, but under different hydraulic parameters and stimuli not tested to date. Measurements and data will be compared to past study results.

The proposal objectives are broken down into two general areas:

- To investigate hydraulic (velocity), physical (crowders), or behavioral (light or crowders) methods to improve downstream fish passage in fish screen channels.
- To Investigate fish response and injury/impacts due to screen occlusion due to debris/clogging conditions.

Previous investigations focused on ideal hydraulic conditions near a fish screen in a circular channel, but did not focus on the higher velocities or behavioral aspects as proposed here. The Treadmill data to date has been very valuable in providing insight into the near screen fish responses to various hydraulic conditions. Design parameters for effective protection and fish salvage operations are shown to be different for different species, especially delta smelt and Chinook salmon. This study will attempt to look at other factors that may achieve the right balance between appropriate hydraulic and behavioral parameters that could improve fish facility functions.

This proposed study has the facility in place and a number of dedicated and experienced researchers available. Studies to date have been peer reviewed and conducted in a scientific manner that has been valuable to the CALFED planning efforts for future Delta facilities.

While CALFED should support the concept of this proposal, we offer the following comments and questions:

- A number of existing experiments have not been completed (reference September 2002 Status Report in the proposal). These experiments should be completed prior to beginning these additional tests. Interpretations of the new tests are based on the information and data collected previously. Until those tests are completed, new tests will not have an adequate baseline. Those tests may also be more critical for CALFED’s immediate design needs, such as for the Tracy Fish Test Facility Design;
- High sweeping velocities in a production facility may result in high headlosses and have adverse impacts on other facility components. Velocities of 5 feet per second may be unrealistic for the facilities being contemplated in design due to additional facility headlosses, stresses, flow uniformity, cleaning issues, and additional facility

needs. For example, bypass systems may have to match this velocity at the entrance to match this velocity (Agency criteria). This could have the unintended effect of enlarging secondary screening systems to match this velocity at the bypasses;

- The fish treadmill device may not be adequate for high velocity testing. The fish swimming channel may be too confining to determine true fish responses. The transit time around the swimming channel at 5 fps will be less than 8 seconds making evaluations difficult and conditions quite non-uniform. It is also unclear if the facility can perform hydraulically well under these high sweeping velocities. Flow mapping should be performed to verify if this testing is appropriate prior to embarking on any high velocity tests;
- The visual stimuli that will be used to move fish downstream is unclear. A test program to determine appropriate stimuli for this could be a significant effort alone. If pilot tests do show promise, can these stimuli be replicated in the field with potentially high turbidity and in deep channels? How will these levels be comparable to field data? It may be appropriate to investigate this, but at a concept level to be developed later. Caution should be exercised when interpreting or transferring these results to the field if these tests go forward.
- Reference to several possible crowding devices are discussed in the text but the level of examination of alternatives is unclear. Like the proposed visual stimuli testing, there are a number of possible permutations and configurations to be investigated, making this a potentially significant research effort in itself. Variables could include: materials (chains, cables, etc.); spacing of wires/chains; speed of crowdors in relation to water velocity; noises of device; fish acclimation to the apparatus; time of day; light conditions; etc. As with the visual stimuli comments above, it may be appropriate to investigate this, but at a concept/pilot level for development later. Caution should be exercised when interpreting or transferring these results to the field if these tests go forward since scaling of facilities may also be a factor.
- Debris or screen occlusion tests are interesting, but the application of these tests should be used cautiously. Velocity hot spots may not be very apparent at the proposed low sweeping velocities where velocities will increase by up to 25% with a 25% screen area reduction. The pattern of screen occlusion could take many forms. Due to the number of possible occlusion configurations, this effort may be better conducted as a pilot effort. It is unclear how 25% was selected as the occlusion variable or why only low sweeping velocities will be investigated. Data from positive barrier screen systems may indicate a range of possible values for this. Velocity uniformity due to structural members and discontinuities may as significant to creating hot spots as screen occlusion may be. This could be addressed at a pilot level as well prior to full testing.

Conclusions

Overall, the proposed project has been and should continue to be beneficial to the CALFED program. I offer the following recommendations based on the information in the proposal:

- Complete the previously recommended set of fish species testing prior to beginning any new work, or include it as the initial part of this effort;
- Investigate salmon and steelhead testing at the 3 fps sweeping velocities, but not at 5 fps. Do not subject delta smelt to these higher sweeping flows, since lower velocities already showed poor results;
- Conduct pilot level tests (behavioral only) on various visual stimuli that will move fish under similar conditions as near to field level conditions as can be expected. Develop specific study plan for promising alternatives as appropriate;
- Conduct pilot level screen occlusion testing (behavioral only) with higher sweeping velocities and variable occlusion testing variables. Develop specific study plan for promising alternatives as appropriate;
- Conduct pilot level fish crowding testing (behavioral only) under a number of hydraulic conditions as might be expected. Coordinate investigations with crowding technologies being investigated by the USBR at the Tracy Fish Test Facility. Develop specific study plan for promising alternatives as appropriate;

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