

# **Monitoring Responses of the Delta Smelt Population to Multiple Restoration Actions in the San Francisco Estuary**

**William A Bennett**

# Final Selection Panel Review

Recommendation: Reconsider if Revised

*Amount Sought:* \$2,658,648

*Fund This Amount:* \$1,482,480

Brief response to comments received:

The applicants submitted a letter in response to the Selection Panel's initial recommendation in which they acknowledge many of the recommendations made by the Panel and other reviewers. The Panel has considered the applicant's comments and appreciates their thoughtful response.

The Panel feels the real issue for smelt monitoring is to sort out the population bottlenecks in the smelt life cycle. This requires a comprehensive assessment of the mortality patterns within the entire system. The effort described in this proposal, together with other studies under consideration by the CBDA's Science Program and the Interagency Ecological Program (IEP), could provide key information on age and growth of different segments of the smelt population that could allow a better understanding of when and where their current life history bottlenecks take place and whether their patterns of growth are consistent with prevailing theories of population declines. The recommendations for revisions are designed to position this research team to provide key information on age and growth and spawning that can be interfaced with other management efforts to begin to assess and understand those patterns and to ensure coordination of this work, including an appropriate sequencing of studies, with other investigations.

The Panel recommendation that the proposal be reconsidered if revised is unchanged, but the review has been revised to emphasize key points that should be addressed by the PI's. The recommendation as well as technical panel comments should be carefully considered in the revised submission:

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1) This project proposes to consider a somewhat narrow set of potential mechanisms that could be impacting current recruitment levels of Delta smelt (food, contaminants) and disregards several other potentially important factors. It is also unclear how the project will focus the subsampling of available smelt to understand specific bottlenecks to Delta smelt recruitment. The Panel recognizes the impossible nature of trying to address all potential causes for smelt mortality and suggests that rather than broaden the scope, the project focus initially on providing age and growth information and spawning habitat data. Both types of data are needed by managers and can be funneled into the larger effort to understand smelt dynamics. A plan should be devised and clearly articulated in the proposal that includes a sample analysis plan that can best provide a basis for understanding of Delta smelt population dynamics within the system. The panel recommends that the mortality patterns of delta smelt observed in the IEP sampling should be reviewed before analyzing age and growth of smelt samples from a given year. A strategy should be devised in consultation with managers to strategically analyze the age and growth of smelt specimens that can best address the variety of factors affecting smelt in any given year.

2) The panel believes this project should not ignore entrained fish as a source of samples. The water projects generate large numbers of fish, perhaps greater numbers and at different intervals than IEP monitoring. Sampling fish from the projects might provide some key insights into smelt behavior at times of entrainment. At a minimum this project could determine if there are any differences in growth or other characteristics of entrained fishes and potential use the otolith chemistry to identify their source. This is possibly a key element in understanding population dynamics of smelt.

3) Better understanding about whether and how contaminants may be affecting smelt is important, the Panel concurs. Given funding limitations and other considerations, however, the Panel believes a decision about funding experiments on contaminant exposure needs to be considered as part of other decisions about investigations of the continued decline in

## Final Selection Panel Review

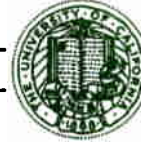
smelt populations. A decision about whether to proceed with the experiments on contaminant exposure that are part of this project's task 3, therefore, should be reached after consultation with the science program and IEP (once their respective grants and work plans are finalized). This coordination should include considering whether funding for these investigations of contaminants' effects should be deferred until after other elements of the new smelt population investigations have made sufficient progress to warrant the histopathology research outlined in this proposal. If a decision to proceed with Task 3 is made, funds beyond the \$1.5 million listed above will be needed.

4) Given the importance of spawning habitat to any species, the assessment of smelt spawning habitat should be a priority for this project. However, the methods should be more carefully planned and articulated for the revised proposal.

5) Although the otolith chemistry appears to be well developed, the methods need to be clearly articulated in the proposal so they can be peer reviewed. The panel also noted that seasonal and interannual variability in Sr isotope ratios could make discriminating the source of some individual smelt tenuous, especially within waters of the Delta where the source waters from the various rivers systems are well mixed. The PI should consider those constraints in the sampling design.

6) The selection panel concurs with the technical panel that the costs for the microscope, grinding wheel and the CCD camera are excessive, and is puzzled by the need for new polishing tools and a new microscope in this project. The panel recommends that the task 2 budget be limited to \$35K for equipment (\$30K for a microscope and \$5K for a polishing wheel).

7) Concerns raised in the administrative review should be addressed.



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May 1, 2005

Selection Panel  
CBDA, Ecosystem Restoration Program  
**Attention:** Dan Ray, Grants Officer  
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Dear Members of the Selection Panel;

We wish to thank the committee for the consideration given to our proposal entitled "Monitoring responses of the delta smelt population to multiple restoration actions". We are also grateful for the many helpful comments, and agreeing to consider a revised proposal. We are writing to provide clarification on 6 key areas that were of concern to the committee, and seek additional guidance for revision of the proposal.

1a. *General Approach*: "... consideration of a somewhat narrow set of potential mechanisms...". First, we certainly did not intend to give the impression that the project would disregard important factors. Overall, we proposed to integrate information from fish otoliths and histopathology to measure the condition of individuals sampled in the ongoing fish monitoring programs. Our overall goal has been to implement this approach as a screening-tool to establish annual baselines of measurements on individual growth processes and their causes, primarily feeding success and exposure to pesticides. In our experience, these are the two most likely ways in which current restoration actions would influence delta smelt vital rates, and they are important factors influencing overall growth-related survival: a key component of recruitment success. Measurements on how fish vital rates are affected by growth-related processes stand-out as primary gaps precluding the accurate evaluation of entrainment effects by the export facilities and potential benefits of restoration actions on the delta smelt population.

We are aware that several other factors can also influence growth, or can be important influences on delta smelt abundance. However, it is not practical or logistically feasible to measure everything at the same time, particularly factors such as competition and predation which can be major influences on growth-related survival. Developing annual baselines on growth-related processes would provide a backbone for an iterative process of eliminating key processes from consideration, and then focusing on the ones that appear important in different regions and from year to year. For example, if annual growth rates, histological condition, and mortality rates are all high and export losses are low, then it is much more likely that some catastrophic or unusual event such as predation by exotic fishes was an important factor limiting

abundance in that particular year. With such a large number of specific possibilities influencing delta smelt in any given season or year, this is a pragmatic way of identifying and eliminating categories of processes (based on how they influence fish vital rates) before further diagnosis.

1b. *Sampling design.* In a proposal revision we will further attempt to clarify using general scenarios for how sub-sampling of available smelt will occur, however, the nature of the problem is akin to following a moving target. Our approach blends traditional methods of monitoring and research into a single program that attempts to adapt in near real-time to an ever-changing “natural experiment”. The investigator can never be certain of the abundance and or distribution of fish in any one year, or often season, “a-priori” to set a specific experimental design as in traditional hypothesis testing.

2. *Samples from the export facilities.* We welcome this recommendation. We have often proposed using “salvaged” fish within our general approach in various CALFED workshops, and only deemphasized their use in the current proposal because the focus of the PSP was to address restoration actions.

3a. *Elimination of Task 3: histopathology and lab exposures.* We strongly request that the histopathology component of this project be included in a revised proposal, and will search for alternative funding for the bioassay work. Removal of histopathology from the proposal, in our view, would be a serious set-back to the success of this project. Our work in this area for delta smelt has undergone about a decade of design, testing, and peer-review in a variety of CBDA forums, professional conferences, and the scientific literature. We agree with the textbook description of histopathological responses provided by one Technical Reviewer, as we have successfully employed this technique and worked with various mechanisms of response on a variety of fish species for over 15 years. Overall, the current state of our knowledge indicates that most histological responses in delta smelt arise primarily from two main processes: poor feeding success and exposure to toxic chemicals, primarily dissolved pesticides. In our past experience, glycogen levels have been a straightforward indicator of feeding success in young striped bass and delta smelt, while a variety of other alterations to the liver are used to diagnose exposure to contaminants. Again as in 1a, we initially use this technique as a screening-tool, but if a large proportion of fish in the samples exhibit liver alterations consistent with toxic exposure, we typically apply complementary biomarkers that can distinguish among classes of contaminants (e.g. P450, or apoptosis methods; see our website for a full listing: <http://www.bml.ucdavis.edu/peir/>), and or collaborate with other work programs (e.g. water quality) to identify potential sources.

Effects from other contaminants are possible but unlikely for delta smelt. For example, the Technical Reviewer also correctly indicates that PAH compounds are prevalent in the *sediments* of the estuary and they elicit similar histopathology responses. However, delta smelt are a *pelagic* species occurring only in the northeastern estuary and Delta where the dominant sources of contamination are *dissolved* pesticides. In addition, infestations are also a possible response, however, no evidence or hypotheses concerning such effects have ever been suggested. Delta smelt do act as hosts for a tapeworm also common in a variety of co-occurring fish species. Although, we typically observe and enumerate these in the digestive tract of delta smelt, thus far their occurrence does not appear to be associated with histological condition or fish growth rates. Thus they are most likely a natural occurrence unlikely to drive population abundance.

Bioassays were proposed as a way to strengthen the level of understanding of the histological responses, and indeed would help to address concerns over histopathological responses. First, our objective would be to identify potentially specific responses from exposure to pyrethroids, a new class of pesticide whose application is currently expanding, and then to fine-tune the temporal component of glycogen gain or loss to more accurately tie the temporal component of responses with the chronology of fish growth and location as determined from the otoliths. As described in response 1a (above) we can't measure everything and it doesn't make sense logistically to investigate other sources of contamination until we consider the most likely suspects first, before chasing-down others. We feel the proposal is stronger with the bioassays, however, we will accept the committee's recommendation and look for funds elsewhere for this component.

3b. *Sample sizes.* We proposed to examine about 100 fish from each of five surveys; a total sample size of 500 fish per year of work. First, we must consider that delta smelt are a threatened species currently at low abundance, such that we will be fortunate if 100 fish are collected at each, and especially the older life stages by the monitoring programs. In addition, delta smelt are typically patchily distributed. For example, currently the majority of the population is located in the lower Sacramento river, such that 100 samples from each of five life stages would provide a sufficient measure of fish response to the prevailing habitat conditions in that region. Finally, logistically speaking, this is a considerable amount of work. Rarely when using these techniques separately are sample sizes of 500 fish per year achieved.

6. *Equipment costs.* We definitely need to purchase a microscope and polishing equipment for a project of this magnitude. In our previous work we either borrowed or rented microscopes which interfered with work efficiency. Polishing tools were also limited and now in serious need of upgrading. We will keep such costs within the amount recommended by the committee.

Again, we thank the Selection Panel for the helpful comments. Given our response, we ask if a revised proposal retaining the histological component, removing the bioassay component, and otherwise addressing all other specific concerns, be an appropriate scope of work? We are willing to fit within the recommended funding allocation, although this will most likely compromise the scope of the project to a two-year investigation.

Sincerely,



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# Initial Selection Panel Review

Recommendation: Reconsider if Revised

*Amount Sought:* \$2,658,648

*Fund This Amount:* \$1,482,480

Brief explanation of rating:

The project proposes to monitor responses of Delta smelt populations to multiple restoration actions in the San Francisco Estuary. This topic addresses the essence of the PSP in terms of monitoring that can benefit a priority fish species. The research team is strong and likely to produce results that are useful to management as well as peer reviewed publications of their results. Delta smelt is a priority species for monitoring and gaining a better understanding of their population dynamics is critical. In spite of the strong need for data on smelt, the project as proposed has several drawbacks for funding as the proposal stands. The project doesn't really focus on a specific restoration action and may not be able to sort out the effects of a specific action on the population success of Delta smelt. However, the panel does not see that as a drawback to funding this project. The panel felt the real issue for smelt monitoring is to sort out the population bottlenecks in the smelt life cycle. This requires a comprehensive assessment of the mortality within the entire system. The recommendations for revisions are designed to position this research team to begin to assess and understand those patterns.

The following revisions as well as technical panel comments should be considered in the revised submission: 1) This project proposes to consider a somewhat narrow set of potential mechanisms that could be impacting current recruitment levels of Delta smelt (food, contaminants) and disregards several other potentially important factors. It is also unclear how the project will focus the subsampling of available smelt to understand specific bottlenecks to Delta smelt recruitment. A plan should be devised and clearly

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## Initial Selection Panel Review

articulated in the proposal that includes a balanced sampling design that represents Delta smelt population in the system. 2) The samples they propose to use in their work are coming from ongoing monitoring by IEP and restoration project monitoring. The panel believes this project should not ignore entrained fish as samples. The water projects generate large numbers of fish, perhaps greater numbers and different intervals than IEP monitoring. Sampling fish from the projects might provide some key insights into smelt behavior at times of entrainment. At a minimum this project could determine if there are any differences in growth or other characteristics of entrained fishes and potentially use the otolith chemistry to identify their source. This is possibly a key element in understanding population dynamics of smelt. 3) This project can move forward and provide badly needed details on the Delta smelt population dynamics throughout the estuary without including lab experiments on contaminant exposure. The panel also concurred with the technical panel that the 100 samples per year from each of 5 sampling areas may be inadequate for system-wide assessment of population level contaminant effects. The panel recommends that task 3 be eliminated from the project in a revised proposal and a plan developed to archive samples for possible future analyses if the results of the monitoring and growth studies indicate their importance in understanding smelt dynamics. 4) The assessment of smelt spawning habitat should be a priority for this project, but the methods should be more carefully articulated for the resubmitted proposal. 5) Although the otolith chemistry appears to be well developed, the methods need to be clearly articulated in the proposal so they can be peer reviewed. The panel also noted that seasonal and interannual variability in Sr isotope ratios could make discriminating the source of some individual smelt tenuous. The PI should consider those constraints in their sampling design. 6) The selection panel concurs with the technical panel that the costs for the microscope, grinding wheel and the CCD camera are excessive, and is puzzled by the need for new polishing tools and a new microscope in this project. The panel recommends the task 2 budget be limited to \$35K for equipment (\$30K for microscope and \$5K for a polishing wheel). 7) Concerns raised in the administrative review should be addressed.

# Technical Panel Review

*Technical Review Panel's Overall Evaluation Rating:*

Above Average

## Explanation Of Summary Rating

The technical review panel feels that this research would make a valuable contribution to smelt recovery efforts and insight into the species ecology. The proposal has many strengths (its multi-disciplinary approach, its tie-in with existing sampling schemes, its use of otoliths microchemistry) and some weaknesses (its lack of information on data analysis and data integration; limitations to inferences from the histopathology work). The proposal generally held up well in the technical review. However, the regional reviews found the project to be much weaker when it comes to the assessment of restoration activities. This may be a case where utility to the program as a whole is higher than its regional value, as it promises to provide important insight for a priority species by testing the conceptual model. Also, the technical panel feels that the project has benefits when it comes to assessing the success of restoration efforts. The insights gained between (for example) environmental stress factors and growth and survival could be used for assessing (at least indirectly) the influence of restoration efforts on Delta Smelt performance. In addition, the otolith microchemistry that allows distinguishing fish from different natal regions would be a tool to relate Delta Smelt population performance to success of restoration activities in those regions.

## Goals And Justification

The background information is well-developed, and goals and objectives are clearly stated. One goal of the work is to overcome a lack of insight into the relationship between various parameters measured in individual Delta Smelt on the

## Technical Panel Review

one hand, and survival to adulthood and population performance on the other hand. While some sampling will be done in/near restoration sites, sampling will be done throughout the species' range and does not allow direct evaluation of the success at individual restoration sites (authors state that the regional scale is more appropriate as a consequence of strong tidal dispersion in the pelagic habitat of the smelt). There are no specific hypotheses that the proposed monitoring will test.

### Approach

The general approach is clearly described and well-designed for achieving the objective of providing insight into the link between vital parameters for individual fish and survival to adulthood at the population level. Measuring the chemical signature of otoliths for determining spawning region is an exciting and powerful tool for getting this important information. Looking at histopathology and glycogen levels - and tying this to fish growth - may work, but is not that straightforward. Glycogen levels may change due to factors other than starvation (e.g. infections) and histopathological changes may be due to factors other than pesticide exposure (PAHs, infections). Also, certain chemical contaminants may affect growth rate but not result in histopathological changes. The proposed bioassays help in filling in the gaps in knowledge of the relationship between the various variables measured in this task, but these bioassays are very limited (done only for starvation, pyrethroids, and their interaction) - missing a host of contaminants that could be important in the Bay area. The researchers mention that they will analyze for stress proteins, fatty acid composition and glycogen levels in "a small number of field-caught fish", but it is impossible to know if this will really make a difference without knowing the number of fish. The analysis of gut contents and zooplankton sampling of the water is straightforward and worthwhile. This research will make a significant contribution to our knowledge base, as it will provide insight into the factors affecting Delta smelt and the relationship between individually-based variables and population performance. As such, it will be useful for

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managers involved with restorations aimed at Delta smelt recovery. With the multidisciplinary approach used here, the insights resulting from this research effort could ultimately be used for understanding potential mechanisms by which restoration efforts and other human activities affect Delta Smelt.

### **Feasibility And Likelihood Of Success**

The project is technically feasible. All the methods are well-established. The two regional reviews did not identify local circumstances affecting project feasibility. The environmental compliance review did not identify issues that would impede the project.

### **Performance Measures**

The proposed monitoring will allow evaluation of smelt recovery, but not of success of specific restoration actions/sites. No specific performance measures are listed. Monitoring and evaluation plans are explicit enough to assess smelt recovery. One problem with performance measures is the lack of information on data analyses. One reviewer commented that this was "the most disappointing and troubling aspect of this proposal."

### **Products**

The information generated will be useful to resource managers and scientists. Data handling and storage methods appear to be appropriate, but it is not clear whether data will be readily accessible by people outside the project. Results are likely to hold up to peer review, though too much of the previous work has ended up solely in the gray literature.

### **Capabilities**

The team's qualifications are very appropriate. There is a good mix of disciplines and the team as whole has the expertise needed to do an excellent job.

## Technical Panel Review

### Budget

The budget is difficult to evaluate. External reviews ranged from "appropriate" to "excessive". Equipment costs are not properly justified; fluorescent microscope and otoliths polishing wheel should be already available to the PIs since they were used in their previous work.

### Regional Review

The Bay regional review finds that the project has high applicability to ERP goals and regional priorities and makes good use of existing monitoring efforts. The review had reservations regarding lack of details on various components of the research, on data accessibility and sharing with the public. It was felt that the research has the potential to improve knowledge about the smelt, but that it is missing a clear explanation of how it would help CalFed with specific restoration activities (setting priorities, site selection etc.). Thus, applicability to the goals of this PSP was found to be relatively weak. Overall ranking: medium.

The Delta regional review finds that the project fills an important gap and could provide valuable data for assessing Delta Smelt fitness in the delta, but does not see how the project will specifically evaluate restoration actions in the delta. Local involvement is felt to be very limited. The research would aid our understanding of the effects of environmental stressors on the Delta smelt population. The regional panel agrees that parts of the proposal have merit from a research standpoint, but feels that it lacks the capacity to be used as an evaluation tool for restoration activities. Overall ranking: low

### Administrative Review

The budget review indicated several problems (indirect cost rate, insufficient detail on equipment purchases, deviation from standard grant agreement terms and conditions, fee remission of student fee requiring further consideration). The environmental compliance review did not identify any obstacles

## Technical Panel Review

to the work.

The prior phase funding review noticed a lack of description of the previous project in the current proposal.

### **Additional Comments**

Improvement that could be made to this project include increased attention to ties with restoration efforts and with the operation of the pumps (at water export facilities) that entrain smelt.

This proposal is related to a modeling proposal submitted to the Science Program. This pair of proposals would produce models that might prove highly successful in the restoration of the Delta Smelt.

# Bay Regional Review

*Bay Regional Panel's Overall Ranking:*

Medium

## Summary:

While the project design appears strong, the applicability of the project to the goals of this PSP is not strong. The project does have the potential to improve baseline knowledge about the smelt life cycle, to show how smelt move through the system, and to locate more precisely where smelt lay eggs and spend different parts of their lives. A clear explanation of how the research results could inform future CalFed restoration priorities, selection of individual restoration projects, or change operation of current restoration projects would have made this proposal stronger. A suggestion of how these research results could shape operation of the CVP and SWP pumps, and other private facilities entraining smelt, would also make the proposal stronger

### 1. Applicability To ERP Goals And Regional Priorities.

The project has high applicability to ERP goals and regional priorities, focusing on one priority endangered species. It proposes to monitor and evaluate the impact on Delta smelt of CalFed and CVPIA restoration activities by quantifying key parameters for individual fish to derive conclusions about the entire delta smelt population. The project will monitor fish from selected locations throughout the CalFed priority area.

### 2. Links With Other Restoration Actions.

The project is designed to assess cumulative responses of a wide variety of restoration actions on delta smelt, including those providing improved smelt habitat, water quality, water

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flows, and entrainment reduction/avoidance actions. The project does make use of existing monitoring, proposing to analyze smelt entrained by water conveyance pumps and to supplement that with additional fish caught for the purpose of monitoring. The monitoring protocol is a creative way to derive conclusions about the overall smelt population from monitoring of individual fish, but it is unclear how the project will quantify the five points of measurement. The project does propose to collect and store data, but does not provide information on whether data will be readily accessible by people outside this project. The project does fill an important gap by monitoring smelt already entrained in more detailed and comprehensive ways to measure impacts of their environment upon them, and also by adding smelt from other locations to the population being monitored. It is not clear how the project, if successful, would validate or challenge assumptions about how various CalFed and CVPIA restoration actions are benefitting smelt. For example, will the project test whether ecosystem restoration program actions provide benefits to smelt that significantly compensate for or outweigh mortality to large numbers of smelt from operation of the CVPIA and SWP pumps? The project may create monitoring capacity that can be used to assess other restoration actions in the region, particularly efforts to reduce toxic pollution in the watershed from agricultural runoff and other non-point sources.

### 3. Local Circumstances.

There do not appear to be local circumstance that affect project feasibility. The project appears to be appropriate to the site(s) and to make realistic assumptions about other projects and operations. It is unclear whether any of the proposed monitoring activities require private property access or permission beyond what is already provided.

### 4. Local Involvement.

The project describes only minimal sharing of information with the public, and is non-committal on details. There is only one sentence devoted to this topic and just a suggestion that the



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project will "explore the use of" teachers and the lay public to help with local monitoring. The "regular communication" with CalFed and stakeholders is undefined. There is no mention of creating a partnership to endure beyond the term of an ERP grant, and no suggestion that other funding sources are being sought or explored.

### 5. Local Value.

The Project Could Be Useful And Synthesize Data In These Ways, But Results Reporting Is Not Explained In Sufficient Detail To Ensure An Increase In Understanding By Stakeholders And Resource Managers. It Holds The Promise Of Helping Them Understand The Impacts Of Restoration Actions Throughout The Region, But The Outcomes And Products Are Not Designed To Reach Outside CalFed Forums And Workshops.

### 6. Other Comments:

There Is Not A Clear Explanation In The Proposal Regarding How The Project Will Gain Access To Fish Entrained At The CVPIA And/Or SWP Pumps For Analysis. It Is Suggested In Several Places That These Fish Will Be Analyzed, But The Process Needs More Clarity.

One Major Gap Could Be The Failure To Incorporate Monitoring Of Entrained Fish And Fish Mortality Data From Private Facilities That May Be Responsible For Significant Smelt Kills. 2001 Data Indicated That Mirant's Pittsburg Power Plant Took An Estimated 64,000 Smelt Annually, Making It As Big Or Bigger A Killer Of Smelt As The Highly-Regulated, Carefully Operated, And Fish-Screened State And Federal Pumping Facilities.

# Delta Regional Review

*Delta Regional Panel's Overall Ranking:*

Low

## Summary:

The Regional Panel agrees that parts of this proposal have merit from a research standpoint, however we believe it lacks the capacity to be used as an evaluation tool for a suite of restoration activities. Therefore we have given it a low ranking.

### 1. Applicability To ERP Goals And Regional Priorities.

Delta Smelt are a Big R Species. The project intends to further MSCS goals by evaluating previously funded restoration actions as they relate to Delta Smelt populations and their stressors. The approach could provide valuable data for assessing Delta Smelt fitness in the Delta. The project plans to link with IEP and CALFED Science Delta Smelt Monitoring and restoration efforts. However the Regional Panel does not see how the proposal will specifically evaluate restoration actions in the Delta.

### 2. Links With Other Restoration Actions.

The project appears to be appropriately coordinated with IEP. The project fills an important gap by systematically measuring a defined set of variables that are designed to track responses in the Delta Smelt population. Data storage methods are appropriate, provided other groups have prompt access to data in the IEP database. The project does build off of techniques developed during a previous study funded by IEP. Much of the information gathered through this project's monitoring could be used to estimate consequences and relative impacts of ecosystem changes and export pumps on Delta Smelt, however it would be difficult to link these changes to specific restoration efforts.

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### **3. Local Circumstances.**

The project does not require additional permits or permission. The project timeline is linked primarily to pre-planned field surveys with agency collaborators and scheduled semi-annual reports, annual conferences and workshops; therefore it has good potential to move forward in a timely manner.

### **4. Local Involvement.**

Local involvement in the project seems to be limited to local university staff and students. The project plan fails to identify stakeholders and only commits to explore the use of science teachers or members of the lay public. Public involvement and outreach is not clearly outlined in this project proposal. The project does involve key research institutions and has potential to create partnerships with local universities which may increase chances of attracting additional funding.

### **5. Local Value.**

The project products would be new and useful data that could be synthesized with data from several existing monitoring programs to better understand the effects of environmental stressors on the Delta Smelt population. Identifying and measuring a standard set of variables will increase understanding of population responses and, over time, aid in resource management decisions.

### **6. Other Comments:**

Overall this appears to be a research proposal with some clearly guided objectives for a study that could produce some useful results. The project team is well qualified and has access to the appropriate resources. The Regional Panel emphasizes the need for data to be made available to managers within a year of collection.

# External Technical Review #1

## Goals And Justification

This project proposes to examine parameters in individual delta smelt in an effort to link them with the survival and abundance of the smelt population. The objectives are fairly appropriate to measure variables in the fish that would play a role in survival of the population, such as spawning success, food abundance, and growth. Furthermore, the use of existing smelt that are being collected during the IEP surveys for the mechanistic work in this project represents a good way to obtain lots of information while minimizing impacts on the population.

Parts of the proposal are difficult to evaluate because of the lack of information provided on monitoring locations and current population abundances in each area. This is particularly true if the success of restoration efforts is to be evaluated by this project. For example, if you are not necessarily monitoring at remediation sites (proposal states that you will weight your samples towards them), how can tell where restoration efforts are being successful? So, you won't really be able to determine the linkages between how the changes in habitat have influenced the population. Using Figure 1, I have no idea where these restoration areas are even located, as the dots do not appear on the map. Figure 2 states that there has been a population decline, but where the decline is seen the most (ie: which region of the bay) is not stated.

## Approach

Task 1: Task 1 states that the objective is to collect 100 specimens for each survey, trying to weight the collections close to the restoration areas. Is 100 specimens enough if you are trying to gather information about 4 specific regions in the Delta? In addition, there are no specific sampling locations given and therefore no guarantee that you will always return to the same place during each of the 4 periods,

## External Technical Review #1

or each of the 3 years. How can you evaluate your success without this consistency?

Measuring the microchemical signature in otoliths is an interesting way for determining where the fish was spawned. This is important aspect of the proposal to determine which breeding grounds provided the best habitat for spawning and hatchling survival.

Task 2: Task 2 consists of 2 main objectives: a) looking at histopathology for various liver/gonadal lesions and glycogen levels; and b) performing bioassays in the lab to examine the actual effects of pesticide exposure and/or food deprivation on delta smelt. The basis for these studies is stated in the proposal that changes in liver pathology will result in a reduction in growth. Although Figure 6 purports to show growth differences in undernourished delta smelt, this is a field study in which a diagnosis of undernourishment was made by examining lowered glycogen levels. There is no direct link though to food deprivation in the field and reduced growth. Deprivation is only assumed because of a decline in E. affinis. It seems that there could also be other causes of changes in glycogen levels that may have nothing to do with feeding frequency (ie: infections). The proposed bioassay studies in Task 2 will fill in these gaps and are extremely worthwhile to do, as you will now be able to correlate specific glycogen levels, mortality, growth, histopathology, etc. with the defined exposure regimens of food deprivation and pesticide exposure. This is a very important aspect of this proposal. However, these studies really should be done first before the intensive field sampling. If you can't show differences in extreme conditions like those in the lab (i.e.: food deprivation for an entire week), how will you show them in the field?

Furthermore, cancers or other liver lesions do not necessarily decrease the growth rate or reproductive success of fish. Again, the lab studies may help you demonstrate this, but as currently written in the proposal, this is an incorrect assumption. How can you ascertain that liver lesions are from pesticide exposure? Much more commonly, one sees lesions after

## External Technical Review #1

PAH exposure. Since the assumption is that Bay area has plenty of PAHs located in sediments, agricultural operations may have nothing to do with smelt population declines. Fish can also have these lesions due to viral or bacterial infections. In addition, I would assume that tumors, as in most fish, should be rare. Don't think you'll accurately be able to pick this up using only 100 samples, particularly when they're collected from different areas of the bay that might not be impacted by contaminants.

Also, I'm not sure that in Task 2, under Histopathology, that further assessment of liver and gonadal samples using the electron microscope is really necessary. Let's assume that your calculations in Figure 5 hold true in the proposed study such that approximately 8% of fish have liver alterations. That translates into 8 fish total per sampling period. Then, you are going to look at a subset of these 8 samples for further analysis? Analyzing 2 or 3 samples by electron microscopy is probably not needed, unless you can show from the bioassay studies that certain lesions which can only be diagnosed using more sensitive microscopy techniques are caused by certain chemicals or exposure regimes.

Task 3: The gut content and water analysis to determine prey items is straightforward, and will help to determine how well the organisms are feeding. The egg survey portion of this task is not particularly well defined.

### **Technical Feasibility**

See comments under approach

### **Performance Measures**

The most disappointing and troubling aspect of this proposal is that no analysis of the data is ever given. The results of the study would be helpful to CALFED and other agencies to determine whether, why, and where smelt populations are recovering. Although data integration is listed as a separate task (Task 4) on page 8, there are no methods provided at all as to how this will be accomplished. The authors state that

## External Technical Review #1

they will build a model using this information if some other grant is funded, but why not do the modeling (or some other user friendly form of analysis) for this grant?

### **Products**

Data handling and storage methods appear to be appropriate. However, again, there is nothing proposed in the project that will allow evaluation of the data in light of restoration activities.

### **Capabilities**

The project team's qualifications are very appropriate for the project. There is a good mix of disciplines and all investigators appear to be experts in each of the areas.

### **Budget**

The budget seems excessive for the work being proposed (both in terms of salary and supplies). The purchase of the instruments is not justified. I would assume that the equipment is already present on site since you have done some of this work previously.

# External Technical Review #2

## Goals And Justification

The proposal does an excellent job of developing the background information, describing the need for the research, and the regional context for the study. The hypotheses emerge clearly from the study design and model components. The proposed work is comprehensive and very appropriate.

## Approach

The approach is clearly described and is totally appropriate to generate important information relative to the management of the Delta smelt. The information that the investigators develop will be integrated with that developed by others. It is core information needed to understand and manage such a species.

Only one minor issue occurred to me relative to the toxicant-related work. However, I am familiar with some of Dr. Teh's publications and suspect that my concerns are likely something that Dr. Teh has taken into consideration. Relative to Task 3, it is difficult to envision liver cancer as a good histological marker for chronic pesticide exposure for fish that live for such a short time. Can other liver lesions, perhaps precancerous lesions, be used? Perhaps the presence of coagulative necrosis, apoptosis, or inflammation in the liver would be more useful? Is gill histology too variable given the smelt movement within the study area?

## Technical Feasibility

All of the methods described in the proposal, including the chemical characterization of otoliths, are well-established in the scientific literature. The integrated package will produce solid and insight-generating data.



## **Performance Measures**

The products are clearly identified. The metrics and information generated in the study will be directly useful for managing the Delta smelt. In fact, I suggest that management would be difficult without this information.

## **Products**

I have no doubt that the products will be directly useful to managers. The information generated in this study will be communicated effectively to managers. The proposed engagement of the public will add a valuable communication venue to this study, making easier the managers' jobs of communicating the importance of certain actions. The research will also result in high quality, peer-reviewed publications.

## **Capabilities**

Absolutely. The team is a manageable size, is working with relevant groups, and has the expertise needed to do an excellent job.

## **Budget**

Yes. The project budget is appropriate given the scope of the project.

## **Additional Comments**

This seems a well-balanced study aimed directly at producing information useful to managers. It is coordinated with other relevant efforts. The investigators are well-versed in the necessary tools and have a good history of success.

# External Technical Review #3

## Goals And Justification

YES re identified restoration actions, goals, objectives, and conceptual model. W.r.t. hypotheses, THE WORD "HYPOTHESIS" DOES NOT APPEAR ANYWHERE IN THE PROPOSAL. IMPLIED BUT NOT STATED IS THAT SOME UNSPECIFIED SET OF CONDITIONS WILL PROMOTE GROWTH AND SURVIVAL OF DELTA SMELT AS THEY MOVE PROGRESSIVELY ACROSS HABITATS DURING ONTOGENY. these implied hypotheses are justified.

## Approach

yes; re: monitoring and evaluation activities: YES, AND WILL IN FACT IMPROVE ON EXISTING RESTORATION EFFORTS. Please see Comments below on significance of contributions, which will be useful to decision-makers.

## Technical Feasibility

yes

## Performance Measures

A STRENGTH OF THE PROPOSAL IS ITS APPLICABILITY TO EVALUATION OF RESTORATION ACTIONS. specific performance measures ARE NOT PROPOSED. YES ON "EVALUATION OF MODELS" AND "EXPLICITNESS AND DETAILED PLAN".

## Products

Does the project explicitly describe how others will be able to access the data NO W.R.T DISSEMINATION:PREVIOUS DISSEMINATION TOO FOCUSED ON GRAY LITERATURE. W.R.T. STANDING UP TO PEER REVIEW: YES; HOPEFULLY INVESTIGATORS WILL CHOOSE TO PUBLISH THEIR FINDINGS IN THE PRIMARY LITERATURE RATHER THAN IN REGIONAL COMPILATIONS.

## Capabilities

YES

## Budget

I REALLY DO NOT FEEL QUALIFIED TO COMMENT ON THIS. IT SEEMS LIKE A LOT OF MONEY. THE BUDGET JUSTIFICATION APPEARS REASONABLE (HAVE THEY REALLY BEEN ABLE TO DO ALL THE BACKGROUND WORK WITHOUT A DECENT MICROSCOPE OR OTOLITH GRINDER?)

## Additional Comments

Delta smelt are a high-visibility component of efforts to arrest degradation, improve conditions, and resolve water allocation controversies in the San Francisco estuary region. Their plight is widely publicized in conservation circles and beyond. Carefully-planned investigations that track survivorship, determine causes of mortality at different stages, and that assess the effectiveness of ongoing restoration activities are all worthy of support. This proposal addresses those issues and is impressive in scope, methodology, and potential impact. The investigators propose to accomplish these goals by measuring growth in juveniles; effects of toxic chemicals; spawning success; feeding habits; and age, growth, and region of origin of older fish. They thereby hope to determine the conditions that contribute to survivorship to maturity in this Threatened fish, information that could be applied directly to decisions about effectiveness of various restoration efforts.

Coordination between the proposed work and ongoing collection protocols is a strength of this proposal because it eliminates the necessity for additional collecting and can only facilitate communication among workers otherwise focused on individual aspects of the recovery effort.

The otolith microchemistry component of this proposal is truly exciting. This relatively new technique, or at least the refinements that have occurred in it recently, has to be one

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of the most powerful tools developed for understanding factors that contribute to survival across the ontogeny of a fish species. An ability to reconstruct the habitats used by individuals at different life history stages is a true breakthrough. The technical barriers in such work are immense; detecting minute chemical quantities in the face of contamination has been a major hurdle. I know that similar efforts are currently underway in a number of locales, the Southeastern Marine Science Center in Miami being one program where they are trying to determine the sources and origins of reef fish larvae in the Florida Keys National Marine Sanctuary. Hopefully, different groups working in different geographic regions on different species and questions will soon come together to share and compare their findings.

The investigators appear well qualified to perform the proposed tasks and have a decent track record of publication from previous work. However, publication in primary literature could be strengthened. Few of the papers produced from the previous work of the investigators are widely available. This is unfortunate as delta smelt are well known representatives of the multiple insults visited on the San Francisco estuary. It is also widely known that considerable resources have been committed to their recovery. I will admit to being surprised how large the gaps in our knowledge of the biology of the species are, e.g., the total lack of information on spawning locals and egg deposition ("Only one egg has been found in the field", p. 4). I am disappointed that restoration efforts are ongoing or planned apparently without equally ambitious plans to assess their effectiveness, or at least that is what is stated in the proposal (e. g., a coherent plan to investigate . . . the effectiveness of the restoration initiatives does not exist."executive summary, p. 1, and later). Such assessment is at the heart of any adaptive management scheme. The proposed work will presumably fill this major gap.

I initially cringed upon reading the bioassay section that involves rearing a threatened species under different feeding/starvation regimes and then exposing fish to pesticides. But given that the larvae will be obtained from a culturing facility, I guess I see the justification in

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establishing baseline/reference material for assessing condition of fish obtained in the field sampling. [note numbering of Tasks does not correspond between lead-in and text, i.e., four tasks are introduced, then we are presented with tasks 1, 3, and 5. What happened to Task 4 - Integration and data analysis?]

My final assessment of this proposal is that it fills some major gaps in our knowledge of the Delta system, uses advanced technology to answer important questions, has been carefully designed, and involves qualified, competent personnel.

# Budget Review

1. Does the proposal include a detailed budget for each year of the requested support?

**Yes.**

2. Does the proposal include a detailed budget for each task identified?

**Yes.**

3. Are project management expenses appropriately budgeted?

**Yes.**

4. Does the proposal clearly state the type of expenses encompassed in indirect rates or overhead costs? Are indirect rates, if used, appropriately applied?

**No.**

If no, please explain

**Indirect rate expenses not clearly identified. Indirect rate is 25%**

5. Does the budget justification adequately explain major expenses? Are the labor rates and other charges proposed reasonable in relation to current state rates?

**No.**

If no, please explain:

**Equipment for task two only \$99,000- microscope \$84,000.**

**Major Expenses -If the grant is awarded a detailed list of equipment purchases should be provided by the grantee so reviewers can better evaluate whether it is more cost effective for the state to purchase large dollar equipment items through the state procurement process. If the equipment list is available within the State inventory or stock, then purchase of some or all of the listed items may be provided, loaned, or leased by the state to the grantee. In the event, that the equipment is purchased by the grantee, the grantee shall maintain an inventory of major equipment for auditing purposes and potential use for future projects. Grantee shall follow State Contracting Manual [SCM] Section 7.61 thru 7.62 rules pertinent to equipment purchase, lease, etc.**

## Budget Review

**Benefits rates varied 48.3%. Recommend standard breakdown on budget detail if awarded.**

6. Are other agencies contributing or likely to contribute a share of the projects costs?

**No.**

7. Does the applicant take exception to the standard grant agreement's terms and conditions? If yes, are the approaches the applicant proposes to address these issues a reasonable starting point for negotiating a grant agreement?

**No.**

If no, please explain:

**Propose grantee is requesting to Delete exhibit B- Travel guidelines Replace exhibit C-general terms for ERP-GIA 101 possible Replace exhibit D- special terms and conditions**

**Contract Language Exceptions -Proposals submitted by grantees which identify exceptions to State of California's standard contract language provisions as provided in the 2004 PSP; and/or submit alternative contract language in lieu of the State's standard contract language should be carefully reviewed prior to awarding grant funds. Review will initially be conducted by the funding agency's contract office and referred to the legal department as needed.**

8. Are there other budget issues that warrant consideration?

**Yes.**

If yes, please explain:

**Recommend evaluation of direct costs for fee remission of student fee (\$25,221). Fee not directly tied to a task/deliverable.**

Other comments:

**none**

# Environmental Compliance Review

1. Is compliance with California Environmental Quality Act (CEQA) required for this project?

**No.**

2. Is compliance with National Environmental Policy Act (NEPA) required for this project?

**No.**

3. Does this project qualify for an Exemption or Exclusion under CEQA and NEPA, respectively?

**Does not apply.**

4. Did the applicant correctly identify if CEQA/NEPA compliance was required?

**Yes.**

5. Did the applicant correctly identify the correct CEQA/NEPA document required for the project?

**Does not apply.**

6. Has the CEQA/NEPA document been completed?

**Does not apply.**

7. If the document has not been completed, did the applicant allot enough time to complete the document before the project start date?

**Does not apply.**

8. If the document has not been completed, did the applicant allot enough funds to complete it?

**Does not apply.**

9. Did the applicant adequately identify other legal or regulatory compliance issues (Incidental Take permits, Scientific Collecting permits, etc.) that may affect the project?

**Yes.**

Comments:

**Applicant and students currently hold scientific collecting permits and are currently working with the USFWS to obtain a permit to archive delta smelt specimens.**



## Environmental Compliance Review

10. Does the proposal include written permission from the owners of any private property on which project activities are proposed or, if specific locations for project activities are not yet determined, is it likely that permission for access can be obtained?

**Does not apply.**

11. Do any of these issues affect the project's feasibility due to significant deficiencies in planning and/or budgeting for legal and regulatory compliance or access to property?

**No.**

# Prior-Phase Funding Review

List the other CALFED or CVPIA grants received by this applicant for which your agency manages contracts:

<b>Project Title</b>	Role of Contaminants in the Decline of Delta Smelt in the Sacramento-San Joaquin Estuary
<b>CALFED Contract Management Agency</b>	Department of Water Resources
<b>Amount Funded</b>	\$437,326
<b>Date Awarded</b>	1998/01/01
<b>Project Number</b>	97-C06

3. Have negotiations about contracts or contract amendments with this organization proceeded smoothly, without persistent difficulties related to standard contract terms and conditions?

**Yes.**

4. Are the status, progress, and accomplishments of the organization's current CALFED or CVPIA project(s) accurately stated in the proposal?

**No.**

**I didn't see any description of the activities of this previous project in the proposal.**

5. Has this organization made adequate progress towards these project(s)' milestones and outcomes, without unreasonable divergences from project schedules or poor-quality deliverables?

**Yes.**

6. Is the applicant's reporting, record keeping, and financial management of these projects satisfactory?

**Yes.**

7. If this application is for a next phase of a project whose contract your agency currently manages, will the project(s) be ready for next-phase funding to monitor and evaluate project outcomes in fiscal year 2005/6, based on its current progress and expenditure rates?

**Yes.**

## Prior-Phase Funding Review

Other comments:

Dr. Teh has produced a large number of papers, posters and technical reports from the study on contaminants in splittail. His quarterly reports and deliverables have always been of good quality and on time. He has asked for 3 amendments to add relevant tasks (and additional budget and time) to the initial project and collect additional information on contaminants in splittail. Two amendments have been approved and are completed, the third amendment is pending approval.

