

Selection Panel Review Summary

Proposal No.: 002

Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Principle Investigator: Nann Fangue

Amount Requested: \$446,690.00

Recommended Amount: \$446,690.00

Summary: This laboratory study of the physiological responses of fingerling to one-year old green and white sturgeon to stresses of changing salinity and temperature under various nutritional regimens is designed to mimic scenarios that may occur in the wild with climate change and global warming.

Assessment: The proposal has a solid and complete experimental design, clear conceptual models, and provides hypothesis-driven research for two key species (green and white sturgeon). The study researches the physiological responses of juvenile sturgeon to stresses of changing salinity and temperature. No one has been able to assess these responses of juvenile sturgeon in the wild. The proposal may not be information that could be used for immediate restoration actions, but it may provide good knowledge that could be used to address future climate scenarios and reservoir operations. The Selection Panel questioned if salinity was really a stressor.

2010 Final Review Panel – Summary of Review

Proposal # 90

Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Lead Primary Investigator: Nann Fangué

Applicant Organization: University of California, Davis

Amount Requested: \$446,690

Panel Findings:

Relevance to Topic Areas: The study is relevant to enhancing our understanding of Native Fish Biology and Ecology and to the wider goal of basic research to foster stewardship of the SFBD region.

Quality of the Proposed Research: Final Panel Reviewers rated the overall quality of proposal as Sufficient, Above Average and Above Average.

Main Summary Comments of Reviewers: The proposal is based on a clear conceptual model and is hypothesis driven. It will contribute importantly to our understanding of two key species and the scope they have for responding to future stresses related to climate change and food web modifications in the SFBD; however, Panel members questioned whether or not the research would produce information useful for the restoration or conservation of the two species. While the laboratory methods outlined in the proposal are sound and will produce publications and a better understanding of sturgeon physiology, the immediate benefits to management seem less well defined. The information the project would produce, in terms of lab responses and condition estimates, would be difficult to relate to the field. The overall approach could be improved to provide direct management benefits if it were to directly involve an assessment of the general condition of wild sturgeon within the system to better justify the need for refinements to the existing studies. Measures such as condition indices or bioimpedance analysis could be used to assess the general condition and nutritional status of

wild fishes without killing the fish. This could be used as a basis for judging the relevance of the lab studies.

Funding Category: Above Average

Proposal Number: 0090

Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Proposal Applicant: Davis, California University of

Amount Requested: \$446,690

Primary Investigator: Nann A. Fangue, UC Davis

FRP primary Reviewer's Evaluation Summary and Rating

Provide a brief explanation of your summary and rating.

Comments:

Purpose	<p>This is a complicated multi investigator project designed to experimentally and by modeling determine relative effects of nutritional status on ecological performance of sturgeon in a changing environmental climate within the delta. The proposal strongly emphasizes the potential for future declines in sturgeon populations because of climate change that will induce stresses related to warmer temperatures and changing salinity patterns influenced by climate induced changes to coastal oceanography and rainfall.</p> <p>This proposal builds on a history of physiological studies of a variety of species important in the SFBD system including sturgeons. Much of the research proposed here represents refinements to existing knowledge on tolerances of sturgeon to salinity and temperature and assessment of swimming performance as a metric of ability to tolerate stress. In other words, as the proposal points out and the citation indicate studies of physiological tolerance, swimming</p>
Background/Conceptual Models	<p>performance, thermal tolerance and salinity tolerance have been conducted before. The justification for continued research along these lines is that it will provide refined assessment of physiological responses that will account for likely changes in nutritional status of sturgeons in the system because of declining food webs and likely future changing salinity and temperature conditions within the Delta. One could argue that it is not just within the Delta as coastal conditions will change with influences of climate on coastal upwelling that are already being experienced.</p>
Approach	<p>The laboratory methods proposed here are for the most part reasonable and the participants are well versed in</p>

what it will take to accomplish the project goals. One exception is the extremes of exposure conditions that may provide quick endpoints and may be standard but are unlikely to mimic field exposures to stressful conditions as well as one might like. It would have been nice to see some field element incorporated into this project that would be able to either apply it directly to resident populations or gauge the relevance of the results for fish in the field. The modeling effort proposes to bridge the gap between the lab and field and promises to provide a set of tools that will allow resource managers to assess management strategies in the context of global climate change by predicting future population trends but it is not clear how that well would work with extreme exposure scenarios. I am also not sure how a model can predict outcomes in the field without considering factors outside the scope of this proposal such as migration patterns, spawning frequency, recruitment success, movement outside the system and nutritional status upon entering the system.

Feasibility This project is technically feasible given that this line of research has a history within the Delta and also is based upon tried and true laboratory methods. Although it is relevant to Delta science, you can also say that this is a broadly based set of issues of importance to multiple species that exist within similar estuarine systems all along the west coast that will be similarly impacted by climate change.

Relevance There is no doubt that this project will generate lots of data and publishable results but it is less clear that it will translate directly to a better understanding of the effects of environmental conditions in the Bay Delta system on sturgeon. Immediate management implications are not well justified given that strategies for dealing with climate change impacts may be limited, especially for population of species spawning at the southern end of their range.

Qualifications This is a highly qualified team, well equipped and well trained to conduct this research.

Summary Comments While the laboratory methods outlined in the proposal are sound and will produce publications, theses and a better understanding of sturgeon physiology, the immediate benefits to management seem less well defined. The overall approach could be improved to provide direct management benefits if it were to directly involve an assessment of the general condition of sturgeon within the system to better justify the need for refinements to the existing studies.

Please identify your overall ranking for this proposal:

- Superior
- Above Average
- Sufficient
- Inadequate

FRP Member's Observations Of External Technical Reviewers' Performance On Review Of Proposal:

Along with your written observations, please **rate the collective performance** of the external reviewers of this proposal utilizing the criteria below. Please also provide a **brief summary** in the comment box below.

- Superior
- Good
- Fair
- Poor

Comments:

Both external reviewers were highly supportive of this proposal. Suggested reviewers were all sturgeon biologists. In spite of giving the proposal an overall rating of above average one reviewer pointed out in feasibility section that the documentation of the study becomes noticeably weaker at the data analysis stage, both technically and conceptually.

Select "Update" after you make changes you wish to save.

Proposal Number: 0090
Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon
Proposal Applicant: Davis, California University of
Amount Requested: \$446,690
Primary Investigator: Nann A. Fangue, UC Davis

FRP secondary Reviewer's Evaluation Summary and Rating

Provide a brief explanation of your summary and rating.

Comments:

Purpose	<p>This proposal examines the ecological performance of two key fishes, green and white sturgeon, in the SFBay Estuary that face ever-changing environmental stressors, especially global climate change factors including temperature and salinity stress on species and their food webs. The proposal addresses Native Fish Biology and Ecology (Topic 1) and Food web effects on key Delta species (Topic 2).</p>
Background/Conceptual Models	<p>Background information is well developed for the most part and reflects the expertise of the PIs in their assigned tasks</p>
Approach	<p>The approach is sound and the research plan is generally well written and based on a conceptual plan with clear objectives, testable hypotheses and well defined tasks. I appreciate the focus on early life history stages and the incorporation of a gradation of three sizes/ages in the experimental design. Changing requirements with ontogeny is often an overlooked aspect of such studies. The modeling section is unclear and unfamiliar or may not be sufficiently developed. One outside reviewer also identified the data analysis section as weak. In this regard I am not sure that statistical designs discussed in Task 3 are entirely appropriate or how they will be analyzed statistically. Such details are lacking. One reviewer was concerned about the circularity of using food limitation as a means of assessing stress and of conducting stress tests (heat and salinity shocks) that go well beyond the environmental conditions the fish are likely to experience in the near term.</p>
Feasibility	<p>The PIs are accomplished at their given tasks in this proposal so the feasibility of the proposal is high and</p>

the likelihood of success is very good for meeting the objectives.

Relevance

The research will make relevant contributions to our understanding of early life history stages of two important species and will contribute greatly to the information base needed to manage sturgeons successfully in the SFB.

Qualifications

The PIs are all highly qualified and well published in their respective fields. They are a mix of junior and senior talents. The most junior is the lead-PI on the proposal, which is well written and organized, suggesting that she is ready to handle the administrative aspects of the project as well as her research task and she has two senior researchers, Drs. Doroshov and Hung, experienced in managing similar large undertakings to assist her as necessary.

Summary Comments

The proposal is based on a clear conceptual model and is hypothesis driven. It will contribute importantly to our understanding of two key species and the scope they have for responding to future stresses related to climate change and food web modifications in the SFB. Climate change will likely effect temperature, salinity and food webs in the long term, but food webs are being changed or stressed in the short term on a regular basis with frequent invasions of exotic species.

Please identify your overall ranking for this proposal:

- Superior
- Above Average
- Sufficient
- Inadequate

FRP Member's Observations Of External Technical Reviewers' Performance On Review Of Proposal:

Along with your written observations, please **rate the collective performance** of the external reviewers of this proposal utilizing the criteria below. Please also provide a **brief summary** in the comment box below.

- Superior
- Good
- Fair
- Poor

Comments:

Two technical reviewers provided thorough and constructive critiques of this proposal and were positive about its relevance and feasibility.

Select "Update" after you make changes you wish to save.

Proposal Number: 0090
Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon
Proposal Applicant: Davis, California University of
Amount Requested: \$446,690
Primary Investigator: Nann A. Fangue, UC Davis

FRP secondary Reviewer's Evaluation Summary and Rating

Provide a brief explanation of your summary and rating.

Comments:

Purpose This study seeks to understand interacting effects of changing nutritional status and climate (temperature and salinity) on the physiological stress tolerance of green and white sturgeon. The authors present three general hypotheses—higher nutritional status is positively correlated with tolerance to environmental stressors, sensitivity to environmental stressors is age dependent, and green and white sturgeon respond differently to environmental stressors. This study is timely, as primary productivity has changed dramatically in the SFBF in recent decades, with the potential to negatively impact native fishes. Green and white sturgeon are species of conservation concern, and they are especially sensitive to anthropogenic alterations due to their long life expectancies and late sexual maturity. Findings from this study will add to knowledge gaps about the resiliency of early life stages of these species when faced with environmental stress.

Background/Conceptual Models The conceptual model is clearly shown as a diagram and supported well with background text. The authors do an exceptional job of introducing complicated topics in a succinct manner—ranging from effects of climate change on the SFBF system, sturgeon biology and ecology, nutritional status of young sturgeon, and measurements of physiological responses of fish. The necessary information is provided and documented to understand the proposed work.

Approach The approach and scope of work are well designed and appropriate for meeting the objectives of the project. The PIs have assembled a team with an array of expertise, and they clearly explain who is responsible

for each task and how the tasks will be managed and coordinated. I particularly like the emphasis on modeling in this project.

Feasibility

The approach appears technically feasible, given the expertise of the PIs. The emphasis placed on coordination among the PIs, such by having annual meetings, will help guarantee that researchers remain on track and that information is shared and synthesized as it becomes available, thus ensuring the success of this project.

Relevance

Study is an excellent fit to Topic 1: Native fish biology and ecology, and it also includes Topic 2: Food web effects on key Delta species. The information will be useful to policy makers, and as stated by the authors, will help link ecosystem health with management decisions in the SFB system.

Qualifications

This is a nice team of researchers that includes an early-career scientist and investigators with progressively greater experience in their fields. They bring a range of expertise, including environmental physiology, reproductive physiology, fish nutrition and toxicology, mathematical modeling, and rearing of sturgeon. In addition, the team will include a Ph.D. student and a post-doctoral fellow who have already been selected based on their existing skill sets.

Summary Comments

The authors made an extremely convincing argument for the importance of this research. I was impressed with their ability to make such a complex topic clear to a reader unfamiliar with this ecosystem. The lead PI is early in her career and has an excellent record of success so far. I expect that under her leadership, this project will be successfully implemented with important findings for managers and researchers in the Bay-Delta system and beyond.

Please identify your overall ranking for this proposal:

- Superior
- Above Average
- Sufficient
- Inadequate

FRP Member's Observations Of External Technical Reviewers' Performance On Review Of Proposal:

Along with your written observations, please **rate the collective performance** of the external reviewers of this proposal utilizing the criteria below. Please also provide a **brief summary** in the comment box below.

- Superior

- X Good
- Fair
- Poor

Comments:

Both reviews are well done and capture the overall merits of the study. R2 scores slightly lower than R1 and offers a few more tangible suggestions for areas that the PIs could reconsider/think about. R2 asks an important philosophical question at the end of the review, touching upon the issue of whether anything can be done to mitigate the effects of environmental change on these populations, even once a clearer sense of the fate of these populations is determined.

Select "Update" after you make changes you wish to save.

External Review, Form #40, of Proposal #0090: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Proposal Number: 0090

Proposal Applicant: Davis, California University of

The reviewer has made no 'accept comment' about whether or why (s)he will Review this Proposal.

Project

comments	<p>One of the real strengths of this proposal is that it is very much hypothesis driven and the broad and specific goals and hypotheses are stated. In the broad sense, the goal of the proposal is to address whether early life stages of green and white sturgeon possess the physiological capacity to survive and thrive when faced with the potentially novel environmental challenges associated with anthropogenic climate change. The specific hypotheses tested in this proposal are 1) Higher nutritional status is positively correlated with tolerance to thermal and salinity stressors and to these stressors in combination. 2) Sensitivity to environmental stressors is age dependent with younger stages of sturgeon showing increased sensitivity. 3) Green and white sturgeon species, with the same nutritional status, will respond differently to environmental stressors. The authors have done a thorough literature review highlighting what is known about sturgeon stress physiology, especially with regard to salinity and temperature change, and it is clear there are large knowledge gaps which desperately need filling before accurate predictions can be made regarding the effect of projected changes in salinity and temperature on these two very sensitive species. While a tremendous amount of knowledge is ultimately required, this project makes a very important first step and in this reviewers' opinion, the proposed approach will provide answers to some of the most pressing questions and the full scale project is justified. There is no doubt that research arising from the proposed project will generate a great deal of novel information which will equip environmental managers with the tools needed to make predictions about the impact of climate change on these two very sensitive species, white and green sturgeon.</p>
----------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

rating	Superior
--------	----------

Background

comments	The proposal is very well written and organized and a conceptual model of the proposed approach is very clear and consistent with the information required to meet the goals of the study. The background information provided is thorough and exhaustive and clearly indicates the large knowledge gaps that exist in our understanding how projected changes in the Bay-Delta region may affect white and green sturgeon, two species that are currently very susceptible. The choice of sub-lethal physiological indicators to assess the performance of sturgeon exposed to different environmental and nutritional treatments is a novel approach that will be very informative and is justified in this proposal.
----------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

rating	Superior
--------	----------

Approach

comments	The researchers have clearly put in great thought to this aspect of the proposal. As described above the proposed approach is well designed to meet the specific objectives that have been outlined in the proposal. Figure 2 simply and effectively demonstrates the relative responsibilities of each PI and how they will be intricately associated. It is indicated in the proposal that the PI will hold quarterly meetings, and write and submit semi-annual progress reports which will be important in integrating findings and updating and that scientific manuscripts resulting from this project will be prepared as soon as sufficient data are gathered. An annual meeting with all personnel involved will be held at the end of each year, and participants will present an overview of achievements accomplished during the current year and propose a detailed work plan for the subsequent year. This level of communication will be integral to optimizing findings from the proposed research and disseminating this information rapidly to environmental managers.
----------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

rating	Superior
--------	----------

Feasibility

comments	The described approach is well documented as indicated above, and consistent with the proposed objectives. Given the experience and track records of the PI and Co-PI's (see further elaboration on this point below), I feel that the project is technically feasible with a very high likelihood of success.
----------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

rating	Superior
--------	----------

Relevance To The Delta Science Program

comments	<p>This proposal is directly relevant to Delta Science Program's 2010 Proposal Solicitation Package in that it addresses two of the programs priority research topics, namely Topic 1: Native Fish Biology and Topic 2: Food-Web Interactions with Native species. The proposal focuses upon two species of interest to the San Francisco Bay-Delta system, white sturgeon and green sturgeon, the latter of which is listed as threatened. This proposed study addresses the potential of multiple, simultaneously combined stressors relevant to the SFBD system; temperature and salinity. Furthermore, studies to assess the effect of these environmental variables on these species is done at multiple life history stages, to increase the chances of finding the time at which these species may be most sensitive, and integrates responses from the molecular to the whole animal level. Thus, this study is highly integrative in many ways. Based upon my understanding, the results of this proposal will be very useful to Delta resource managers and policy makers.</p>
rating	Superior

Qualifications

comments	<p>Although the lead PI (N. Fangue) is relatively junior, she has an impressive track record at this stage of her career and has the support of more established researchers as Co-PI's whom have a great deal of experience with what used to be CalFed. Given the quality of this research proposal, there is every reason to believe that she has the abilities to oversee and run this research proposal and disseminate this information quickly and to the best journals in the field (Task 1). The procurement of experimental animals (Task 2) for use in tasks 3 & 4 is lead by S. Doroshov who has a great deal of experience in sturgeon husbandry and both white and green sturgeon will be provided for these experiments from the captive white and green sturgeon stocks, at sturgeon farms and the UC Davis Center for Aquatic Biology and Aquaculture (CABA), respectively. S. Doroshov is a leader in the field of sturgeon culture, experimentation and conservation. Generation of sturgeon on different feed rations to generate fish of differing nutritional status (Task 3) which will be central for experiments will be lead by S. Hung, a renowned expert in the field, again with a very strong track record in this area and with a great potential to rear fish on the proposed diets. N. Fangue is charged with overseeing Task 4: Physiological Tolerance to Key Environmental Stressors which is her specific field of expertise. She has a great deal of experience with conducting the physiological challenges (swim performance trials and thermal tolerance studies in particular for which she already has an international reputation) and is experienced with most of the proposed sampling and analytical methodology. While she does not have lot of experience with salinity tolerance. Finally, Task</p>
----------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

0090: Ecological Performance of Fishes in an Ever-changing Estuary: The ...

	5, Data Management/ Statistical Analysis/ Modeling, will be conducted by E. Kebeab who also has a strong publication record in the proposed statistical and modeling approaches to be used to analyze the data. In short, the intellectual and technical expertise, along with the required infrastructure appear to be in place to ensure completion of a very interesting study.
rating	Superior

Overall Evaluation Summary Rating

comments	<p>This is a very well written and interesting proposal to address two topics in the Delta Science PSP 2010 Topic 1: Native Fish Biology and Ecology, and Topic 2: Food web effects on key Delta species: where nutritional status will be assessed on physiological tolerance of white and green sturgeon to key environmental stressors relevant to the SFBD. The proposal is hypothesis driven and clearly outlines data gaps that need to be filled in order to predict the effect of projected changes in the abiotic and biotic environment in the years to come. The manipulation of the nutritional status of fish simulates food-web disruptions in the Bay-Delta ecosystems, which combined with measurements of sub-lethal disturbances at different developmental stages following exposure to relevant changes in temperature and salinity should be invaluable in making predictions on populations of green and white sturgeon in the Bay-Delta system. The PI and Co-PI's are each experts in tasks to which they have been assigned and the infrastructure at UC Davis is in place to conduct the proposed experiments. The time-line and proposed costs are reasonable and based upon the past record of the PI's and Co-PI's the information will be disseminated rapidly and appropriately.</p>
rating	Superior

External Review, Form #40, of Proposal #0090: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Proposal Title: Ecological Performance of Fishes in an Ever-changing Estuary: The Effects of Nutritional Status on Environmental Stress Tolerance in Sturgeon

Proposal Number: 0090

Proposal Applicant: Davis, California University of

The reviewer has made no 'accept comment' about whether or why (s)he will Review this Proposal.

Project

comments	This study has ambitious goals: to estimate the effects of changing nutritional factors on the ability of two sturgeon species to withstand environmental stresses. The concept is a tad circular in that already experienced and also expected environmental changes will not only stress these species in general, but will also stress and change their food sources, while they're nutritional status is being used as a metric to examine their ability to withstand stress. This is not fatal, only complicated and it bears keeping in mind when analyzing results. Another way of looking at it is that nutrition and environmental stresses are both moving targets, resulting in endless possible permutations.
rating	Above Average

Background

comments	Yes, the conceptual model is made clear in the very useful Figure 1, which hierarchically integrates a whole lot of diverse information. Review of climate change effects and sturgeon species life histories are a bit cursory but adequate. However, the strength of this section was with the team's expertise--the descriptions of the roles of nutritional status, environmental effects on physiological responses, and the quantification of nutritional and thermal responses.
rating	Above Average

Approach

<p>comments</p>	<p>Tasks are very well described, with clear lines of authority and responsibility. The project hangs around three reasonable hypotheses, none of which are highly detailed or provocative but which all serve to provide a framework to this highly complex study plan. The quarterly meetings seem essential to keep all these elements moving forward in concert.</p> <p>The graded series of life stages is a plus, given the likelihood of different vulnerabilities at those stages.</p> <p>The critical thermal tolerance and salinity tolerance and interaction experiments both seem considerably more extreme than what would be experienced in nature (at least in their speed of onset), which may provide a clear response spectrum but don't seem realistic to me, especially for mobile creatures that can adjust distributionally. It would have been good if the investigators had discussed the relationship between these challenges and conditions in the real world.</p> <p>Inclusion of the apparently cutting edge structural equation model has the potential to distill what will appear to be a great deal of noise down to to some sort of signals.</p> <p>I found mention of the possible importance of a new bivalve (Asian clam) as a source of food to be a potentially important topic. There is circumstantial evidence in the Hudson River that the almost endless supply of non-native zebra mussels may have assisted the major recovery of shortnose sturgeon there. It could be that a suddenly bountiful wild food source might offset some of the negative effects identified in isolation in these lab-based studies.</p> <p>Finally, I'm sure the team will report their experimental results but how will they use them to forecast future effects given the vagaries of environmental change in the system. How far out on a limb can they or should they go? It is up to the investigators to try and make all this as useful as possible to the Delta's resource managers.</p>
<p>rating</p>	<p>Superior</p>

Feasibility

<p>comments</p>	<p>I see no reason why any of the proposed work is infeasible. It is a large-scale project but broken down into numerous individual components. The young fish apparently are available, the individual researchers know what they are doing, and the budget is not ungenerous. Despite inclusion of the structural effects model, documentation of the study becomes noticeably weaker at the data analysis end, both technically and conceptually.</p>
-----------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

rating	Sufficient
--------	------------

Relevance To The Delta Science Program

comments	The proposed study is relevant (as the investiagtors point out) to two of the Delta Science Program's Priority Research Topic List. These are Native Fish Biology and Ecology and, Food Web effects on Key Delta Species. The case for their relevance is well made.
rating	Above Average

Qualifications

comments	The qualifications of the investigators are appropriate to the goals of the project. Fangue is relatively fresh to her position and the Delta landscape but she is joined by experienced UC Davis-based professionals such as Doroshov and Hung, and another newcomer, Kebreab, who has a good track record from elsewhere. Moreover, the faculty of UC Davis have considerable experience managing these large CALFED projects and have published productively from that source of support.
rating	Above Average

Overall Evaluation Summary Rating

comments	<p>The proposed study includes an unusually high number of metrics and thus, will produce quite a lot of data. Given that much of the data will be associated across a range of endpoints including many with sublethal effects, many different levels of effects will be seen, from nothing to severe. This is a strength of the proposal but it will make final analysis difficult and nuanced. Indeed, conflicting signals may be detected and needed to be sorted out. I'm all for more rather than less information but I suspect it may not boil down to a few clear take-home messages. The great hope here is the structural equation model, which seems to show promise for this application.</p> <p>It is safe to say that no matter how many of the findings are actually applicable to the management of the Delta, at minimum, a great deal more will be learned about basic sturgeon physiologies.</p> <p>In keeping with those comments, it's not altogether clear that much can be done with the resultant information, other than having a clearer sense of what the fate of these populations will be. Environmental change, both in expected and unexpected forms (i.e., Ever-Changing Estuary) is hitting the Delta in pronounced fashion and the trajectories of these two sturgeon populations likely will be altered, but can anything be done to mitigate</p>
----------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

0090: Ecological Performance of Fishes in an Ever-changing Estuary: The ...

these changes from the information this study will provide. I'm not sure, and I don't feel that is reason not to do the study; in fact, it is a question that is germane to much environmental work.

rating

Above Average