UNIVERSITY OF CALIFORNIA, DAVIS

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DEPARTMENT OF ANIMAL SCIENCE
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ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8521

May 7, 2002

CALFED Bay-Delta Program:
Attn: Dan Ray
1416 9th St., Suite 630
Sacramento, CA 95814

Dear Dan,

We appreciate the opportunity to respond to CALFED's appraisal of our proposal, "Delta Smelt Culture and Research Program" (# 194). We requested two-years of funding, at the annual levels of $299,546 and $302,372. CALFED recommends one-year of funding at $200,000. We are very concerned that such partial and greatly reduced funding will impair the success of this project, which has the unique value for research and restoration of this threatened species, endemic to the Sacramento-San Joaquin Estuary. While we appreciate the decision to fund this project "in part", we would like to share our concerns with CALFED and to suggest some alternative levels of funding which may reduce the cost to CALFED while insuring success of this valuable program.

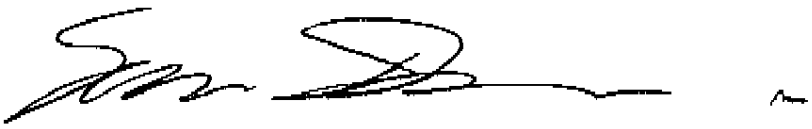
We accept several critical comments of the reviewers however, a reduction of our annual budget from $ 300,000 to 200,000 would require a significant decrease of our planned work, beyond the deletion of the spawning substrate study and a reduction in the management task. It will impose significant limitations on our ability to supply cultured delta smelt to research laboratories and collaborate with state and federal agencies. While one reviewer noted the elevated costs for culture work, we believe that the value of a research and development project on endangered species with unstudied reproductive biology should not be judged by such criteria. If the CALFED recommended funding level is implemented, the value and benefits of delta smelt culture for the research and restoration of this threatened species can be jeopardized.

We are pioneering the development of smelt culture in a controlled environment, where other laboratories in the U.S. and abroad have failed. The development of culture techniques for species with a "difficult" larval stage (pelagic, with delayed metamorphosis) requires continuity of efforts and high level of expertise. Previous support form state agencies (DWR and CDFG), IEP, and CALFED has brought us to close to achieving our final goal-to establish a reliable culture system and methodology, which will be reproducible and used for research and restoration of delta smelt. After reviewing the CALFED recommendations, we decided to omit the spawning substrate experiment (we are seeking support by the IEP, since our recent pilot experiment was highly successful and provided important insight). We feel compelled, however,

to request *two years* of funding at the reduced annual level, to complete the development of larval culture methodology, with the nutritional studies outlined in the proposal and to supply cultured smelt requested by research laboratories and state/federal agencies (see Appendix). For the effectiveness of our project and assured continuous supply of smelt to other laboratories, we suggest a reduction of our original budget by the amount listed in Task 3 (Spawning behavior, original budget), resulting in an annual funding level of $274,000. If further reduction deems necessary, we will be able to accept a minimal budget of $250,000 per year (reduced labor, supplies, and equipment), which will limit our ability to supply other laboratories with cultured smelt. The risks to our project with recommended single-year funding of $200,000 are: (1) the loss, to a more secure employment, of our top-level research personnel who have leadership skills and unique expertise in larval smelt biology and live-prey culture; (2) the incomplete development of larval culture methods in a species with seasonal reproduction; (3) the interruption or cessation of live smelt supply to other laboratories and agencies. It seems to be an inopportune time to hamper this program, built with the state and federal monies, just as it is achieving success and utility to the CALFED restoration goals.

Several aspects affect production of delta smelt, compared to commercially reared species. Low fecundity and constraints on collection due to their *threatened* status largely influence the availability of eggs and larvae. Furthermore, delta smelt have a prolonged larval period requiring a high level of technical expertise, experience, and vigilance (10 hours/day, 7days/week). Live cultures of food organisms (rotifers and *Artemia*) are also necessary during the early larval stages and must be maintained for most of the year. Health management and early detection of bacterial and fungal diseases are critical, since they can quickly decimate the population. While delta smelt culture is labor intensive, it can be sustainable at the optimal funding level requested. We appreciate the support of CALFED, and look forward to working with the agency to promote the CALFED goals of species recovery and habitat restoration.

With kind regards,



Serge Doroshov (sidoroshov@ucdavis.edu)
Joan Lindberg
Bradd Baskerville-Bridges

Appendix

Use of cultured delta smelt for research and restoration

Development of delta smelt culture was initiated to address questions related to restoration and management of this threatened species. After a recent breakthrough in the development in larval culture techniques, we are now able to produce sufficient numbers of all life stages to meet the demands of the research community. Cultured delta smelt are currently being utilized by state and federal agencies (DWR, CDFG, USBR) and the university researchers (UC Davis, Bodega Marine Laboratory, BML) to generate knowledge contributing to understanding the life-history of smelt and the effect of environmental changes on this at-risk species. Our project cooperates with these agencies and laboratories to determine how we can most effectively meet their specific needs. Some projects require participation of our personnel, including experiments on site, collecting background life-history data, and regularly preserving specimens. Below is a list of projects to which our program has contributed by providing methodology, observations, and the animals for research and restoration-oriented purposes.

- Development of a diagnostic key for distinguishing between delta smelt and wakasagi smelt larvae: DWR, CDFG, USBR, National Environmental Scientists.
- Toxicity testing of herbicides on larval and juvenile delta smelt: CDFG
- Experimental testing of "fish friendly" pumps, fish screen design, and louver efficiency: USBR
- Performance, behavior, and physiology of delta smelt exposed to two vector flows to improve fish screen design: UCD
- Evaluation of predatory effects of inland silversides on delta smelt larvae: UCD, BML
- Role of contaminants in the decline of smelt in the Sacramento-San Joaquin Estuary: UCD, BML

The delta smelt culture project conducts its own research on reproduction of delta smelt. While some studies are designed to improve culture methods, others address the environmental issues and smelt restoration goals. Our experiments, conducted over the past few years, included the effects of tank size and stocking density on larval growth and survival, water turbidity and phytoplankton density on larval feeding behavior, temperature on hatching, onset of exogenous feeding, growth and survival of larvae and juveniles, and the physical characteristics of spawning substrate and egg spawn deposition in delta smelt.

We expect the demand for cultured delta smelt to increase with improved larval culture and availability of all life stages. Some agencies have already submitting requests one year in advance. For example, we have been informed that the Tracy Fish Test Facility will need thousands of juvenile smelt to conduct their tests, and there is currently no alternative to cultured fish to meet this demand. Our research on smelt culture were presented at Delta Smelt Workshops, World Aquaculture Society meetings, and published in several issues of the IEP Newsletter. We are preparing several papers to peer-reviewed research journals. The availability of delta smelt culture provides opportunity for the research on reproduction and development, environmental biology, ecotoxicology, pathology, and behavior of this endemic and threatened species.

TRACY FISH COLLECTION FACILITY
U.S. BUREAU OF RECLAMATION
RR #1; Box 35
Bryon, CA 94514-9614
May 1, 2002

CALFED BAY-DELTA PROGRAM
Attn: Dan Ray
1416 9th Street, Suite 630
Sacramento, CA 95814

Dear Dan Ray:

This letter is to lend support to full funding of the Delta smelt Culture Project for the next two years. The Delta smelt culture work is headed-up by principal investigators Drs. Lindberg, Baskerville-Bridges and Doroshov.

The "Delta Smelt Culture Project" has provided Reclamation with smelt for testing of a fish friendly pump, and louver efficiency tests. It is very instrumental to have "Delta smelt" available for development of new fish screens in the delta.

The Tracy Test Facility Program could use cultured delta smelt for at least the next five years. New fish screens for the Delta are being designed to meet Delta smelt requirements. If we do not have smelt available it will be impossible to test new screens effectiveness, and may have serious impacts on this other Cal-Fed Program.

We recommend you re-evaluate your decision to only partially fund this program, and recommend you provide full funding for this valuable program.

Sincerely,

Lloyd Hess
Fisheries Research Biologist

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State of California - The Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
1701 Nimbus Road, Suite F
Rancho Cordova, CA 95670
(916) 358-2950

GRAY DAVIS, Governor

May 7, 2002

Dan Ray
CalFed Bay-Delta Program
1416 9th Street, Suite 630
Sacramento, CA 95814

Dear Mr. Ray,

The California Department of Fish and Game's Aquatic Toxicology Laboratory has a critical interest in seeing that the Smelt Culture and Research Program continues. During the year of 2002, we required approximately 2000 larval smelt for testing the sensitivities to aquatic herbicides used for controlling aquatic weeds in the Sacramento-San Joaquin Delta. We will also require juvenile smelt for testing water samples collected from weed control areas in the Delta. This work was required by the U.S. Fish and Wildlife Service to address the potential effects of the water hyacinth and elodea control programs conducted by the California Department of Boating and Waterways on this species. The Smelt Culture and Research Program has been very helpful in not only providing the fish, but also in providing training in laboratory culture methods.

We anticipate needing smelt for the year of 2003. Mr. Bradd Baskerville-Bridges and the Smelt Culture and Research Program are a vital source of smelt for our testing needs. We recommend that the Smelt Culture and Research Program be fully funded for the full two-year period. Information and the availability of smelt have benefited the California Department of Fish and Game and other agencies.

Should you have any questions or require further assistance, please call Mr. Frank Riley at (916) 685-0370

Sincerely,

Brian Finlayson, Chief
Pesticide Investigations Unit

cc. Frank Riley, Aquatic Toxicology Laboratory
Mr. Bradd Baskerville-Bridges

Conserving California's Wildlife Since 1870

University of California, Davis
Department of Environmental Science and Policy
1 Shields Avenue
Davis, CA 95616
(530) 752-3938

CA Department of Water Resources
Environmental Services Office
3251 S-Street
Sacramento, CA 95816
(916) 227-2194

05-08-2002

To the
CalFed Bay-Delta Program
Attn: Dan Ray
1416 9th St, Suite 630
Sacramento CA 95814
FAX: (916) 651-6486
PHONE: (916) 653-0198

Re.: Open comment re. **"Delta Smelt Culture and Research Program"** (CALFED 2002 PSP proposal # 194)

Dear Dan Ray,

I am writing to express my concern about the recommended shortening and funding cuts for the "Delta Smelt Culture and Research Program" proposed by Dr.s Doroshov, Lindberg, and Baskerville-Bridges of UC Davis. I believe that the recommended cuts will seriously imperil the success of this important work. I would thus like to ask you to reconsider this project for full funding as a two-year project.

Having been intensely involved with a number of CALFED projects as well as with Bay-Delta monitoring programs as a UC Davis and CA DWR staff scientist, I am deeply aware of the importance of a reliable supply of delta smelt for research purposes and as a refuge population for this threatened fish species. Knowing more about this fragile and quite elusive fish species is highly relevant to CALFED's goals, CALFED restoration and adaptive management actions, other existing CALFED studies, and to ongoing Bay-Delta monitoring and research programs. A steady supply of delta smelt is an absolute necessity for high-quality research on this species. The UC Davis delta smelt culture and research program has recently made great progress in successfully rearing delta smelt and is now delivering fishes to various agency and university scientists as well as conducting research at its facility. However, much remains to be learned regarding the most appropriate nutritional and spawning conditions, as described in the recent ERP proposal. I am particularly interested in the nutritional research, as it is closely related to our CALFED-funded UC Davis zooplankton nutrition project (CALFED ERP 2001 K221). We have already initiated some collaboration with the delta smelt program, and very much hope to be able to carry out these plans. Decreased funding of the delta smelt program would likely prevent us from doing so.

Furthermore, to be able to continue along its current successful trajectory, it is essential that the delta smelt program be able to retain its experienced staff. Raising fragile delta smelt juveniles is truly demanding work and requires a high level of training. The current well-trained staff is thus a highly valuable resource for the continued success of this project. Retaining marketable staff requires the prospect of some financial stability. The recommended cuts in funding and program length would thus likely cause the most experienced staff to prematurely leave the program for more secure employment. This would be a great loss for CALFED sponsored and other delta smelt research, and the threatened delta smelt themselves.

Sincerely,

Anke Mueller-Solger, Ph.D. – DWR & UC Davis

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5-7-02

CalFed Bay-Delta Program
Attn. Dan Ray
1416 9th St, Suite 630
Sacramento CA 95814

Dear Mr Ray.

I support the full funding of our colleagues' delta smelt culture proposal (#194) for CALFED funding. We at the Fish Treadmill project (proposal #203) rely, in part, on delta smelt produced by Bradd, Joan, and Serge's special facility. In addition, critical water quality (e.g , bioassay) testing of delta smelt's responses to contaminants in our watershed also argue for the restoration of full funding for this program. If their funding is limited to one year, they risk losing their most experienced personnel (to more secure jobs), threatening their ability to continue the project. The culture of this species requires considerable time, effort, and experience. They are working towards increasing the production efficiency, but they will need two more years to do so. They are also conducting research which is of interest (temperature effects on growth and survival of smelt, the effects of water turbidity of larval feeding, and the effects of incubation temperature on hatch rate and first feeding success) to the CALFED Bay-Delta Program. They are just now producing delta smelt in quantities, and assurances of full funding will allow research to be planned in advance and smelt secured.

Thanks for your support

Sincerely,

Joseph J. Cech, Jr.
Professor

UNIVERSITY OF CALIFORNIA, DAVIS

Department of Animal Science
Telephone: (530) 752 – 1250
Facsimile: (530) 752 - 0175

One Shields Avenue
Davis, California 95616

May 3, 2002

CalFed Bay-Delta Program
Attn: Dan Ray
1416 9th St, Suite 630
Sacramento CA 95814

Dear Dan:

I am writing to you in regard to the delta smelt culture program. While my colleague, Dr. Raul Piedrahita and I are not directly involved with delta smelt we have faced many of the same kind of problems in culturing the early stages of the California halibut, *Paralichthys californicus*. The researchers, Joan Lindberg, Bradd Baskerville-Bridges and Serge Doroshov have all been quite helpful to our project. They have provided helpful advise based on their experiences with rearing delta smelt as well as providing us with culture techniques and starting cultures of rotifers with which to feed the larval halibut.

While I realize the demand for CalFed funding is undoubtedly high, I would like you to be aware that at least in our case the value of this project reaches beyond just the delta smelt. Consequently, I would very much hope that funds could be found to continue the support of this valuable program.

Sincerely,

Douglas E. Conklin
Chair of the Executive Committee
Center for Aquatic Biology and Aquaculture

Office Phone: (530) 752 - 4177
E-mail: deconklin@ucdavis.edu