

PROPOSAL REVIEW
Draft Individual Review Form

Proposal number: 2001-K221-3

Short Title: Food Resources for Zooplankton

1a) Are the objectives and hypotheses clearly stated?

A list of 10 hypotheses to be tested is provided, but it is not shown how hypothesis #8 will be tested. This hypothesis is that more nutritious producers result in more nutritious copepods as food organisms for fish. It's not clear what constitutes a more nutritious copepod. What chemicals or concentrations of chemicals in copepods will be used to determine nutrition value?

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

The conceptual model does a good job of describing the causal interconnections between key ecosystem components, in this case food supply, habitat type, and copepods.

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

I see some problems with the approach arising from site location. There are no sites in the Low Salinity Zone (0.6-6.0 mS/cm). *Eurytemora* populations historically peaked in this salinity range (Orsi and Mecum 1986) and it is where *Potamocorbula* now preys on *Eurytemora* nauplii and phytoplankton, reducing the concentrations of both (Kimmerer et al. 1994). *Pseudodiaptomus forbesi* populations are high here in spite of the clam grazing. This is also prime habitat for larval striped bass and delta smelt. I would like to see a "floating" site here at a fixed bottom salinity or EC.

The site at Twitchell Is. does not have the high populations of copepods that the SJR at Stockton does. It's also under the influence of the Mokelumne River and cross-delta flow from the Sacramento River when the Cross-Delta Channel is open. Secchi disc depths can change >20 cm over a short distance at this site as you enter or leave the influence of cross-delta flow. For a large tidal site, the San Joaquin River at Stockton would be a good choice. Copepod and cladoceran populations in the delta have always been highest there (Orsi and Mecum 1986).

Site 5 in Suisun Slough is not a tidal marsh site. The marsh is leveed off from the channel. Brown's Island in Suisun Bay contains sloughs that drain a tidal marsh.

I'm not sure why the site at Sherwood Harbor was chosen, but the Sacramento is not really a tidal river here; tides at Sacramento are very small and direction of flow does not reverse on the flood tide. The Sacramento River upstream from the delta contains very little crustacean plankton and has low phytoplankton concentrations (Greenberg 1964). This is typical of large rivers with strong directional flow. However, if it is being used as a control site for the Yolo Bypass, it would have value.

I don't understand what the investigators mean by "integration site." This needs definition.

Description of tasks lacks details. For example, sampling frequency, timing, and methods are not described. The "zooplankton" net is not described.

This proposal will determine if zooplankton are food limited but it's uncertain that restoration can improve the food resources for zooplankton. Increasing phytoplankton abundance in the estuary, for example, should be difficult or impossible. Channeling energy and nutrients away from *P. forbesi* (if that were possible) would be a mistake since it is now important to delta smelt and larval striped bass.

Work on *Eurytemora* may be of limited use because *Eurytemora* is removed from the system in summer and fall by *Potamocorbula* in the LSZ and by unknown factors in fresh water. It might be more useful to study the freshwater decline in *Eurytemora* in May and June at Stockton. Wim Kimmerer sampled *Eurytemora* in the LSZ this year to see if its decline could be attributed solely to *Potamocorbula*, but was unable to sample in freshwater where *Potamocorbula* does not occur.

Notes: egg ratio data for *Eurytemora* exist for some years from data collected by the DFG study. For *Pseudodiaptomus forbesi*, egg ratios can be calculated from 1989, 1994, and 1995 DFG clutch size data. Additionally, DFG has archived samples going back to the 1970s. Some of these might be used to make *Eurytemora* and *P. forbesi* egg counts. A caveat here is that *Eurytemora* often loses some of its eggs when captured.

Finally, the proposal says nothing about dry weight measurements of copepods but these will be necessary for biomass estimates. Such biomass measurements would have to be done by sex and at different times of year to take length changes into account. The sex ratios of the sampled populations would also have to be known.

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

Yes, much needs to be learned about the feeding of copepods before we can manage the system to increase their abundance and nutritive content.

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

Yes, we should learn what copepods eat and what habitat types produce food of greatest benefit and abundance for them. Of course, managing the system to improve food production for copepods is another matter.

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

See 1b2 for problems with the monitoring plans.

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

Data analysis is not as well described as it should be.

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

Yes. Previous work of the same type on cladocerans has been successful.

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

Yes, they have shown by their previous work on cladocerans that they are highly qualified to succeed in this work.

Miscellaneous comments:

We need to know what role the Chinese cyclopoid *L. tetraspina* is playing in the estuary since this is a

predatory species and could be feeding on nauplii of calanoid copepods, including *Eurytemora*. There is nothing in the proposal about studying the food habits of this species, which is now the most abundant in the estuary (Orsi 1999). Although it is too small to be eaten by fish its trophic role deserves investigation.

Overall Evaluation Summary Rating: Good

This is an important proposal that is technically feasible and will answer many questions in regard to copepod feeding and production. My problems with it are limited to site selection, description of sampling frequency, biomass measurements, and the possible addition of *L. tetraspina* to the study.

References:

Greenberg, A.E. 1964. Plankton of the Sacramento River. *Ecology* 45:40-49.

Kimmerer, W.J., E. Gartside, and J.J. Orsi. 1994. Predation by an introduced clam as the likely cause of substantial declines in zooplankton of San Francisco Bay. *Marine Ecology Progress Series* 113:81-93.

Orsi, J.J. 1999. Long-term trends in mysid shrimp and zooplankton. *IEP Newsletter* 12(2):13- 15.

Orsi, J.J. and W.L. Mecum. 1986. Zooplankton distribution and abundance in the Sacramento- San Joaquin Delta in relation to certain environmental factors. *Estuaries* 9:326-339.