Draft Individual Review Form

Proposal number:_2001-K221-1____Short Proposal Title:_Food for zooplankton in S-S J Delta

1a) Are the objectives and hypotheses clearly stated?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The main question in the proposal is: Does the quantity and quality of available food resources limit zooplankton, and specifically native and exotic copepods abundance in various Delta habitats? The proposal is, thus, focused on the role of copepods in the food chain. This is very well justified, not only because of the fact that research on copepods has been very sporadic compared to research on cladocerans. Also, in contrast to cladocerans, copepods contain high amounts of the long-chained fatty acid, docosahexaenoic acid (DHA) (Desvilettes et al. 1994. Aquat. Living Resour. 7:67-77) which is essential for most fish larvae (Sargent et al. 1995. J. Appl. Ichthyo. 11:183–198). All 10 hypotheses are clearly worded and address each factor separately. A great credit is that the hypotheses include alternative tests, e.g. if the copepods are limited by quantity or quality of various food resources, if there are seasonal or habitat differences, if copepods have other food requirements than cladocerans, and whether polyunsaturated fatty acids (PUFA) or phosphorus (P) predict copepod growth and reproduction.

1b1) Does the conceptual model clearly explain the underlying basis for the proposed work?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The authors' conceptual model (Figs. 1 & 2), built on the classical Elton-Lindeman model (Fig. 3) (Lindeman 1942. Ecology 23:399–418) shows very clearly the target components of the food web that will be investigated. The transfer of energy from the basic level (phytoplankton) to copepods can take two routes, one more direct from phytoplankton to herbivorous copepods, and another from detritus, including internal and external dissolved organic carbon (DOC) and particulate organic carbon (POC), via microbial plankton to omnivorous or carnivorous copepods. The model clearly shows that the alternative routes may favour different groups of copepods.

1b2) Is the approach well designed and appropriate for meeting the objectives of the project?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The approach is very well designed and described in detail (nearly two pages). The tasks are focused on investigation of quantity and quality of food resources for copepods. Therefore, in addition to collecting field data, feeding experiments will also be performed with native and exotic copepods. This is good and necessary because field data primarily give indications whereas feeding experiments give more direct tests of the hypotheses. A great credit is, then, that the applicants will start by isolating Delta copepods and experimentally find out optimal growth conditions for these copepods. The food in the feeding experiments will be seston from the different Delta habitats including laboratory-grown control diets. With controls consisting of highly nutritional and defined

food items, e.g. a green alga for herbivorous copepods or a small flagellate, e.g. *Rhodomonas* for carnivorous copepods, it would be possible to answer the main question (cited under 1a) more exactly than only by comparison within the various Delta habitats (cf. Fig. 4).

1c1) Has the applicant justified the selection of research, pilot or demonstration project, or a full-scale implementation project?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The authors make a strong point of that more knowledge is needed about the structure and function of the particular food webs in the delta of Sacramento-San Joaquin River in order to guide planned restoration projects. I strongly agree that more knowledge is needed, particularly for these complicated food webs. The plans to analyze historic phytoplankton and zooplankton data also deserves commendations. If the past is not known, 'restoration' actions can not be planned correctly.

No demonstration or implementation projects are proposed.

1c2) Is the project likely to generate information that can be used to inform future decision making?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The goal, according to the applicants, is to provide the scientific basis for guiding and evaluation Delta Management and restoration. One practical product, will be recommendations about restoration efforts that would benefit the production of appropriate food for native copepods which, in turn, will be good feed for native fish fry. This information is necessary in future decision making for optimal management.

2a) Are the monitoring and information assessment plans adequate to assess the outcome of the project? Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes, but I have some doubt about the sampling frequency. The monitoring will be in eight, well motivated, sampling sites in the Delta area (Fig. 6). Performing feeding experiments once per season is perhaps enough, considering the relatively few members in the research team and that the laborious feeding experiments will be performed with several types of copepods. However, there is a great risk that sampling only once per season for the field data, particularly for seston, phytoplankton and zooplankton, will give incomplete pictures of the seasonal variation of the food quantity and quality and the organism abundance. Some phytoplankton groups can pop up and disappear within one week (e.g. ref [40]). A more frequent sampling of these variables is desirable, e.g. 1–2 times per month, more frequent under the spring outburst. Extra sampling is easy but costly. The mentioned coordination with IEP compliance or other project monitoring schedule is highly recommended.

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

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes, they are all very well described in detail. In addition to the ordinary limnological variables (e.g. recidence time, temperature, nutrients), the quantity and quality of seston, i.e. the copepod food resources, consisting of phytoplankton, zooplankton and detritus, will be measured by analyses of C, N, P and fatty acid content. High content of N and P (% of dry weight or C) as well as high protein and P-lipid (PUFA) content are all measures of high food quality. Analyses of protein or amino acids, which are not included, are probably not necessary in living organisms which usually contain high amounts of these components. However, analyses of protein and/or amino acids would be desirable in seston because the detritus part in seston is highly variable during the season as well as the quality of detritus, depending on the degree of decomposition (e.g. ref [2], Kreeger et al. 1997, Freshwat. Biol. 38: 539–554).

3) Is the proposed work likely to be technically feasible?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. All the techniques are very well known and used before by the applicants except the 'desirable amino acids' which can be bought from an authorized laboratory (if the budget allows). Among all the measures of quality, N, P, and PUFA content are the most important. Also using certain fatty acids as markers (ref [14], Desvilette et al. 1994. J. Pl. Res. 16: 643–659) in the food web is mentioned, which is a very useful tool when tracing the trophic transfer of different food items to the grazers.

4) Is the proposed project team qualified to efficiently and effectively implement the proposed project?
Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Yes. The research team is very well qualified. Charles Goldman is a well-known limnologist whose leadership of many research projects is outstanding. Allan Jassby is also a well-known research ecologist with long-time experience in algal research, e.g. photosynthesis, productivity, culturing, mathematical modelling and as a leader of ecological programs. Anke Mueller-Solger is the zoologist of the team, already an expert on culturing cladocerans. She will be responsible for most of the tasks including project management, of which she already has extensive experience. Each of the applicants are experts in their fields and make very good complements to each other. They also demonstrate excellent knowledge of the relevant literature.

Miscellaneous comments
[Note: in the electronic version, this will be an expandable field]

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**

- ☐ Excellent [Note: in the electronic version, this will be an expandable field]
- ☐ **Very Good**
- ☐ Good
- ☐ Fair
- ☐ Poor

Summary Rating: Very Good.
I strongly recommend this interesting proposal, particularly for its ecosystem approach. The applicants have all the competence and experience necessary to do fruitful research of the food webs in the Sacramento-San Joaqiun River Delta. The project has the potential to give important and fundamental knowledge for future recommendations on restoration efforts.
