# Comparison of hyporheic water quality and methylmercury exposure in salmonid redds within restored and unrestored gravels in the lower American River

**Charles N. Alpers**

# Technical Panel Review

| *Technical Review Panel's Overall Evaluation Rating:* |
| --- |
| **Inadequate** |

## Explanation Of Summary Rating

**Most reviewers ranked this project 'low' because of the lack of preliminary information on mercury levels, the lack of methodological details in the body of the grant and the lack of linkages between variables measured and actual impacts on salmon populations. On a positive note, most reviewers also recognized the value of discovering the likelihood and extent of methlymercury problems for instream gravel restorations.**

### Goals And Justification

**The goal of this project is clearly defined – it is to test hyporheic water quality and methyl mercury levels in salmon redds in restored (gravel added) and unrestored sites of the American River. The justification is that fish embryos could be exposed to mercury from historic gold mining if oxygen levels are low beneath the redds. Little is known about mercury in the hyporheic zones of these restored areas. Most reviewers appreciated the importance of the main goal.**

**However, the hypotheses to be tested seemed more like statements of known facts than things to be discovered about this restoration (e.g., mercury plus low oxygen leads to methylation, methylmercury harms fish, and the severity of contamination can be measured in water and macroinvertebrates). Individual hypotheses were poorly linked. Only the first hypothesis was adequately addressed methodologically. Most reviewers (technical panel, external and regional)thought that a full grant was not justified at this time because no preliminary measures of mercury levels had been completed in the study areas, especially in riffles**

**where MeHg is less likely to form because they are typically well-oxygenated. Two external technical reviewers and the regional panel stated that there is no evidence that MeHg levels in the American River's main channel is high enough to be toxic to anadromous fish. Reports cited for high mercury levels in fish from this region pertained to reservoirs with anoxic conditions over extensive areas and periods. In addition, 'virgin' gravel (presumably clean) was used in the 1999 restorations, which if anything might decrease levels of contamination.**

## Approach

**Most external technical reviewers and the technical panel were complimentary about the sampling design for methylmercury in salmon redds, which included restored and unrestored sites. However, the authors gave few details on how they would test whether methylmercury harms developing fish. There were no proposed measurements of embryo or fish body tissues, and no measures of embryo development or hatch rates. Of course, attributing poor hatch or development to methylmercury is not an easy task because low oxygen and related conditions can also cause poor hatch, but checking for lower hatch rates in contaminated areas would have been a logical first step.**

**Methods for measuring concentrations in invertebrates were poorly developed. All external technical and technical panel reviewers were concerned that there was no conceptual model or methods for relating levels in water and invertebrates to the level of contamination in the area, embryos, or YOY fish.**

**The authors did not provide enough methodological details for reviewers to assess the approach for tasks 2 and 3.**

## Feasibility And Likelihood Of Success

**External and technical panel reviewers could only verify the feasibility of the parts of the project involving measurement of redds and water chemistry. Technical panel reviewers and external reviewers could not assess methods for monitoring macroinvertebrates, or for estimating how water levels of MeHg**

**would relate to body burdens of MeHg in embryos or fish. It was difficult to determine how much of the proposal effort would fall into these latter tasks. The latter task is essential to the success of this project.**

## Performance Measures

**As above, only the first part of the project had clearly articulated performance measures.**

## Products

**The author presents a good plan for information dissemination to managers and the scientific community. Data management seems fine. Without preliminary information on contaminant levels, it is difficult to estimate likely productivity for this project (that is, methylmercury contamination may simply not be a problem under the biochemical conditions typical of these salmon redds).**

## Capabilities

**The investigators are well-qualified for this work and have good track records plus local experience. One external technical reviewer also suggested including a fisheries ecologist.**

## Budget

**There were few concrete budget concerns, although the lack of detailed methods for some parts of the project made this difficult to evaluate. One reviewer suggested that the justification for 2 years for MeHg site characterization seemed strange, and seemed to suggest performing a broader survey the first year, rather than tacking on sites the second year.**

## Regional Review

**The regional review panel ranked this proposal as low. They**

**pointed out that gravel restorations and historic mines are common in the region, therefore this project could have broad applicability if mercury is indeed shown to be a problem. The regional panel also found good involvement of interested and affected parties. However, the regional panel did not find that the project was likely to make causal links between the data to be gathered and the population dynamics of species of concern, and thought that the project was more appropriate for a research grant rather than for this monitoring program.**

## Administrative Review

**There were some concerns about prior funding performance. Draft reports from the Upper Yuba work have been delayed, and their progress is uncertain. The only environmental compliance issue raised was the need for a scientific collecting permit.**

**The administrative budget reviewer cited difficulty in assessing the project due to the lack of methodological detail, and requested costs associated with particular tasks and deliverables. The author needs to provide justification for subcontractors, describe selection of subcontractors, and provide hours and rates for tasks and deliverables.**

## Additional Comments

# Sacramento Regional Review

| *Sacramento Regional Panel's Overall Ranking:* |
| --- |
| **Low** |

**Summary:**

**The panel ranked the proposal LOW. The project does not seem to provide information that is relevant to the priorities of the current funding source. Information may be useful for mercury management actions, but is not relevant to how restoration increases habitat or species populations.**

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

**This project proposes to monitor restored gravel beds in the American River watershed for methyl mercury production, effects of methyl mercury on anadromous fishes, and methyl mercury concentrations in benthic macroinvertebrates. Little evidence of methyl mercury toxicity to anadromous fishes is offered. Studies referenced indicate potential effects at concentrations far higher than those found in the American River. No monitoring of at-risk species populations or habitat is included.**

**2. Links With Other Restoration Actions.**

**Gravel restoration is common in the watershed. Should restored beds be shown to be an important source of methyl mercury production, the results from this project will be of greater importance. Links to other restoration and monitoring in the region are strong and results will be made available publicly through the DWR BDAT database.**

**3. Local Circumstances.**

**There do not seem to be any local constraints to implementing the project.**

**4. Local Involvement.**

**The project outreach plan considers the majority of interested and affected parties. Locally active entities are partners on the project.**

**5. Local Value.**

**The project does not synthesize existing data as this type of monitoring has not previously been conducted. Project results may be useful in prescribing future gravel restoration and may be applicable at various scales under similar gravel bed conditions.**

**6. Other Comments:**

**This project seems more appropriate for a research oriented funding source.**

# External Technical Review #1

## Goals And Justification

**This proposal identifies several CVPIA funded gravel augmentation restoration projects designed to benefit Salmonid spawning in the American River. While it is unclear if these projects were originally funded by the Ecosystem Restoration Project, they do fall within the goals of the program. The proposal provides a brief summary of the various restoration projects of concern, as well as a description of the subsequent monitoring performed and information derived. No clear conceptual model of the restoration actions was provided, however several integrated conceptual models of proposed monitoring were included.**

**Three main hypotheses were articulated in this proposal, which for the most part were justified. However, the design of the project only provides information for hypothesis 1. Little explanation is provided for how hypotheses 2 and 3 will be tested.**

## Approach

**This project is well designed for examining the extent of methylmercury contamination of salmonid redds, and comparing methylmercury exposure of redds from restored and "unmanipulated" sites. However, it is not clear how the approach will determine whether methylmercury exposure has harmful effects on early life stages of anadromous fishes, or how effective analysis of mercury in river water and invertebrates will be towards determining the severity of methylmercury contamination. As designed, the only way hypotheses 2 can be addressed is by comparing the methymercury concentrations in the redds to those from the literature values shown to cause toxicity. However, no information is provided regarding concentrations thought to be of concern for salmonid redds. The authors mention one study on fathead minnows (Hammerschmidt et al., 2002) as describing the effects of aqueous methylmercury exposure being detected at 2.0 ng/L.**

**However, the study cited was focused on dietary mercury exposure and is not an adequate comparison of data with the project being proposed. Thus the authors provide no evidence that the mercury exposures likely for redds in the American River are of any toxicological significance. Furthermore, no work is proposed to monitor the success of the redds, the concentrations of mercury in the eggs or larvae, or effects on the early life–history stages. Tasks for biological sampling and analysis are indicated, however no information is provided regarding how this work will be done, what will be gathered from it, or why it is valuable.**

**Hypothesis 3 indicates that water sampling and biosentinal invertebrates will be used as an indicator for the severity of methylmercury contamination and bioaccumulation. However, no specific information was provided regarding how this will be done or how it relates to the overall goals of the project. It was left to this reviewer to infer that bioaccumulation in invertebrates would be used to estimates bioconcentration in eggs and fry since no discussion of sampling those matrices was included.**

**This proposal provides a succinct summary of previous monitoring activities at the sites of interest and explains clearly what data gaps exist even with those activities having been conducted. The data gathered from the redd monitoring will be very valuable for understanding how subsurface conditions in the redd influence methyl mercury production. Decision–makers will directly benefit from this by evaluating the conditions of future gravel amendment sites prior to conducting work to determine the potential of methymercury exposure in the redds. However, there is little description of how that information will be applied to risk or effects to salmonids. Thus, the best a decision–maker could do with the information is estimate methylation potential of a site and decide whether or not restoration is prudent based on an arbitrary threshold value.**

## Technical Feasibility

**The portions of the project dealing with physical characterization of redds and water sampling and analysis are certainly feasible and farily well-described. However, little description is provided for the remainder of the project.**

**The objectives eluded to in the hypotheses section are not along the same scale as the work being proposed. The authors state formal hypotheses concerning effects of methyl mercury on salmonid early life stages, however do not indicate whether or how this will be investigated other than estimating exposure.**

## Performance Measures

**The performance measures are adequate for the work being proposed. The redd monitoring data will provide valuable information regarding environmental conditions within the redds. As previosly mentioned, it is unclear what other data will be collected.**

## Products

**Task 2 will likely generate very useful information for managers regarding mercury contamination in redds and how exposure is influenced by within-redd microhabitat conditions. It is unclear what the value of the data generated by the rest of the project will be. Data handling, storage, and dissemination all seem reasonable.**

## Capabilities

**The team of investigators on this proposal are well-qulaified to conduct this work and have demonstrated their ability to successfully conduct projects of similar magnitude several times. The project would be well-served by including a fisheries ecologist and toxicologist to evaluate the effects of mercury to the eggs and fry.**

## Budget

**The budget is reasonable and adequate for the work described to address hypothesis 1, however there was not enough information on the other hypotheses and tasks to determine whether or not the budget was reasonable. If the project did include some sort of assessment of effects to salmonid reproductive success then the total request would certainly be reasonable.**

# External Technical Review #2

## Goals And Justification

**The issue of Hg bioaccumulation has obviously important ecological and human health consequences. However, the proposal does a poor job of justifying that this issue is of probable enough concern to merit an expensive investigation. Very little background information is given. What are the concentrations of Hg in river water or in gravel pores at these (or any) restoration sites? Are they "high enough" to merit concern, given the levels of DO characteristic of salmon redds?**

**The 3 hypotheses are in a sense obviously true (in that they are posed in quite general or non−specific terms), and the Approach section of the proposal sheds virtually no light on how theses hypotheses will be tested. I am unable to evaluate the quality of the proposed work when methods are omitted in favor of referring to previous reports/publications (to which I have no access) (viz., the Alpers et al. (2000a) in Subtask 3C , the "Slotten reports" in Task 4, and Evenson 2001 in Task 5).**

**The strength of the proposal is in the characterization of hyporheic flow paths at some specific restoration gravel bars. But I am unconvinced by the authors' claim that their results will necessarily have "great transfer value to other watersheds of concern" (p. 22, 23). Even if the collection methods are appropriate, it is not clear to me how findings from these specific sites will be transferable to other locations that will almost certainly differ in their hydraulic details. Further, the trophic linkages among inverts and fish can be rather complex due to fine−scale spatial variation in invertebrate availability to juvenile salmonids; therefore, a fairly sophisticated sampling design would be required to characterize this complexity in a "transferable" way. I do not conclude that these "obstacles" are insurmountable, rather that I have reasonable doubts in the absence of any articulated proposal.**

## Approach

**The proposal offers inadequate detail to evaluate this criterion (as discussed above).**

## Technical Feasibility

**No, there is poor documentation about specific methods. The proposal generally refers to previous publications/reports without providing detail adequate for evaluating the proposed work. When details are provided, justification for the sampling or analytical scheme is not well articulated. The project may indeed be feasible; however, the proposers have done an inadequate job in demonstrating this.**

## Performance Measures

**This cannot be evaluated from the proposal, as critical details are missing.**

## Products

**Perhaps, but it would seem to depend on the actual "risk" of MeHg formation and bioaccumulation in the restoration gravels, and this information is not provided in the proposal.**

## Capabilities

**The principals appear quite competent from their brief CVs. However, again, they have not demonstrated this project can be done effectively.**

## Budget

**I cannot speak strongly to this; however, I would raise the question of whether 2 years of field work are needed for the MeHg characterization. In the Executive Summary the rationale for a 2–yr study is twofold: 1) to develop a statistically significant data set (presumably meaning adequate sample size and statistical power), and 2) focus on a second year "focus**

**on areas where initial results identify the potential for methylmercury production." These seem somewhat at odds. If a "pilot" year is needed to identify the most active sites, then how do we know that enough active sites will be captured in the "pilot" study to ensure an adequate sample size for statistical analysis and for "transferability" of results to other restoration sites?**

# External Technical Review #3

## Goals And Justification

**The proposed project very effectively identifies a potential exposure of protected fish to methylHg. Our current understanding that Hg can act as an endocrine modifier increases the potential for harm to developing fall-run Chinook salmon in redds.**

## Approach

**In general the approach is appropriate.**

**Task 2. The use of a Hach kit for measuring N-species seems inadequate. Can the appropriate accuracy and precision be obtained with this approach?**

**Task 3 (subtask 3c.). "See Alpers et al. (2000a)" is not adequate description for a reviewer to judge the approach to "sample preservation and analysis." The same is true for Task 4a for which "See Slotton reports" is the only detail that a reviewer has for the approach.**

**It would have been helpful to get details about statistical analyses and linkage of the proposed statistical analyses to the detailed experimental design.**

## Technical Feasibility

**There is no question in my mind that the project is feasible. The investigators have relevant backgrounds and experiences. My only issue relates to the lack of details about specific methods. I assume that this is an oversight, not an indication that the investigators might use inappropriate methods. The materials describing the investigators suggest that they are very aware of the appropriate technologies and will conduct high quality research.**

## Performance Measures

**The data will be collected in a manner that clearly allows evaluation of actions.**

## Products

**The expected outcomes seem balanced between the scientific community and more direct users of the information. The results will be presented in a very effective manner. I am a little surprised that more peer−reviewed journal publications will not emerge from the study. Perhaps the investigators are being conservative in their estimates. The text suggests that the M.S. student will be first author on any publication arising from his/her thesis. That reflects effective mentoring by the investigators.**

## Capabilities

**The team is extremely capable relative to the proposed tasks. They all have established histories with different aspects of the research area. They also have worked in the area for many years and understand the area's priorities.**

## Budget

**The budget is appropriate for a 3 year study. I see no issues of concern. The mercury analyses will be done at a good laboratory at a reasonable price.**

## Additional Comments

**Overall, the project adddresses an important issue that should be studied. The investigators have strong backgrounds in the subject and in the area of concern. Normally, I would be very negative because of the lack of detail provided for portions of the study and the lack of any discussion of statistical analyses. Regardless, the study has a very good likelihood of producing valuable information for managing the salmon of the region.**

# 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.**

If no, please explain:

**Clarification on other direct cost line items is recommended ($58,000).**

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

**No description of indirect costs were indicated.**

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

If no, please explain:

**Labor rates for sub. Recommend to complete a better comparable.**

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:

**Not stated.**

8. Are there other budget issues that warrant consideration?
**No.**

If yes, please explain:

**Task and Deliverables –More detailed information is needed for task and deliverables including subcontractor work for each specific task, services, and work to be performed with the appropriate and corresponding deliverable or end product for each task(s) and/or sub–task(s). Costs associated with each task and deliverable should be evaluated based on what is considered to be reasonable costs for performing similar services.**

Other comments:

**Subcontracting –Proposals for work to be performed by subcontractors or other entities in excess of the 25% of the total project dollars the grantee is required to provide a justification for subcontracting services. If subcontractors are pre–selected and identified in the proposals as part of the project team, the grantee should provide a justification on how each subcontractor was selected. Grantee shall identify labor rates and indirect costs rates paid to each identified subcontractor to ensure that labor rates are comparable to State rates.**

**The Subcontracted work should be identified with a rate and hours and attributed to each task and deliverable for each year. A performance evaluation is also recommended for subcontractors that receive more than 50% of the grant funds. If the subcontractor has not been identified, a position description complete with education level, experience, and abilities be submitted and the rate and hour associated with that position will be attributed to a task, and deliverable. The grantee must also comply with the State competitive bidding process as stated in the PSP.**

# 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:

**They correctly state they need a SCP but they have not obtained it yet. They will need to obtain this permit before they begin the project.**

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:

| | |
|---|---|
| **Project Title** | Upper Yuba River Studies Program |
| **CALFED Contract Management Agency** | CBDA |
| **Amount Funded** | $4,794,966 |
| **Date Awarded** | 2001/01/01 |
| **Project Number** | 4600002330 |

| | |
|---|---|
| **Project Title** | Upper Yuba River Studies Program |
| **CALFED Contract Management Agency** | CBDA |
| **Amount Funded** | $534,000 |
| **Date Awarded** | 2001/01/01 |
| **Project Number** | 4600001955 |

| | |
|---|---|
| **Project Title** | Upper Yuba River Studies Program |
| **CALFED Contract Management Agency** | CBDA |
| **Amount Funded** | $191,000 |
| **Date Awarded** | 2001/01/01 |
| **Project Number** | 4600001129 |

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?
**Yes.**

**I am not as familiar with the American River work. Upper Yuba work is not described in much detail.**

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.**

**There is some concern that we haven't seen draft reports from the Upper Yuba work as there have been delays in the program and several amendments thus far.**

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

**However, we have not kept close enough track of getting deliverables submitted and knowing where they are in their Upper Yuba contract.**

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.**

**Different river where they'd be ready to go.**

Other comments:

**Recommend very close contract management with any new USGS contract. They do good work but without close supervision could get off track.**