Response to the 2002 EWA Panel Report

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Earlier in the year we forwarded to the Panel the responses of the management agencies and the delta smelt biologists to the 2002 EWA Review Panel report. In this report I provide the CALFED Science Program's assessment of how CALFED and it member agencies are responding to recommendations made by the review panel. I also provide some broader perspectives on the EWA and the program evaluation.

Several long-term water operations plans are being finalized in the next several months, thus it is possible that decisions regarding continuing the EWA past year four, and its role in future operations, may be made before the 2004 review. The Panel's deliberations this fall will be essential for the design and ongoing assessment of the EWA, and will feed into future decisions on continuing the EWA. We are expanding the scope of the October 2003 review session beyond the EWA itself. The goal is to provide better knowledge of the full suite of water operations in the Central Valley, of which the EWA is a key element.

Since our October, 2002 meeting some panel members have participated in symposia and workshops on issues related to EWA operations and assessment. Jim Cowan and Kenny Rose participated in a June 19-20, 2003 symposium exploring the effects of Delta water operations. Kenny attended the 2003 EWA salmon workshop to chair and help facilitate the modeling session. The annual EWA workshop on delta smelt, held on August 18-19, focused on developing smelt population models, with Kenny leading the discussion and Jim providing his expertise on population dynamics and modeling. With the help of Jim Anderson, NOAA Fisheries organized a September 8 and 9 workshop to continue the work of the Central Valley Technical Recovery Team which will lead to a salmonid recovery plan. Summaries of these symposia and workshops will be provided to the panel as they become available. Additional information about scientific progress in the CALFED areas of interest is available at http://science.calwater.ca.gov (click on "Workshops and Conferences"), the summary of the January 2003 CALFED Science Conference.

The Panel's 2002 report combines an ambitious vision for the EWA, with a useful level of detail. Of course, it would take several years to implement all the recommendations, even under the best of circumstances. But the pace of implementation is also governed by the constraints of the system in which this work is conducted: there is no federal authorization for CALFED and the state is taking draconian measures to balance its budget. That said, state bond money is available for many CALFED programs, although the bond money is not necessarily balanced among all CALFED goals.

Below are specific responses to the Panel's 2002 recommendations. Many of the panel recommendations have influenced day-to-day activities and plans, in addition to the

specific responses that are documented. The annual review has become an integral part of the EWA. Thorough discussion, documentation, and justification of activities are now normal components of agency water operations activities. Consideration of the influence of EWA and other actions on populations of threatened species is now routinely included when discussing the environmental impacts of water operations.

CALFED and agency staff recognize that the panel will continue to ask about progress on past recommendations. This retrospective analysis is extremely beneficial and should continue.

Responses: General approach

Many small steps vs. few large steps. The general strategy of the response to the panel from the Science Program, CALFED, and the agencies is to take small steps to address a wide number of the recommendations (as compared to one large step to implement one suggestion). This implicit approach is probably most compatible with the existing allocation of resources within the system; and the difficulties of quickly re-directing or adding new human resources to address a new problem.

Interdisciplinary teams. In several places, the report calls for the creation of specific interdisciplinary teams, following workshop analyses of specific problems. The workshop/expert approach to developing research agendas is promulgated by the Science Program and has been widely adapted. From April 2003 through April 2004, we have planned more than 20 workshops, symposia, formal reviews, and conferences. Workshops last year resulted in research agendas on delta smelt, effects of water operations, mercury issues, and effectiveness of fish screens. Thus, open discussion of needs and uncertainties is part of our response to your recommendations. On the other hand, getting new work going, and establishing new interdisciplinary teams, is more challenging. Creating interdisciplinary teams within the agencies, as the Panel envisioned, would require a much different resource allocation than now practiced. Neither wholesale new hires nor re-assignment of staff from existing positions to these jobs seem likely, with either CALFED operational funds or by state agencies. Finally the Science Program does not have the guaranteed funding continuity which would allow us to hire permanent employees for the resources agencies, eg., a statistician as you recommended.

In spite of the problems described above, we will continue to work with the IEP and agency staff with the goal of creating and effectively using interdisciplinary teams. The Delta Cross Channel studies and VAMP are examples that show that this approach can work. The recent delta smelt workshop may be leading to another such team assembled to test our collective capabilities of building one or more predictive delta smelt models.

Building collaboration from the bottom up. Another way to build teams and more thorough analysis of existing data, as you suggested, is to foster greater collaboration among the agencies and the academic community. That can be done from the top down or from the bottom up. We prefer the latter. Responses to open solicitations is one way

to fund research teams developed by interested applicants. Although somewhat ad hoc, this approach results in teams that are likely to work well together. We have two programs in place in which we use a solicitation process to leverage existing agency resources through university participation. One is a $2M/year program run jointly with Sea Grant, whereby we solicit proposals for teams involving postdoctoral fellows or graduate students, university faculty, and agency mentors to work on issues relevant to the watershed, with emphasis on analyzing existing data sets – including publishing the results of these analyses. Last year we selected, via a competitive peer-review process, six such teams for funding. (Note that we are still encountering difficulties in contracting with the University of California.) This year the request for proposals will specifically include some of the issues raised in your 2002 report. The second program will occur later in 2003 when we will release an RFP from the CALFED Science Program to award between $10M and $20M in research grants. We will call for proposals that draw together interdisciplinary teams to address most of the subject areas you have identified as important.

We establish priorities for research for programs, such as those above, using a variety of inputs, including suggestions by stakeholders, review panels and advisors. The EWA Panel's suggestions will continue to play a prominent role in helping us establish research priorities.

Specific Responses

1. Resources for EWA. One of the most important insights in the Panel report was the observation that "there is a great risk that EWA lacks both the resources and flexibility to respond to extreme events." The response to this comment must come from the EWA managers, and we have specifically asked them to respond during the October review. This is especially important, since operational flexibility will influence near-term decisions on the EWA's future. We will ask Jerry Johns to address such questions as:
    a. Is a greater burden is being placed on EWA despite fewer assets being provided?
    b. What are the limits to providing greater temporal flexibility for the program (p. 14)?
    c. Are Tier III assets adequate, so that asset use early in the year is not overly conservative?
    d. What has been done to better integrate all federal and state environmental water programs?

    We will ask managers to address your suggestion that EWA could expand the market for its water acquisitions and sales, and could look for new forms of water transactions that can stretch its budget. The question of carrying over water or money from one year to the next is also critical to a sophisticated management system for using environmental water. We will ask for information on how managers are using hydrologic forecasts and financial tools to help with water acquisitions. The agencies have addressed a number of these issues in recent reports by the Project Agencies and responses by the Management Agencies,

which you will receive as reading material. Your insights on how they might do some of these things better will be greatly appreciated.

2. Better integration of environmental programs. Two different kinds of integration are needed to maximize CALFED's effectiveness: integration among the institutions and programs involved, and integration among the goals and actions. This recommendation is one of the most important to come from the panel. As you noted in several places, better integration of CALFED, CVPIA, IEP, and other programs will benefit efforts to meet environmental needs and to increase understanding of the results of our actions,. Probably even more important is the need, as noted on page 10 of your report, to integrate all the actions that involve managing operations, manipulating flows, and managing or developing habitat. You recommended that the Science Program develop a strategic plan in this regard. Frankly, although we continue to raise awareness of the need for better integration, our strategic plan is implicit and opportunistic, and probably will require persistence to achieve results. The following steps are underway:

    a. The first step has been to establish a dialogue about integration, raising awareness of the importance of the issue. To this end, we have discussed integration with CALFED Program Managers, and both staff and managers in the implementing agencies. We also include in our talks to the stakeholders, public advisory groups, and interested scientists examples of conflicts in program management or goals, illustrating why we must think and act across programs. Several workshops have helped communicate the need for thinking across programs and artificial geographic and institutional boundaries, for example:
        i. The variety and depth of science funded by CALFED (as illustrated at the biennial CALFED Science Conference, with 4 concurrent sessions and almost 300 oral presentations and posters in the January, 2003 conference) served to bring out many examples where conflicts occur and integration is essential.
        ii. The annual salmonid and delta smelt EWA workshops continue to serve as a communication mechanism among programs.
        iii. In June 2003, DFG (with CALFED financial support) held a multi-institutional workshop which may lead to a more coordination in the salmonid escapement monitoring program in the Central Valley.
        iv. Kim Taylor continues to serve as an IEP coordinator, with integration of IEP with other CALFED activities a key goal.
        v. The Bay-Delta Science Consortium has released an RFP soliciting small science projects (graduate student support) that encourage novel ways to foster institutional collaboration.
        vi. CALFED is supporting three scientists to help NOAA Fisheries develop its Central Valley salmonid recovery plan.

b. The second step is to work toward integration within regions, as illustrated by two examples.
    i. First, the upstream Environmental Water Program will get started this year; and they are coordinating and looking for joint water use opportunities with EWA managers.
    ii. Second, CALFED management and the agencies are working toward an integrated approach to design long-term water operations in the Delta, including proposals for changes in South Delta facilities. Important actions or decisions have been pulled into one timeline and managers from all agencies are talking about co-implementation of a plan termed the "Integrated Key Milestones". The Science Program is developing workshops/symposia/reviews (see attachment) that will complement the Integrated Key Milestones. These activities discuss the interface between the suite of Delta operations as they might be configured, and the environmental processes that can influence the effects of these operations. Integration of Delta proposals with upstream activities is only beginning, however, and probably will advance slowly.

c. The third step is to begin specific experiments that encourage an integrated view of actions or management. CALFED has worked with a consultant for the Water Use Efficiency Program to develop a conceptual proposal for an integrated water management experiment. The experiment would integrate water conservation measures, ground water management/conjunctive use, reservoir releases/surface water management, watershed management and water transfers into a joint effort to find the water to meet ecosystem restoration goals. This experiment, to begin with modeling, is in the early planning stages and has not been funded. Butte Basin or the Tuolumne Basin are possible sites. In addition there is a not-yet funded USGS proposal to develop scenarios about effects of climate changes and in the configuration of water operations on important environmental processes in the Delta.

Performance measures for EWA. Another valuable panel recommendation was for CALFED to devote significant effort toward developing measures of the biological performance of the EWA. Ideally such performance measures could help avoid conflict over the biological value of the program. As our advisors have noted, performance measures can take many forms. There are measures that evaluate actions (e.g., how much water did EWA buy), measures that evaluate biological responses (e.g., how many fish saved), and measures to evaluate progress or system condition (e.g., winter-run abundance). The latter is the ultimate goal but it is not likely that increases in the system performance measures can be attributed to individual programs like EWA. To date, our formal efforts with performance measures for CALFED emphasize system-level responses (e.g. winter-run salmon population size). We have also established protocols

for developing, following and interpreting performance measures, for all CALFED programs that should be useful by all CALFED programs, including EWA.

As a result of your recommendations in the 2002 report, the EWA Biologists drafted a report "Goals, Objective and Measures of Success of EWA" for salmon. (This report is being sent under separate cover.) The biologists identify three goals and about 20 or so recommendations. They did not assign priorities, as of yet, although several suggestions have moved forward. One was the workshop on salmon models (see later description). Another was Sheila Green's presentation at the salmon workshop on adult equivalents as a common currency to evaluate the benefits of specific actions. Progress in developing formal metrics, trends in those metrics and balanced interpretations are the next steps. We will have a session in the October meeting that will discuss progress on such criteria, developed by a stakeholders and agencies. Implementation of a coherent strategy, at least in developing salmon measures, is at least beginning; but conceptual, resource, and data challenges must be overcome for progress to be significant.

Six Avenues for Scientific Investigation.
These suggestions (listed as "science challenges"), and their level of detail were extremely useful.. Each of these subject areas is being incorporated in the upcoming Science Program RFP. Responses and related activities are listed in the agency responses and below.

Science Challenge #1: *To determine the combination of physical conditions in the Delta (flow, transports, temperature) that give rise to "entrainment events" of delta smelt*.

Through a series of fortunate circumstances I have some confidence that progress on Science Challenge #1 will occur in 2003-4. The existing particle tracking model already plays an important role in assessing the benefits of specific actions, hydrology and circulation patterns on delta smelt entrainment. In particular, as part of the EWA process, the Fish and Wildlife Service typically requests PTM runs to project where smelt may wind up under different situations. In addition, three small independent teams are working on modeling studies using the DWR Delta Simulation Model – II (DSM2). These studies will help us to understand the physical and chemical conditions that define the "zone of influence" of south delta export facilities. Conceptually at least, many agency scientists believe that young delta smelt occurring inside the zone of influence are much more susceptible to entrainment. Refining and quantifying the conceptual model, defining measurement criteria, and understanding the temporal and spatial scales of variability of the "zone of influence" are all important steps that will be addressed with the results generated by the three study teams working with the DSM2.

Each study team has initiated work, although the timelines for completion of the work and the exact goals of the teams differ. Team one (including Pete Smith and John Donovan, USGS and Henry Wong, USBR) is working with the DSM2 and a three-dimensional model developed by Pete Smith to provide quantitative evidence for the extent and variability of the zone of influence based on residual or net flows within the

Delta. This work will use hydrologic and water project conditions that occurred in spring 1999, a period of high delta smelt salvage. These results could also yield insight into the temporal and spatial scales of variability associated with the zone of influence. This team will also work to develop post-processing software to provide an information rich display of the model results.
Team two (including Wim Kimmerer, RTC and Matt Nobriga, DWR) is working with the DSM2 and a companion particle tracking model to learn how hydrologic transport affects the fate of particles under various hydrologic and water operation scenarios. Results from this modeling work could provide a transport-based definition for the zone of influence and may provide insight into the probability distribution of entrainment influence thought to underlie the zone of influence. This team also intends to use the particle-tracking model to develop a predictive index of risk of entrainment, as an alternative to the export to inflow (E:I) ratio.

Team three (including Jim Wilde and Bob Suits, DWR) is using the DSM2 to develop water fingerprinting tools. Ultimately, these tools will be able to estimate the proportion of source waters comprising the water at selected points within the Delta under past and future conditions. This information could be used to provide an environmental water quality description for the zone of influence.

Teams one and two began their work in 2003, while team three's work is well underway. A meeting of the IEP Estuarine Ecology Team in July 2003 enabled teams 1 and 2 to compare notes and coordinate efforts, and also led to a clearer focus on Science Challenge 1 as an objective of their research.

The 2002 EWA review panel report also recommended "independent… statistical analyses of Delta smelt distribution…" In August 2003 Bill Bennett released a revised draft of the delta smelt white being prepared with CALFED funding. Comments from agency and other reviewers have been received and Bill is revising the report – a report which includes statistical analyses of delta smelt data. In a new development, Larry Brown (USGS) and Mike Dege (DFG) have completed a paper analyzing existing data to determine how delta outflow influences delta smelt distribution. This paper was presented at the Early Life History conference sponsored by the American Fisheries Society in August 2003 and will be published by AFS (with IEP and CALFED financial support) in a proceedings volume. However, more work is needed to analyze existing data to asess how factors such as water temperature, water project operations, or a combination of factors might affect delta-smelt distribution.

Of particular interest in this area may be the results of the 2003 EWA delta smelt workshop. (The workshop summary is being sent under separate cover.) The workshop focused on modeling delta smelt using individual based or matrix modeling approaches. These approaches are being pursued to the point where a proposal to CALFED or IEP can be developed. Initial discussions at the workshop were encouraging and an ad hoc modeling team established. This is discussed in more detail in my response to science challenge 3.

Overall, I think the work described will help us refine our conceptual model and detail specific hypotheses to test in determining the factors that give rise to entrainment events. The work of Bennett, Kimmerer and others continues to point to a potential importance of such events (both catastrophic take episodes and annual average take), so understanding the causes is important.

Science Challenge #2: *What are the growth and mortality rates, habitat use and movement patterns of Chinook salmon within the Delta?*

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Incremental progress is being made on meeting this challenge. Dan Bottom, NOAA Fisheries', Newport, Oregon Laboratory reminded attendees at the 2003 CALFED Science Conference that nursery environments like the Delta can have beneficial effects for fish both in terms of abundance and in preserving important aspects of genetic diversity. On the other hand, a common conceptual model for salmon and water management in the Delta is that it is best to help salmon move through the Delta as fast as possible. Does this apparent contradiction affect restoration plans for building salmon habitat within the Delta? One of the benefits of having outside panels is that your emphasis on this questions forced a fuller appreciation of its challenges.

You recommended a 3-phase approach to this challenge. I comment on and discuss some progress on each phase.

Phase 1. Analysis of existing data sets. CALFED has resurrected the salmonid white paper by assigning John Williams and Ron Yoshiyama to write a new draft by January, 2004. Mike Healey (UBC), Wim and Randy are working as technical advisors for this effort. The first chapter is to describe the use of the Delta by juvenile Chinook salmon. Analyses by Low, Brandes and Newman are discussed in the early draft of the Delta section.

Although nothing tangible has come of it yet, the IEP recently formed a salmon Delta rearing project work team. The team, chaired by Joe Miyamoto of East Bay Municipal Utility District, is charged with assessing how Chinook salmon use the Delta – both as migratory corridor and for growth.

Phase 2. Development of a fish tracking model. Recent studies at the Delta Cross Channel using CWT and radio tagged fish, along with extensive flow measurements, demonstrated that simple models, such as the particle tracking model, are not capable of capturing the complex patterns of juvenile Chinook salmon movement through the Delta. On the other hand, these same studies have provided considerable information on how salmon migrate past the DCC and in the interior Delta. Studies associated with the Vernalis Adaptive Management Plan have yielded fish movement and fate data on the San Joaquin side. Finally, data analysis associated with the weekly DAT calls is providing useful information on fish movement, in particular from Knights Landing to Chipps Island and the salvage facilities. We are not to the point where all these data can readily be incorporated into a fish tracking model but may be getting closer.

Phase 3. Development of fish tracking system. You recommended we consider use of PIT tags to monitor fish movement through the Delta. Partly in response to this recommendation, Randy attended a PIT tag session at the August, 2003 AFS meeting in Quebec City. His general conclusions were that the use of PIT tags could yield extremely valuable results in many situations. It did seem that, on the Columbia River, tag reading was not quite perfected in the open waters of an estuary, in particular in the areas with varying salinity – ie the detectors may have varying efficiency depending on the salinity of the water. With CALFED support, Wim and Randy are going to organize a ½ day seminar this winter at which 2-3 PIT tag experts will be asked to present their experiences with this technology. They will contact Jim Anderson for the names of potential experts to lead this seminar. We will withhold any further consideration of PIT tags until after this seminar.

Science Challenge #3. *To develop a quantitative synthesis of the life cycles of delta smelt and Chinook salmon.*

Below I discuss each species separately.

Delta smelt. At the suggestion of Kenny Rose and Jim Cowan, CALFED dedicated the 2003 EWA delta smelt workshop, held on August 18 and 19 in Santa Cruz, to modeling the delta smelt population. Kenny brought the code for a very preliminary version of an individual based model. Bill Bennett described the Leslie matrix model used in his white paper. Two other models, the DAT decision tree and the particle tracking model, were also included in the discussion. One end result was formation of a delta smelt working group (representative from agencies, academia and the stakeholder community) to take the next steps in model development. Kenny has agreed to devote a limited amount of time to improving the IBM. The delta smelt workshop summary, including a description of the next steps has been sent under separate cover. I do believe this is a significant step towards meeting this science challenge.

In a related effort, the California Urban Water Agencies have contracted with Steve Cramer to develop delta smelt and winter Chinook life cycle models. I anticipate that Steve will work closely with CALFED and the agencies in these efforts. He started with winter run salmon.

Chinook salmon. Before going into specific efforts to respond to this challenge, It may help to list some of the studies and activities that will help in this evaluation..

1. Recent advances in otolith microchemistry (as described by NOAA researchers at the 2003 EWA salmon workshop), offer promise in helping determine where the young salmon spent their early life.
2. Genetic differentiation of individual winter run is now routine, and progress is being made on use of a mixed stock analysis approach to estimate how many spring run are in a mixed sample of juvenile salmon..

3. DFG studies on Butte, Mill and Deer creeks demonstrate that spring Chinook have a complicated and variable life history pattern – neither ocean or stream type.
4. On the Feather River and Butte Creek tagged naturally spawned juvenile salmon are being used to help track their movement and contribution to the subsequent adult population. Trapping downstream migrants on these and other streams has demonstrated that most Central Valley (circa 90%) juvenile salmon leave their natal streams as fry and are mostly gone by March 1.
5. The NOAA Central Valley Technical Recovery Team meets periodically to review data, including salmonid and related data related. The team also held a public meeting on September 8th and 9th to learn more about the biology of Central Valley salmonids, as well as possible causes of the decline.
6. The Delta Cross Channel studies have helped us understand salmon movement through the Delta.
7. The VAMP studies are yielding valuable information on the fate of San Joaquin basin emigrants.
8. DFG is expected to release a proposal for a coordinated Central Valley Chinook salmon monitoring program in the next few months.
9. Through CALFED funding, this fall Dave Hankin (Humboldt State) and Ken Newman (University of Idaho) will release their draft proposal for a constant fractional marking program for Central Valley hatcheries. This is program is particularly important since hatchery fish make an important, and largely unknown, contribution to the ocean fisheries and escapement.
10. Several efforts are underway to better understand winter run Chinook, including the importance of the Delta.
    a. DFG has established a winter run team to look at all aspects of the biology of this race.
    b. Through five years of CALFED supported monitoring, the USFWS now has good picture of juvenile winter Chinook movement from the spawning and early rearing areas above Red Bluff.
    c. CUWA sponsored Cramer's efforts to develop a predictive winter Chinook life cycle model.
    d. Wim and Randy are drafting a conceptual model of winter Chinook life history and factors controlling their abundance.
    e. NOAA is reconstructing the 1999 cohort from the Livingston Stone National Fish Hatchery to the fate of the tagged fish.
    f. An extensive data set continues to be collected and interpreted (although not published beyond the EWA reports) as part of DAT-related efforts to implement the EWA.
    g. IEP studies are ongoing of the role of the Yolo bypass as salmon habitat .
    h. As noted in your report, CALFED is planning a workshop to investigate predators and their effects on salmon mortality in the Delta. See Science Challenge #4 for more details.

At present Steve Cramer's CUWA-sponsored effort is only the program tasked with developing a mechanistic Chinook salmon model. In early September Steve released a

progress report (including a conceptual model of the winter Chinook life history) on these efforts and a preliminary version of a spreadsheet winter Chinook model. His initial draft provides a useful justification for use of certain knowledge in the model and a review of the status of existing models. The role Cramer will play relative to other efforts is currently under discussion in the usual multi-agency-stakeholder CALFED setting. Steve is working with agency and stakeholder biologists to refine the model and expects to move towards an IBM. .

For additional thoughts on Chinook salmon modeling, please see the summary of the 2003 EWA salmon workshop, sent under separate cover.

Science Challenge #4. *To determine the magnitude of predation mortality in Clifton Court Forebay, including elucidation of whether losses through the Forebay differ by species and vary as a function of prey density.*

As mentioned earlier, CALFED will be sponsoring a 2-day predation workshop, tentatively scheduled for April, 2004. I have asked Jim Cowan, Matt Nobriga, Wim and Randy to take the lead in organizing the workshop. They envision a mix of agency biologists and predation experts from around the country, including the Columbia River.

Initial thinking is that about one day will be devoted to exploring what we know about predation in Clifton Court Forebay – including study design and results. We will be asking one or more agency biologists to prepare a written summary of these studies, including the results of the abundance and distribution of potential predators, bioenergetic and hydroacoustic studies that have not been widely circulated. The goal will be reach agreement that we know the magnitude and causes of predation losses. I must emphasize that most of the data we have has been pointed towards understanding losses of juvenile Chinook salmon in the Forebay. We are on much less solid ground for other species – in fact there is a hypothesis that delta smelt actively spawn in the Forebay.

Once the workshop format agenda is close to final, we circulate it to the full panel for your information. We expect to be at that stage around November 1.

Science Challenge #5. *Optimizing Delta Cross Channel Gate operations relative to the EWA.*

As you know, over the past few years, CALFED and the IEP have devoted considerable time and effort to understanding the effects of Cross Channel Gate operations on salmon smolt movement and survival as well as the effects of this operation on water quality in the interior Delta. As you also know, gate operation is permanently fixed between February 1 and at least the end of May each year – they are closed. Between October 1 and February 1, the gates may be closed for up to 45days at the request of the DAT biologists or when flows in the Sacramento River exceed about 25,000 cfs.

The intensive DCC interdisciplinary studies have dramatically increased our understanding of how gate operations influences flow partitioning in the vicinity of the

Cross Channel gates, including water (and fish) movement in Georgiana, Steamboat and Sutter sloughs. We have some ideas on how the gates could be operated tidally to help salmon emigrants and internal Delta water quality. We expect the information gained to date to be used by agency biologists and project water operators as they consider alternative operations as part of the new biological assessments and opinions associated with this current round of evaluating the effects of project operations on endangered species. We are not, however, at the point of making these recommendations.

Science Challenge #6. *Are there reservoir management strategies to improve the availability of cold water for in-habitat enhancements?*

Realistically this challenge is limited to the Lower American River. Maximizing the use of cold water is already an important part of project operations for Lake Shasta and Lake Oroville. Temperature control is an important component of fish protection routinely considered by the American River Operations Group. Since the cold water pool is much smaller in Folsom Reservoir than that available in either Shasta or Oroville, its management is much more of a challenge.

There are three efforts underway to help maximize the fish benefits of the coldwater stored in Folsom Reservoir. First CALFED has funded the American River Water Forum to develop a daily temperature model for Folsom and Nimbus reservoirs. This model will help operators better define how much coldwater is available under different operational scenarios and optimize its use. Second, last spring Water Forum efforts lead to a temperature control device that provides access to additional cold water in Folsom Reservoir. Third, the Water Forum is designing a comprehensive in-river monitoring program to help biologist determine when coldwater will provide the maximum benefits to spawning Chinook salmon and rearing steelhead. The monitoring program is part of a package of in-stream flow recommendations that will be presented to the State Water Resources Control Board. In addition to the new efforts, the EWA staff continues to work with the American River Operations Group to use EWA funds to reimburse the USBR for any power losses associated with use of cold water in Folsom for environmental protection.

<u>Conclusion</u>

The managers running the EWA and other water operations have not implemented all the recommendations of the 2002 EWA review; but I hope the long summary above provides for you a sense that activities are occurring in response to the need to better understand EWA and the linkages between ecosystem protection and water operations. I believe the panel's reasoned, serious, detailed recommendations, along with recognition that the panel will demand accountability in its review each year, have played a major role in the serious investments this program has made in improved transparency, trying to improve the science, and building an institutional base for its efforts. We may have a long way to go before we can be sure the EWA is sustainable, the best way to spend taxpayers money, and is accomplishing its goals of protecting ecosystems, improving water supply reliability and helping hold the CALFED compromise together. Your role as a review

panel has been and will continue to be critical to successes along that path. We thank you for those contributions.