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Sent c/o Joanne Vinton (jvinton@deltacouncil.ca.gov) via email

Dear Dr. Norgaard,

Thank you for inviting me to provide comments to the Delta Independent Science Board (Delta ISB) on the organization, operation and use of science in the ongoing Delta planning and management efforts. These written comments address the questions posed by the Delta ISB and include the points that I made in my oral testimony at the meeting on December 1, 2011.

Before addressing the specific questions posed by the Delta ISB, I would like to reiterate my view that the San Francisco Bay-Delta is one of the best studied estuaries in world. We have continuous data records that go back for many decades, multi-disciplinary and integrated scientific analysis of ecosystem function and species response (most recently synthesized by the Pelagic Organism Decline [POD] research team), and conceptual and quantitative models for species, ecosystems, hydrodynamics, water management, and climate change impacts. While we don't know everything or all the details, we have a good understanding of the key physical and biological drivers in the system, the key stressors, and the likely future changes resulting from climate change, landscape change (e.g., levee failure and island flooding), and species invasions. It is not true, as some have suggested, that we don't understand how this system works or have a good enough scientific understanding to make changes in management to address well-documented and worsening environmental and water supply reliability problems. In fact, given the broad agreement that current environmental and water supply management practices (and expectations) are unsustainable and the legislative mandate to manage the system to meet the co-equal goals of a healthy ecosystem and reliable water supply, it is our responsibility to apply our existing scientific understanding to develop and implement management actions to alleviate known environmental and water supply reliability problems.

Below I address the specific questions posed by the Delta ISB.

1. In what ways do you feel Delta science is a) meeting the challenges of water and environmental management in the Delta, and/or b) not meeting these challenges?

Regarding environmental management, with the important exceptions of establishment of minimum regulatory protections (e.g., the Water Quality Control Plan, the most recent delta smelt and salmon biological opinions, and new wastewater discharge limits) and some limited adaptive management actions (e.g., the Vernalis Adaptive Management Program, the Fall X2 action), in my view, application of our scientific understanding of the system in the Delta to develop or implement management actions that manipulate key drivers and minimize known stressors for the purpose of reversing the ongoing ecosystem and species declines has been limited. In fact, in a number of instances, strong pressure to preclude or delay application of science-based management changes has come from specific subsets of the diverse decision-makers, government agencies and stakeholders engaged in governing, planning, managing and utilizing the system's resources. Thus, in effect, with our science we are monitoring and analyzing ecosystem collapse rather than proactively developing plans or adaptively managing for recovery.

In my view, this failure is not attributable to inadequate science or an inability to craft management actions based on the science but rather a failure of managers and regulators to apply the science (even as adaptive management experiments) due to a lack of will, lack of administrative and political support, and/or resistance by parties dependent on other Delta resources (such as water or floodplain land use).

Regarding science meeting the challenges of water management, I would argue that, other than limited engineering and operations studies, there has been little scientific research or analysis applied to this side of the co-equal goals equation. For example, there is broad scientific agreement that:

A) freshwater flows are a key physical and ecological driver in the Bay-Delta ecosystem; and
B) current flow conditions are insufficient to meet ecosystem needs.[1]

However, to the best of my knowledge, there have been no properly designed analyses done to determine, given the inter- and intra-annual variability and likely climate change effects on

[1] The State Water Resources Control Board's Delta Flow Criteria analysis, a process that included direct participation by virtually all of the academic, agency, and NGO scientists who work in this system, and their 2010 report is just the most recent compilation of scientific results that yield this conclusion.

runoff in the watershed, how much water can be reliably diverted for consumptive use after meeting ecosystem needs at some specified level (other than the current, insufficient flow conditions). More than a decade post-CALFED and five years into the Bay Delta Conservation Plan (BDCP) process, we still do not know the answer to the question: What is the reliable and sustainable water supply yield of the Delta (and its watershed) when it is managed to meet ecosystem and species needs? Similarly, quantitative scientific and economic analyses of alternative water supply reliability strategies, including alternative water supplies and demand management, have not been undertaken as part of the Delta planning process. In the water supply reliability arena, Delta science is failing to meet the challenges of water and environmental management.

2. What factors have led to science being effective in addressing today's critical issues, and what factors have led to it being ineffective?

In my view, science has been (sometimes) effectively applied to address today's critical issues when:

A) it is applied through regulation, mandated protective actions (e.g., biological opinions for listed species) and/or a clearly governed adaptive management (or real-time management) framework with specific, measureable goals and objectives;
B) it is needed to understand a crisis (e.g., the POD); or
C) it is used in an organized manner to develop science-based decision support tools (e.g., the Delta Regional Ecosystem Restoration Implementation Plan, DRERIP).

However, there are important examples in each of these categories of failures where science is ineffective, rejected and/or not being used at all. For example, mandated protections in the biological opinions have been regularly challenged in court even after exhaustive independent peer review has determined that the actions are scientifically justified. Even implementing protections as adaptive management experiments, such as the Fall X2 action for delta smelt protection, has been legally and politically problematic. In my view, this example, in which the action was challenged in court by stakeholders unwilling to accept any possible impact on water supply, is particularly troubling because it demonstrates a lack of commitment to even doing the science to better understand the system and answer this specific question.

In another example, in 2008 and 2009 the relatively modest 2007-2009 drought and implementation of new science-based export curtailments to protect endangered species resulted in large, abrupt reductions in Delta exports (annual exports in 2008 and 2009 were nearly 40%

lower than in 2007, which were the 8th highest on record).[2] This large fluctuation in annual export levels in the second year of a dry sequence of years was clearly a water resource management failure to provide a reliable water supply. In my view, just as the POD stimulated analyses of drivers and stressors influencing Delta species, this event should have stimulated research and a science-based analysis of water management and supply reliability in this system. However, as far as I am aware, it did not. As mentioned above, there appears to be a dearth of science on the water supply reliability side of the equation; analytical and management focus remains on maximizing annual supplies in the short term rather than determining the long-term sustainable yield in a system managed to meet the co-equal goals. This critically important scientific analysis of water supply and reliability, integrated with our scientific understanding of ecosystem needs, should have been undertaken as part of the BDCP and, absent that must be a integral element of the Delta Plan currently under development.

As a final example: during the 2000s, with the DRERIP process, state and federal agency scientists worked with representatives of the CALFED ISB and large numbers of other scientists (including myself) to synthesize our scientific understanding of the Delta into a suite of conceptual models and develop structured decision support tools for evaluating and ranking proposed ecosystem restoration actions. The objective was to apply these tools to develop a comprehensive Delta ecosystem restoration plan. When the BDCP process began, DRERIP team members provided training and guidance to the BDCP parties and consultants on use of these tools but, since then, these tools as well as subsequent efforts within the BDCP planning process to encourage incorporation of science-based, objective-driven evaluation of proposed actions (e.g., the "logic chain" approach) have been largely ignored. BDCP's failure to utilize these specific tools, or even a science-based, objective-driven approach for developing their plan represents the most recent and most serious failure to use science to address critical environmental and water supply reliability problems.

In the latter two examples (water management for reliable supply and the BDCP), I believe the major causes for the ineffective use and application of science are, first, the lack of clearly articulated, specific, measureable and realistic goals and objectives and, second, failure to meaningfully hold the involved parties to account for lack of these essential planning and management elements. For both management of water resources in this watershed (the most important in California) and the BDCP, lack of such goals and objectives, something that should be the starting point for such a planning process rather than an afterthought, has been and continues to be a fatal flaw.

[2] Analysis by the Department of Water Resources determined that only approximately 25% of the reduction in Delta exports was attributable to the new endangered species protections.

3. What are the emerging critical issues in the Delta that science will need to have addressed a decade from now?
4. What should we be doing now and over the next few years to ensure these scientific issues are addressed?

In addition to the elements discussed above, Delta science needs to address:

- Water management strategies for meeting the co-equal goals of ecosystem needs and reliable supply (also discussed above) in both the near term and future (i.e., with and without proposed new conveyance facilities), in the face of climate related changes to precipitation and runoff and energy costs;
- Sea level rise and its impacts on the Delta landscape, infrastructure, ecosystem, water management and land management;
- New species invasions (e.g., quagga mussel, zebra mussel); how to prevent them and how to respond to control and minimize impacts; and
- Development of a suite of ecosystem and water management indicators to track and evaluate conditions and trends relative to environmental and water resource management goals and objectives.

To ensure that these scientific issues are addressed, the Delta ISB should:

- Identify critical scientific, research and monitoring gaps (such as those identified above), and review research plans developed to address them;
- Recommend continuation of ongoing long-term monitoring programs; if new monitoring is needed, expand monitoring efforts rather than replacing existing programs with new ones;
- Provide scientific review of the BDCP, the Delta plan and any associated adaptive management plans to ensure that they are designed to meet clearly articulated goals and objectives and are based on comprehensive, credible and relevant science (rather than some selected subset of available science).

5. To what extent is poor or incomplete communication of science an issue in the Delta? How can and how should the communication of science be improved?

In this system, communication among scientists has been generally good: scientific results are regularly communicated in reports, journal articles, newsletters, conferences, workshops, and in multi-disciplinary workgroups such as the Estuarine Ecology Team. However, communication of science, as well as of the ecological and water management condition of the system, to non-scientist audiences, including decision-makers and the public, has been less successful. Given the long-standing resource management conflicts and controversy in this system, additional tools

to communicate science – its interpretations, conclusions, uncertainties and management recommendations – and to report water and environmental management progress (or lack thereof) need to be developed. I recommend that the Delta ISB require development and provide review of a simple but comprehensive suite of science-based ecological and water supply indicators that are regularly reported to all parties and the public. Indicators provide both information and accountability. Based on my own involvement and experience in Bay-Delta environmental and water management during the past two decades, the systematic (and repeated) failure to develop these important monitoring, evaluation and reporting tools has contributed to the current poor and declining condition of the ecosystem and our unsustainable water management approach.

6. Should separate and distinct roles be assigned to different sectors of the science community in the Delta (e.g., state agency scientists, academic scientists, NGO scientists, federal agency scientists, consulting firm scientists, water contractors, and municipal utility districts)? If so, what are these separate and distinct roles?

The community of government, academic, consulting firm, water contractor, municipal utility and NGO scientists who work in this complex system is vibrant and productive. I do not believe that scientists from different entities should be relegated to separate or distinct roles. All credible, correctly designed and implemented scientific experimentation, analysis and interpretation can add valuable information to our understanding of the system. Rigorous peer review is essential to ensure that the science meets these standards, and work that fails to meet these standards based on independent peer review needs to be identified and not used to confuse or obfuscate ongoing planning and management.

Conclusions

Development and initial implementation of the Delta Plan and the BDCP, which may be incorporated into the Delta Plan, will benefit from regular engagement and rigorous review by the Delta ISB, followed by clear and frank reporting of your review results. At least as in regards to the BDCP, I have grave concerns that the ongoing failure to incorporate either the best available science or an objective-driven plan development process will result in a proposed plan that is legally and scientifically deficient and unlikely to effectively address either the environmental or water supply reliability problems that we face in the Delta.

Thank you for your service with the Delta Stewardship Council and for sharing your expertise and experience with all of us engaged in trying to plan for the future management of the Delta that meets the needs of both the ecosystem and a reliable water supply for California. My NRDC

colleagues and I appreciate the opportunity to provide these comments to you. If you have any questions or would like to discuss any of the issues I have raised here, please do not hesitate to contact me.

Sincerely,

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