

A Review of the Use of Science and Adaptive Management in California's Draft Bay Delta Conservation Plan

California's draft Bay Delta Conservation Plan—a draft plan to conserve habitat for endangered and threatened species, while continuing to divert water to agriculture and domestic water users in central and southern California—is incomplete and contains critical scientific gaps. The Bay Delta is a large, complex ecosystem that supplies water from the state's wetter northern regions to the drier southern regions, and also serves as habitat for many species. The Bay Delta Conservation Plan describes a proposal to construct a tunnel or canal to divert water from the northern Delta to the south, thus reducing the need to convey water through the Delta. This report reviews the use of science and adaptive management in the draft Bay Delta Conservation Plan and identifies opportunities to develop a more successful plan.

Encompassing the deltas of the Sacramento and San Joaquin Rivers, and the eastern margins of the San Francisco Bay, the San Francisco Bay Delta Estuary was once a great tidal freshwater marsh. But over the last century and a half, the land has been drained, cleared, and used for agricultural and residential purposes. Today, the Delta is a maze of canals and waterways flowing around more than 60 islands of farmland and occupying an area of 1,150 square miles.

The modified Delta plays an integral role in the water delivery system of California. Water flows into the Delta from the watersheds of the Sacramento and San Joaquin rivers, and is transported through a network of engineered canals to supply water to the drier southern regions of the state. This water helps irrigate millions of acres of arid and semi-arid farmlands, and supplies municipal water to approximately 25 million Californians.

Several other forces of change, including land subsidence, sea level rise, and increased urbanization, have also shaped the Delta, making it one of the most modified deltaic



Credit: California Department of Water Resources

systems in the world—and this transformation has come at a cost. The Delta has supported a diverse array of fish, birds, other animals, and plants, but now, some of these species are listed as threatened or endangered. Restrictions on water exports to protect

those species during some periods, together with the effects of several dry years, have exacerbated tensions over water allocation, spurring the development of a variety of plans to provide reliable water supplies and protect the ecosystem.

One of those plans is the Bay Delta Conservation Plan, currently under development by a consortium of federal, state, and local agencies; water supply entities; environmental organizations; and other parties. The plan is intended to support authorization, under both state and federal endangered species statutes, for a proposed “isolated conveyance facility,” a mechanism to take water from the northern part of the Delta to the south, thus reducing the need to convey water through the Delta. At the request of the U.S. Secretaries of the Interior and Commerce, the National Research Council

The Bay Delta Conservation Plan is a Habitat Conservation Plan—a plan that developers must submit to the U.S. Fish and Wildlife Service before undertaking an activity or project that could incidentally take* species listed as threatened or endangered under the federal Endangered Species Act. These plans must outline actions that will be taken to protect the habitat of threatened or endangered species in order to compensate for incidental take. Similarly, the Bay Delta Conservation Plan is a Natural Community Conservation Plan under California’s Natural Community Conservation Planning Act. These plans aim, among other things, to help the recovery of the species.

* “Take” includes actions that “harm” wildlife, including habitat modification that actually kills or injures wildlife by impairing breeding, feeding, or sheltering behaviors. For further clarification, please see the full report.

convened a panel of experts to review the use of science and adaptive management in a working draft of the Bay Delta Conservation Plan.

The draft Bay Delta Conservation Plan is incomplete in a number of important areas. For example, at the outset of its review, the panel found that although the Bay Delta Conservation Plan aims to address management and restoration of the San Francisco Bay Delta estuary, it omits any analyses of the potential impacts of the plan’s efforts on the San Francisco Bay itself (aside from Suisun Bay). Furthermore, the report identifies other key scientific and structural gaps in the draft plan that, if addressed, could lead to a more successful and comprehensive final Bay Delta Conservation Plan.

The Lack of an Effects Analysis

The Bay Delta Conservation Plan describes an effects analysis as a systematic, scientific look at the potential impacts of a proposed project on the species that the project will potentially affect, and at how those species would benefit from various conservation actions. Clearly, such an effects analysis is intended to be the basis for the choice and details of those conservation actions. However, the effects analysis for the Bay Delta Conservation Plan is still in preparation, and was therefore absent from this draft of the plan, representing a critical gap in the science underlying the plan and the corresponding conservation actions.

The panel noted that a successful effects analysis should include an integrated description of the components of the system and how they relate to each other, a synthesis of the available science, and a representation of the dynamic response of the system.

The Lack of Clarity as to the Bay Delta Conservation Plan’s Purpose

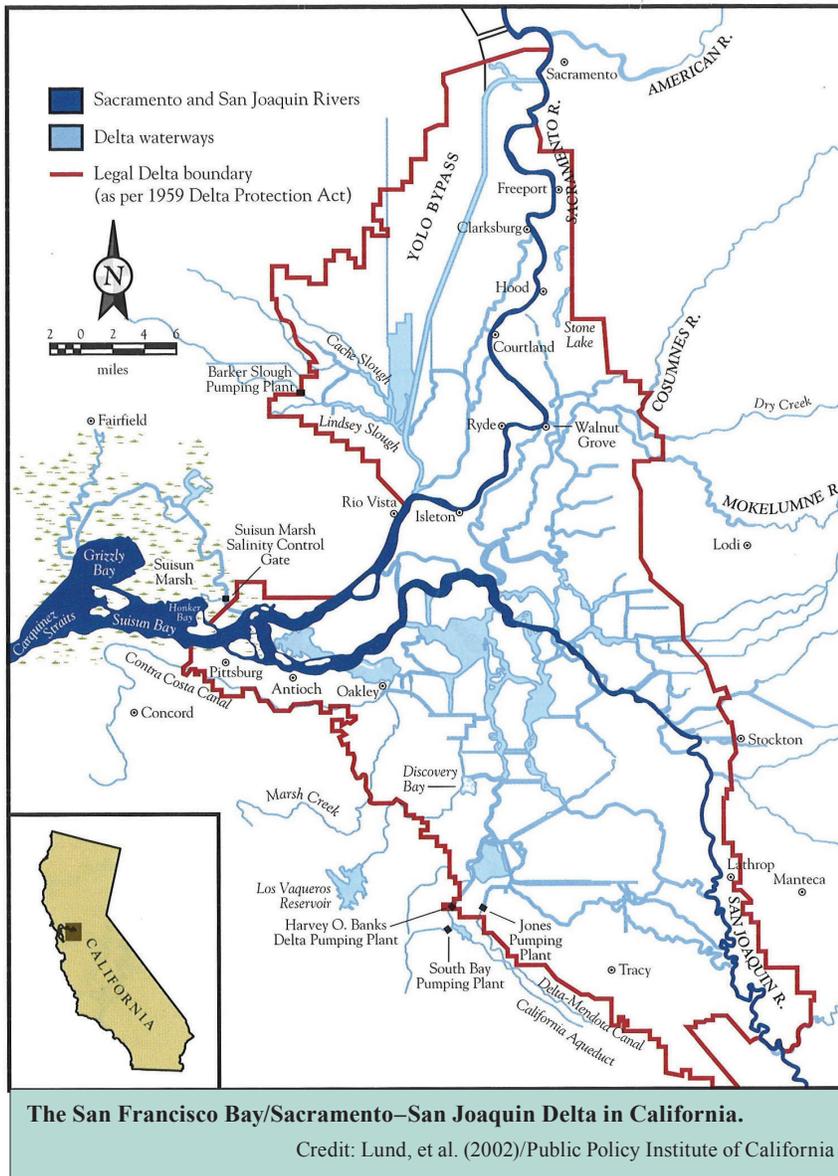
The legal framework surrounding the Bay Delta Conservation Plan is complex. In attempting to comply with all the relevant laws and regulations, the authors of the Bay Delta Conservation Plan have undertaken to develop a conservation plan of great importance, scope, and difficulty. The panel recognized these challenges, and also acknowledged that the Bay Delta Conservation Plan it reviewed is a work in progress. However, the panel found that the purpose of the Bay Delta Conservation Plan is not clear, making it difficult to properly understand, interpret, and review the science that underlies the plan.

The central issue is that although the plan states it is an application for the incidental take of listed species as a result of the proposed water diversion project, it also sets out the goals of providing a more reliable water supply for the state of California and protecting the Delta ecosystem. Because different processes would be used to fulfill these different purposes, the panel concluded that it would be difficult to evaluate the Bay Delta Conservation Plan without clarification of the plan’s goals.

To obtain an incidental take permit, developers would design conservation methods to minimize and mitigate the adverse effects of a specific project or operation. However, if the Bay Delta Conservation Plan were a broader conservation plan that aims to protect the ecosystem and provide a reliable water supply, then it would be more logical to carry out an effects analysis, and then identify several alternative projects to reach the two goals. Under the latter scenario, choosing the alternative project before evaluating alternative ways to reach a preferred outcome would be post hoc rationalization—in other words, putting the cart before the horse. Scientific reasons for not considering alternative actions are not presented in the plan.

The Use of Science and Synthesis in the Bay Delta Conservation Plan

Many scientific studies have sought to understand the hydrologic, geologic, and ecological interactions in the Delta, efforts that constitute the



focused on water operations, in particular the pumping of water at the south of the Delta for export to other regions. However, a variety of other environmental factors have potentially large effects on these fishes; and considerable uncertainties remain about the impact that different aspects of flow management in the Delta, especially management of the salinity of the water, have on their survival.

The lack of clarity concerning the volume of water to be diverted through the proposed isolated conveyance facility is another major shortcoming of the Bay Delta Conservation Plan. Without a clear specification of the volume of water deliveries, the expected impacts to the ecosystem cannot be assessed. Overall, the panel concluded that the Bay Delta Conservation Plan is little more than a list of ecosystem restoration tactics and scientific efforts, with no coordinated strategy for reaching the goals of the plan.

Adaptive Management

Numerous attempts have been made to develop and implement adaptive management strategies in environmental management, but many of them have failed for reasons

scientific foundation of the Bay Delta Conservation Plan. However, it is not clear how the authors of the Bay Delta Conservation Plan synthesized this material and incorporated it into the decision-making process that led to the plan's conservation actions. For example, it is not clear whether the analyses carried out by the numerous other Delta conservation plans and scientific assessments were used in the draft Bay Delta Conservation Plan.

Quantitative evaluation of the environmental stressors that impact species of interest, ideally using life-cycle models, would strengthen the Bay Delta Conservation Plan. For example, much of the analysis of the decline of smelt and salmonids in the Delta has

such as a lack of resources, the high cost of implementation, or the inherent variability of natural ecosystems. Despite these challenges, there often is no better option for implementing environmental management regimes, and therefore the panel

Adaptive management is a formal, systematic, and rigorous program of learning from the outcomes of management actions and using this information to inform the next steps of the plan. Predicting the outcomes of management alternatives in natural systems is difficult, due to the many uncertainties involved. Adaptive management, at least in theory, can provide resource managers with iterative strategies to deal with uncertainties and use science, with a heavy emphasis on monitoring, for planning, implementation, and assessment of restoration efforts.

concluded that the use of adaptive management is appropriate for the Bay Delta Conservation Plan, although adaptive management applied to a large-scale problem such as the California Bay Delta will not be easy, quick, or inexpensive. These considerations further emphasize the need for clear goals.

Adaptive management programs cannot be fully described in advance, because the program must evolve as it is implemented. However, some aspects of the program could be laid out more clearly than they were in the draft Bay Delta Conservation Plan, the panel found. The plan developers would benefit from experience with adaptive management efforts in other large-scale ecosystem restoration projects, such as the Comprehensive Everglades Restoration Program.

Management Fragmentation and a Lack of Coherence

The management of any science-based process has a profound impact on the use of science and adaptive management in that process. The absence of scientific synthesis in the draft Bay Delta Conservation Plan draws attention to the fragmented system of management under which the plan was prepared, lacking coordination and

accountability. No single public agency, stakeholder group, or individual was made accountable for the coherence, thoroughness, and scientific integrity of the final product. Rather, the Bay Delta Conservation Plan reflects the differing perspectives of the federal, state, and local agencies, and the many stakeholder groups involved. Unless the management structure is made more coherent and unified, the final product may continue to suffer from a lack of integration, in an attempt to satisfy all discrete interests and, as a result, fail to achieve its goals. Development and implementation of large restoration and conservation programs such as the Bay Delta Conservation Plan often require a complex structure to incorporate technical, political, and legal realities and the evolving dynamics of both the physical and organizational environments. The panel suggests the agencies responsible for implementing the plan review other examples of large scale restoration programs that have been developed and implemented. In conclusion, the panel underscores the importance of a credible and a robust Bay Delta Conservation Plan in addressing the various water management problems that beset the Delta.

Read or purchase this report and locate information on related reports at
<http://dels.nas.edu/wstb>

Panel to Review California's Draft Bay Delta Conservation Plan: **Henry J. Vaux, Jr.** (*Chair*), Professor Emeritus, University of California; **Michael E. Campana**, Oregon State University; **Jerome B. Gilbert**, Private consultant, Orinda, CA; **Albert E. Giorgi**, BioAnalysts, Inc., Redmond, WA; **Robert J. Huggett**, Professor Emeritus, College of William and Mary, Seaford, VA; **Christine A. Klein**, University of Florida College of Law, Gainesville; **Samuel N. Luoma**, U.S. Geological Survey, Emeritus, Menlo Park, CA; **Thomas Miller**, University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons; **Stephen G. Monismith**, Stanford University; **Jayantha Obeysekera**, South Florida Water Management District, West Palm Beach; **Hans W. Paerl**, University of North Carolina, Chapel Hill; **Max J. Pfeffer**, Cornell University; **Desiree D. Tullos**, Oregon State University; **Laura J. Helsabeck** (Study Director), **David Policansky** (Scholar), **Stephen D. Parker** (Water Science and Technology Board Director), **Susan Roberts** (Ocean Studies Board Director), **Ellen de Guzman** (Research Associate), **Sarah Brennan** (Senior Program Assistant), **National Research Council**.

The National Academies appointed the above committee of experts to address the specific task requested by the U.S. Department of the Interior. The members volunteered their time for this activity; their report is peer-reviewed and the final product signed off by both the committee members and the National Academies. This report brief was prepared by the National Research Council based on the committee's report.



For more information, contact the Water Science and Technology Board at (202) 334-3422 or visit <http://dels.nas.edu/wstb>. Copies of *A Review of the Use of Science and Adaptive Management in California's Draft Bay Delta Conservation Plan* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.

*Permission granted to reproduce this brief in its entirety with no additions or alterations.
Permission for images/figures must be obtained from their original source.*