



Science News

News from the CALFED Science Program



After a dry autumn, snows return to the high country adding to the snow pack, water storage, and eventual runoff into the Delta.

Seven New Ways to Understand the Delta

State of Bay-Delta Science 2008 Report Explains How

As a result of nearly a decade of intense CALFED Science-supported study of California's Delta, our knowledge and understanding of how the Delta functions is vastly improved. The newly released CALFED Science Program's *State of Bay-Delta Science 2008: Summary for Policymakers and the Public* highlights the most important changes in how scientists understand the Delta — along with the policy implications of that understanding. The report, the preview chapter to the larger report scheduled for release in spring, defines seven new perspectives on how we should view and understand the Delta.

Seven New Perspectives

One: The Delta is a continually changing ecosystem. Uncontrolled drivers of change (population growth, changing climate, land subsidence, seismicity) mean that the Delta of the future will be very different from the Delta of today.

Two: Because the Delta is continually changing, we cannot predict all the important consequences of management solutions.

See Summary next page

Levees' Impacts on the Delta Ecosystem

Contrary to popular belief, Delta levees do not always help to sustain a healthy Delta ecosystem. Rather, levee construction probably caused many of the current ecological problems in the Delta by cutting off the critical exchanges of materials between land and water. This is an important assertion in a November 26, 2007, memorandum on Delta levees sent to the Delta Vision Blue Ribbon Task Force by science advisors Dr. Michael Healey (CALFED Lead Scientist) and Dr. Jeffrey Mount (Independent Science Board Chair).

However, the memorandum also makes the point that the Delta levee system is critical for many present-day uses of the Delta. Levees can offer beneficial uses for conservation purposes as well, when designed with that specific intent in mind. The following is a summary of the important points made in the memorandum.

See Levees page 3

Science News
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Also In this Issue

- Task Force Releases Final Delta Vision Report: Robust Science is Critical for the Delta's Future (page 2)
- Smelt Migration and Spawning Habits: Workshop Helps Unravel the Mystery (page 4)
- Upcoming Science Program Events (page 4)

CALFED Science Program

Establishing a Body of Knowledge

The CALFED Science Program's mission is to integrate peer-reviewed science into every aspect of the CALFED Bay-Delta Program. The Science Program is establishing the best scientific information possible to guide decisions and evaluate actions critical to the CALFED Program's success.

The long-term goal of the Science Program is to establish an unbiased, relevant and authoritative body of knowledge integrated across program objectives and communicated to the scientific community, agency managers, stakeholders and the public.

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Summary: *Continued from front page*

The best solutions will be robust but provisional, and will need to be responsive and adaptive to future changes.

Three: It is neither possible nor desirable to freeze the structure of the Delta in its present, or any other form. Strengthening levees is only one element of a sustainable solution and is not applicable everywhere.

Four: The problems of water and environmental management are interlinked. Piecemeal solutions will not work. Science, knowledge, and management methods all need to be strongly integrated.

Five: The capacity of the Sacramento-San Joaquin water system to deliver human, economic, and environmental services is likely at its limit. To fulfill more of one water-using service we must accept less of another.

Six: Good science provides a reliable knowledge base for decision-making, but for complex environmental problems, even as we learn from science, new areas of uncertainty arise.

Seven: Accelerated climate change means that species conservation is becoming more than a local habitat problem. Conservation approaches need to include a broad range of choices other than habitat protection.

The Way Forward

If these new scientific perspectives highlight the growth in scientific understanding of the Delta and of ecosystem management, where does the science program go from here? The *State of Bay-Delta Science 2008* pre-release chapter offers specific strategies on how to improve the CALFED Science Program to most effectively support its mission.

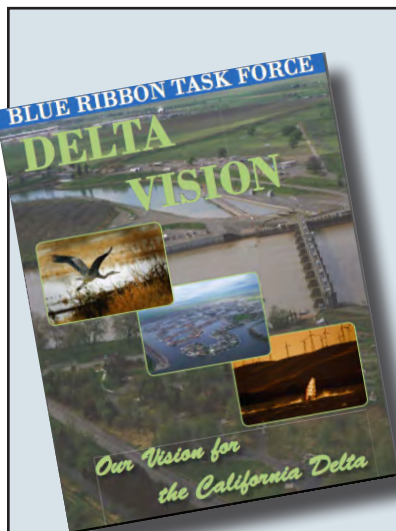
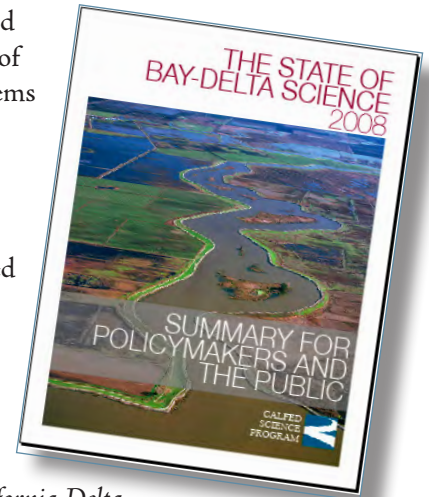
Generally, science provides three important elements to the debate about resource management problems: (1) objective infor-

mation about the system and how it behaves; (2) models of physical and biological systems that illustrate how different policies might affect the problems; and (3) a shared, formalized language and a forum that permits informed debate. The way forward for CALFED Science is to strengthen its capacity to make these contributions.

The landmark *Delta Vision: Our Vision for the California Delta* (see below) reiterates that CALFED-supported science has helped clarify the extent and seriousness of problems in California’s Delta. It also points out the importance of science in managing the Delta in the future.

CALFED and the CALFED Science Program were created in recognition of a need for stronger coordination, integration, and communication to address problems of water supply, water quality, levee integrity, and ecosystem performance. CALFED science has had considerable success facilitating these processes within the scientific community, and has also stimulated new science to address important gaps in knowledge. These science-based activities will be even more important in the future.

The preview chapter of the *State of Bay-Delta Science 2008: Summary for Policymakers and the Public* (pdf) can be downloaded from the CALFED Science Program website at: <http://www.science.calwater.ca.gov/>. The full report, the first of a regularly updated series, will be available in spring 2008.



Task Force Releases Final Delta Vision Report
Robust Science is Critical for the Delta’s Future

“The Delta is in crisis,” states the Delta Vision Blue Ribbon Task Force in its final version of the *Delta Vision: Our Vision for California’s Delta*, and “the time for action is now.” The report, which was issued on December 17, 2007, defines actions for supporting a sustainable Delta with co-equal goals on the environment and water supply reliability. The report calls for 12 integrated and linked recommendations that “make common sense but are bold.”

Science plays an important role in this vision. In one of its 12 recommendations, the Task Force calls for a new governance system to implement the vision that “must be

See **Vision** page 5

Levees: *Continued from front page*

The Delta Before Levees

California's Delta is a floodplain estuary and, at one time, was one of the planet's most productive ecosystems. The exceptional productivity of the Delta came from the intimate interplay of river, ocean, and land.

In the natural Delta ecosystem, water flowed in and out of deeper channels onto adjacent low-lying marshes and floodplains. When water flowed into the floodplain (at high tide or during larger floods), small fish and other organisms rushed out of the channels to feed on the organic materials. When the water receded, the fish retreated back into the channels. The receding water carried nutrients, sediment, and organic materials with it.

What Levees Have Done to the Ecosystem

Construction of the Delta levees transformed over 90 percent of the original riparian and marsh habitat into a mosaic of farms



The short-term social and economic consequences of a massive levee failure and flooded islands would be serious.

surrounded by tidal channels. The levees now block the complex interchange between land and water that supported the rich biological productivity in the Bay-Delta estuary.

Important historic land-based food and energy sources are no longer available to the estuary. Most Delta species – those that live in open water, marsh, and uplands — have been impacted

by this dramatic transformation of the Bay-Delta ecosystem through levee construction.

Some scientists argue that the configuration of the channels and levees in the Delta creates hydrology that homogenizes the Delta's water characteristics — in terms of flow rate, flow paths, temperature, turbidity, and other factors. A more uniform hydrologic environment may have helped the establishment of dense non-native species such as the Asian and overbite clam, among other effects.

Beneficial Uses for People

Levees are useful in preventing flooding of adjacent lands and protecting navigation. We clearly cannot abandon the use of all Delta levees — even if there are ecological benefits in doing so.

However, there is significant risk in the Delta of levee failure from a catastrophic event, such as a large flood or earthquake. Especially vulnerable are islands that were created by building levees around their perimeters. The land within many of these islands is now deeply subsided — with land elevations many feet below sea level. When a levee fails, the island will flood.

The short-term social and economic consequences of a massive levee failure and flooding of the islands would be serious. Measures should be taken to avoid catastrophic levee failure. At the same time, resource managers and private interests need to evaluate ways to make both land and water use sustainable into the future.

Levees and Ecosystem Restoration

Considering the future seismic and flooding risks, it can be reasonably assumed that a significant portion of the deeply subsided western and central Delta will eventually flood. An unplanned flood in these areas will not restore the Delta ecosystem to a wetlands habitat; instead, because the leveed islands are so deeply subsided, the island would transition to open water habitat. The long-term ecological consequences of adding open water habitat are not obvious and would depend upon a number of complex and inter-related factors. At this point, it's not possible to predict whether the long-term ecological consequences would be positive or negative.

As part of the future dialogue about sustainable land use and ecosystem restoration in the Delta, serious consideration should be given to removing or altering specific levees to allow restoration of seasonal and tidal wetlands. Suisun Marsh — the largest contiguous brackish-water marsh remaining on the west coast of North America — is invaluable ecological habitat. Even so, the ecological coupling between open water and marsh is not strong because the marshes are managed for waterfowl, not necessarily for pelagic species.

A more variable hydrology within the Delta, in which flow characteristics vary in space and time, might create combinations that are more favorable to native species, thereby assisting in their recovery. Re-establishing more variable flows may be more important for conserving pelagic species such as Delta smelt and striped bass than constructing marshes or opening floodplains. Levees could be used as barriers or deflectors to complicate the flow patterns and increase hydraulic heterogeneity.

There are many uncertainties about ecosystem restoration — including potential levee reconfiguration — that need to be acknowledged. Through funding research projects, the CALFED Science Program is informing attempts to re-establish some of the complex historic connection between land and water, and improving the capacity of the Bay-Delta estuary to sustain its native species. The memo (pdf) is available on the Science Program website: <http://www.science.calwater.ca.gov/>.

Smelt Migration and Spawning Habits Workshop Helps Unravel the Mystery

Delta and longfin smelt probably spawn in shallow water. They probably spawn most often on sand or gravel substrates. They are also secretive spawners, making overnight forays into spawning microhabitats and leaving them before dawn.

But how do Delta smelt and longfin smelt make decisions about where to spawn or how to find their way to suitable spawning microhabitats? The short answer is that scientists don't know the answer to this question.

These are the main conclusions from *Unraveling the Mystery: Where do Delta Smelt and Longfin Smelt Spawn and How Do They Get There?* a workshop co-hosted by the CALFED Science Program and the US Fish and Wildlife Service on November 15, 2007.

Scientists actually know very few specific details about the migration and spawning behavior of the Delta smelt (*Hypomesus transpacificus*), a species listed as threatened under the state and federal Endangered Species Acts (ESA), and the longfin smelt (*Spirinchus thaleichthys*), another San Francisco Estuary species that has recently been petitioned for listing under the ESA.

The workshop was convened to provide a forum for exchanging information and developing a road map for further study. The workshop was prompted, in part, by comments made in January 2007 by the Environmental Water Account Technical Review Panel. In their Review of the 2006 Environmental Water Account report, the review panel stated, "one major data gap does exist...: we have no data pertaining to what spawning substrate Delta smelt are using, and whether or not this substrate is limiting."



The imperiled Delta smelt

The morning session included presentations by three scientists who have studied smelt migration or spawning biology: Lenny Grimaldo (California Department of Water Resources); Dr. Paulinus Chigbu (University of Maryland Eastern Shore); and Dr. Doug Hay (Pacific Biological Station Nanaimo). Additionally, Dr. Nat Scholz (National Marine Fisheries Service) gave a presentation about how urban contaminants affect migratory behavior of salmonid fishes.

Some additional insights into the mysteries of smelt were revealed during the presentations and afternoon panel discussions. For instance, Delta smelt are strongly associated with turbid water. Longfin smelt often occupy deep habitats that are likewise dark. The association of these two fish with "the dark" suggests that visual cues are less important than olfactory cues for finding spawning habitats, that maturing smelts "smell" tributary flow signals. Toxins in storm-water runoff can interfere with fishes' ability to smell.

The workshop concluded with a formidable list of research questions that, when answered, will help determine how to mitigate human impacts on spawners. A summary report of the workshop findings is currently being prepared, including the possibilities and pitfalls associated with studying smelt spawning biology in the San Francisco Estuary. The report will be posted on the CALFED Science Program website: <http://www.science.calwater.ca.gov> in early 2008.

Upcoming Science Program Events

Independent Science Board Public Meeting

January 31-February 1, 2008

CALFED, 650 Capitol Mall, 5th floor, Sacramento, CA.
For more information, visit: <http://www.science.calwater.ca.gov/>.

Upcoming Events of Interest

Delta Vision Blue Ribbon Task Force

January 31-February 1, 2008

Holiday Inn, 300 J Street, Sacramento, CA.
For more information, visit: www.deltavision.ca.gov

Delta Vision Committee

February 5, 2008

Resources Building, 1416 Ninth Street, Room 1305, Sacramento, CA.
For more information, visit: www.deltavision.ca.gov

Long Range Planning and Water Policy in California Conference

February 11, 2008

Ontario Convention Center, Ontario, CA.
For more information, visit: www.agwt.org

Interagency Ecological Program 2008 Annual Workshop

February 27-29, 2008

Asilomar Conference Grounds, Pacific Grove, CA
For more information, visit: www.iep.ca.gov/AES/Asilomar_2008.htm.

Salmonid Restoration Federation Conference

March 5-8, 2008

Hutchins Street Square, 125 South Hutchins Street, Lodi, CA
For more information, visit: www.calsalmon.org

Vision: *Continued from page 2*

supported by robust programs of science focused on improving understanding of the Delta and of the effects of policies and programs.”

The Task Force goes on to say that proper decision-making will only be possible when strong science structures and processes are in place. “Robust science and public understanding will be critical to support effective policymaking and operational management required for adaptation,” the Task Force states in the report.

No Single Fix

The Task Force, appointed by Governor Arnold Schwarzenegger in 2006, declared that there is no single fix for helping California’s complex Delta out of its troubles. The conflict between environmental threats and water shortages does not allow simple solutions.

Rather, the Task Force calls for further studies on how to help the fragile Delta stating that it was “applied science, particularly science supported by the CALFED Bay-Delta Program, that provided the foundation of understanding that identified the need for a new vision.” Identified studies include an assessment for using a “dual conveyance” option. Such a conveyance system could allow water to flow around the Delta and through the Delta in an attempt to obtain the best attributes of both mechanisms.

12 Recommendations

Twelve integrated and linked recommendations are at the heart of the Delta Vision:

1. The Delta ecosystem and a reliable water supply for California are the primary, co-equal goals for sustainable management of the Delta.
2. The California Delta is a unique and valued area, warranting recognition and special legal status from the State of California.
3. The Delta ecosystem must function as an integral part of a healthy estuary.
4. California’s water supply is limited and must be managed with significantly higher efficiency to be adequate for its future population, growing economy, and vital environment.
5. The foundation for policymaking about California water resources must be the long-standing constitutional principles of “reasonable use” and “public trust”; these principles are particularly important and applicable to the Delta.
6. The goals of conservation, efficiency, and sustainable use must drive California water policies.
7. A revitalized Delta ecosystem will require reduced diversions — or changes in patterns and timing of those diversions upstream, within the Delta, and exported from the Delta — at critical times.
8. New facilities for conveyance and storage, and better linkage between the two, are needed to better manage California’s water resources for both the estuary and exports.
9. Major investments in the California Delta and the statewide water management system must integrate and be consistent with specific policies in this vision. In particular, these strategic investments must strengthen selected levees, improve floodplain management, and improve water circulation and quality.
10. The current boundaries and governance system of the Delta must be changed. It is essential to have an independent body with authority to achieve the co-equal goals of ecosystem revitalization and adequate water supply for California—while also recognizing the importance of the Delta as a unique and valued area. This body must have secure funding and the ability to approve spending, planning, and water export levels.
11. Discouraging inappropriate urbanization of the Delta is critical both to preserve the Delta’s unique character and to ensure adequate public safety.
12. Institutions and policies for the Delta should be designed for resiliency and adaptation.

Delta Vision: Our Vision for California’s Delta is available online at www.deltavision.ca.gov. The Task Force will next begin to develop their strategic plan, which will contain specific steps for achieving their vision. The strategic plan is due to the governor in October, 2008.



Do you have a science question about the Delta you would like answered?

To have your question considered for *Science News*, email the editor, Robert Ullrey at rullrey@calwater.ca.gov. You must include: your full name, postal address, and daytime phone number. If your question is selected, you will receive a token memento from the CALFED Science Program.