

“The Delta is the most subsided landscape in the world relative to its total size. Once we put homes in the Delta, all bets are off: public safety trumps everything.”

— Jeff Mount, UC Davis

“All of our restoration efforts will be futile if we are unable to stem the tide of urbanization in the Delta. Restoration can wait—but the time for acquisition is now.”

— John Cain
Natural Heritage Institute

“Funding for restoration and environmental programs will increasingly become a challenge as bond monies dry up.”

— Ellen Hanak
Public Policy Institute
of California



Big Picture; Warning Bells

California 2025: the Estuary in the Big Picture

HANAK, ELLEN
PUBLIC POLICY INSTITUTE
OF CALIFORNIA

In the near future, money for restoring the Estuary—and for environmental programs in general—will be harder to find, as existing bond money runs out. *California 2025: Taking on the Future*, a study published by our institute in June 2005, provides context for thinking about the funding challenges and strategies in support of the San Francisco Estuary. The study considers whether the state is facing a growth and infrastructure crisis and how to best think about planning for the future. It looks at population and

economic growth; patterns of infrastructure financing; current estimates of infrastructure needs; governance and institutional challenges for planning; issues of equity; and the public's perceptions of the future; preferences regarding schools, water, and transportation; and willingness to pay higher taxes or fees to fund those preferences.

Findings relevant to the Estuary concern the overall picture for public investment and the specific picture for water resources. Overall, California's levels of public investments are largely on par with those elsewhere in the nation. In recent years, however, the state's contribution to this spending has been predominantly funded through general obligation bonds. High projected debt ratios suggest that alternative sources may be needed over the years ahead.

In the area of water supply and quality, the study finds that the state's numerous water and wastewater utilities are largely on track to fund anticipated capital needs. Moreover, utilities have a straightforward way to raise revenues through user fees, which are still low relative to median income. Although the state's population continues to grow, demand management and water markets can lessen demand for new water, and there are many options available for generating new supplies. The thorniest challenges relate to environmental programs, including the restoration of the San Francisco Estuary and non-point source pollution programs. To date, restoration and non-point source programs have largely been funded with state bonds. As existing bond monies dry up, the question of appropriate contributions from water users will become increasingly important. Despite funding challenges, a survey we conducted in 2003 showed that 65 percent of Californians—compared to

45 percent of U.S. residents—strongly support protecting the environment, even if it curbs economic growth. That same survey showed that water quality issues are a big concern of more than half of the Californians surveyed.

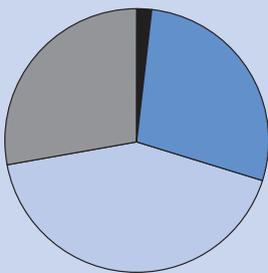
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TAKE HOME POINTS

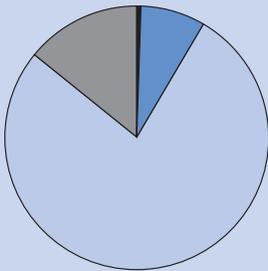
- Funding for restoration and environmental programs will increasingly become a challenge as bond monies dry up.
- Despite funding challenges, a majority of Californians surveyed support environmental protection and are concerned about water quality.
- Californians strongly support protecting wetlands, improving water quality, restricting private development of coastal land, creating more marine reserves, and selling environmentally safe fish or seafood.
- Although the state's population continues to grow, demand management and water markets can lessen water demand growth.

STATE RELIES INCREASINGLY ON BONDS TO PAY FOR PUBLIC INVESTMENTS

1965-66: \$307/capita



2002-03: \$299/capita



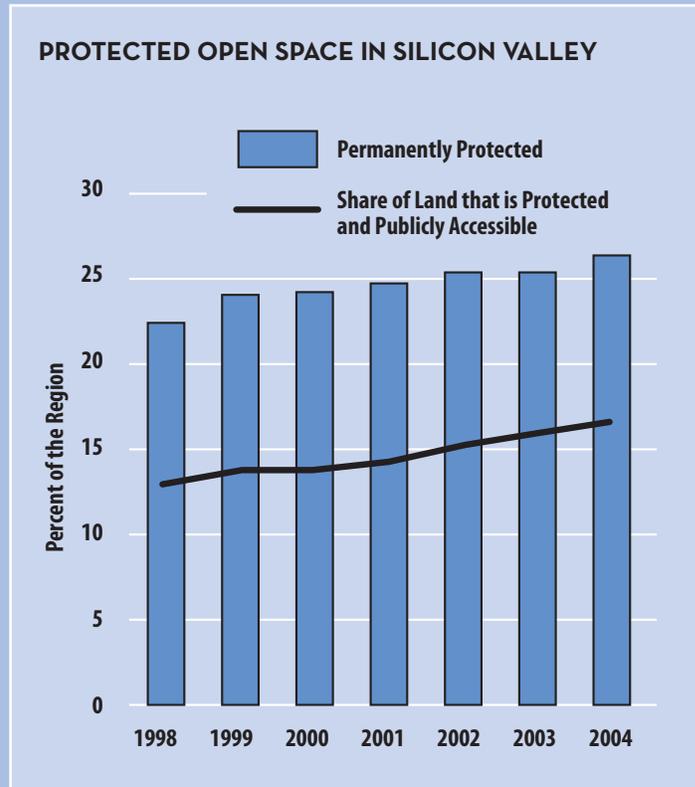
■ General Fund
■ Special Funds
■ Bonds
■ Federal Funds

Changing Bay Area Economics and the Estuary

RUSSELL HANCOCK
JOINT VENTURE:
SILICON VALLEY NETWORK

It is important for people who care about the environment to care about the economy too. The Estuary Conference focuses on a number of environmental performance indicators for San Francisco Bay. However, these indicators—as well as our ability to influence them—are shaped in important ways by some larger considerations, including the region's job growth, economic performance, and the ability of our public bodies to balance economic and environmental stewardship.

The Silicon Valley has a huge influence on the Bay Area economy. At the height of its boom, the “dot com” industry created 350,000 jobs. Since then, we have lost 220,000 jobs—the Internet bubble wasn't real or sustainable, with its never-ending spiral of prosperity. Yet Internet-based



commerce was a real revolution, and important companies came out of it—Google, Yahoo, EBay, to name a few, and we tend to forget the net gain of 130,000 jobs. A newly emerging paradigm for the region in a globalizing economy is that of small start-up companies—those with seven people or less. There are 7,000 of them in the Silicon Valley. But while Valley productivity is 2.5 times the national average, that is not translating into job growth or payroll increases, in large part due to intense competition from India and Asia where we are outsourcing many of our jobs, including white collar jobs. Yet our new, scaled-back economy is more viable from a sustainability standpoint, and the Valley will compete with its high-end work force. The Silicon Valley is committed to sustainability issues such as open space and quality of living. If we are serious about competing with

other regions of the country, the best way for us to do that is to provide a fabulous place to live, and that means continuing to steward the Bay.

That commitment can be seen in the increase in the amount of open space that has been protected since 1998 — from 22 to 26 percent of the region.

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TAKE HOME POINTS

- The new economy in the Silicon Valley is better from a sustainability standpoint. We are no longer talking about growth management strategies.
- Silicon Valley businesses and community leaders show a high commitment to environmental stewardship.
- A high-end workforce is often characterized by heightened environmental sensibilities.
- Environmental stewardship is our best competitive strategy.

Can Serial Engineering of the Delta be Stopped?

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The Sacramento-San Joaquin Delta has become one of the most highly-engineered estuaries of the Americas. For the past 150 years, interventionist approaches have dominated the extraction of ecosystem services from the Delta and its tributary watersheds. The over-dependence on structural and technological “fixes” to enhance ecosystem services has locked management into a cycle of serial engineering. Every engineered intervention appears plagued by the law of unintended consequences, creating an ever-escalating demand for more engineering fixes. With CALFED at a political and economic crossroad, it is reasonable to question whether this approach is sustainable.

The Delta is the regional archetype for serial engineering. The reclamation of more than 500,000 acres of tidal marsh involved the engineering of 1,100 miles of levees, 1,800 water diversions, and 250 agricultural drain returns. The serial engineering challenges associated with this effort are well known, including managing the most subsidized landscape in the world at the juncture of two large, flood-prone river systems. The second great ecosystem service engineered in the Delta—the CVP and SWP water supply pumps—created a cascade of serial engineering projects throughout the watershed. Use of the Delta for shipping, flood control, disposal of urban and agricultural runoff, and as a thermal dump for power plants has spawned demand for multiple fixes, both within and outside of the Delta. Even recreation—including

fishing, hunting and messing around in boats—has its own unique suite of engineering efforts and unintended consequences.

Rather than waning due to its lack of success, the interventionist culture of Delta management is only growing, with new, more elaborate, and more expensive proposals. This engineering approach is predicated on the assumption that conditions will remain the same. That is, historic imperfections in ecosystem services can be engineered out of the system in the future. Yet landscape change, including fundamental shifts in hydrologic conditions, subsidence, changes in land use activ-

ity, and successive waves of non-native invaders, makes the Delta a rapidly moving target, with prospects for even more dynamic conditions in the future. Institutional viscosity, limited resources, and relying on the past as a predictor of the future limits our ability to keep up with the pace of change. The grand plans of today will be obsolete within a generation or two, demanding new, more fantastic engineering fixes. Breaking out of the cycle of serial engineering may involve making politically unpalatable decisions about which ecosystem services can be provided by the Delta and which will have to be curtailed.

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TAKE HOME POINTS

- The Delta is the most subsidized landscape in the world relative to its total size.
- Once we put homes in the Delta, all bets are off: public safety trumps everything.
- We have enough science to estimate the probable state of the Delta for the next 50 years—to predict critically dry years and how to save fish.
- The Delta is warming up. It will be a vastly changed place over the next 100 years; we will see changes within the next 15-20 years.
- Working hard on today isn't going to change things for tomorrow.
- We could also see punctuated change versus gradual change, meaning that change could take place abruptly. Gradual change is a certainty. Punctuated change is likely.
- We will have a physical collapse of the Delta.
- The Delta was designed based on hydrology 20 years old, with no consideration of the future.
- South Delta improvements and barriers will adapt poorly to changes in the Delta.
- Serial engineering of ecosystem services is not working and won't work in the future.
- Some of the Delta's ecosystem services cannot be sustained over the long term.
- A peripheral canal will create its own cascade of ecosystem effects.

A Delta Perspective on the Delta Improvement Package

TOM ZUCKERMAN
CENTRAL DELTA WATER AGENCY

The Delta Improvement Package, or “DIP,” is a CALFED proposal based upon an integrated regional management plan that grew out of the stakeholder negotiations that formed the basis of HR 2828, the federal reauthorization bill for CALFED. Environmental interests were notably absent in the negotiations, and the whole process preceded recognition of the precipitous decline of the pelagic fishery in the Bay-Delta system.

Nevertheless, the DIP recognizes and includes topics that must be addressed to improve water supply and quality issues in the Delta and in the Lower San Joaquin River. Those issues, which have resulted largely from water export operations, include:

- Water quality at sensitive diversion points in the Delta
- Water supply and channel level sufficiency at sensitive diversion points in the Delta

- Upstream water quality and flow in the San Joaquin River below the mouth of the Merced River
- Drainage regulation from farmlands and wildlife refuges in the San Joaquin Valley
- Levee protection in the Delta

Correction of these existing problems, and avoidance of any aggravation, are conditions of any increase in allowable export levels. Similar protections for fish and wildlife resources must be developed through the NEPA-CEQA process applicable to the DIP, recognizing that much of the burden of addressing these issues falls upon the exporters as mitigation for problems created or aggravated by the exports.

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Photo courtesy of USGS

TAKE HOME POINTS

- The problems in the Delta aren't going to change that much. The issue is how to get the federal and state governments to focus on them.
- We need to avoid making poor decisions such as putting people behind levees in tract homes.
- We have an opportunity to preserve the standard of living and way of life in the Delta, but we need to give the Delta priority. It is an environmental and recreational treasure.
- We cannot go on thinking of the Delta as an inexhaustible water supply for southern California.
- We need to figure out how to maintain Delta water quality, keep enough water in its channels, and how to restore the lower San Joaquin River, where water quality is critical for the river and for its users and exporters.
- The emphasis always seems to be on exports. We need to focus instead of restoring pelagic fish, salmon, and striped bass to the Delta.
- Solutions need to be Delta-centric.

Challenges Facing the San Joaquin Valley

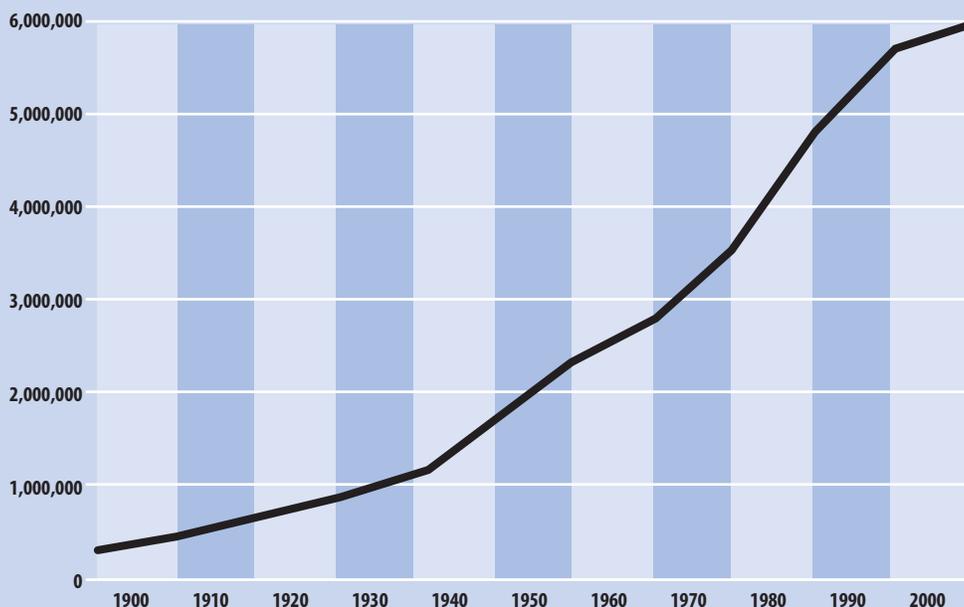
CAROL WHITESIDE
GREAT VALLEY CENTER

The San Joaquin River runs through a valley 450 miles long and 50 miles wide—an area the size of the state of Kentucky—and it is a region that is rapidly changing, with implications for the entire state and the Bay-Delta Estuary. Within the last 150 years, the valley has been transformed from a place characterized by seasonal wetlands, deep tules, and roaming grizzly bears into one of the richest agricultural areas in the world. Now changes are flowing again, this time from different sources. Waves of new residents—immigrants from faraway places and migrants from the coastal parts of California—plus a high birth rate in the valley are swelling the population at a growth rate that exceeds that of Mexico. People come to the valley to seek affordable housing and new opportunities, prompted in part by high housing costs in coastal areas. The impacts of the valley's

TAKE HOME POINTS

- Habitat Conservation Plans have met with very mixed results in the valley. There is a belief that if people just wait long enough, the Endangered Species Act will go away.
- The focus of the region is on jobs and economic development. The environment is not seen as a Republican issue.
- Public concern about the “environment” is limited to issues with immediate impacts on people, such as air quality and asthma and water quality and taste.
- We need to frame environmental and resource/watershed conservation in terms of their economic payback.
- We have a chance to develop a strategic long-term view of the valley—we urge Bay-Delta Estuary folks to help us. Otherwise, the future of the valley environment looks very shaky.
- Why are farmers and environmentalists not partners? Some farmers fear costly environmental regulations that make them feel vulnerable, plus it is hard to turn down \$1 million an acre from developers.
- We need to put some certainty back into farming and create buffers between farmland and urban areas.

CENTRAL VALLEY POPULATION GROWTH



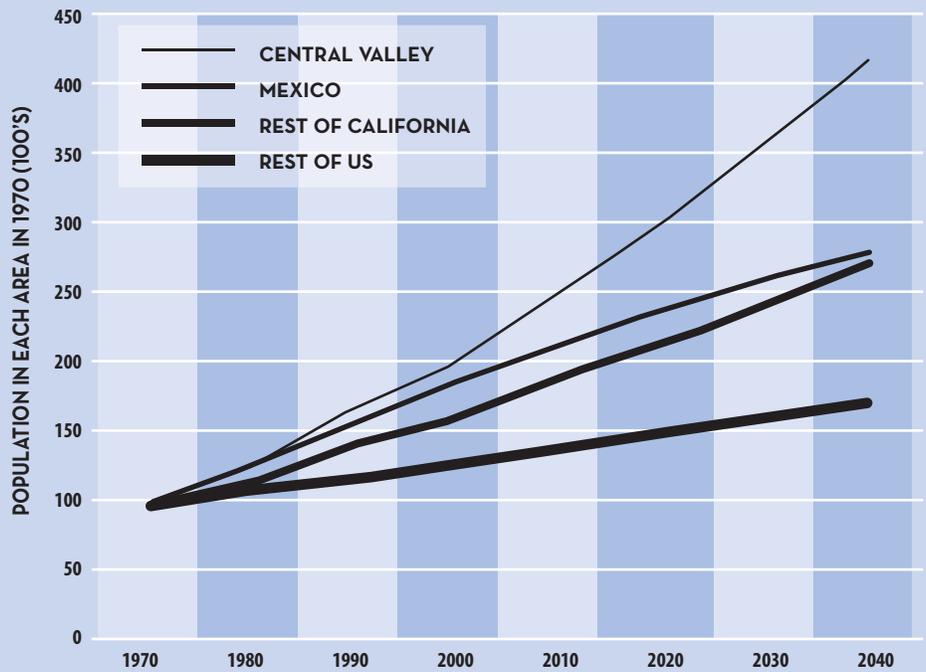
growth are evident in traffic delays—up 52 percent in the north San Joaquin Valley and 577 percent in the southern San Joaquin Valley since 1998.

Some people have created a false dichotomy between protecting the environment and economic well being. The short-term response most often opts for the economy over the environment. The environmental health of the entire San Joaquin Valley will depend in part on local politics as

well as on the engagement and attention of the rest of the state. People who live in the region see resources in abundance and don't understand the value of those resources to the world. Those who are often in the best position to protect and conserve resources are often resentful of having to make economic sacrifices for others, whose economic well being is already secure and is not limited by the environment. Finding fair and balanced ways to meet all the legitimate needs of this growing and changing region is not impossible, but it will be darn hard.

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CENTRAL VALLEY'S PROJECTED GROWTH RATE



CENTRAL VALLEY STATS

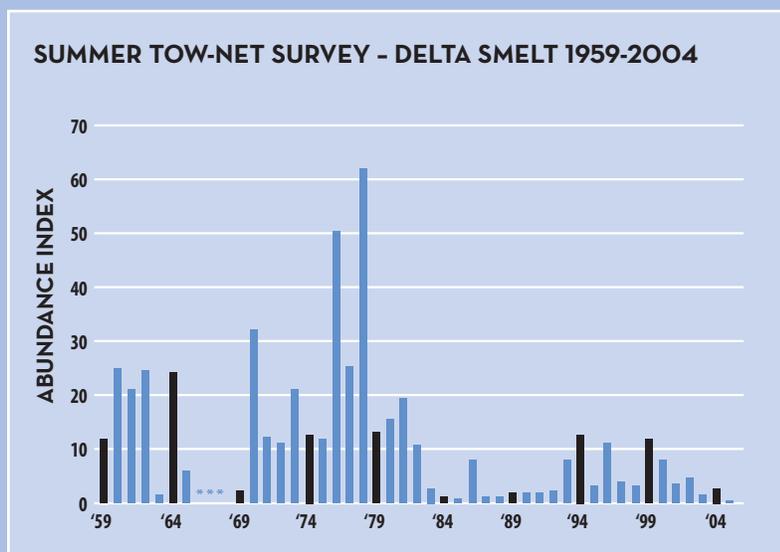
- The valley produces more than 300 crops, 57 percent of the state's \$30 billion agricultural output. If the valley were a state, it would rank first in agricultural production in the nation.
- Twenty percent of valley jobs depend directly or indirectly on agriculture.
- The valley's population has doubled every 30 years since 1900 and now stands at 6.3 million. Its projected growth rate outpaces Mexico, California overall, and the U.S.
- By 2020, more people will live in the Central Valley than the San Francisco Bay Area.
- By 2040, there will be the equivalent of 10 new Fresno's.
- By 2050, the population will be up by 131 percent.
- Despite the rapid growth rate, regional per capita income relative to the state has dropped: the San Joaquin Valley has the highest percent of children under 18 living in poverty: 26 percent, compared to 20 percent U.S. and 17 percent California overall.

Where Have All of the Pelagic Fishes Gone?

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PROGRAM

Abundance indices calculated by the Interagency Ecological Program (IEP) suggest recent marked declines in numerous pelagic fishes (Delta smelt, longfin smelt, threadfin shad, and striped bass) in the Delta and Suisun Bay through 2004. Initial statistical analyses of the data for these pelagic species indicate that there are statistically significant long-term declines in the Delta/Suisun Bay, and evidence of a recent step-change—a very rapid decrease in population. Similar analyses for the fishes of the San Francisco Bay showed no clear decline. Recent abundance estimates for the summer tow-net survey suggest that low Delta smelt abundance continued in 2005.

The low levels of Delta/Suisun Bay pelagic species are unexpected given the relatively moderate hydrology over the past three years. Our

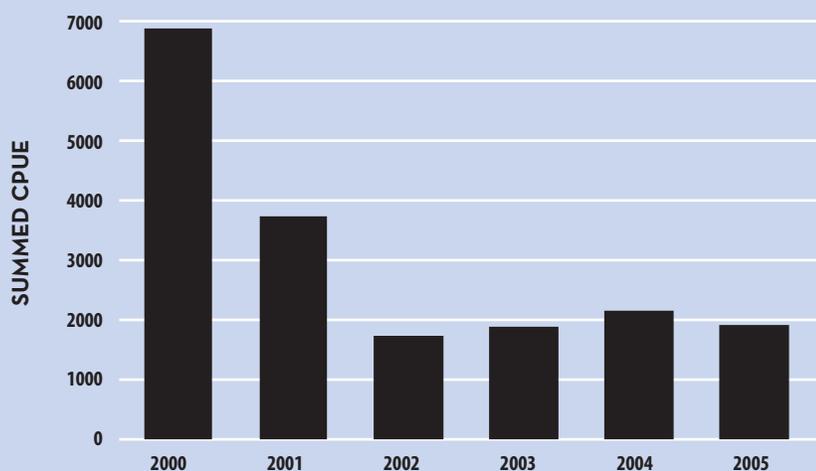


conceptual model includes at least three general factors that may be acting individually or in concert to lower pelagic productivity. Those include toxins, invasive species, and water project operations. IEP has undertaken an interdisciplinary, multi-agency study effort to evaluate these stressors. The overall approach is based on a “triage” model to identify the most likely causes of the decline,

and to assign priorities to projects on the basis of where funds and resources can be best used. The proposed work falls into four general types: an expansion of existing monitoring (four expanded surveys); analyses of existing data (nine studies); new studies (six studies); and ongoing studies (four studies).

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INITIAL CLUES FROM 2005 20MM-DELTA SMELT SURVEY GREAT HYDROLOGY, LITTLE IMPROVEMENT



TAKE HOME POINTS

- Abundance of pelagic fishes still hasn't improved much, despite favorable hydrology in 2005 and relatively moderate hydrology during 2002-2003.
- The IEP is investigating three stressors—contaminants, water exports, and invasive species—as major causes.

Clues to the Delta Pelagic Food Web Decline

**WIM KIMMERER
AND JOHN DURAND**
SAN FRANCISCO STATE UNIVERSITY

The recent decline in abundance of several species of fish in the Sacramento-San Joaquin Delta has prompted an unprecedented cooperative effort aimed at identifying the causes. Public and media attention to this decline has been great: pictures of copepods are appearing on the front pages of newspapers!

Determining the cause or causes of the decline is an extraordinarily difficult problem, exacerbated by the intense pressure on agency scientists and their university colleagues to find “the answer.” One way to begin delimiting the problem is to investigate where changes have occurred across each of several dimensions. The most obvious of these are space and time, and these give clues: the declines have occurred generally in fresh to brackish water; since 2001, more in Suisun Bay and the Delta than in Suisun Marsh. Another key dimension is species: only some of the species present within the spatial-temporal box of concern have declined, while others have not. Contrasting life histories may give a clue to why some have declined and others not.

An additional dimension is trophic position. The species that have declined include the copepod *Pseudodiaptomus forbesi* and several species

of fish. *P. forbesi* is important food for at least some of these fish during summer, implying a causal link. Chlorophyll concentration, used to indicate the availability of food for copepods, has not changed over the same period. The lack of decline in chlorophyll would indicate that the breakdown is occurring in the population dynamics of the copepods, but phytoplankton species composition has also changed. *P. forbesi* seems to have a very low reproductive rate, so a small decrease in food consumption could have a big impact on abundance. Our ongoing work on population dynamics may shed some light on these issues.

The next dimension is “stressors,” i.e., factors that might have negative impacts on populations. Although there is a strong tendency to point fingers at recent changes in water export patterns in the south Delta, temporal changes in actual volume exported do not correspond with the observed population changes. Other potential stressors include anthropogenic contaminants and toxic releases from the cyanobacteria *Microcystis aeruginosa*, which has bloomed in the Delta since 1999. These stressors have their own suite of dimensions, and the extent of their potential effects on the foodweb may be difficult to determine, especially in retrospect.

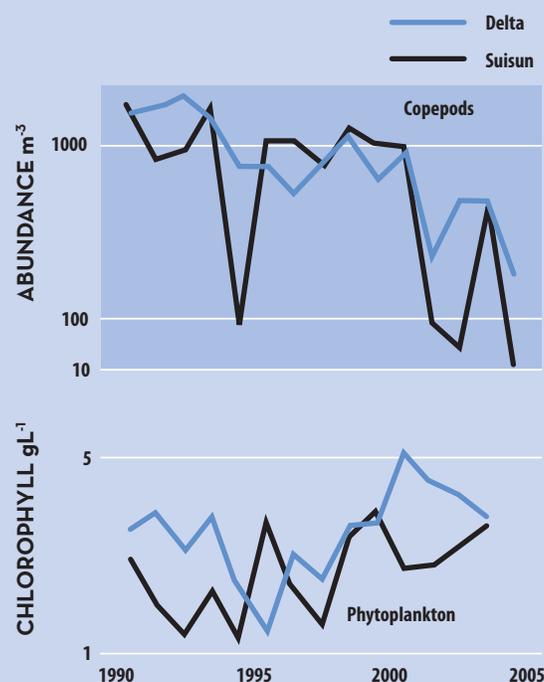


Illustration: Joe Eaton

Figuring all this out will take more than expanded monitoring, although there are some key system elements not being monitored. Measuring processes such as growth, fecundity, and sensitivity to contaminants will be required if we are to go beyond status and trends. These efforts are beginning, but must be adaptive if results are to be achieved soon.

**MORE
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PLANKTON PATTERNS - GLIMPSES INTO THE FOODWEB



TAKE HOME POINTS

- Possible influences on the pelagic organism decline include water project effects, climate effects, contaminants, toxic algae, and introduced species.

The Delta: A Case Study in Management Adaptability

JERRY JOHNS
CALIFORNIA DEPARTMENT OF
WATER RESOURCES

The concept of adaptive management has worked its way into the interface between water and biological sciences. Adaptive management allows water and biological managers to modify environmental conditions, develop data on the effects of these changes, and then adapt operations or standards to reflect the knowledge gained. This works well when the system being evaluated is staying relatively constant. However, recent events in the Bay-Delta Estuary have shown us that this system has changed markedly in the last few years, both from an ecological point of view and a funding and institutional perspective. The issue now is not so much adaptive management but management adaptability to respond to these changes. Can water and fishery managers change directions as fast as the political and ecological changes around them and adapt their approaches to problem solving fast enough to resolve conflicts?

CALFED has been the institutional pillar upon which we have built today's relationships between agencies and programs to protect and enhance both environmental conditions in the Bay-Delta Estuary and to provide the water for those who rely on the Bay-Delta watershed. However, the funding for the CALFED programs has been less than expected, and this program is undergoing extensive review and possible "refocusing" to evaluate its successes and to hone its mission to concentrate on resolution of Bay-Delta conflicts. Most importantly, CALFED will attempt to develop appropriate user contributions

to the CALFED Programs so that it has sustainable funding.

In the past three years there has been a decline in the relationships between the abundance of many open water fish inhabiting the upper Bay-Delta Estuary and the ecological factors that have historically affected their abundance. This unexpected decrease in abundance of these pelagic organisms has sparked an intensive effort by agency, university, and outside scientists to determine the cause or causes. Making water management decisions in light of this uncertainty requires us to be pragmatic and cautious. In addition, the sustainability of the current Delta levees infrastructure has been brought into question by the 2004 Jones Tract levee failure, funding issues, and by scientists studying the long-term subsidence, earthquake probability, and prospects for sea level rise due to global warming. Given these questions, the state needs to reevaluate what the Delta will look like in the next 50 to 100 years and develop a strategic plan towards that vision.

Water planning in general in California has taken a new shift with the release of the latest California Water Plan in spring 2005. Two new initiatives, Integrated Regional Water Management and Improving the State's Water Management System, build upon the principles of increased water use efficiency, improved water quality, and environmental stewardship. A water resource investment fund is needed to help meet California's water investment strategies for the future. A partnership with funding is needed between local and regional entities and the state to meet California's growing water needs.

The environment in which we find ourselves is changing rapidly. It will test our water management adaptability. Our ability to pass these tests will determine our future.

**MORE
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TAKE HOME POINTS

- Adaptive management works when the ecosystem is relatively stable.
- The Delta ecosystem is changing rapidly. Salmon numbers are up, but pelagic organisms have declined.
- The state's new water plan encourages environmental stewardship. That concept hasn't been discussed in past water plans but will be—more so—in the future.
- It may be that we should put off decisions about water export operations in the Delta until we have more data and a new Record of Decision.
- We need to make "no regrets" decisions that improve flexibility.
- In 50 to 100 years, the Delta will be a different place. We probably can't have everyone on the island. How are we going to protect all of the infrastructure that crosses the Delta? We need to take a comprehensive view.