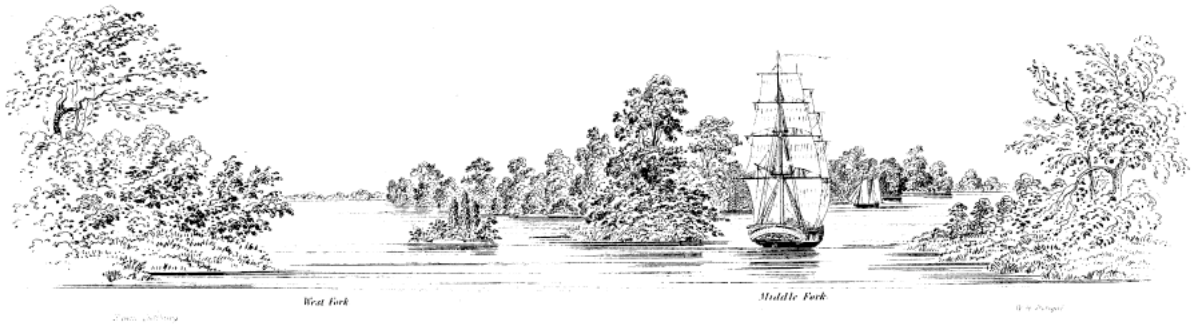
National Research Council Committee on Sustainable Water and Environmental Management in the California Bay-Delta

Marks for entering the Sacramento and its Forks at their confluence



Mark for entering the second section of the Middle Fork of the Sacramento River

Jeffrey Mount

UC Davis

January 24, 2010

Center for Watershed Sciences
UCDAVIS

I. Concerns

The 2001 Klamath Crisis

- NRC Review of 2001 BiOps for Klamath Projects set precedent
- Concern over use of NRC committees to review and recommend RPAs
- NRC RPAs not developed using the standards under the law yet likely to influence operations and court cases
- May be worth your review and comment

II. Define Sustainable Water and Environmental Management

Water Supply

Agriculture

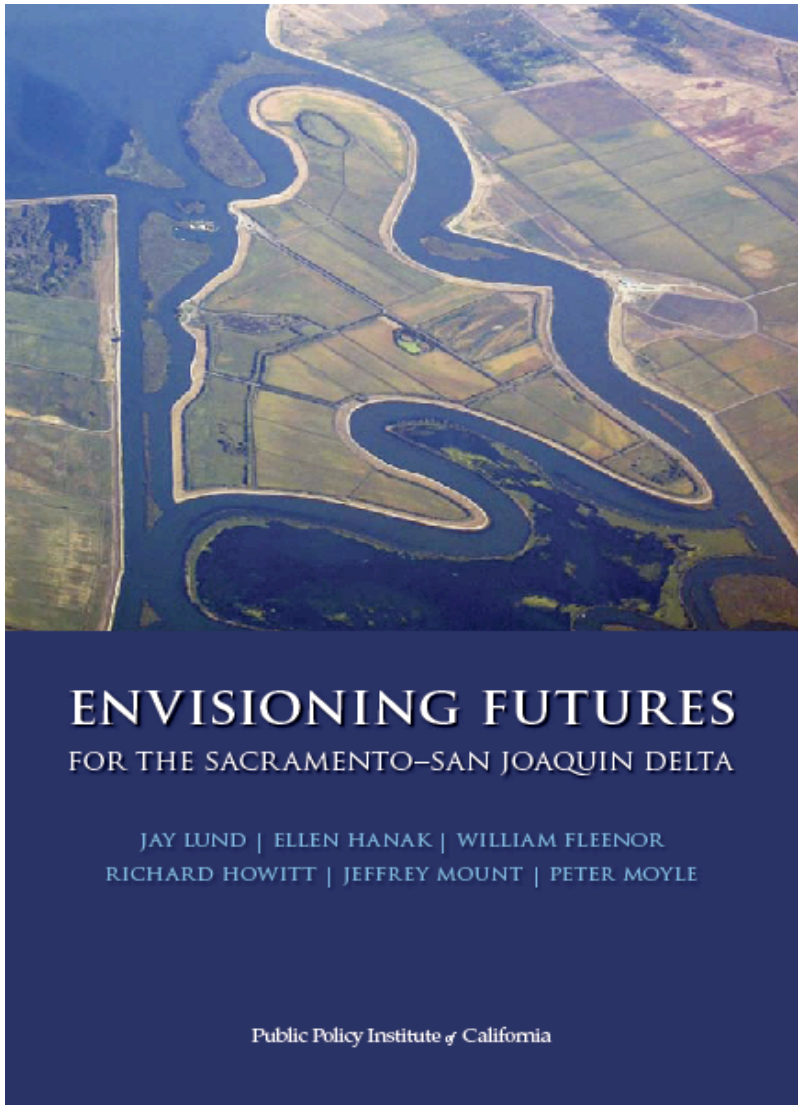
Ecosystem

Infrastructure

Recreation

Housing

Trotting Out the Elephants



Engineers:
Jay Lund, UC Davis*
William Fleenor, UC Davis

Economists:
Ellen Hanak, PPIC*
Richard Howitt, UC Davis

Geologist:
Jeffrey Mount, UC Davis

Biologist:
Peter Moyle, UC Davis

** Lead authors*

More Elephants: Comparing Futures for the Sacramento-San Joaquin Delta

Supported with funding from Stephen D. Bechtel, Jr. David and Lucile Packard Foundation

Engineers:

Jay Lund, UC Davis*

William Fleenor, UC Davis

Economists:

Ellen Hanak, PPIC*

Richard Howitt, UC Davis

Biologists:

Peter Moyle, UC Davis

William Bennett, UC Davis

Geologist:

Jeffrey Mount, UC Davis

**Lead authors*

California Water Myths

Supported with funding from S.D. Bechtel, Jr. Foundation, The David and Lucile Packard Foundation, Pisces Foundation, Resources Legacy Fund, Santa Ana Watershed Project Authority

Biologist:
Peter Moyle, UC Davis

Economists:
Ellen Hanak, PPIC*
Ariel Dinar, UC Riverside
Richard Howitt, UC Davis

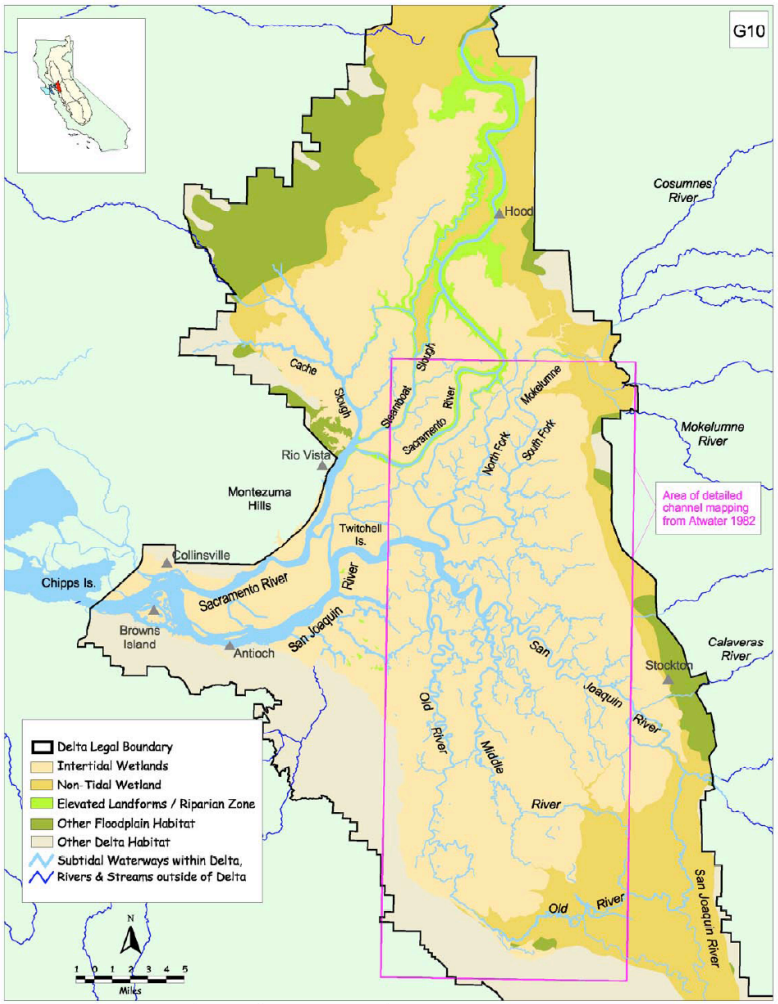
Engineer:
Jay Lund, UC Davis*

Geologist:
Jeffrey Mount, UC Davis

Lawyers:
Brian Gray, UC Hastings
Buzz Thompson, Stanford

**Lead authors*

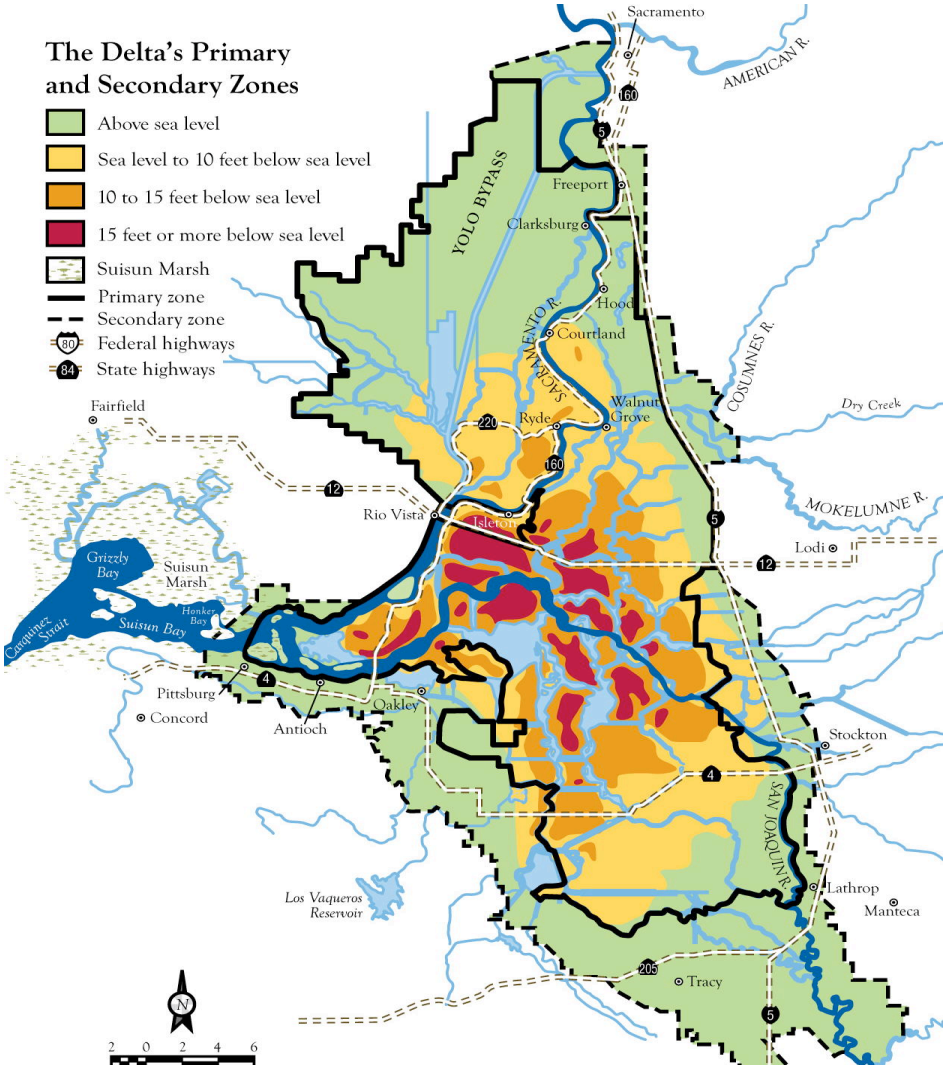
Historically: a complex, productive estuary

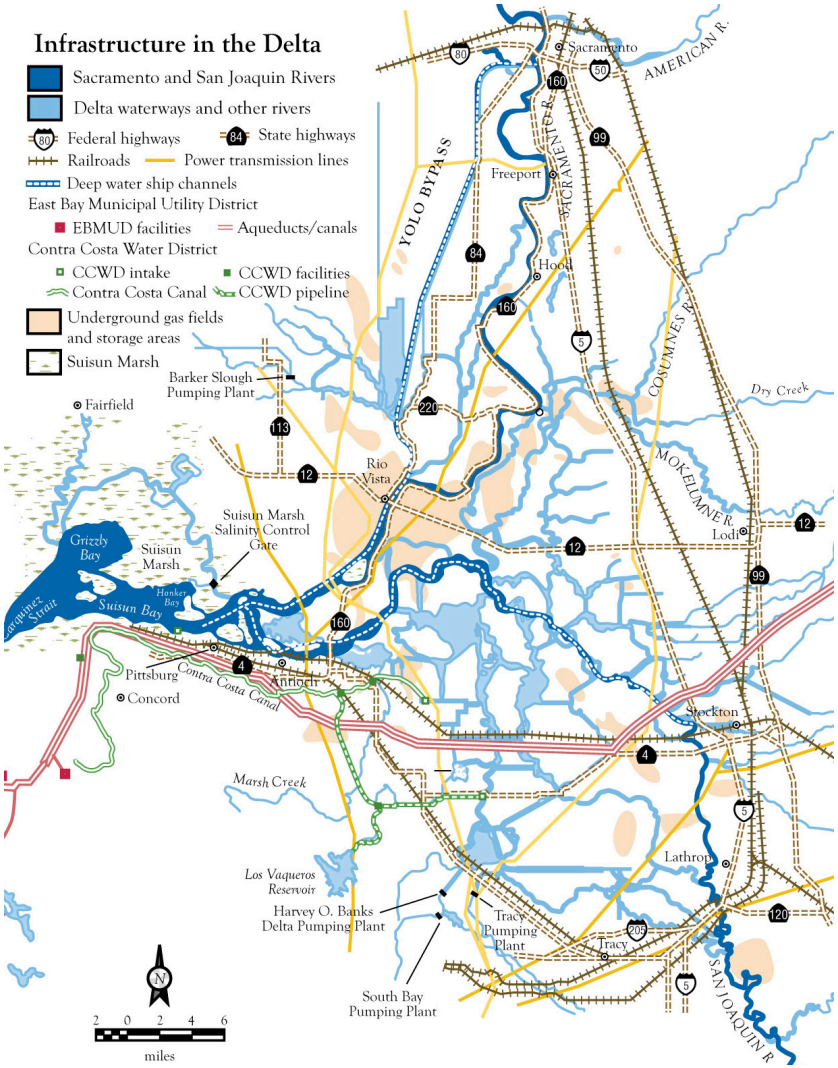


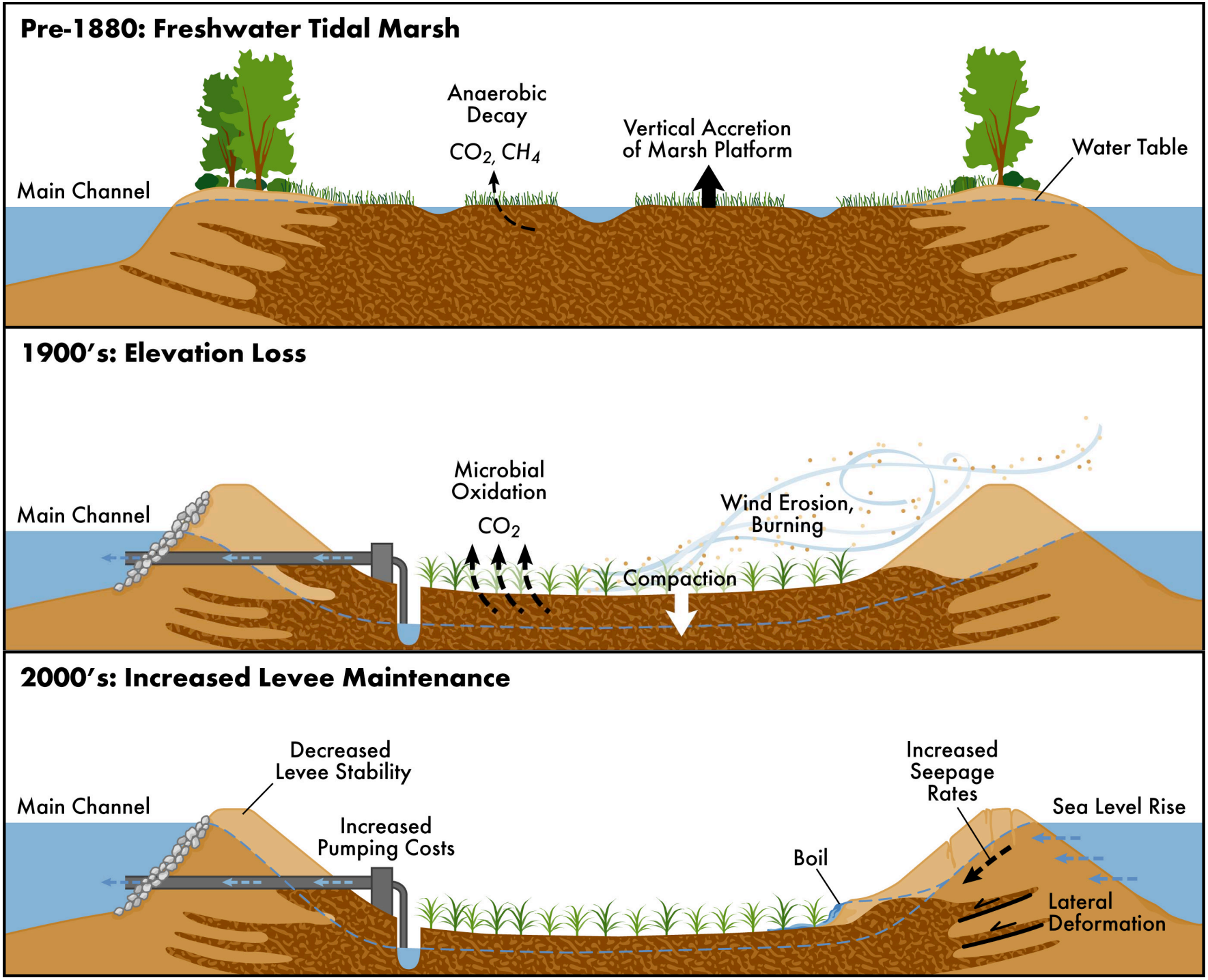
The Delta Historical Aquatic Ecosystem
• Bay Institute, 1998

- Mosaic of intertidal marsh, floodplain, riparian, and tidal channels
- Low diversity aquatic communities
- High regional and local hydrologic residence time
- High interannual variability
- Self-adjusting in response to flows, sediment supply and sea level rise

Meeting the Life History Strategy Needs of Native Species in the 20th Century Delta



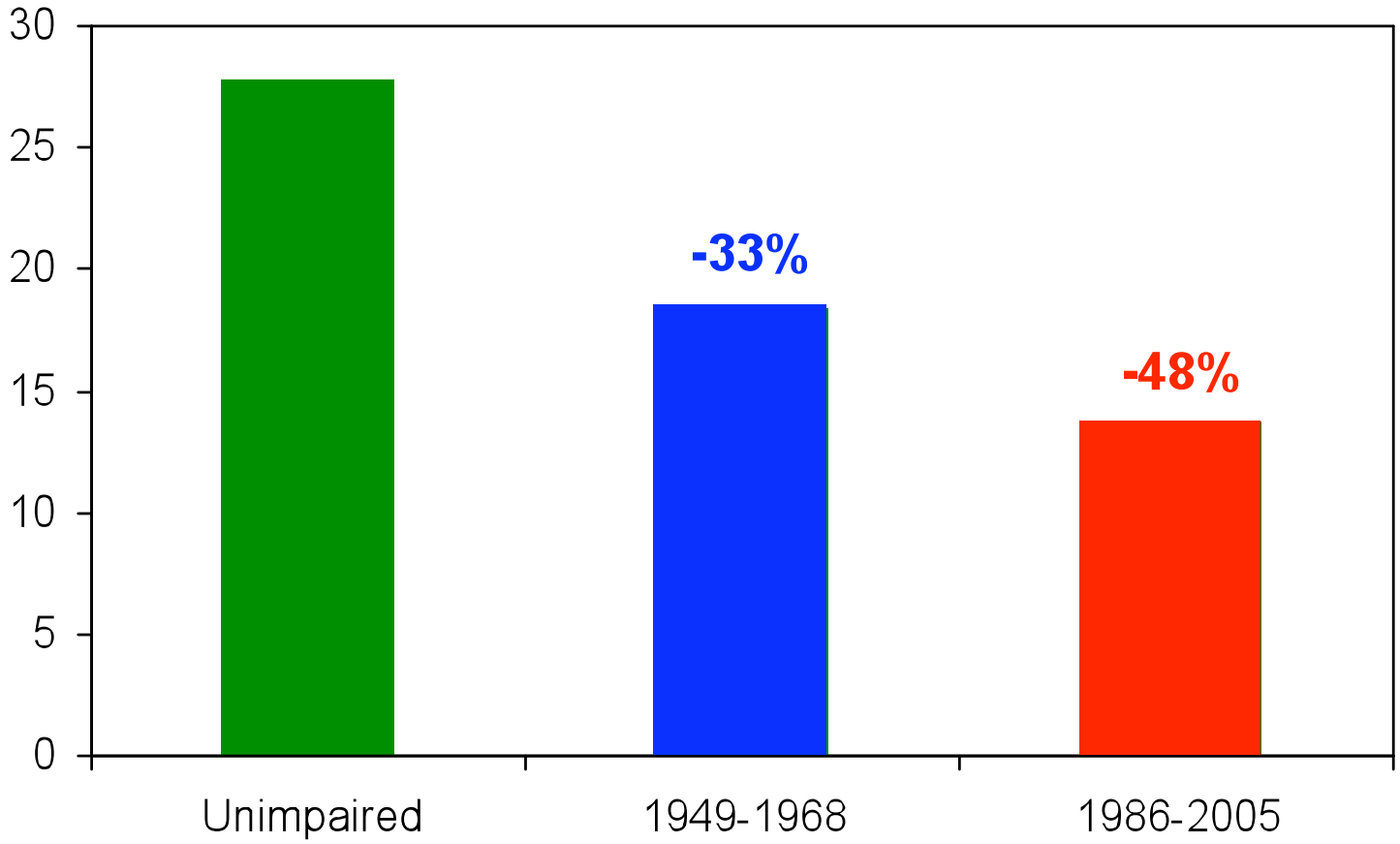



Pre-1880: Freshwater Tidal Marsh
Anaerobic Decay
CO_2, CH_4
Vertical Accretion of Marsh Platform
Water Table
Main Channel
1900's: Elevation Loss
Microbial Oxidation
CO_2
Wind Erosion, Burning
Main Channel
Compaction
2000's: Increased Levee Maintenance
Decreased Levee Stability
Increased Seepage Rates
Sea Level Rise
Main Channel
Increased Pumping Costs
Boil
Lateral Deformation

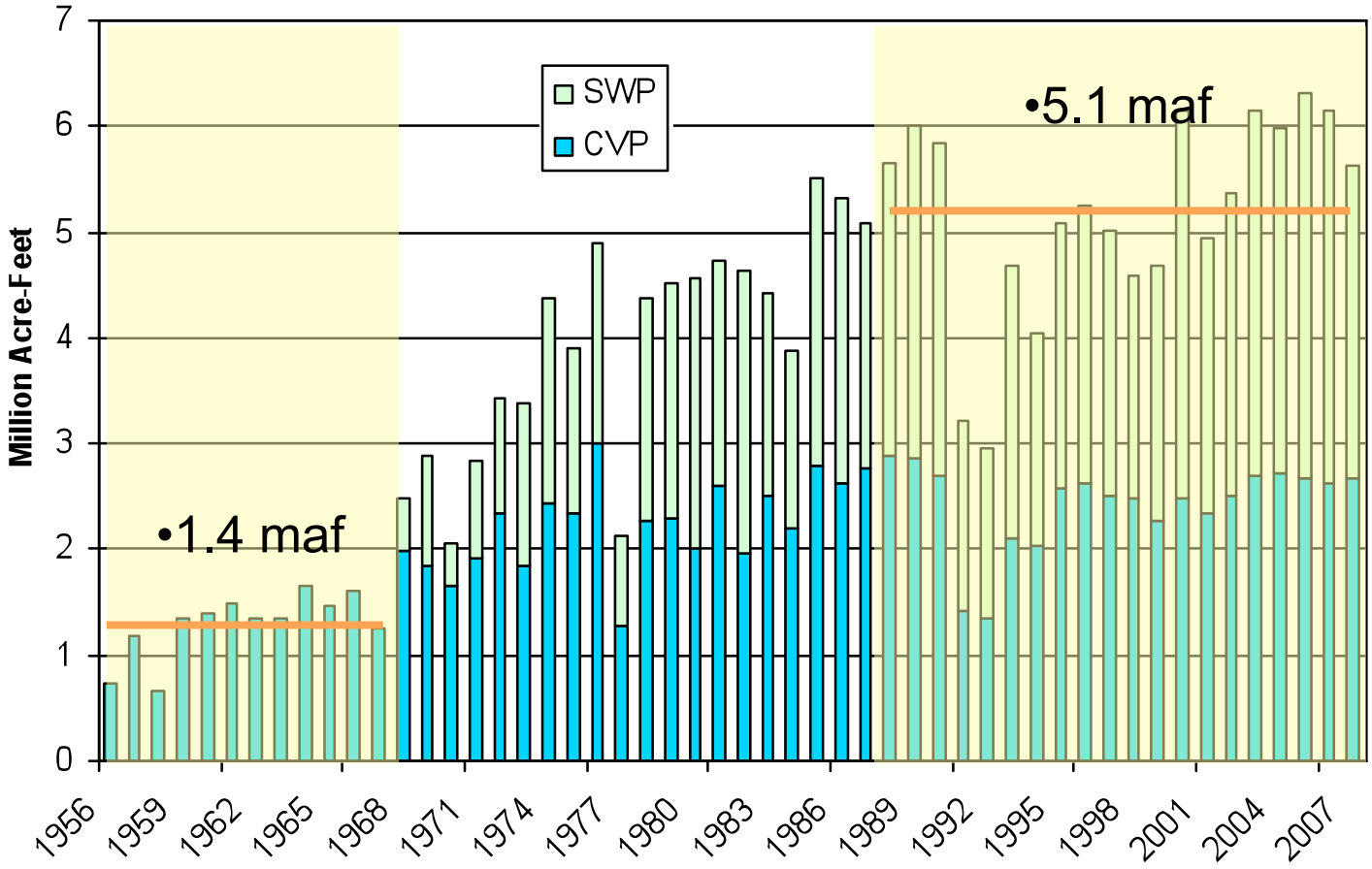
Changes in Flow Regime due to Water Use

- Changes in flow volume
- Changes in Timing, Magnitude, Salinity and Direction

Total Consumptive Use of Delta Waters (inflow + export)

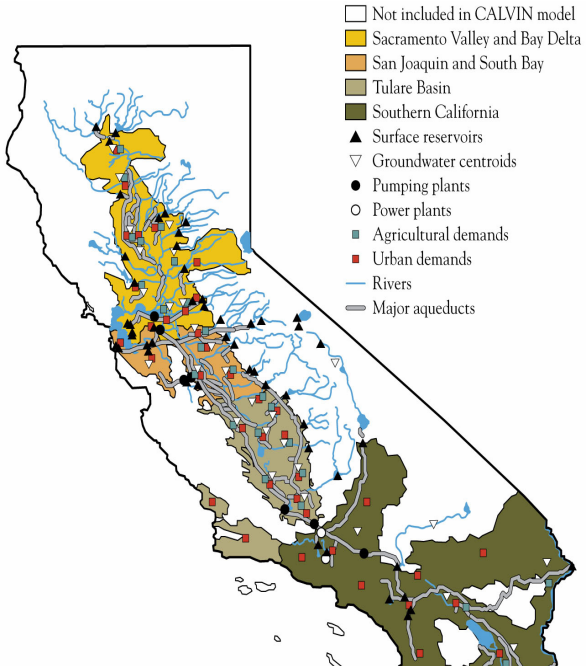


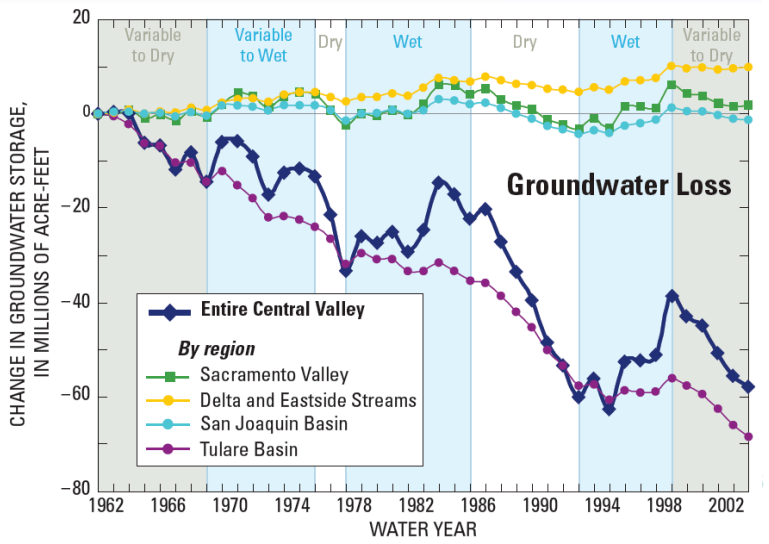
Total Delta Exports



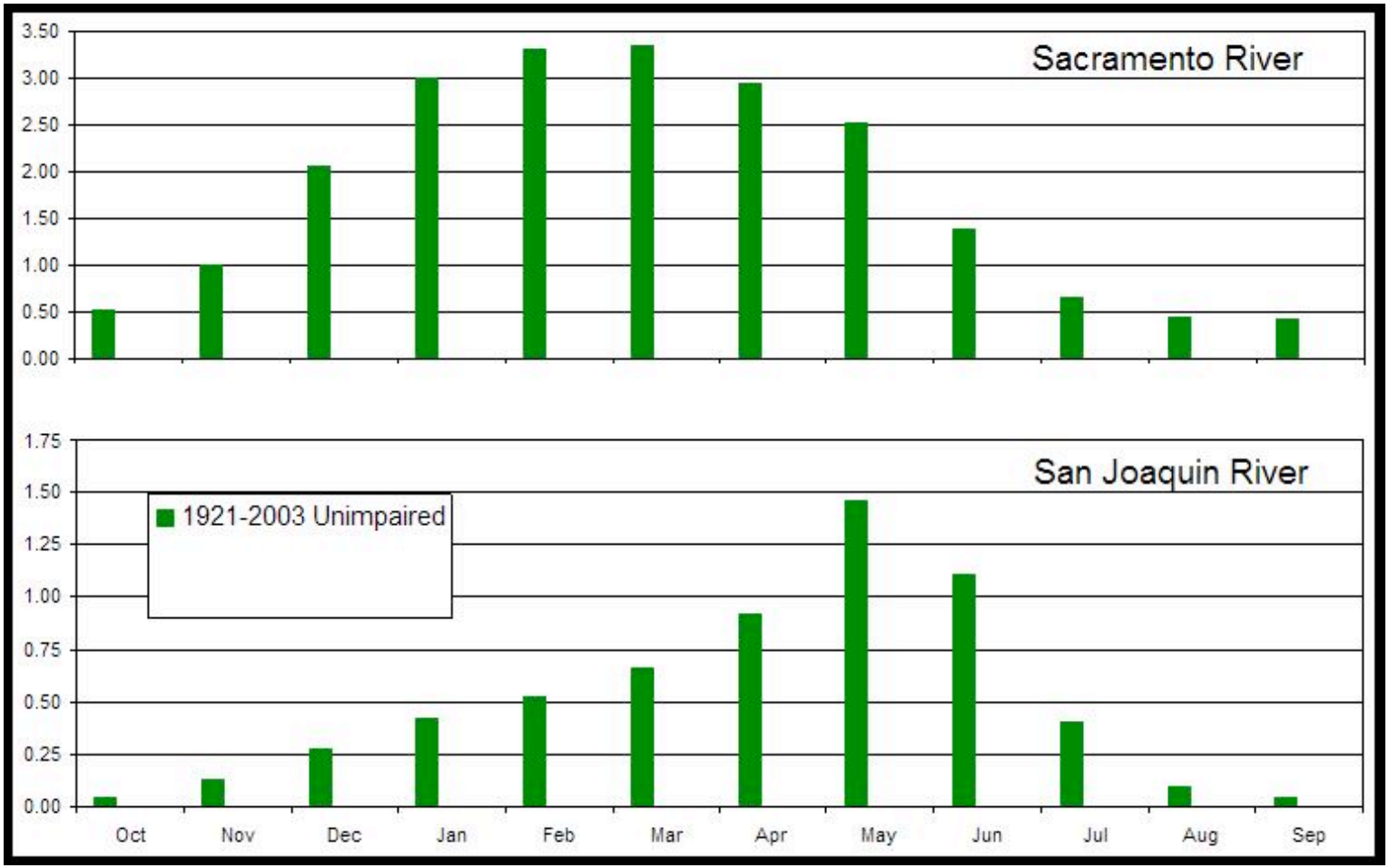
Who depends on the Delta?

- Sacramento Valley – 4+ maf taken upstream; water leasing by IDs
- S. California – 30% of water supplies, 1 maf
- Bay Area – 30% of water supplies directly, 1 maf, another 40% upstream
- Delta farmers – 1+ maf
- Southern Central Valley – 4 maf directly and 4 maf upstream, 2+ maf overdraft

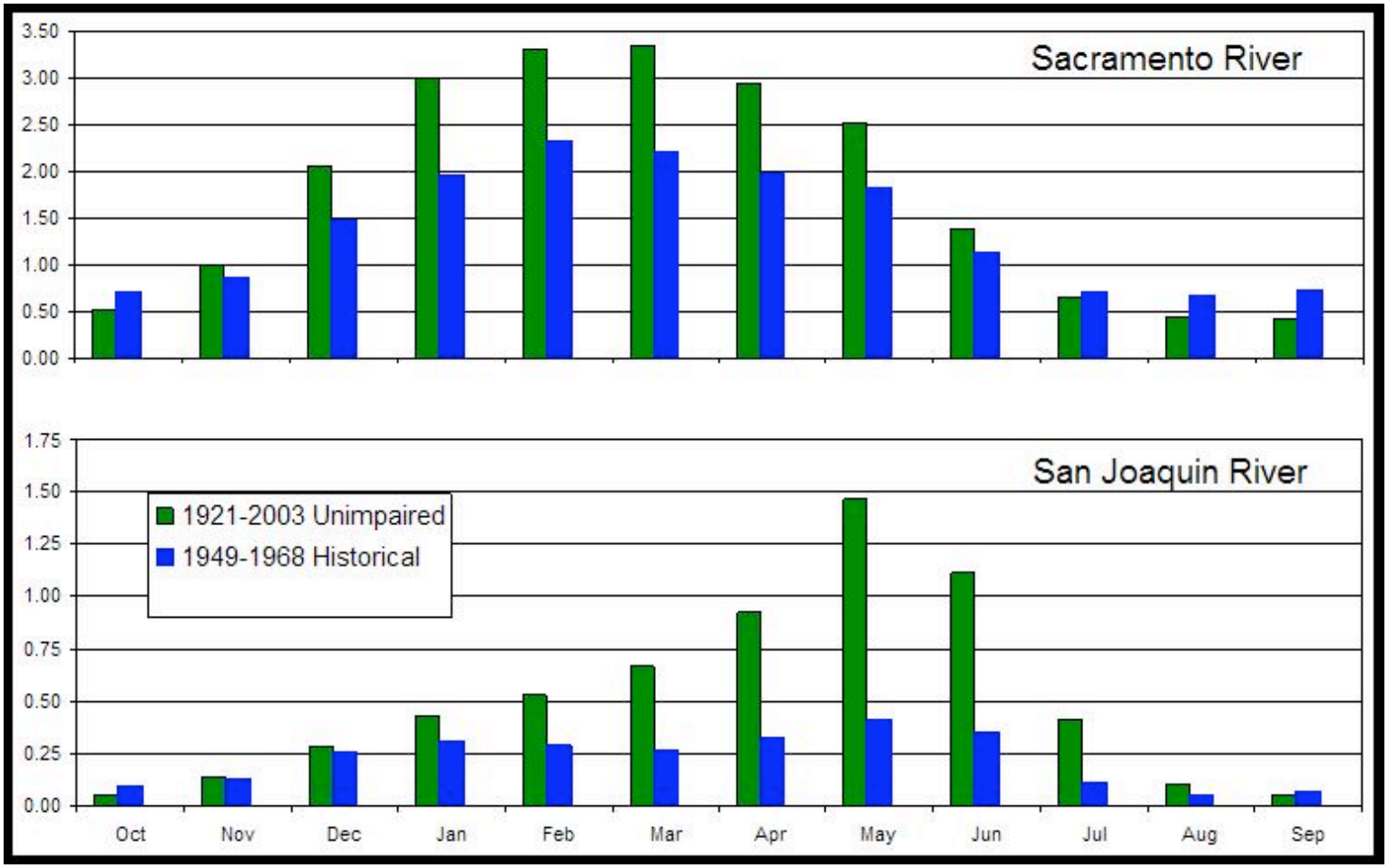




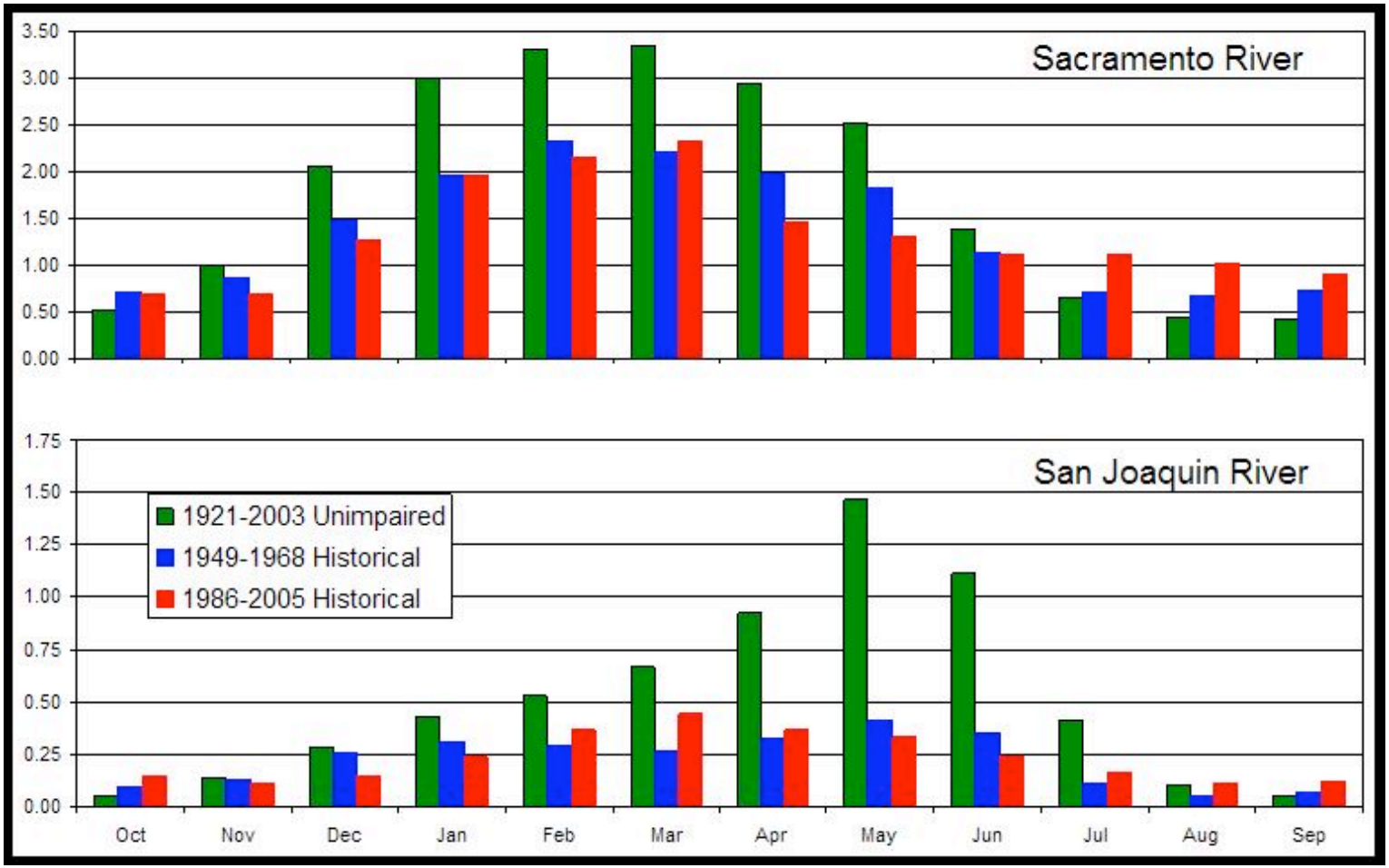
Changes in Flow Timing



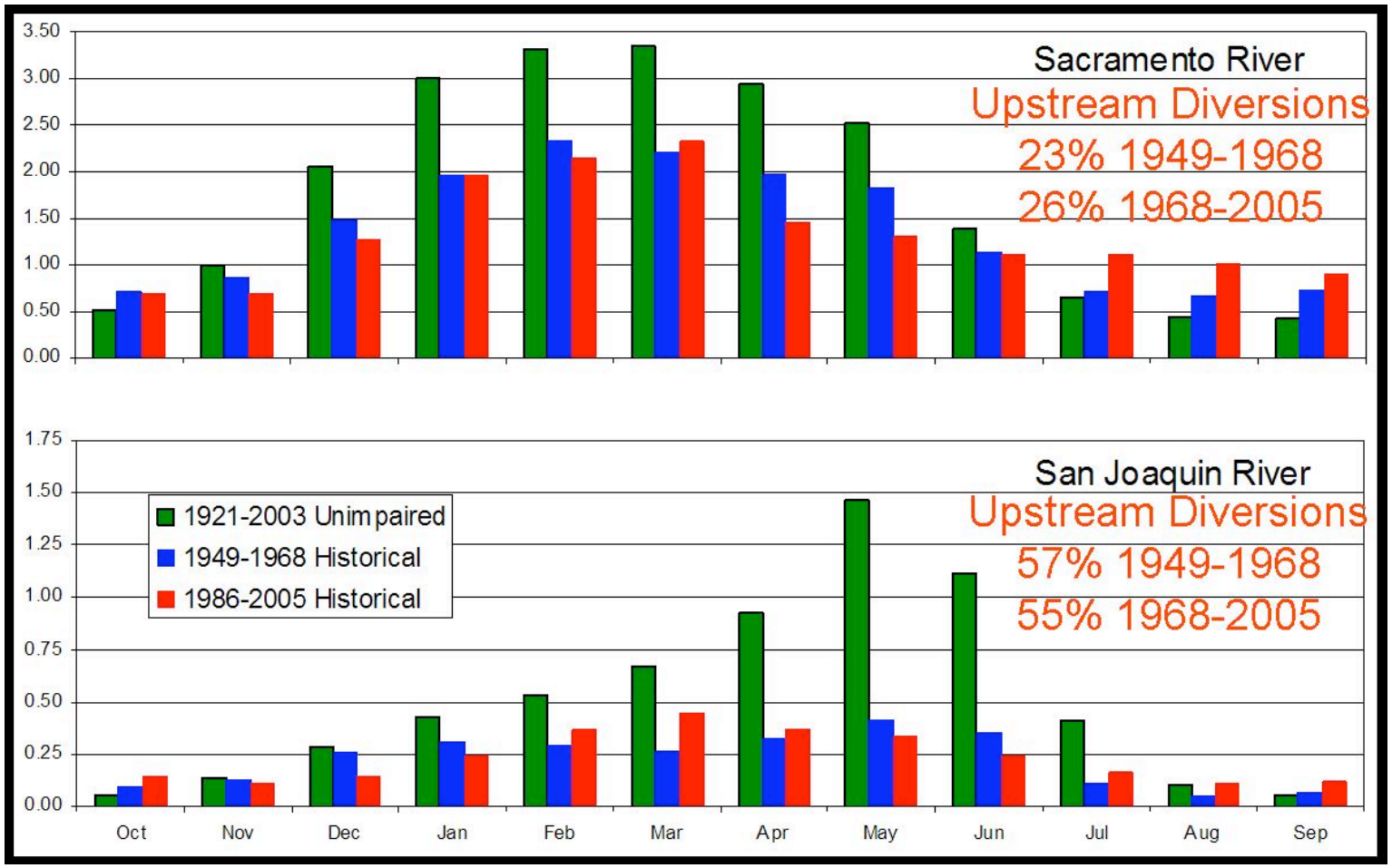
Changes in Flow Timing



Changes in Flow Timing



Changes in Flow Timing



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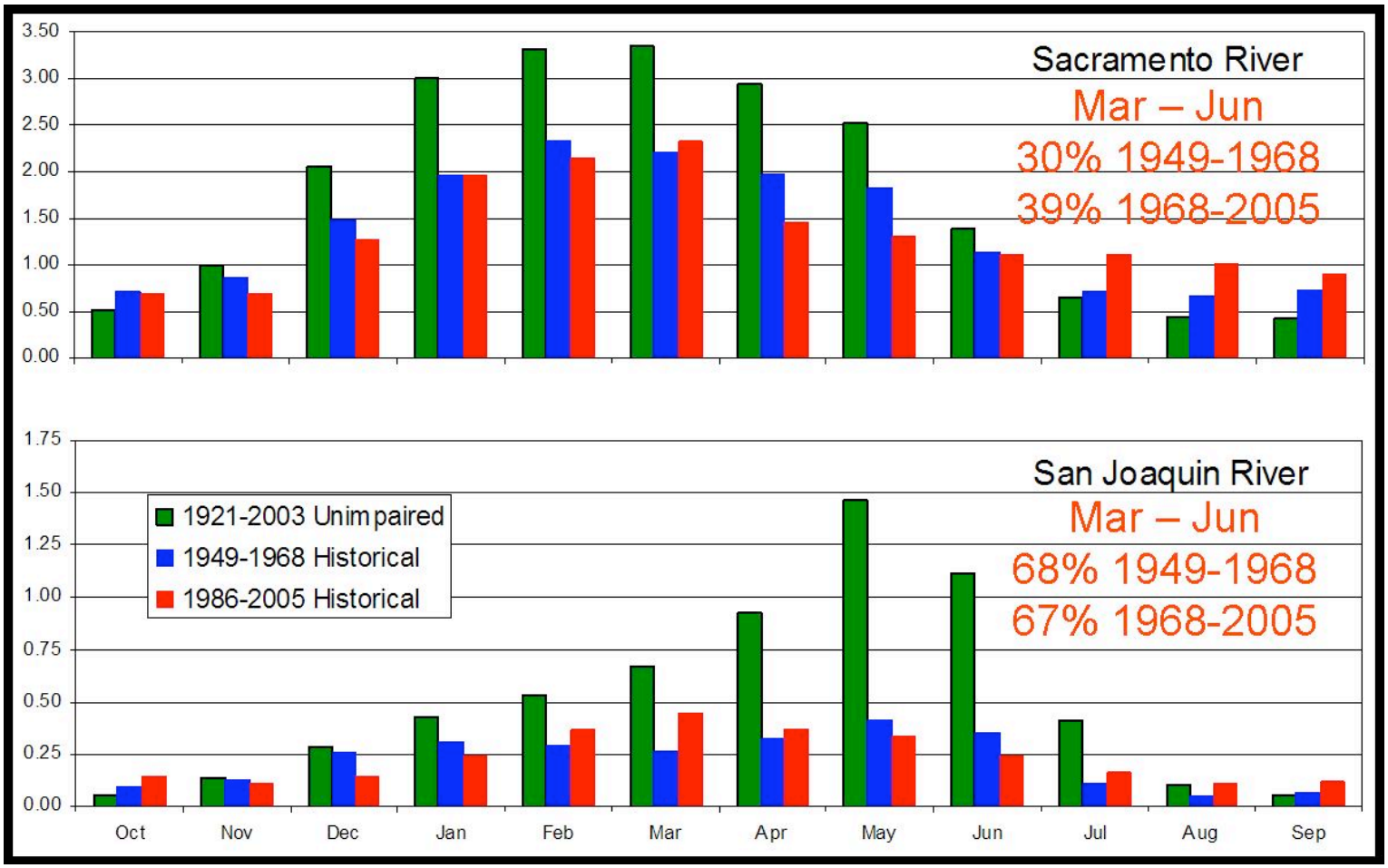
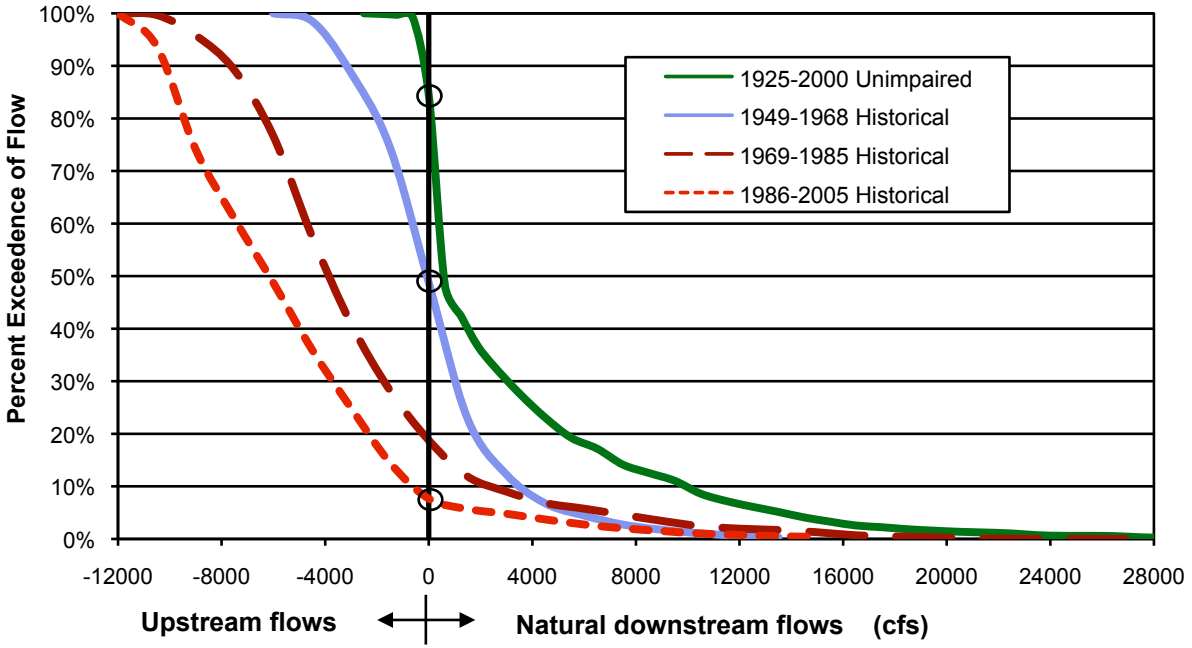
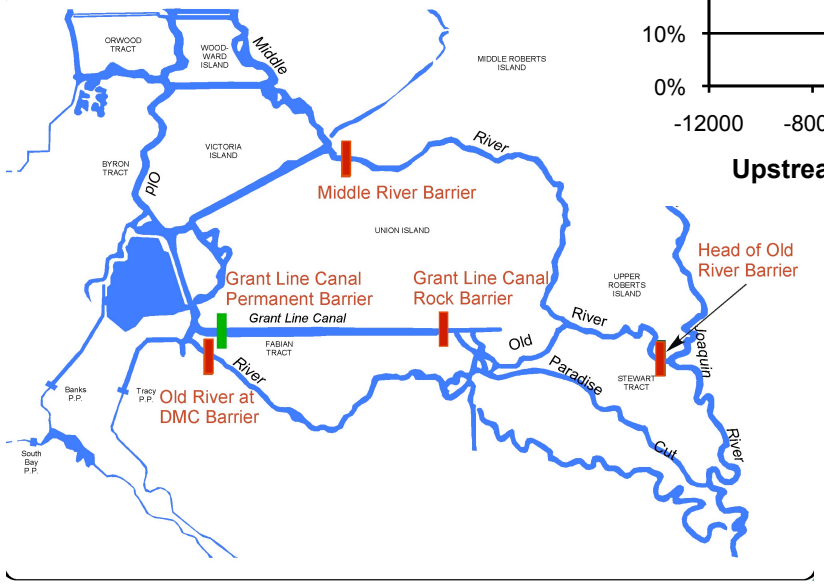


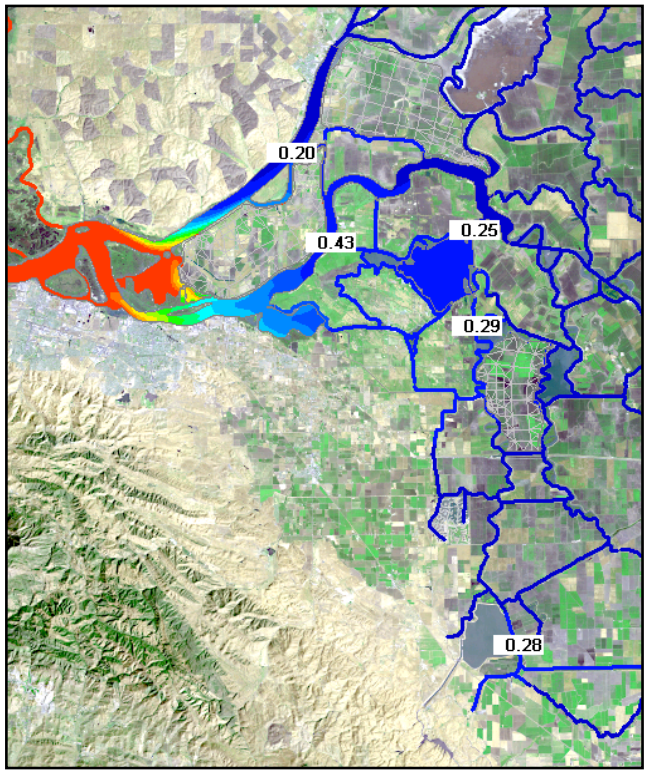
Changes in Flow Directions

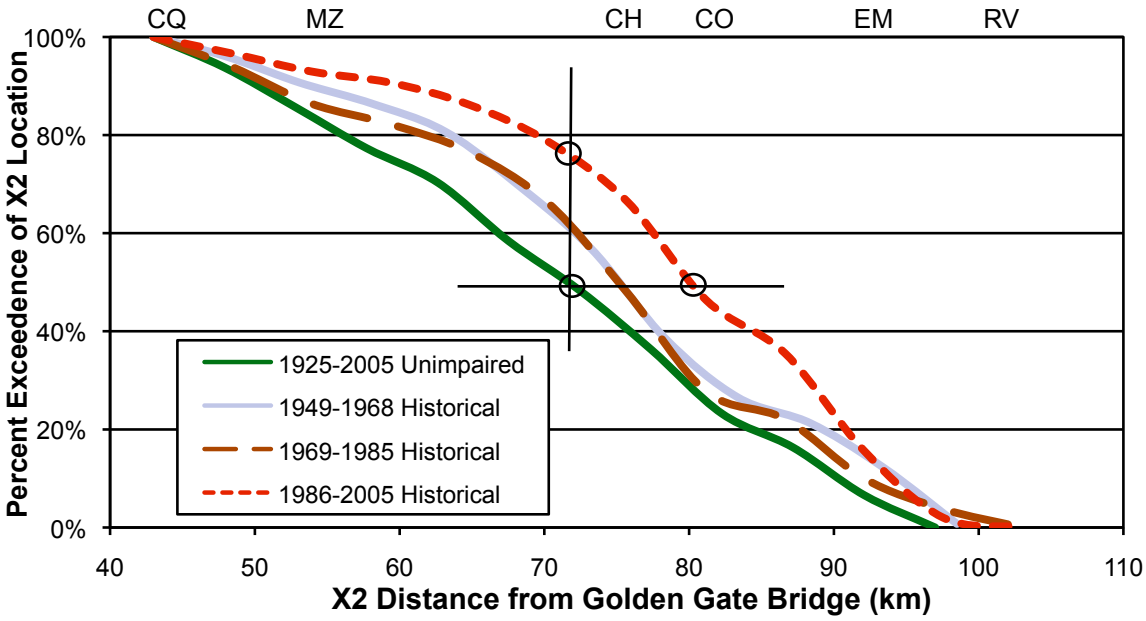




- Reverse flows at Old and Middle Rivers

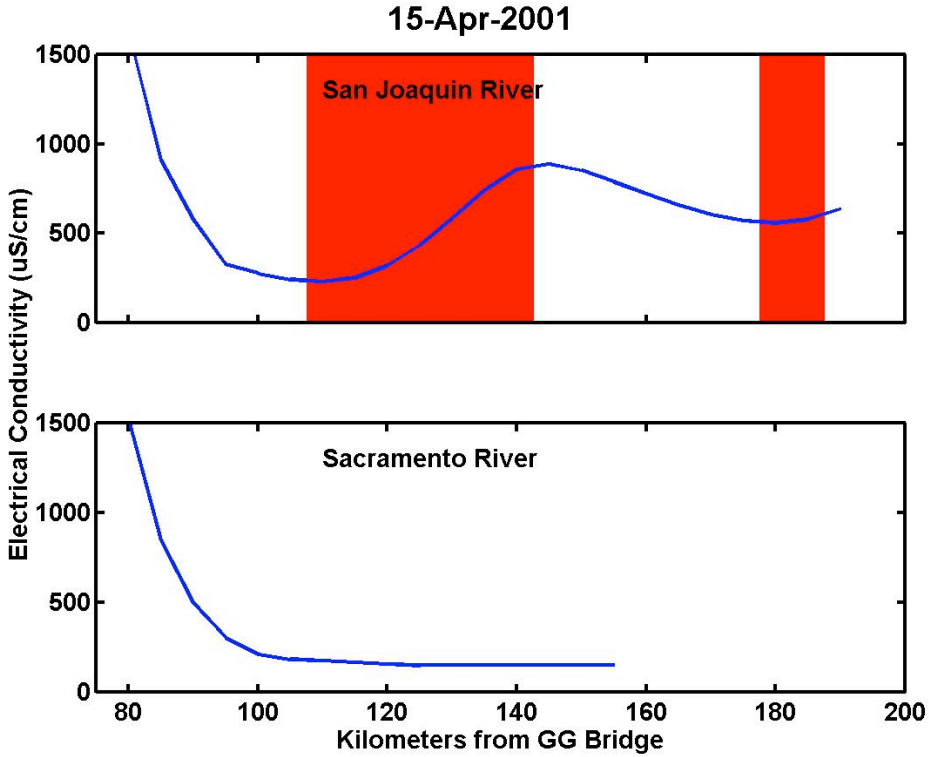
Changes in Location and Dynamics of Estuarine Salinity Gradients





- Landward shift in salinity; decrease in variability

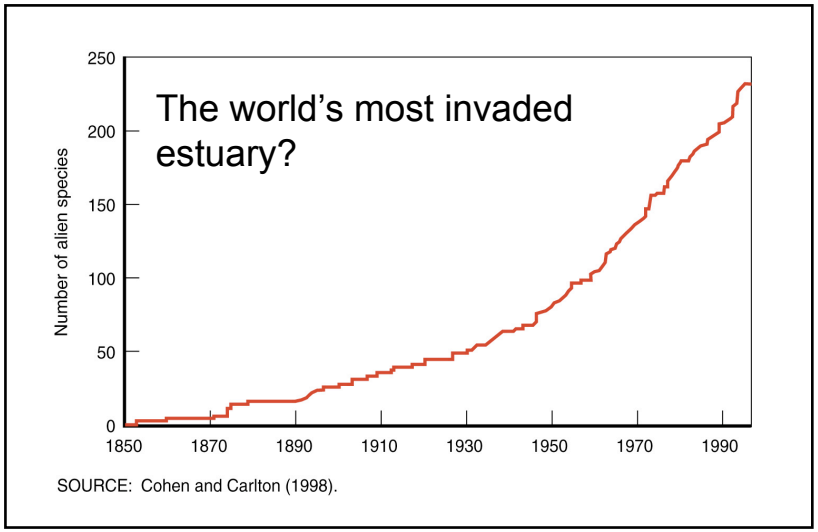
Changes in Location and Dynamics of Estuarine Salinity Gradients



- and inverse salinity gradients

Static, Warm, Freshwater Delta Ideal for Invaders, Poor Habitat for Native Fishes

- Profound, on-going changes in food webs and physical habitat due to invasions and changes in flow conditions
- Alien species do best with constant salinity (fresh or saline); natives evolved in and tolerate variability
- *Delta plant and animal communities starting to resemble a lake in southern Arkansas*



Asiatic clam

Brazilian waterweed

Overbite clam

Sustainability and Homogenization

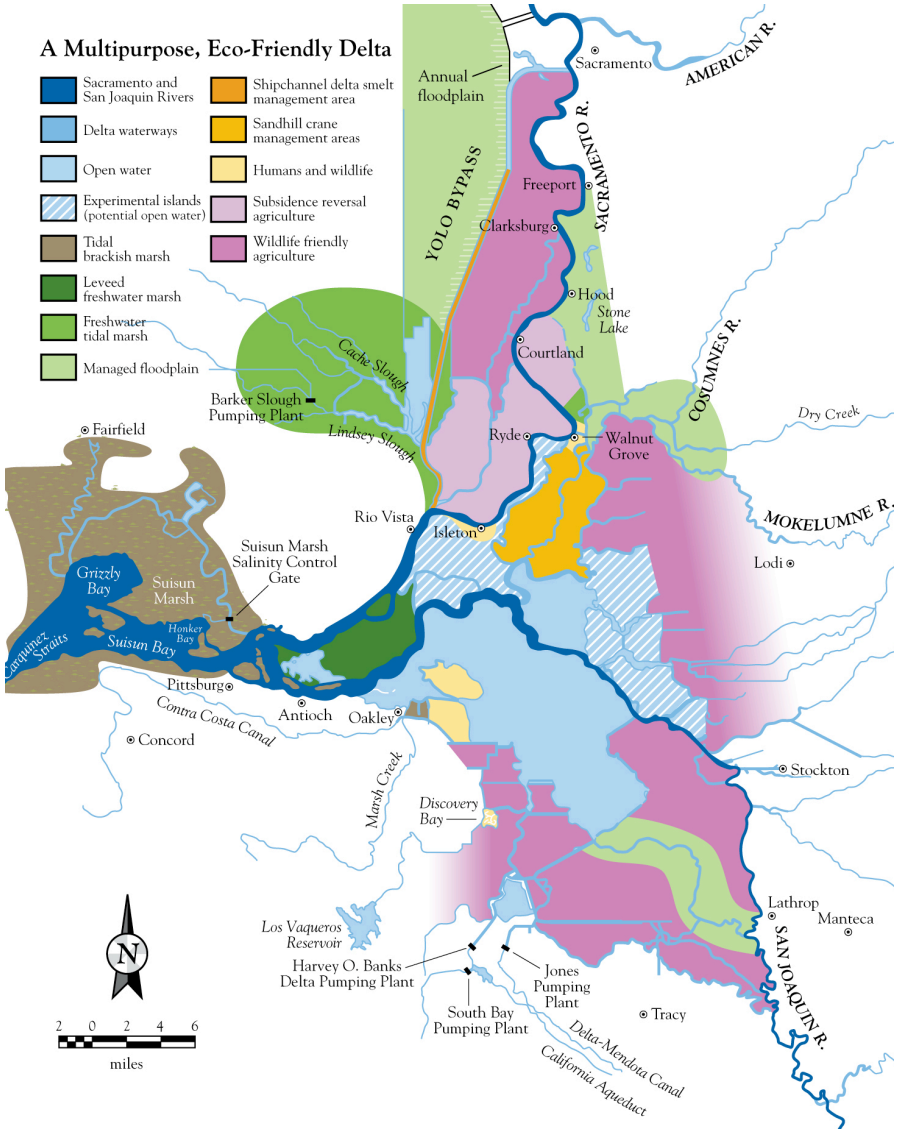
Physical complexity
Hydrologic connectivity
Hydrologic variability

Sustainable Transition to the 21st Century Delta

- A “new” Delta shaped by
  - Sea Level Rise
  - Subsidence
  - Changing Inflows
  - Seismicity
  - Economic Capacity
  - New Invasive Species

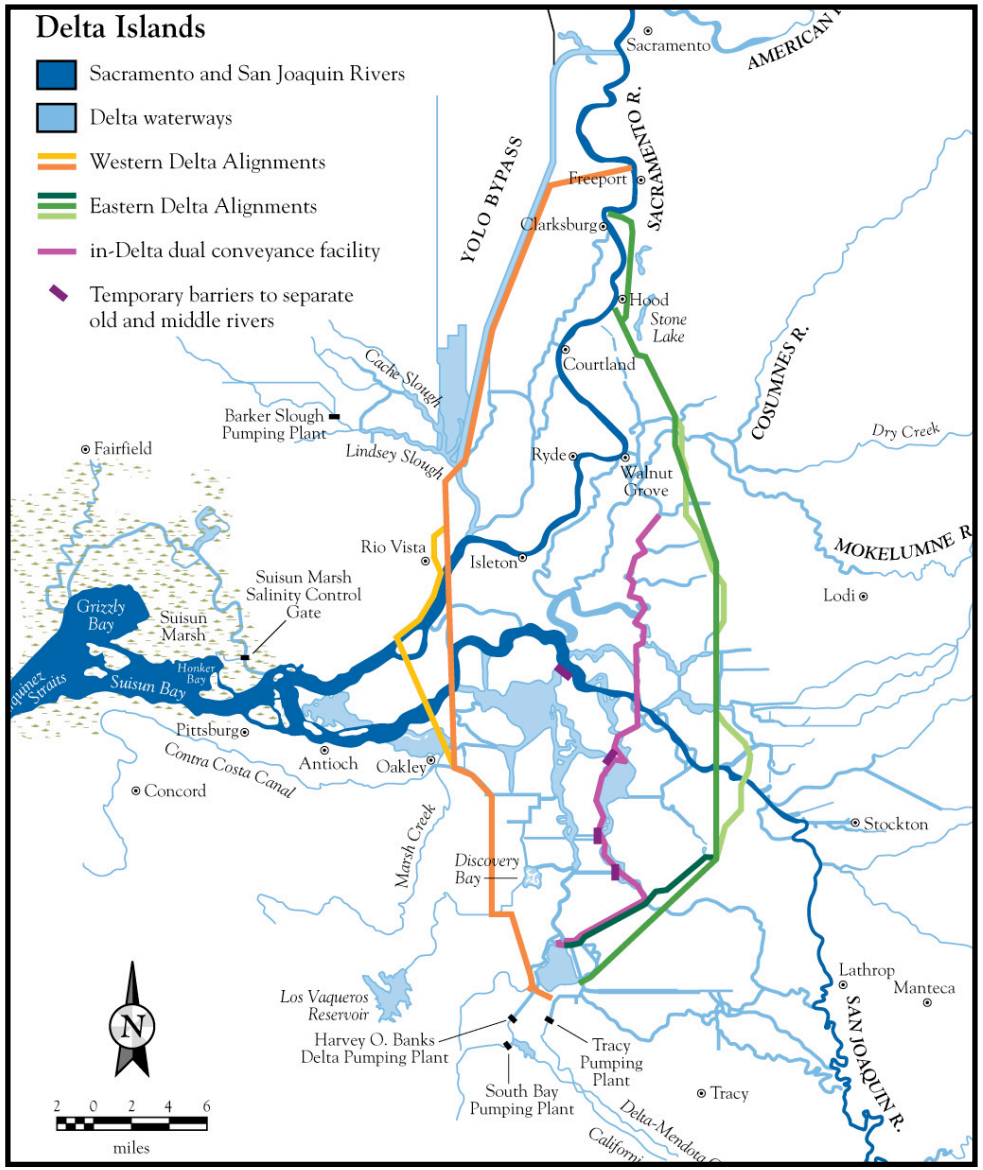
III. Opportunities

- Considerable potential for lasting impact of NRC review
- Made possible by mature, diverse science and monitoring infrastructure
- Led (after a fashion) by the CALFED Science Program, Interagency Ecological Program



Program Engagements for NRC

- Bay Delta Conservation Plan
- State Water Resources Control Board Flows Criteria
- State Plan of Flood Control
- Delta Stewardship Council



CONCLUSION