IEP Science Highlights

2009 - 2010

Interagency Ecological Program

COOPERATIVE ECOLOGICAL INVESTIGATIONS SINCE 1970

Anke Mueller-Solger
IEP Lead Scientist
Delta Stewardship Council

IEP Annual Workshop, May 2010

IEP Science Highlights

2009 - 2010

DWR • USBR • USFWS • SWRCB • DFG • USGS • NMFS • USACE • USEPA

Interagency Ecological Program

COOPERATIVE ECOLOGICAL INVESTIGATIONS SINCE 1970

Thank You!

IEP Science Highlights

2009 - 2010

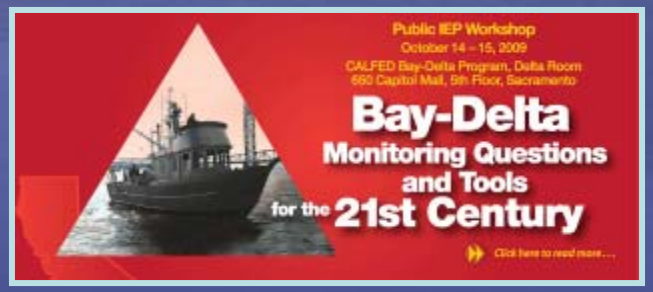
Interagency Ecological Program

COOPERATIVE ECOLOGICAL INVESTIGATIONS SINCE 1970

- Monitoring
- POD Research
  - Conceptual Models
  - Current Studies
  - Products
- Science Informing Solutions

IEP Monitoring Highlights

2009:



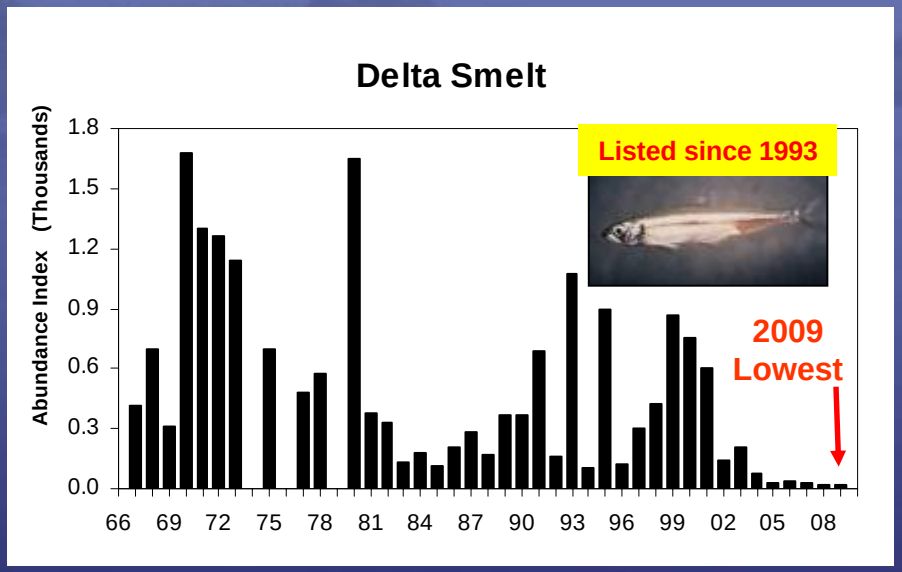
2010:

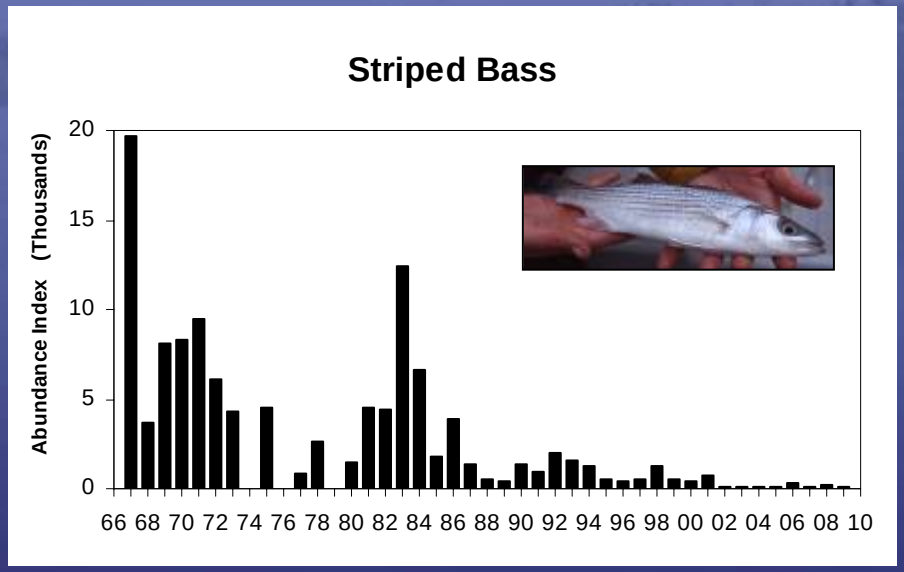
- Fish Monitoring
  (e.g. SmeltCam, Genetics, Marking & Tracking…)
- Other Monitoring
  (e.g. Turbidity, Stable Isotopes, *Microcystis*…)
- New Monitoring Initiatives
  (Delta RMP, CAWQMC)

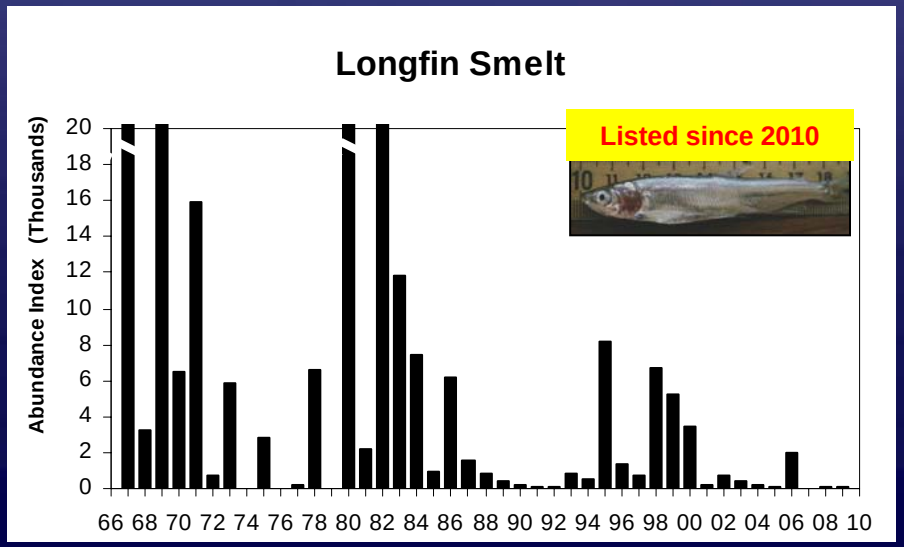
Innovation & Long-Term Continuity

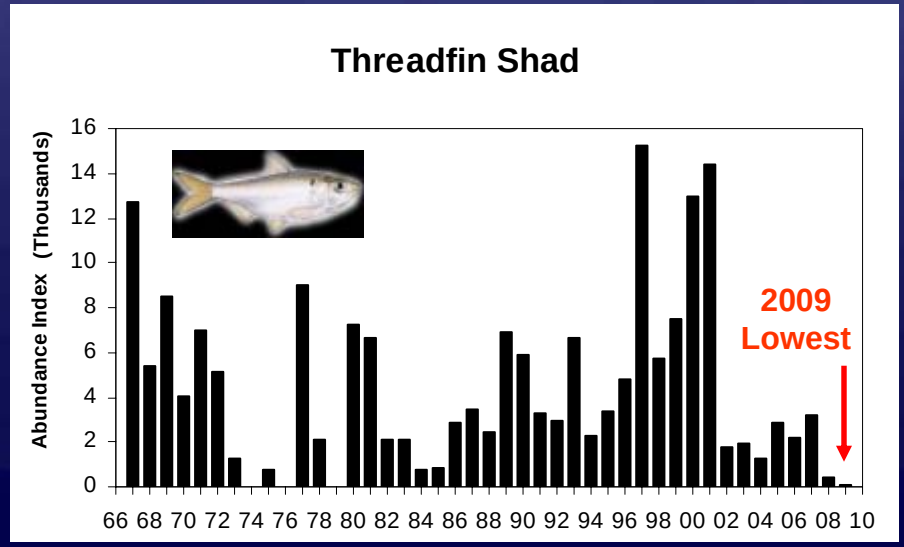
Long-term IEP Monitoring Shows Fish Declines

2009 Fall POD Fish Abundance Remains Low





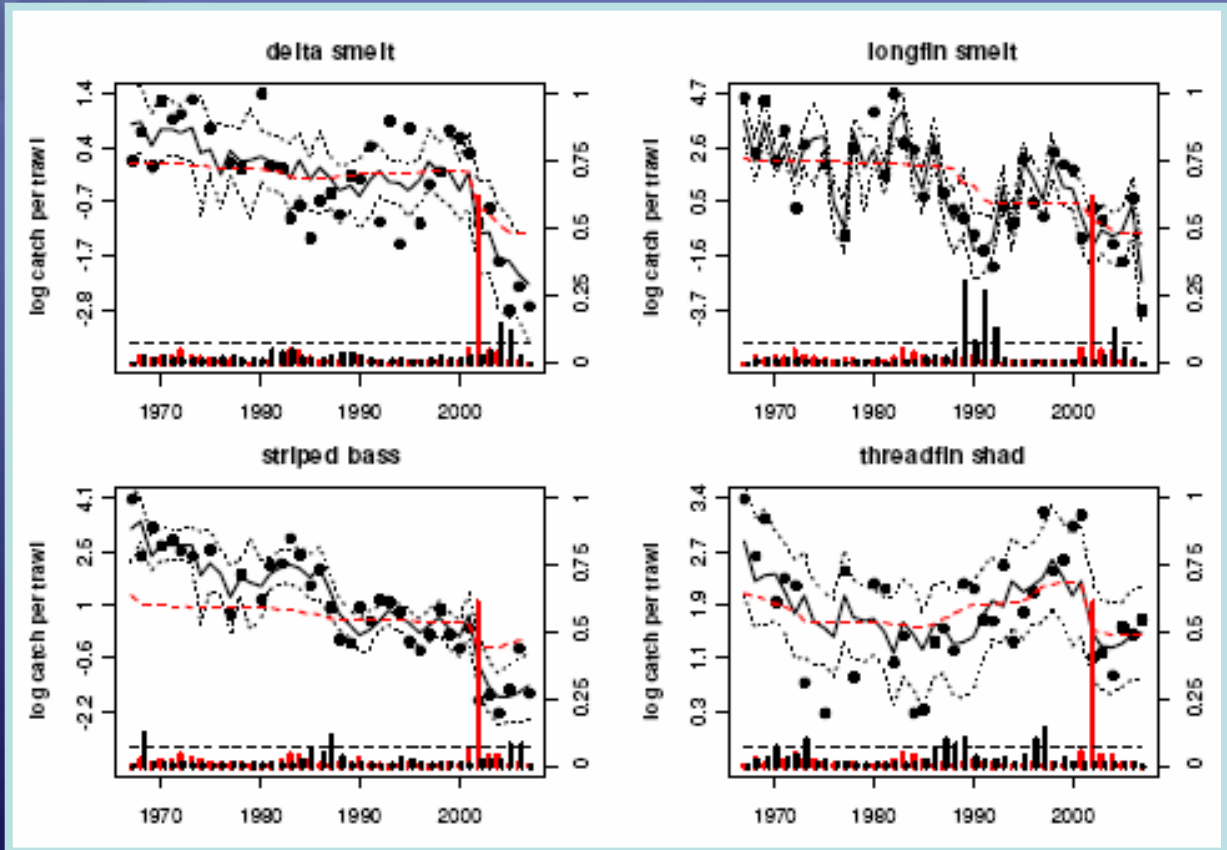


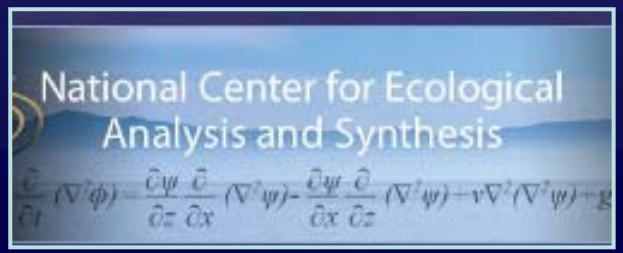


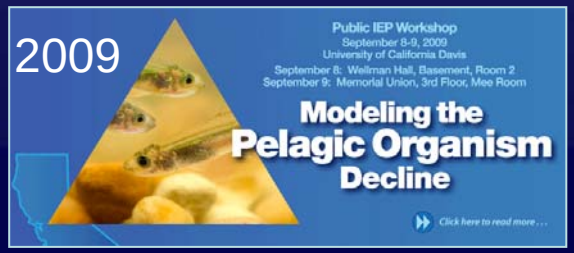
Source DFG 2008 Fall MW Trawl - No indices in 1974, 1976 and 1979

Long-term IEP Monitoring Shows Fish Declines

POD Change Point in 2002 - Thomson et al. 2010

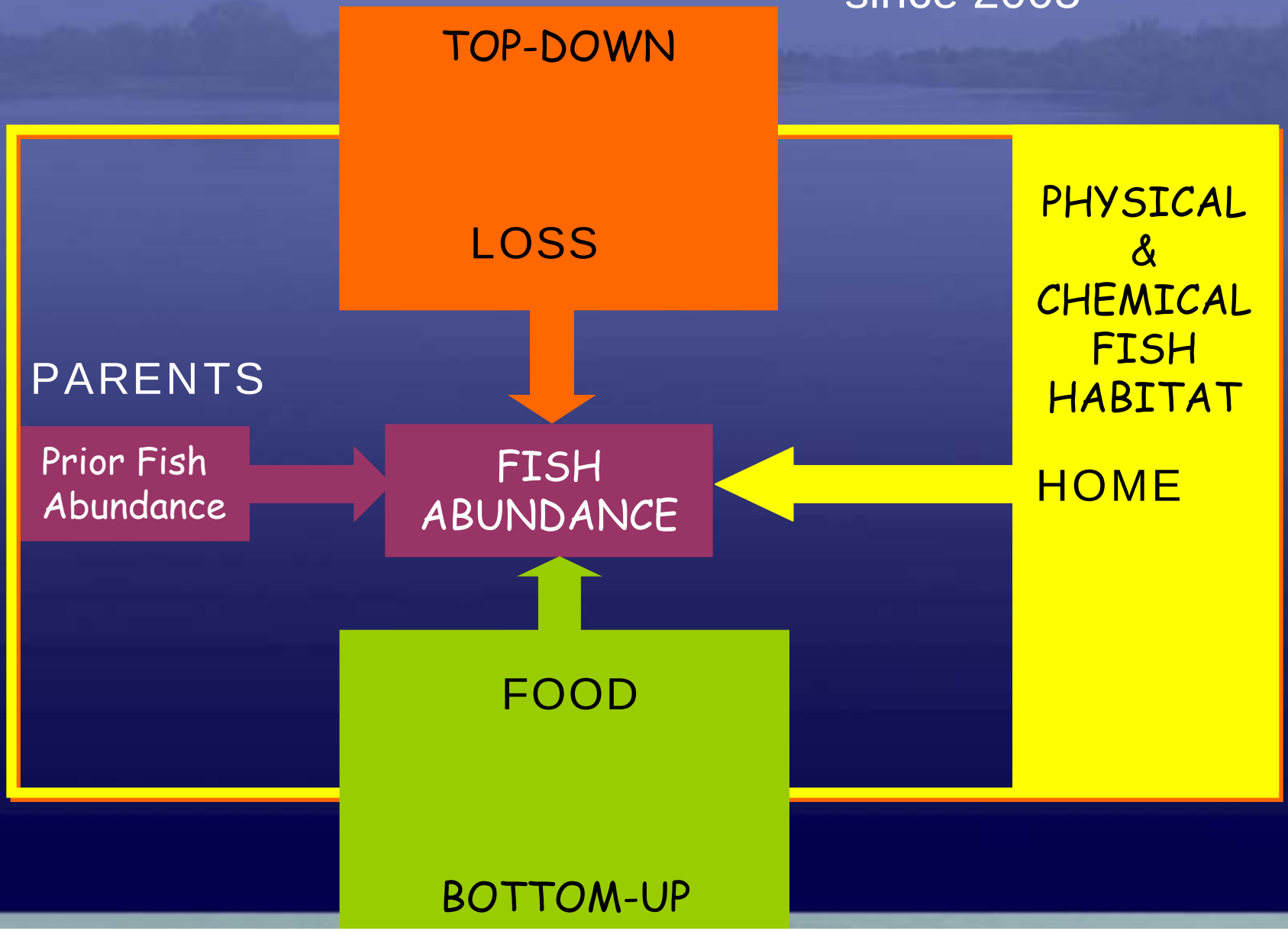




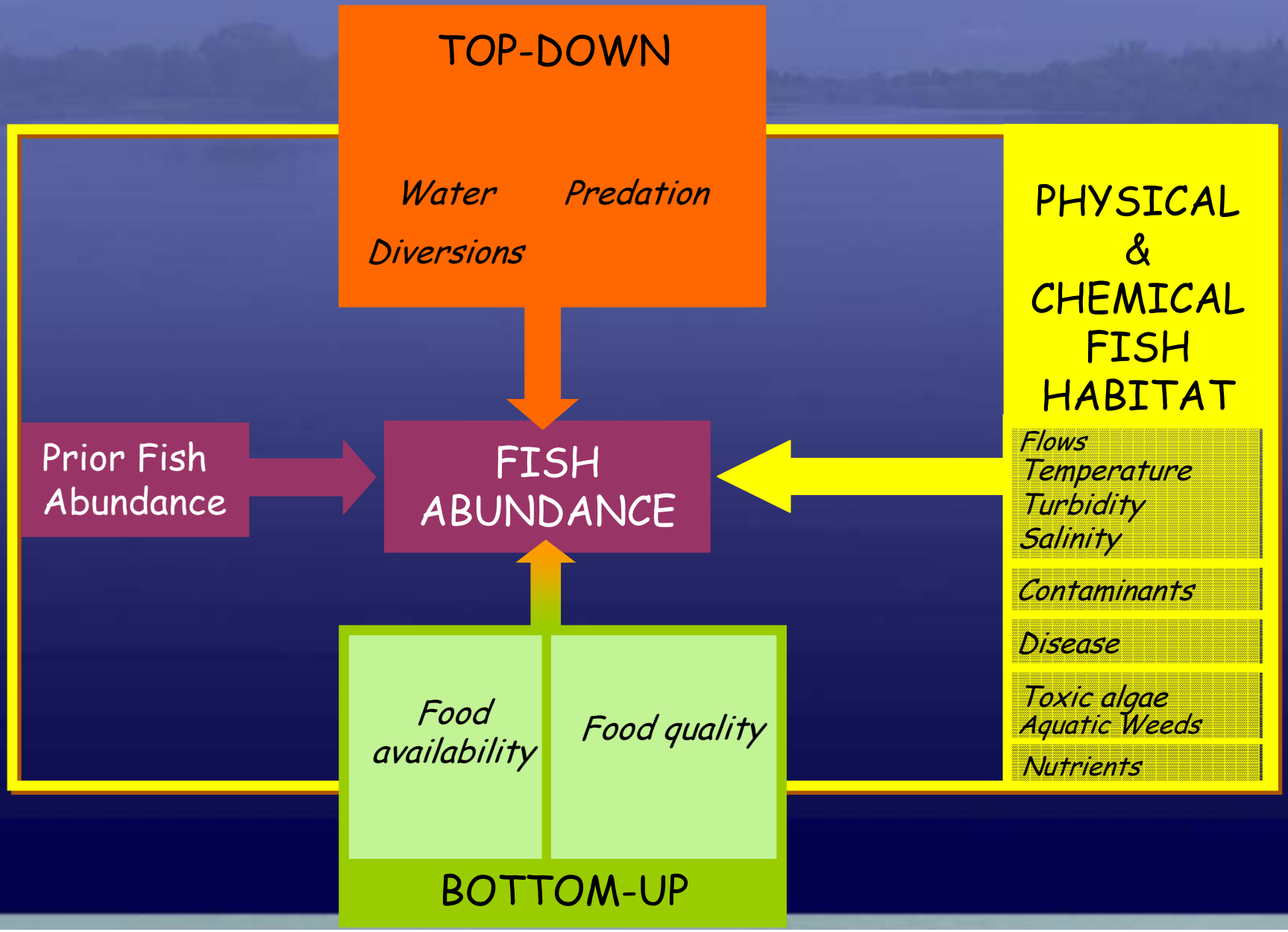


Pelagic Organism Decline (POD) Research

since 2005



Multiple Stressors… in Combination!



Ecological Regime Shift

"Rapid reorganization of an ecosystem from one relatively stable state to another."

From river estuary … to weedy "lake"

1873 → Today

Changes in Environment

Then		Now
Little	Ammonium	Lots
Low	Contaminants	High
Highly variable	Outflow	Constant, low
Low	“Harvest”	High
Lots	Phosphorus	Limited
Cool	Temperature	Warm
High	Turbidity	Low

Lead to Changes in Organisms

Then		Now
Little	Ammonium	Lots
Low	Contaminants	High
Highly variable	Outflow	Constant, low
Low	"Harvest"	High
Lots	Phosphorus	Limited
Cool	Temperature	Warm
High	Turbidity	Low

Natives dominate
Pelagic fish
Large copepods,mysids
Diatoms

Invasives dominate
Edge & benthic fish, jellyfish
Clams, small copepods
Microcystis, aquatic weeds

And a New Ecosystem "Regime"

Then		Now
Little	Ammonium	Lots
Low	Contaminants	High
Highly variable	Flow	Constant, low
Low	"Harvest"	High
Lots	Phosphorus	limited
Cool	Temperature	Warm

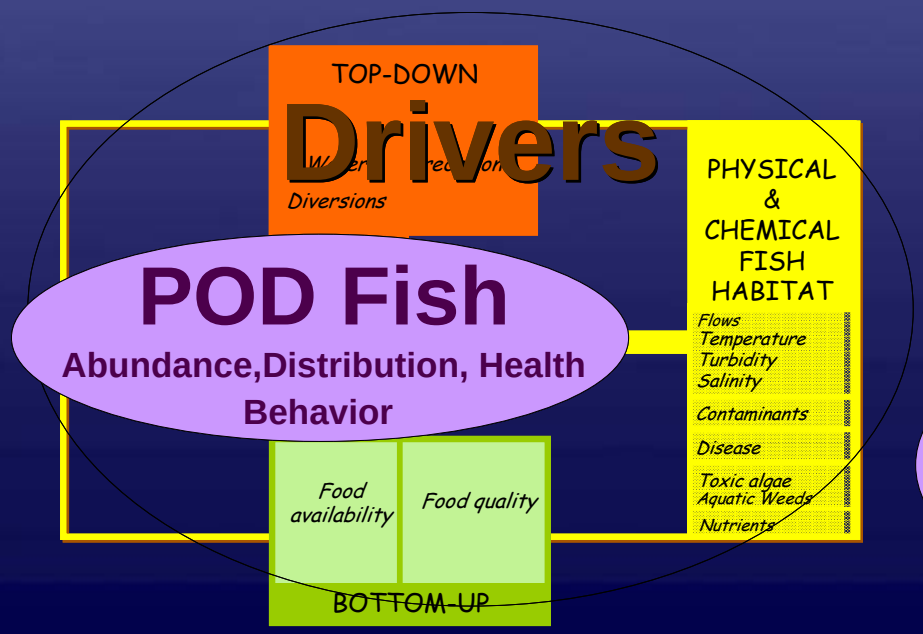
Drivers

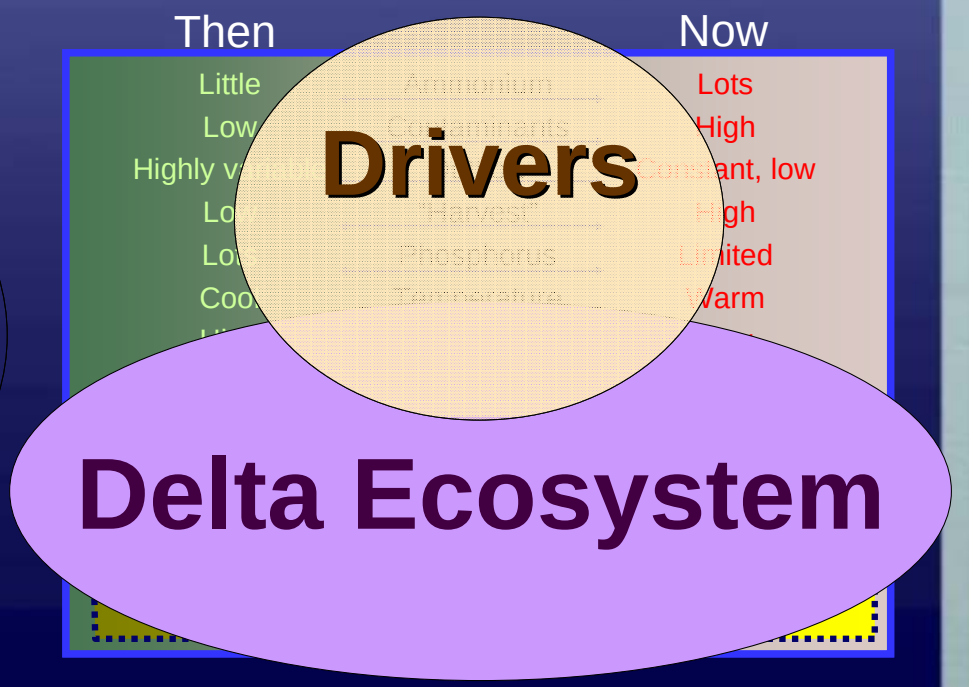
="Knobs"

Delta Ecosystem

Current POD Studies:
Science Informing Solutions

Focus on Multiple Drivers of Change





Current POD Studies:
Science Informing Solutions

Focus on **Multiple Drivers** of Change

Jared Diamond, 2005

Collapse - How Societies Choose to Fail or Succeed

"People often ask, "What is the single most important environmental problem facing the world today?"

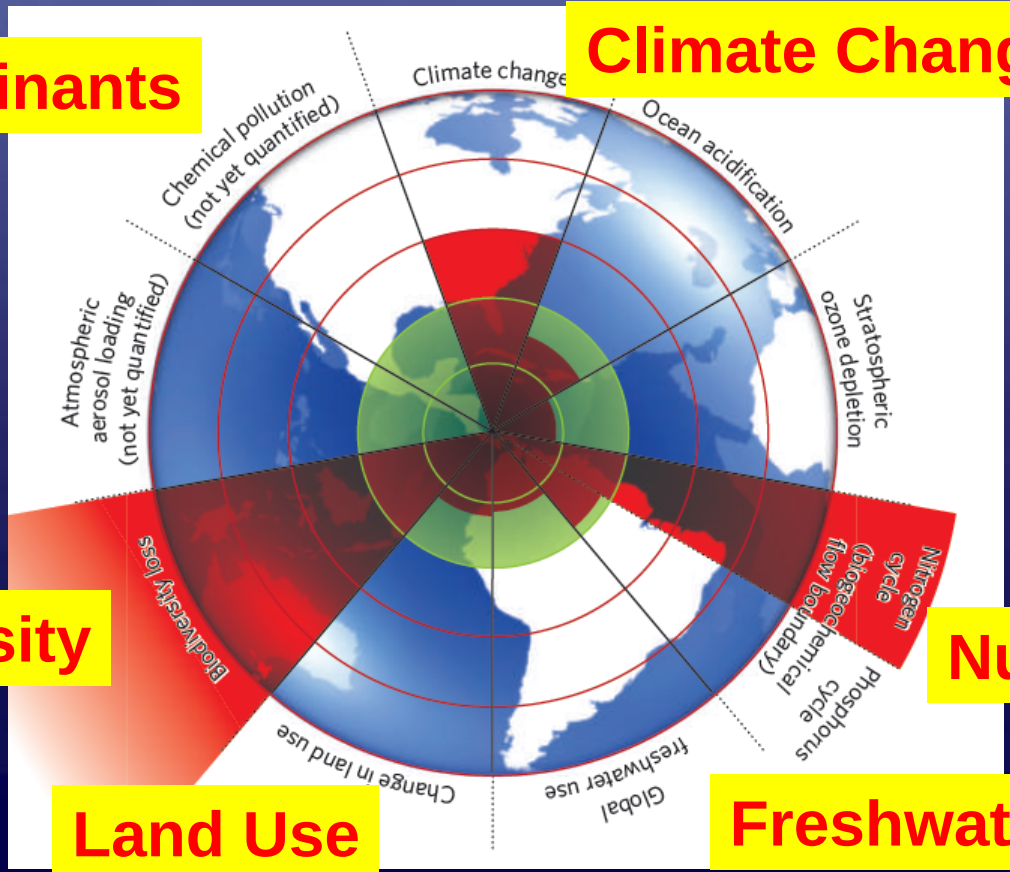
The single most important problem is our misguided focus on identifying the single most important problem!

… because any of the dozen problems, if unsolved, would do us great harm and because they all interact with each other.

We have to solve them all."

Current POD Studies:
Science Informing Solutions

Focus on **Multiple Drivers** of Change



Climate Change

Contaminants

Biodiversity

Nutrients

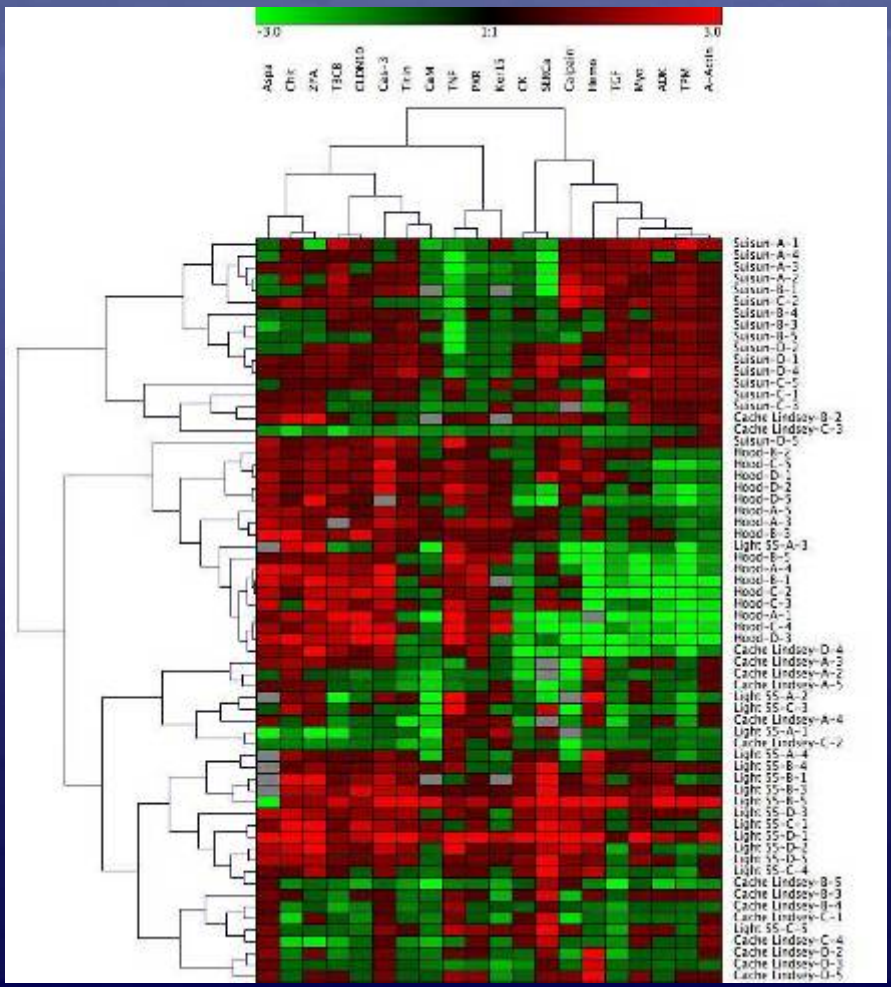
Land Use

Freshwater Use

Rockström et al. Nature 2009 – Nine interlinked "planetary boundaries" keeping earth in "desirable" state

POD Driver: Contaminants

Growth & Survival, Health & Behavior



Source: Connon, unpublished

POD Driver: Nutrients

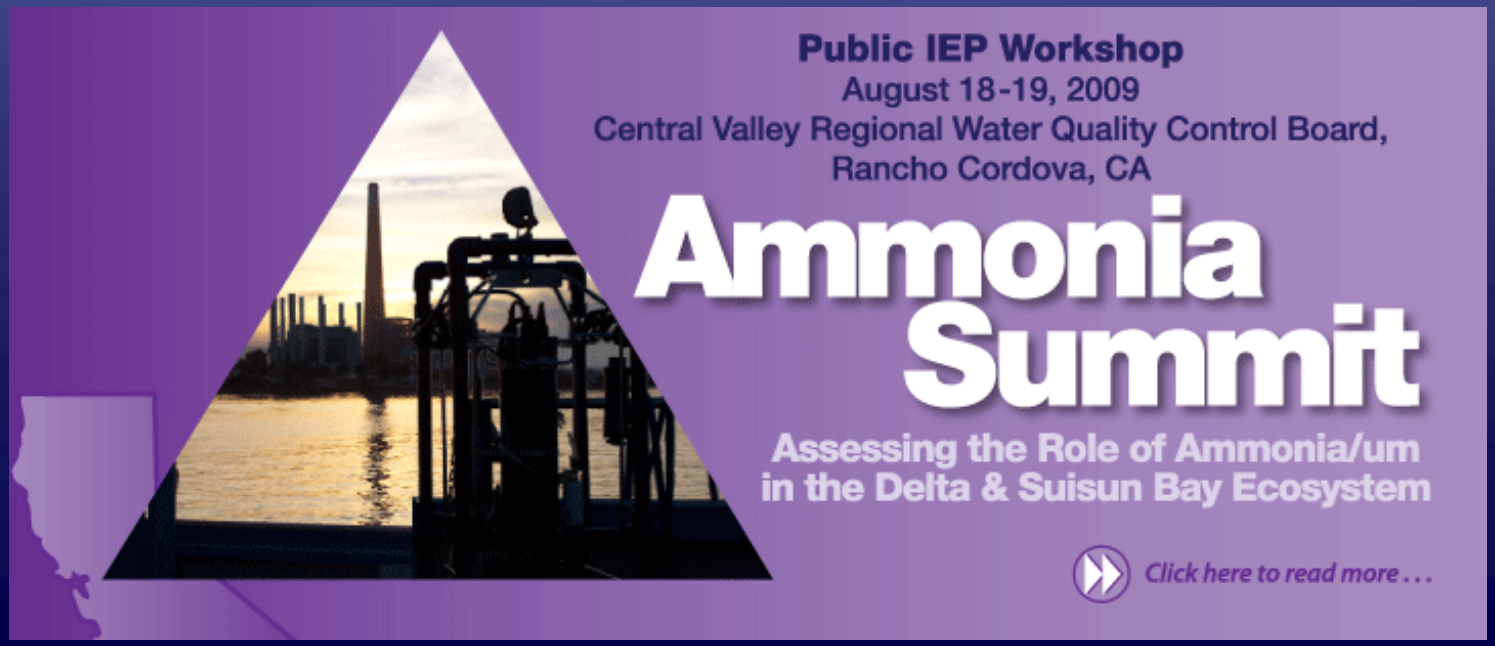
Food Quantity & Quality, Water Quality

A Framework for Research Addressing the Role of Ammonia/Ammonium in the Sacramento-San Joaquin Delta and the San Francisco Bay Estuary Ecosystem

Submitted to:

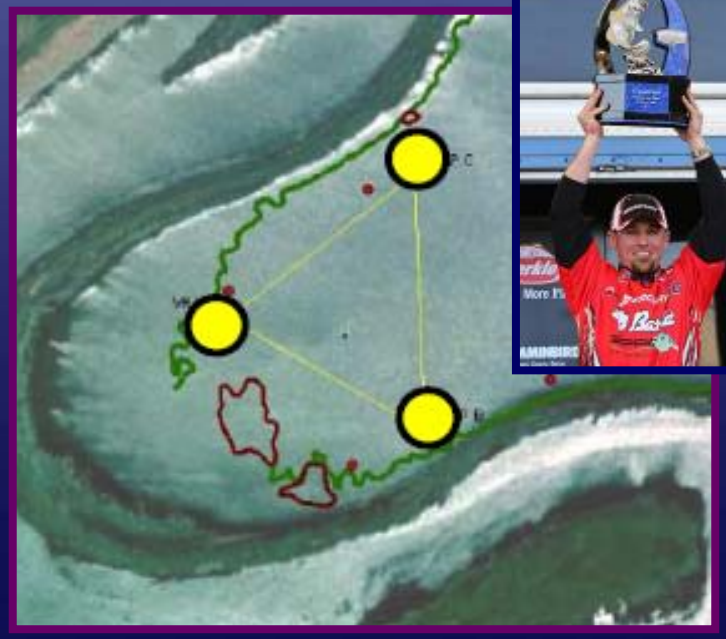
The CALFED Science Program
650 Capitol Mall, 5th Floor
Sacramento, CA 95814

4/2009



POD Driver: Biodiversity Changes

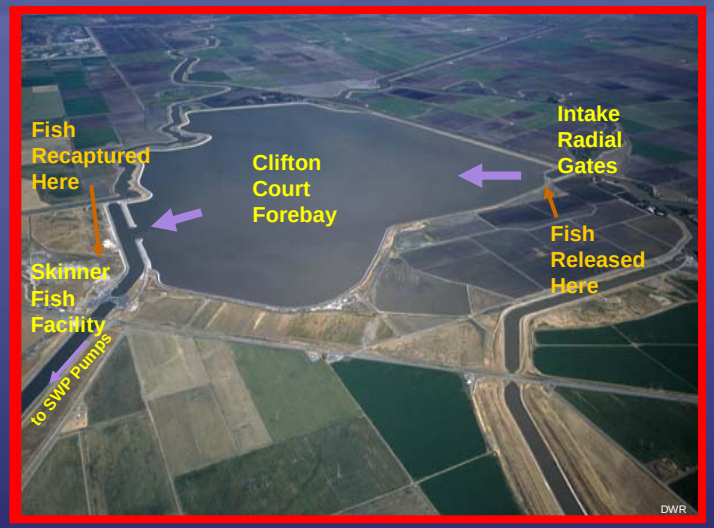
Dominance by Introduced & Nuisance Species

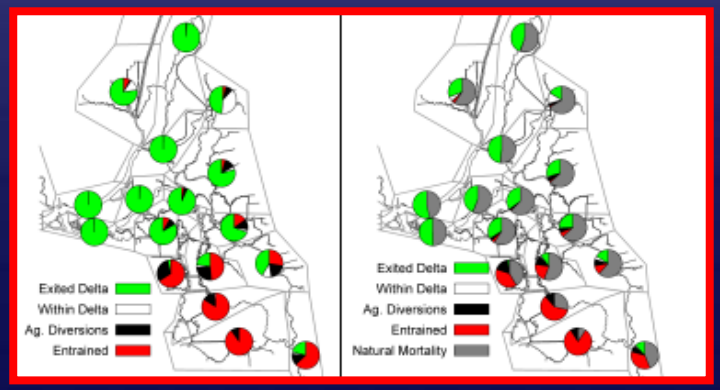


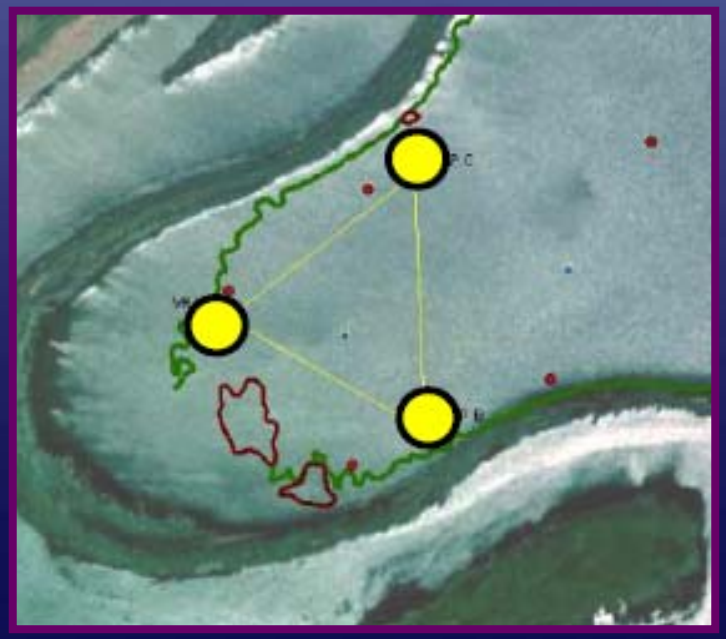
Sources: Conrad, Stephenson, unpublished

POD Driver: Biodiversity Changes

Loss (Mortality) of Desirable Species







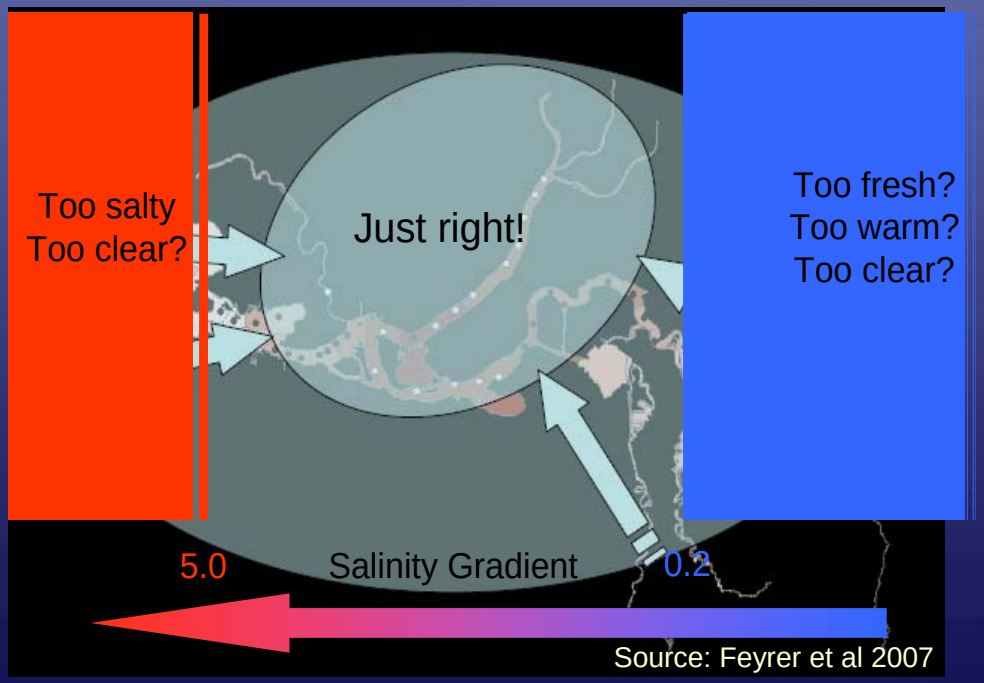
Sources: Castillo, unpublished
Gross et al. 2010

Sources: Conrad, Stephenson, unpublished

POD Driver: Water and Land Use

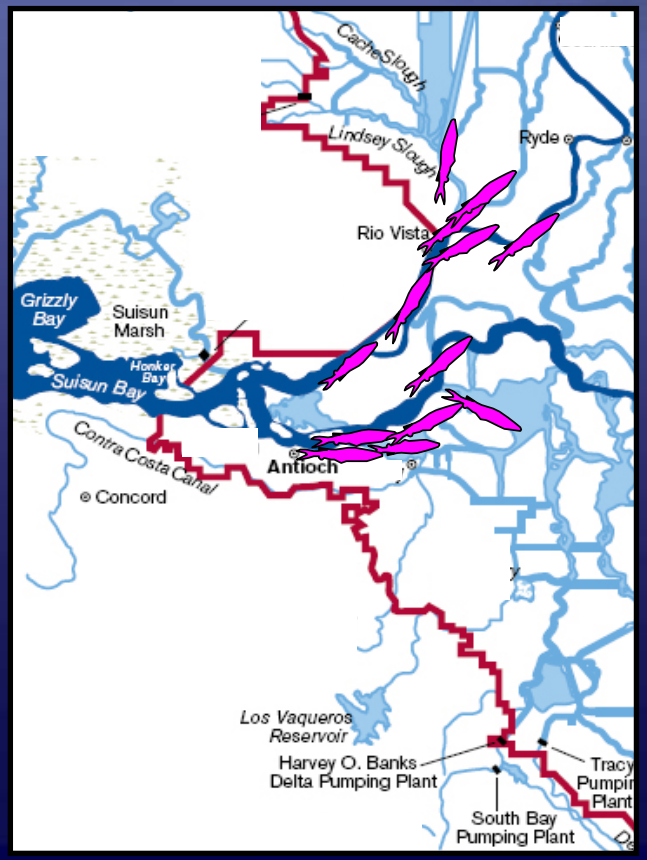
e.g. Outflow, Salinity, Turbidity

Fall Habitat



Source: Feyrer et al 2007

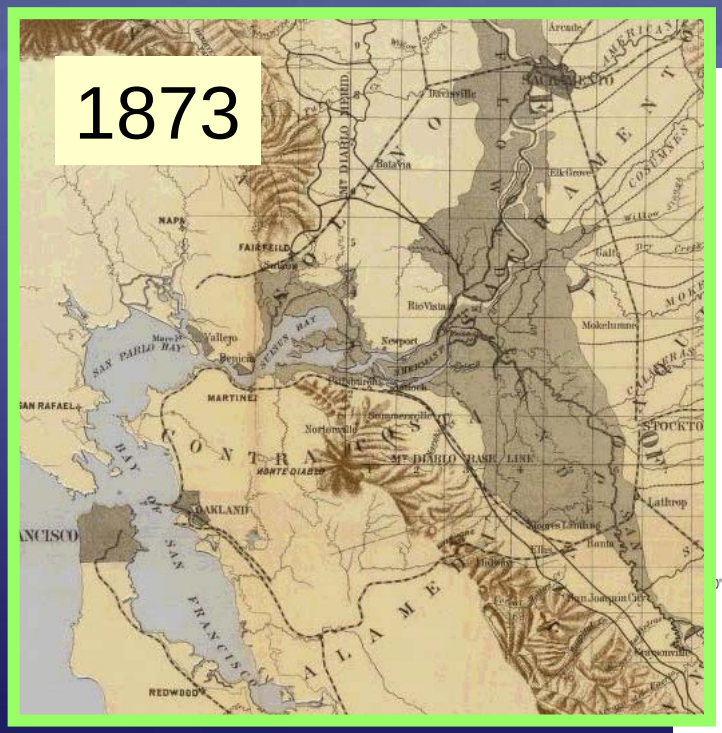
Spawning Migration

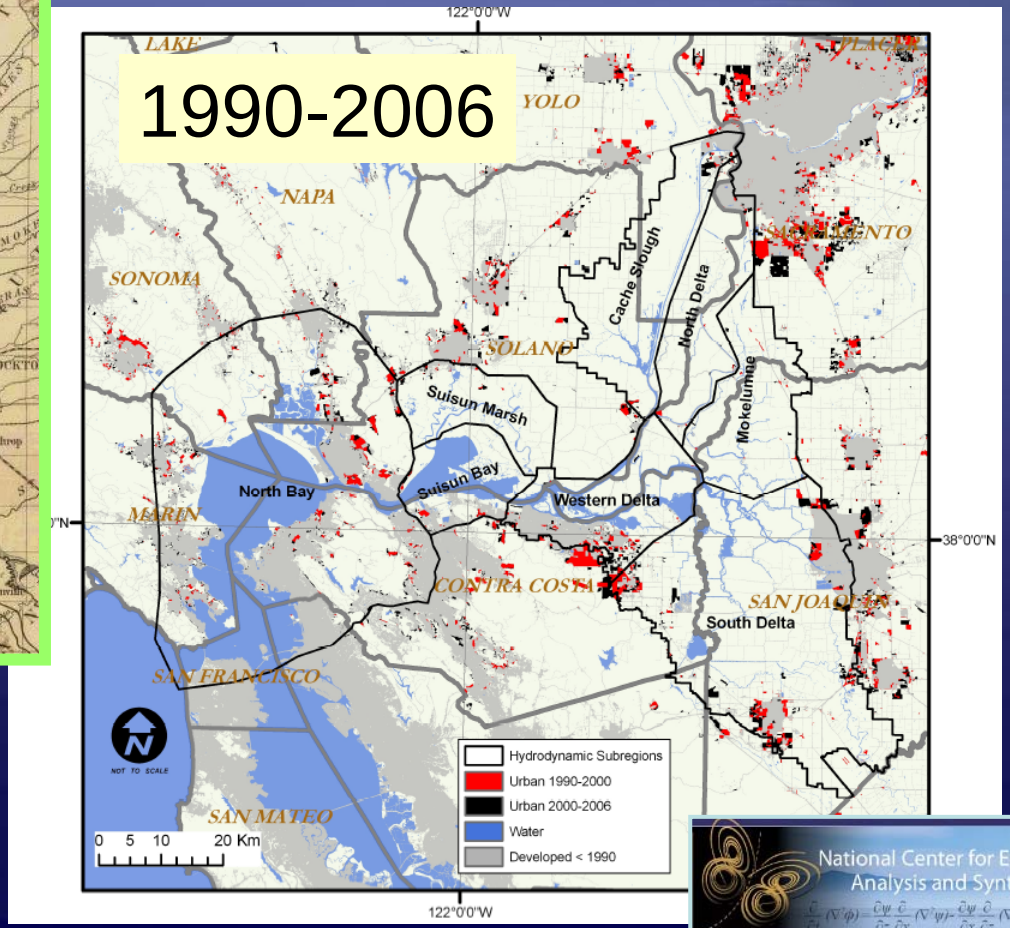


Source: Sommer et al, In Review

POD Driver: Water and Land Use

e.g. Landscape Modifications, Restoration Opportunities



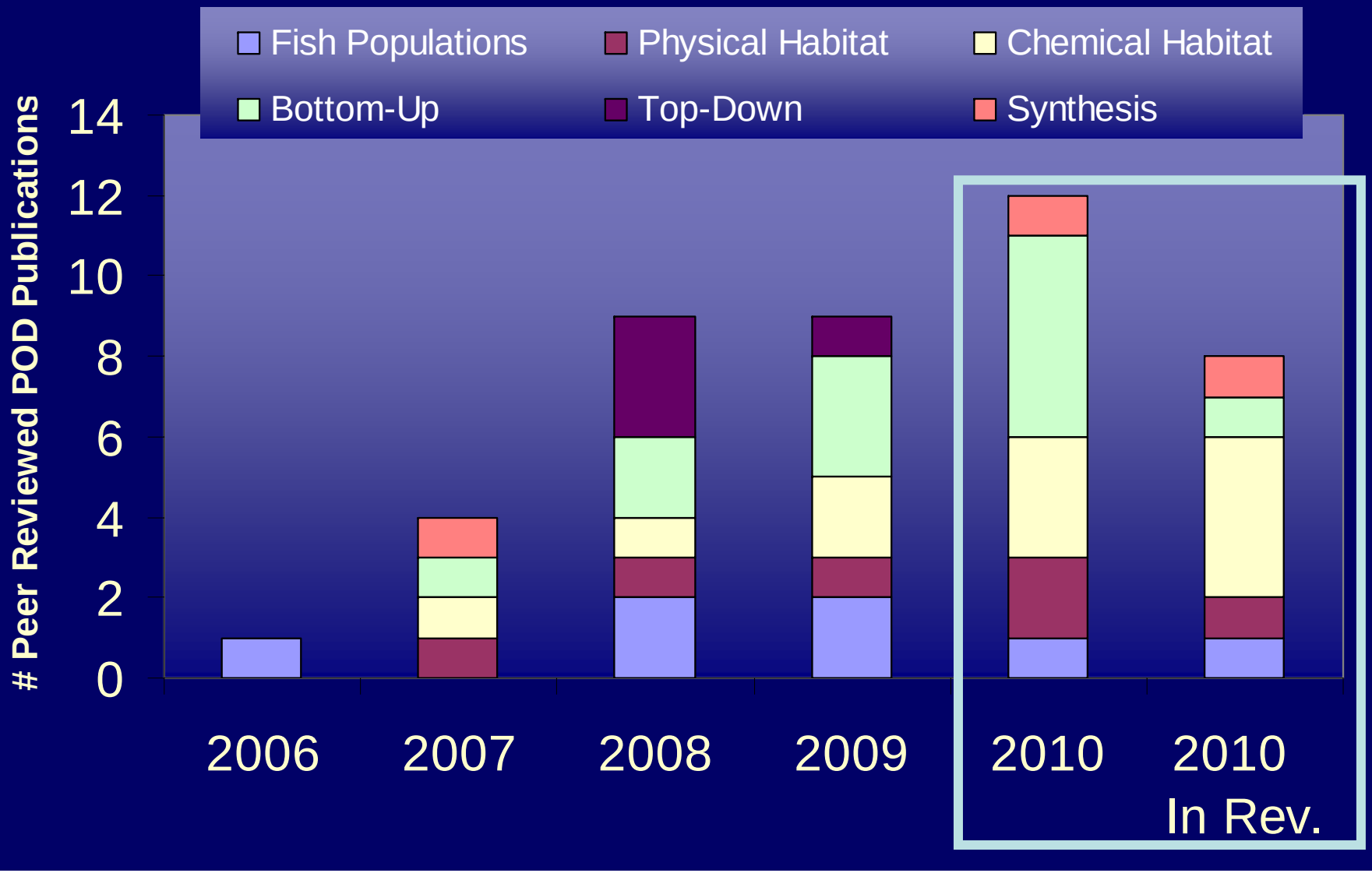


National Center for Ecological Analysis and Synthesis

Source: Stoms, In Press, SFEWS

Products: POD Publications

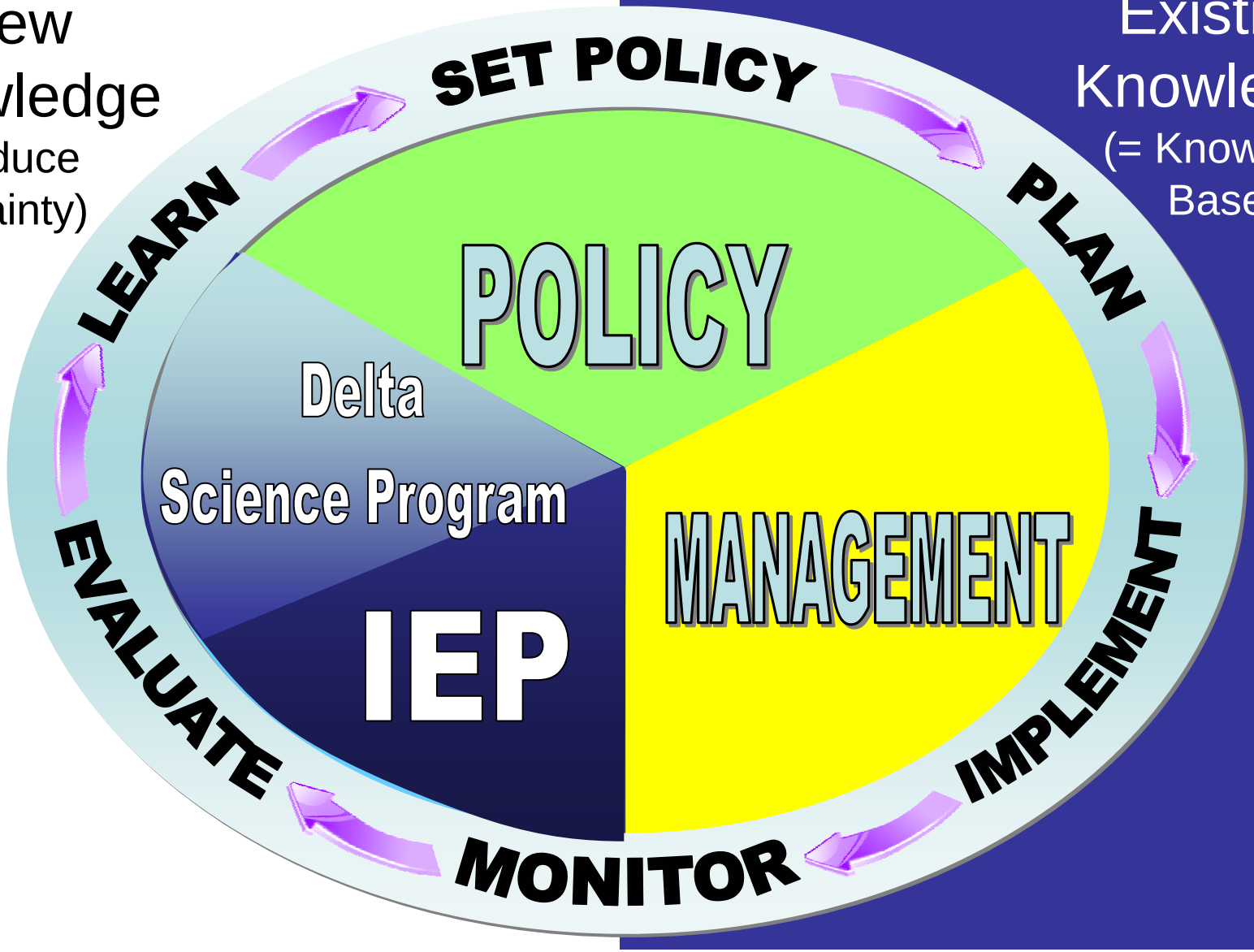
http://www.science.calwater.ca.gov/pod/pod_publications.html



Science Informing Solutions:
Adaptive Management Cycle

New Knowledge
(= Reduce Uncertainty)

Existing Knowledge
(= Knowledge Base)



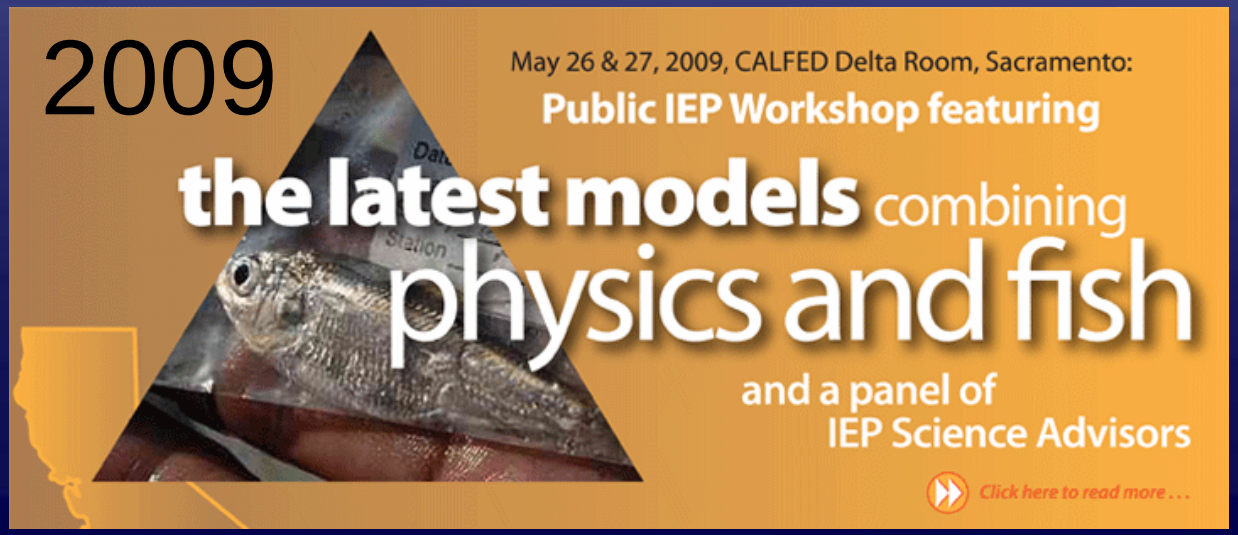
Thank You!

“Planning for the future without a sense of history is like planting cut flowers.“

Daniel Boorstin

Historian and Librarian of Congress

Modeling, Synthesis, Products

- NCEAS/UCSB
- Modeling Review

  http://www.water.ca.gov/iep/activities/reviews.cfm