

Delta Independent Science Board: Recent Accomplishments and Current Activities

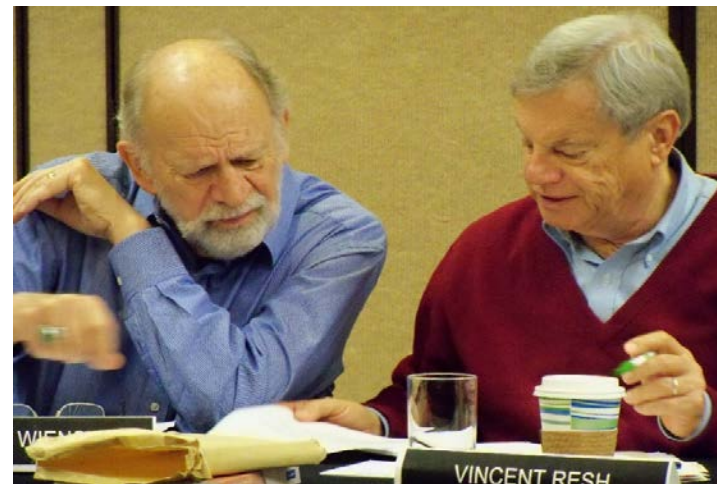
*Dr. Stephen Brandt
Dr. Elizabeth Canuel
Delta Independent Science Board*

Agenda Item 9
August 22, 2019



Statutory Role

- 85280. “...provide oversight of the scientific research, monitoring, and assessment programs that support adaptive management in the Delta through periodic reviews of each of those programs....”
- Review programs by themes and specific science documents (e.g., Delta Science Plan)
- Thematic reviews presented to the Council:
 - 1) Restoration (2013)
 - 2) Fish and Flows (2015)
 - 3) Adaptive Management (2016)
 - 4) Levees (2016)
 - 5) Delta as an Evolving Place (2017)
 - 6) Water Quality (2018)



Overall Purpose

- Evaluate the state and adequacy of the science
 - ✓ Recommend forward-looking strategic science priorities
 - ✓ Identify gaps
 - ✓ Increase scientific credibility
 - ✓ Improve research clarity
 - ✓ Advance the debate about Delta issues
 - ✓ Seek better connectivity between science, management and policy
- Do not make or recommend policy decisions

Overview of Review Process

1. Identify relevant thematic topics
 - Delta Plan Chapter Topics
 - Panels/Discussions
2. Prospectus on topic, goals, methods
3. Draft review for public comment
4. Final review and report to Council
5. Outreach

Summary Sheet: Delta ISB's 2018 Water Quality Review January 2019

Water Quality Science in the Sacramento-San Joaquin Delta Chemical Contaminants and Nutrients

"There is little that is simple, and much that can be misconstrued, in the description and interpretation of water quality in the Delta."

BACKGROUND AND MOTIVATION
Water quality in the Sacramento-San Joaquin Delta (the Delta) is impaired, yet perceptions differ on the severity of impairment and its causes. Changes to water conveyance, hydrology, and climate change will further affect water quality in the Delta. This review focuses on contaminants and nutrients, and on how information about them is sometimes neglected in decisions related to ecosystem health in the Delta.

Water quality is a complex subject and has different meanings, as shown by this word cloud portraying the most frequent 40 words in the review.

APPROACH The Delta ISB's analysis of the state of water quality science in the Delta was based on information gathered from: 1) reviews of recent publications on water quality, 2) responses to a questionnaire distributed to a range of agency personnel, 3) in-person interviews with individuals involved in various aspects of water quality, 4) comments received on a draft released for public comment, and 5) information gathered from relevant meetings, workshops, and conference presentations.

PERCEPTIONS In the questionnaire, respondents were asked how strongly they agreed with different statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Responses were binned to reflect those that agreed (4-5) or disagreed (1-2). While several of the statements in the questionnaire produced varied responses, some statements (below) showed a greater consensus of opinion.

Response	Count
Agree	4
Disagree	12

Sufficient research has been done on water quality issues in the Delta.

Response	Count
Agree	2
Disagree	12

Water quality in the Delta currently is sufficient to support the recovery of threatened/ endangered species (left) and overall ecosystem recovery (right).

Response	Count
Agree	5
Disagree	8

There is integration among physical, biological, and chemical monitoring programs.

Delta Independent Science Board 980 Ninth St., Suite 1500, Sacramento, CA 95814 www.deltacouncil.ca.gov

ISB Products Since July 2018

Reviews:

- Water Quality Thematic Review (July 2018)
- 2019 Delta Science Plan
 - ✓ Submitted Report to Delta Stewardship Council (December 2018)
 - ✓ Submitted Comment Letter to DPIIC on the Need to Improve Interagency Science (February 2019)

Prospectus:

- Non-native Species (September 2018)

Summary Sheets:

- Habitat Restoration
- Fish and Flows
- Water Quality

Current Work Plan

Efforts	2019				2020			
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
IEP	Draft and Refine Report		Finalize and Outreach					
Monitoring Enterprise	Inventory Method		Inventory Development		Delta ISB Synthesis and Report			
Water Supply Reliability	Workshop & Synthesis		Information Gathering/Report Writing				Outreach	
Ecosystems: Non-native species	Workshop & Synthesis		Draft Report				Outreach	
DPIIC Science Needs Assessment		Workshop Planning			Synthesis			
Implications of Rapid Environmental Change		Draft Paper		Panel/Brown Bag		Finalize Paper		Outreach
Delta Lead Scientist Recruitment								

Upcoming/Potential Requests:

- Delta Plan Ecosystem Amendment PMs
- Climate Change Vulnerability Assessment and Adaptation Strategy?

Current Thematic Reviews

Gathering Information:

- Water Supply Reliability
- Delta Monitoring Enterprise

Analyzing and Synthesizing:

- Ecosystems: Non-native Species

Finalizing and Outreach:

- Interagency Ecological Program

Current Thematic Reviews (1)

Gathering Information:

- Water Supply Reliability
- **Delta Monitoring Enterprise**

Analyzing and Synthesizing:

- Ecosystems: Non-native Species

Finalizing and Outreach:

- Interagency Ecological Program

Delta Monitoring Enterprise

1. Part 1: Inventory of All Monitoring Programs by ESSA Technologies Ltd., cbec, and PAX
 - a) What is being collected?
 - b) Who is collecting and funding?
 - c) Why is it collected?
 - d) How it is used in management?

2. Part 2: Delta ISB Review and Recommendations
 - a) How can programs be better linked and coordinated?
 - b) Are programs meeting the needs of management?

Timeline: Monitoring Review

- **April 2017:** Finished Prospectus
- **November 2017 to July 2018:** Hosted 5 Brown Bag Seminars and Panels
- **December 2018:** Contracted with ESSA, cbec, & PAX to Develop Inventory
- **March 2019:** Inventory Methodology Developed
- **April 2019:** Workshop to Inform Scope of Inventory
- **End of 2019:** Inventory and Final Reports from ESSA
- **Late 2020:** Delta ISB Findings and Recommendations

Monitoring Inventory Framework

DIRECT SOCIO-ECONOMIC DRIVERS

Hydrologic alterations \$

- Water operations / exports ^^
- Water storage ^^
- Water demand ^^ vv
- Water conveyance / infrastructure ^^
- Wastewater discharge
- Stormwater runoff / drainage ^^

Habitat alterations \$

- Levees
- Dredging
- Water intakes & fish screens

Biological resource use

- Fishing ^^ vv
- Hunting
- Forest harvesting

Human intrusions & disturbance

- Agriculture
- Urban development
- Recreation & tourism
- Energy

Transportation & service corridors

- Roads & bridges
- Rail lines
- Docks & ports
- Shipping channels

ENVIRONMENTAL DRIVERS / CONDITIONS

Hydrology & hydrodynamics ☉

- Surface water / flow ^^
- Groundwater
- Stage
- Velocity
- Direction
- Tides
- Residence time
- Waves
- Flood
- Drought

Landform & natural disturbance

- Land elevation
- Subsidence
- Sea level rise vv
- Seismicity
- Wildfire

Weather & climate \$

- Air temperature
- Precipitation
- Wind
- Solar irradiance
- Extreme heat
- Extreme storms

Nutrients, energy & food web ☉ ^^

- Nitrogen / ammonia
- Phosphorus
- Carbon
- Chlorophyll A / B
- Detritus
- Primary productivity
- Harmful algal blooms (HAB)
- Phytoplankton
- Zooplankton

Sediment ☉

- Suspended sediment ^^
- Bedload
- Deposition
- Erosion

Water quality \$ ^^

- Salinity ☉
- Water temperature
- Dissolved oxygen
- pH
- Turbidity
- Hg & methyl mercury \$ ☉
- Polychlorinated biphenyl (PCB)
- Polycyclic aromatic hydrocarbons (PAH)
- Hydrocarbons
- Flame retardants
- Endocrine disruptors
- Lead
- Cadmium
- Copper
- Zinc
- Arsenic
- Selenium
- Constituent of emerging concern (CEC)
- Insecticides
- Rodenticides
- Herbicides
- Fungicides
- Pyrethroids
- Microplastics
- Nutrients
- Fecal coliform
- E. coli
- Other discharge contaminants

HABITATS

Tidal wetlands ☉

- Mudflats
- Saltwater / freshwater marshes
- Intertidal / transition zones
- Above-highwater refugia

Channelized

- Main channels
- Sloughs
- Backwater

Aquatic vegetation ☉

- Submerged
- Floating

Floodplain ☉

- Seasonally flooded
- Open water
- Managed ponds

Riparian ☉

Terrestrial

- Forests
- Non-forested vegetation
- Delta islands
- Pacific flyway

SPECIES

Fish

- Chinook Salmon ☉ ++
- Steelhead ☉ ++
- Green Sturgeon ☉ ++
- White Sturgeon ☉ ++
- Delta Smelt ☉
- Longfin Smelt ☉
- Sacramento Splittail ☉
- Pelagic fish

Mammals

- Salt marsh harvest mouse

Birds

- Non-resident / overwintering birds ++
- Waterfowl ++
- Shorebirds ++
- Gulls ++

Amphibians & reptiles

- Giant garter snake
- California tiger salamander

Invertebrates

- Insects
- Mollusks
- Crustaceans

Invasive / non-native species \$

- Striped bass
- Nutria
- Water hyacinth
- Brazilian waterweed
- Spongeplant
- Giant reed
- Yellow star thistle

MANAGEMENT ACTIONS

Water supply management

- Water operations ^^
- Water storage ^^
- Water demand ^^ vv
- Water conveyance / infrastructure ^^
- Groundwater management

Flood management

- Flood control structures
- Protection and expansion of floodways, floodplains, & bypasses
- Subsidence reversal

Habitat management

- Habitat protection
- Natural environmental flows
- Habitat restoration

Native species management

- Incidental mortality / take
- Harvest ^^ vv
- Population enhancement ^^

Invasive / non-native species management

- Pathways of introduction
- Creation of favorable habitat conditions
- Population control

Water quality ^^

- Wastewater management
- Pollution control

Land use management

- Land zoning, designation, and ownership
- Land use

Monitoring Review Topics

- Purpose of monitoring programs, types, and theoretical underpinnings
- Science and scientific rigor of monitoring
- The role of monitoring in the context of adaptive management
- Inventory
- Suggestions for improvement of monitoring
 - Weak fields/strong fields
 - Meeting management needs
 - Performance measures
- Recommendations and to whom

Current Thematic Reviews (2)

Gathering Information:

- Water Supply Reliability
- Delta Monitoring Enterprise

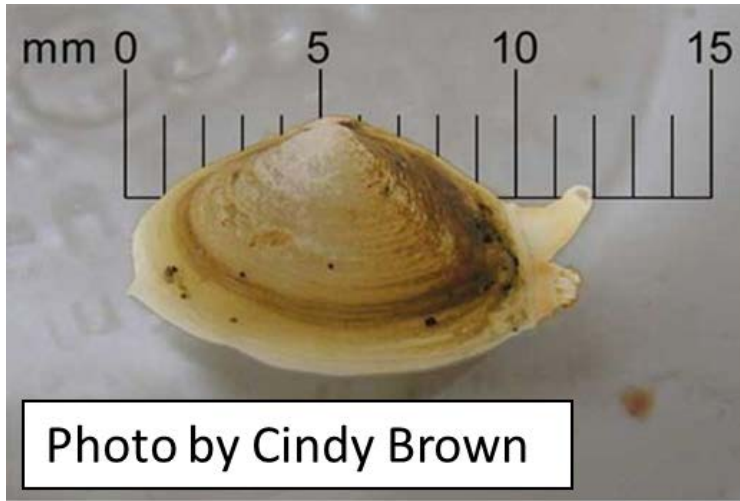
Analyzing and Synthesizing:

- **Ecosystems: Non-native Species**

Finalizing and Outreach:

- Interagency Ecological Program

Ecosystems Review Purpose



Review the science on non-native species, their effects on Delta ecosystems, and how to control or adapt to them



Timeline: Ecosystems

- **August 2018:** Finished Prospectus
- **November 2018:** Workshop/Panel: Broad Concepts
- **March 2019:** Workshop/Panel: Key Delta Issues
- **April to June 2019:** Follow up Analysis and Report Outline
- **September 2019:** Initial Draft
- **March 2020:** Complete Report for Public Comment
- **Summer 2020:** Report Finished/Outreach

Main Topics in Report

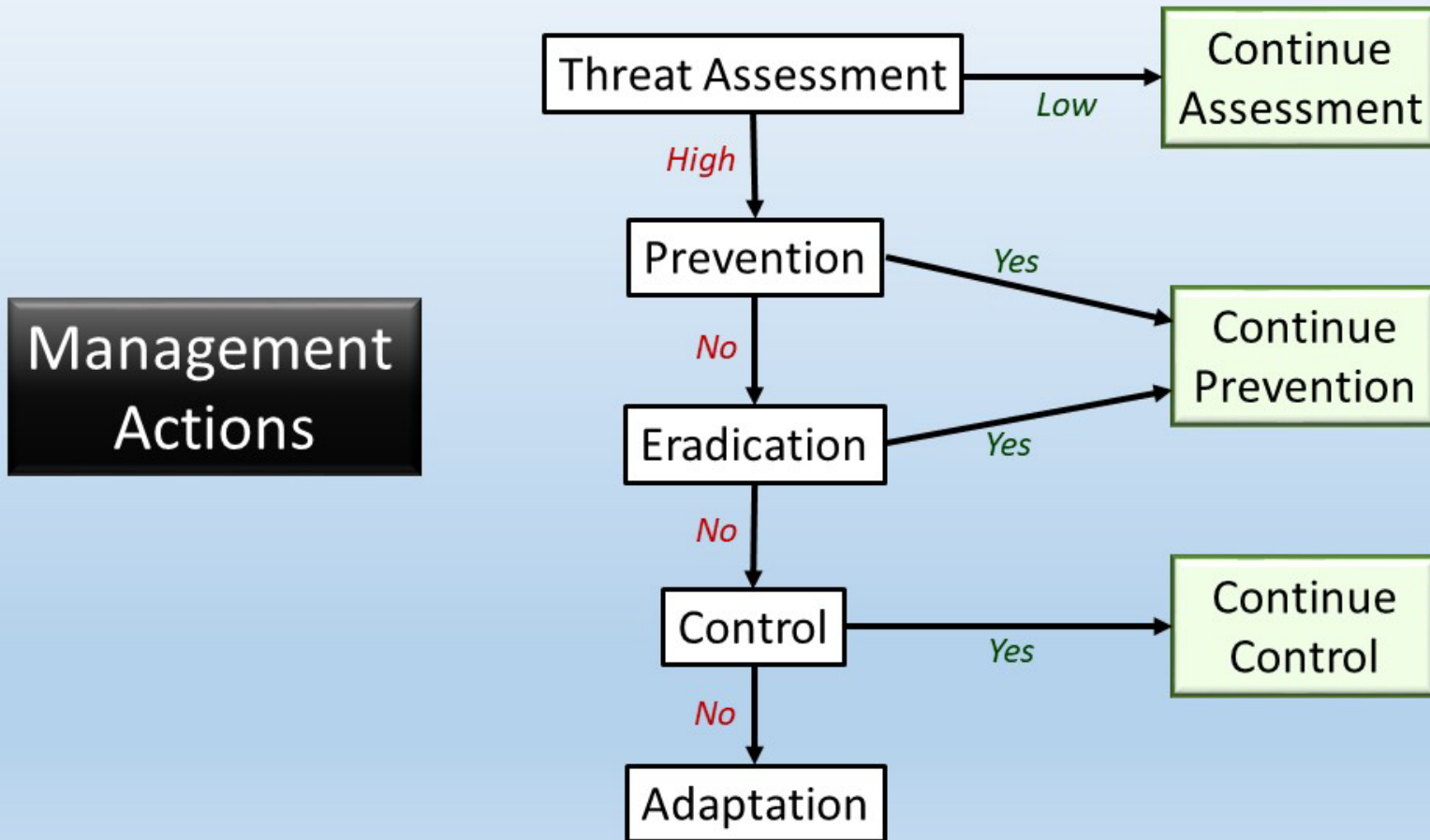
1. Introduction: Non-native species in the Delta
2. Science related to the “invader”
3. Assessing impacts of the “invader”
4. Science related to the dynamic Delta
5. Ecosystem restoration
6. Science related to non-native species in the context of ecosystem management
7. Management considerations, conclusions, and key recommendations

Science Related to “the” invader

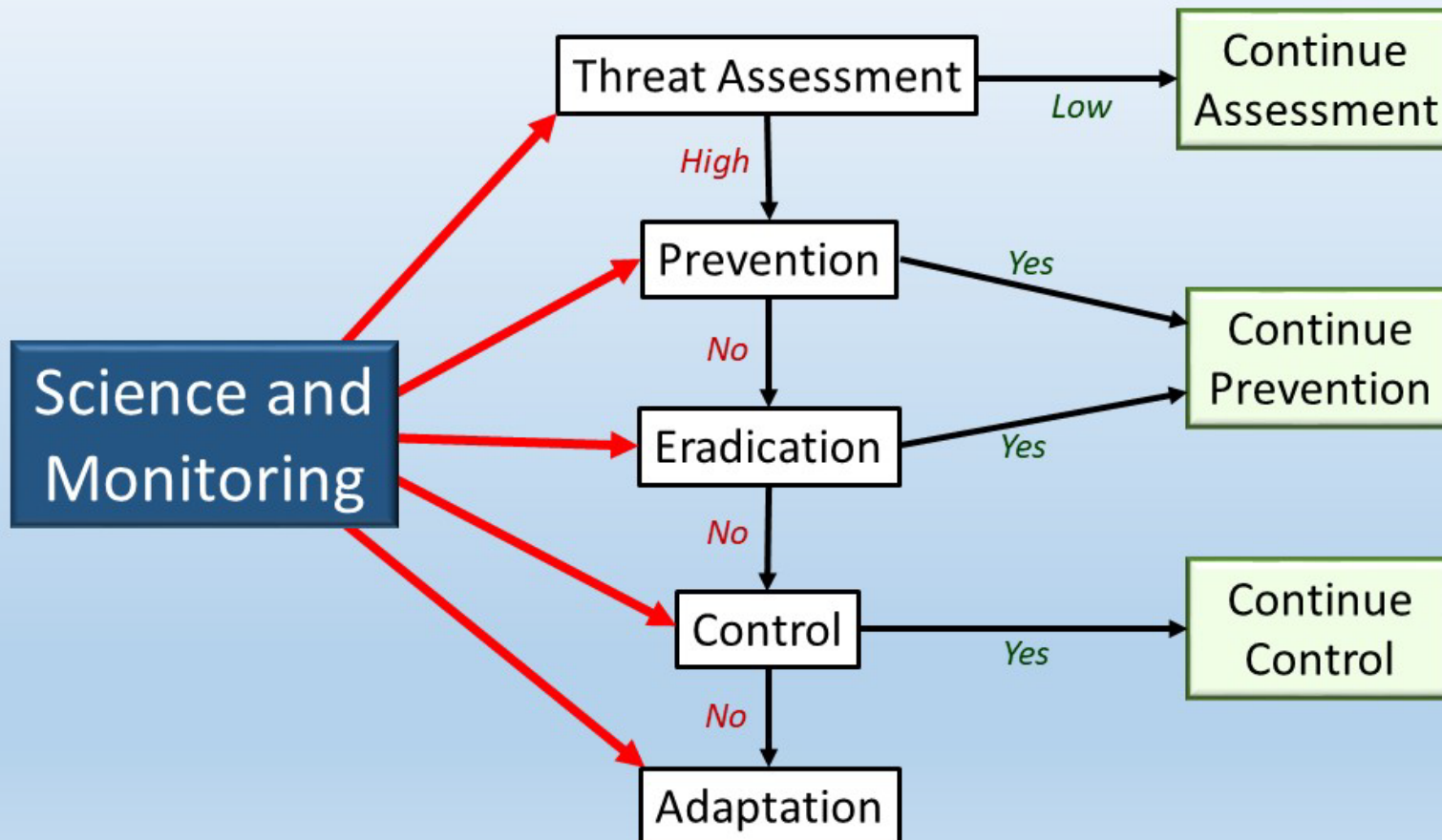
1. Prediction of invasions
2. Habitat suitability in the context of individual invader requirements
3. Invader life history characteristics
4. Routes and corridors
5. Detection
6. Eradication
7. Control
8. Monitoring and Assessment



Management Related to Invader: Conceptual Model



Science Related to the Invader: Conceptual Model



Recommendations

1. How should management actions be directed?
Where to do what?
 - a) When to eradicate an invader; when to control; when to accept?
 - b) How to prioritize actions on which invaders or ecosystems using what criteria?
 - c) How does consideration of non-native species and their effects enter into the adaptive management process?
2. Fundamental Science Needs

Current Thematic Reviews (3)

Gathering Information:

- Water Supply Reliability
- Delta Monitoring Enterprise

Analyzing and Synthesizing:

- Ecosystems: Non-native Species

Finalizing and Outreach:

- **Interagency Ecological Program**

Delta ISB Chair: Elizabeth Canuel

- Faculty Member at Virginia Institute of Marine Science/William & Mary (25 years)
- Member of the Delta ISB since 2010
- Expertise: Carbon Cycle; Biogeochemistry
- Research:
 - How have human activities altered the delivery of carbon
 - Climate impacts on carbon
 - Food resources for aquatic organisms



Delta ISB: Forward Looking

- IEP Review – Recommendations
- Delta ISB – Transitions in membership
- Upcoming reviews



IEP Review: Update

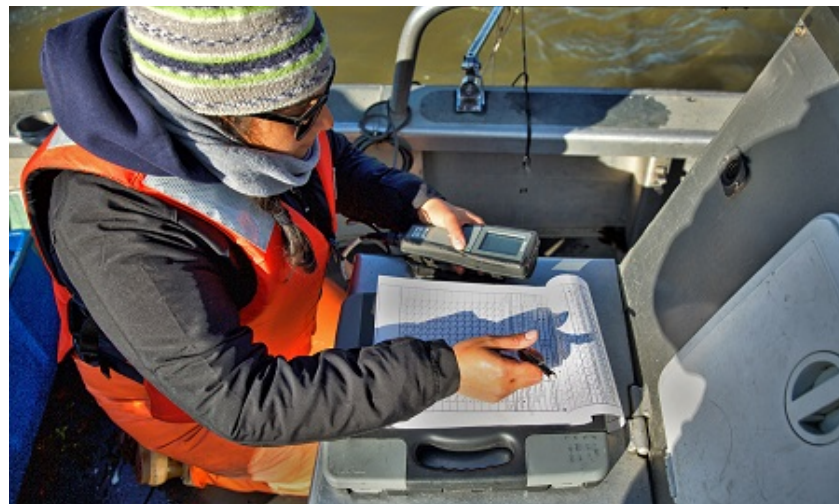
Review Process

- Interaction with IEP
- Consideration of prior reviews of IEP
- Experiences of the Delta ISB members in science organizations
- Brief review of how science is organized across other large ecosystems
- Review of IEP documents
- Insights reached through responses to a questionnaire and in-depth interviews with IEP participants and other stakeholders

IEP Review: Findings (1)

What IEP Does

1. To support adaptive management of the Delta both now and in the future, the core monitoring and reporting functions of IEP must be continued.
2. To sustain the decades-long dataset developed by IEP, **the value of long-term data in coping with rapid environmental changes should be promoted through powerful and consistent statements and examples.**



IEP Review: Findings (2)

What IEP Does

3. To broaden the constituency of IEP, **data management should be improved by enhancing the accessibility of the IEP website and data portals and assessing stakeholder needs and uses of information.**
4. To integrate improved monitoring technologies into existing programs, **a standing committee within IEP should continually assess new monitoring methods, phasing out those that are no longer appropriate while taking care to cross-calibrate data from former and revised methodologies.**



Environmental Data Initiative

- Create . Package . Archive . Discover . Reuse -

IEP Review: Findings (3)

What IEP Does

5. To provide the mechanistic understanding needed to address the Delta's environmental problems, **additional resources should be obtained to augment monitoring with the experimentation and synthesis needed for effective adaptive management and to guide both short- and long-term management and decision-making in the Delta.**



Climate change and extreme events



Impacts of non-native species

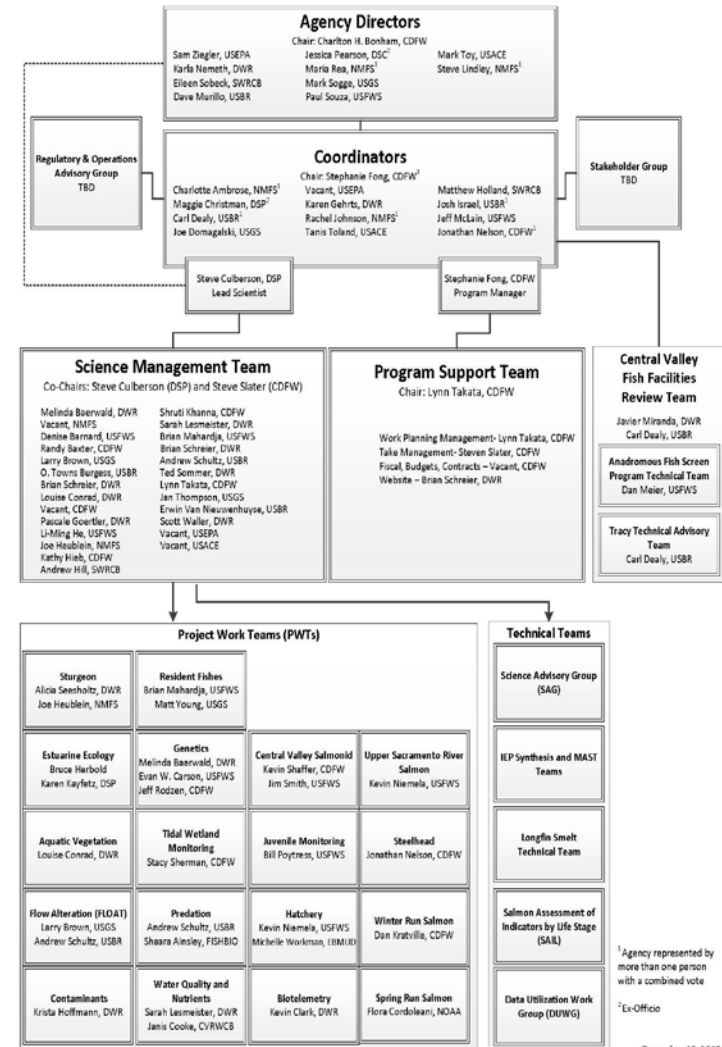


Restoring native species and communities

IEP Review: Findings (4)

How IEP Works

- To ensure that IEP continues to serve its multiple partners and stakeholders, IEP should undertake a formal, transparent assessment to develop a consistent set of goals that define its mission and activities in addressing the diverse management needs of the Delta.



¹ Agency represented by more than one person with a combined vote

² Ex-Officio

IEP Review: Findings (5)

How IEP Works

7. To develop a new and clear sense of direction, **IEP Directors, staff, funders, and stakeholders should engage in in-depth discussions of IEP's organization and operations, including alternative organizational structures.**
8. To be strategic, efficient, and effective, **IEP should prioritize its activities to justify additional funding and partnerships and/or reallocate resources among existing activities.**



Understanding Food Webs



Restoration

Current & Changing Membership



Dr. Stephen Brandt
Fish & Food Webs



Dr. Elizabeth Canuel
Biogeochemist



Dr. Tracy Collier
Fisheries/Toxicology



Dr. Joe Fernando
Engineer



Dr. Tom Holzer
Geologist



Dr. Jay Lund
Engineer



Dr. Richard Norgaard
Economist



Dr. Vince Resh
Ecologist



Dr. John Wiens
Landscape Ecology



Dr. Joy Zedler
Botany/Wetlands

Delta ISB: Upcoming

Future Reviews

- **All current reviews should be completed or have a public draft in circulation when original members retire in August 2020.**
- **Topics**
 - **Emerging issues/challenges in environmental science?**
 - **Specific emerging issues/challenges specific to the Delta ecosystem?**
 - **Revisit topics identified at our last retreat**
- **Timing**
 - **Engage new members**
 - **Identify expertise needed. This will help with recruitment/onboarding of new Delta ISB members**

Questions?

