

Fishes and Flows in the Sacramento-San Joaquin Delta:

Research Needs in Support of Adaptive Management

Delta Independent Science Board

November 19, 2015

Thematic Reviews of Science and the Delta:

Done:

Habitat Restoration – 2013

Fishes and Flows – 2015

Public Draft:

Adaptive Management

Being formulated:

Water Quality, Delta as Place

Future:

Delta Levees, Water Reliability

Purpose of Fish and Flows review

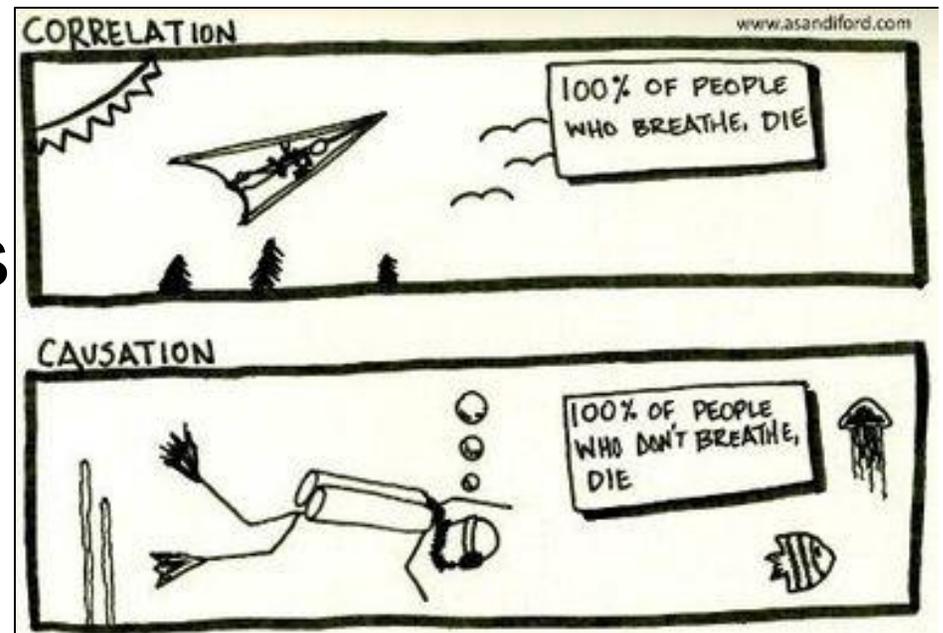
To identify strategic science needs to improve understanding, scientific collaboration, and communication about ...

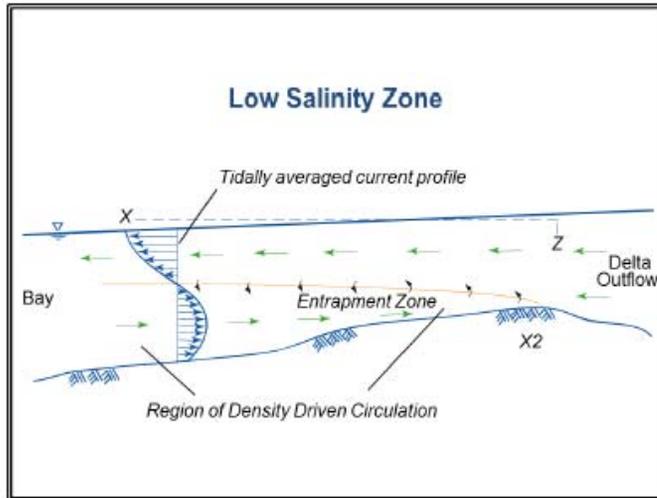
Relationships among fishes, flows, and stressors.



Context and Challenges

- All-encompassing topic linked to co-equal goals
- Multiple stressors and altered ecosystem
- Much work on topic, particularly by correlation/statistical analyses
- Excellent recent reports
- Policy implications





Workshop on Delta Outflows and Related Stressors Panel Summary Report

Panel

Denise Reed - Water Institute of the Gulf (*Panel Chair*)

James (Tim) Hollibaugh - University of Georgia

Josh Korman - University of British Columbia/Ecometric Consulting

Ernst Peebles - University of South Florida

Kenneth Rose - Louisiana State University

Pete Smith - United States Geological Survey, retired

Paul Montagna - Texas A&M University, Corpus Christi

May 5, 2014



Workshop on the Interior Delta Flows And Related Stressors Panel Summary Report

Panel:

Stephen Monismith – Stanford University (*Panel Chair*)

Mary Fabrizio – Virginia Institute of Marine Science

Michael Healey – Professor Emeritus, University of British Columbia

John Nestler – U.S. Army Corps of Engineers (retired)

Kenneth Rose – Louisiana State University

John Van Sickle - U.S. EPA (retired)

July 2014



INTERAGENCY ECOLOGICAL PROGRAM, MANAGEMENT, ANALYSIS, AND SYNTHESIS TEAM

An updated conceptual model
of Delta Smelt biology:
our evolving understanding of an estuarine fish



Technical Report 90
January, 2015

Interagency Ecological Program
for the
San Francisco Bay/Delta Estuary

A Cooperative Program of:

California Department of Water Resources	State Water Resource Control Board
California Department of Fish and Wildlife	U.S. Fish and Wildlife Service
U.S. Bureau of Reclamation	U.S. Geological Survey
U.S. Army Corps of Engineers	U.S. Environmental Protection Agency
	National Marine Fisheries Service

MAST 2015

Sustainable Water and Environmental Management in the California Bay-Delta



NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

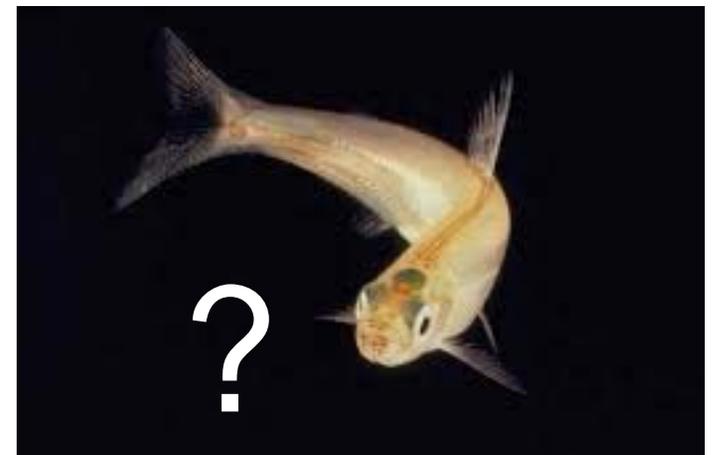
NRC 2010, 2012

Process

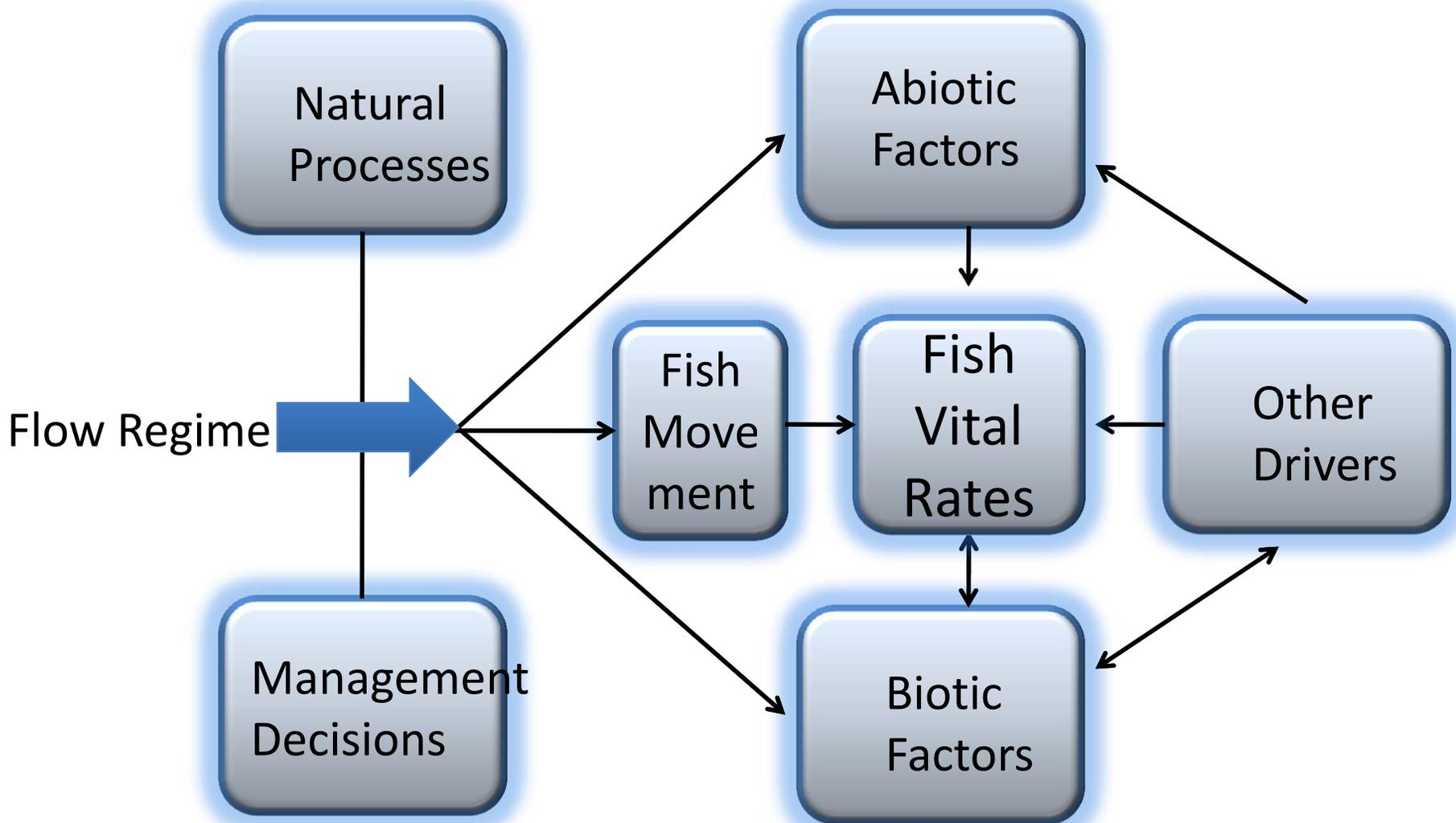
- ✓ Reviewed published literature and agency reports on fishes and flows in the Delta and other ecosystems
- ✓ Interviewed scientists from state and federal agencies, consulting, interest groups, and academia
- ✓ Attended workshops and received presentations at ISB meetings
- ✓ Solicited public comments

Findings

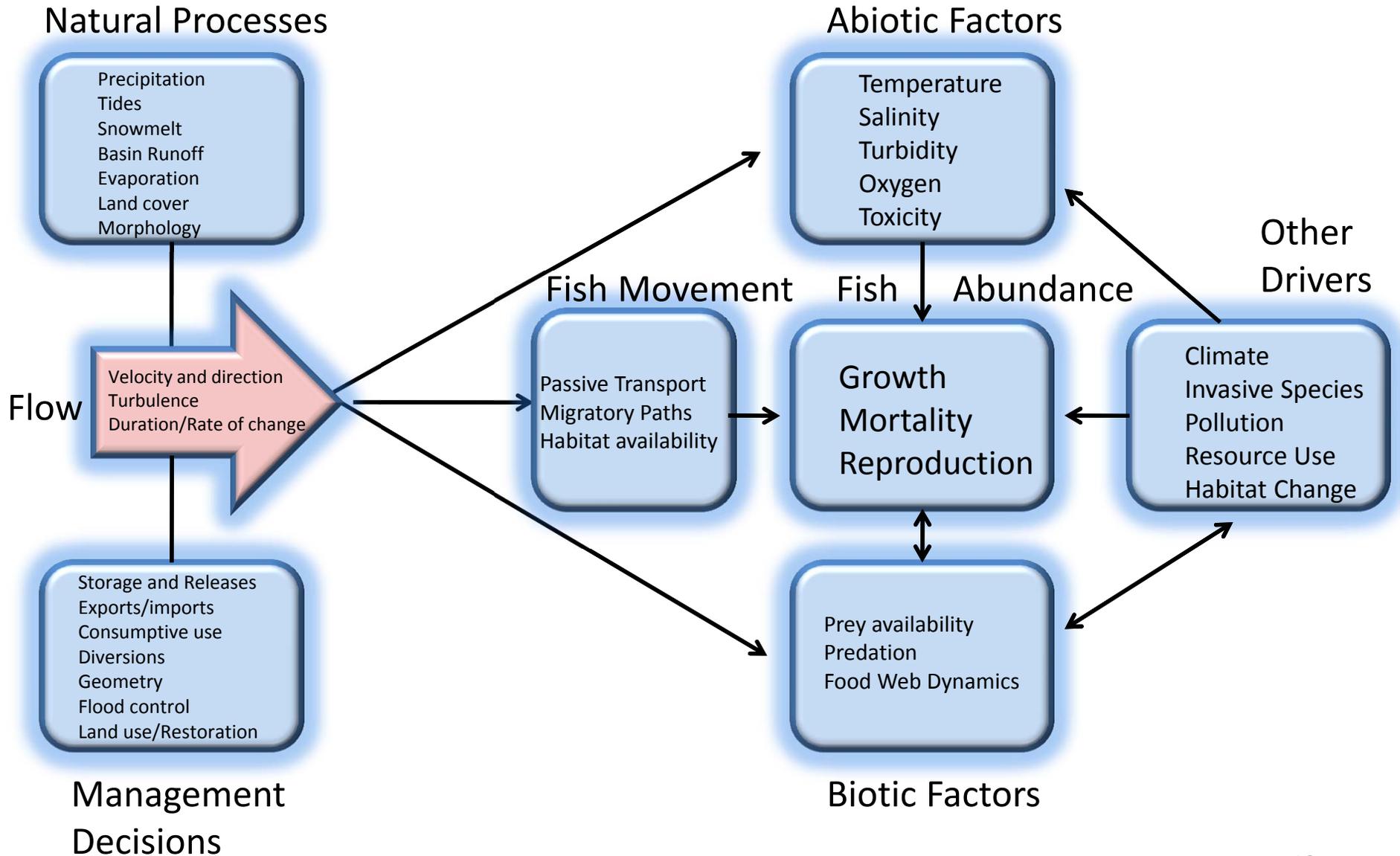
- 1) Connecting water flows and fishes is central to state's coequal goals
- 2) Modern Delta is not a native ecosystem, but is dominated by non-native species with some natives
- 3) Statistical analyses show that flows affect fishes, but decisions need more causal understanding of how flows affect fishes
- 4) Flows vary in time and location
- 5) Many agencies involved



Flows affect fish populations directly and indirectly involving multiple stressors



You wanted more detail?



Strategic Science Needs

1. Focus on cause & effect
2. Expand integrative science approach
3. Link numerical fish models with 3-D water flow models
4. Link time and space scales to mechanisms
5. Monitoring vital rates of fishes
6. Broaden species focus
7. Enhance national and international connections
8. Timely synthesis of research
9. Improve coordination among disciplines & institutions

1. Focus on Cause and Effect

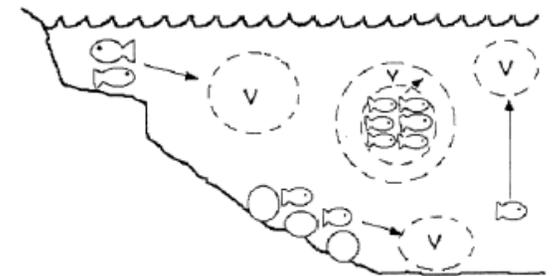
- Mechanistic understanding of responses to environmental drivers will improve predictions
- Understand how time and location dynamics of water flows affect fish movements
- Understand how flow velocities, depths and dynamics affect physical, chemical and biological factors
- Quantify how fish vital rates are affected by the interaction of environmental conditions (and how this affects abundance)

2. Expand Integrative Science Approach

- Comprehensive, strategic, integrative and planned scientific approach focused on processes, drivers and predictions
- Ecosystem, multispecies, multi-stressor framework
- Interagency and cross-disciplinary framework
- Research and monitoring need more focus on vital rates and ecosystem functions

3. Link Hydrodynamic and Fish Models

- Sustained, collaboration to develop a public 3-D hydrodynamic water-quality model coupled with models of fish growth, survival, reproduction and migration
- Develop cross-disciplinary teams of hydrodynamic modelers and fisheries experts
- Use new 3D modeling and particle tracking methods, individual-based life history fish models, acoustic and genetic measures of fish passage and distribution. and new tag and tracking methods



Link Hydrodynamic and Fish Models

Simple steps forward:

- Modeling summit
- Synthesis reports



- Standing joint working group/ program of hydrodynamic and fish modelers.

Slide 15

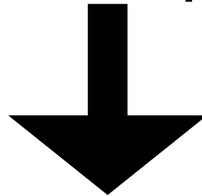
KS1

This is also mentioned on the previous slide

Kelly Souza, 11/12/2015

4. Link Timing & Location to Mechanisms

Timing and frequency of flows have ecological consequences sometimes lost with average monthly flows or annual population estimates.

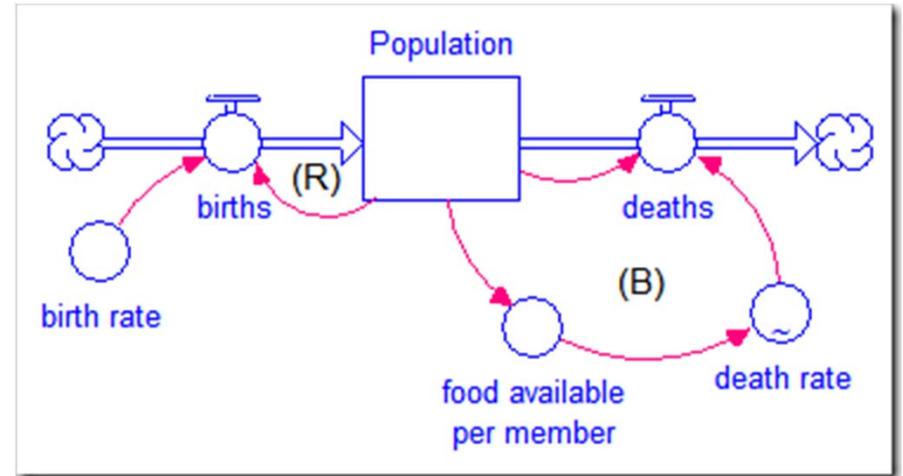


- Match time, space and parameter scales of models to fish habitat needs (e.g., temperature)
- Measure of fish responses at time scales of expected responses (e.g., fish movements and fish growth rates respond rapidly to flow changes)

5. Monitor Vital Rates

Individual growth rates, mortality, predation, etc., not only trawl counts.

- Increase monitoring to understand fish vital rates.
- Link monitoring to modeling efforts
- Monitor factors likely to respond to flow (e.g. growth rates, movement, predation, mortality).



6. Broaden Species Focus

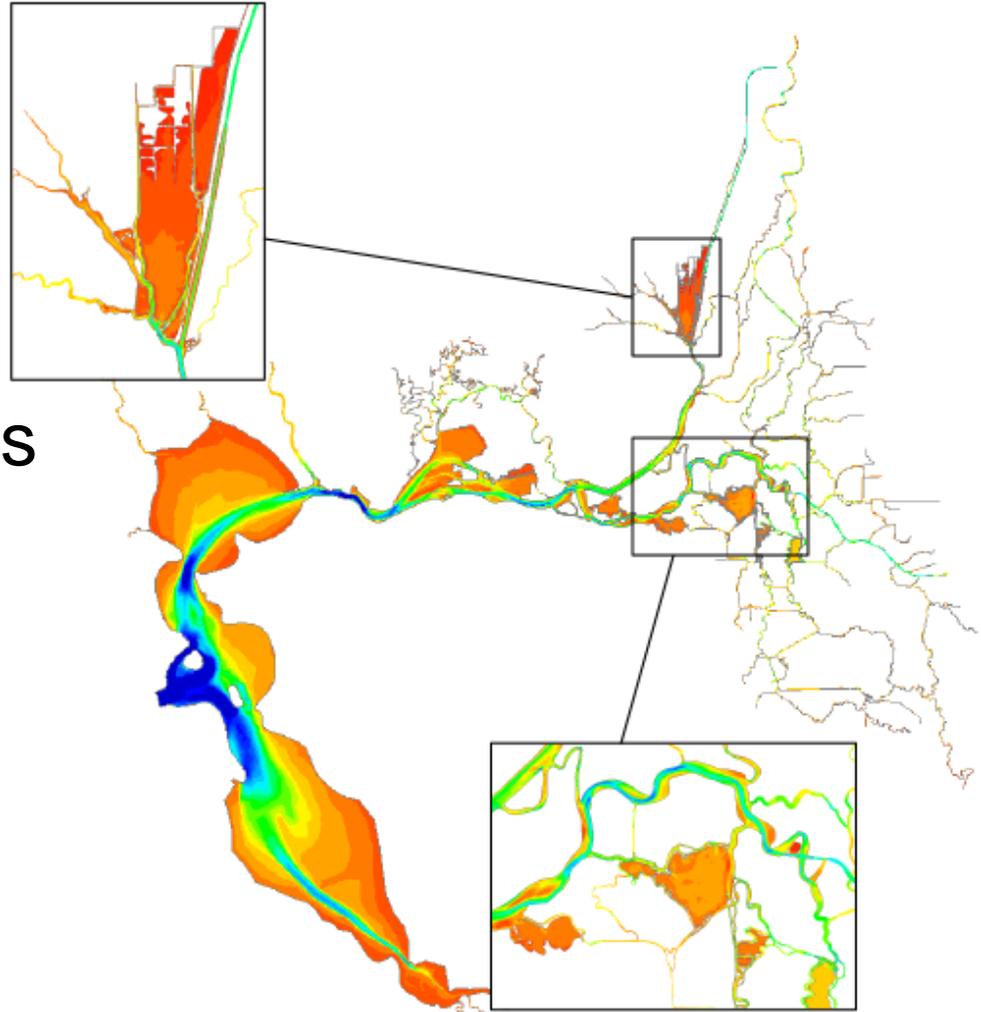
Less is known about other species, upper food webs and top-down processes including:

- Predator and competitor distribution and abundance
- Flow influence on predators and predation rates
- Predator impacts on salmon smolts, delta smelt, and other native species

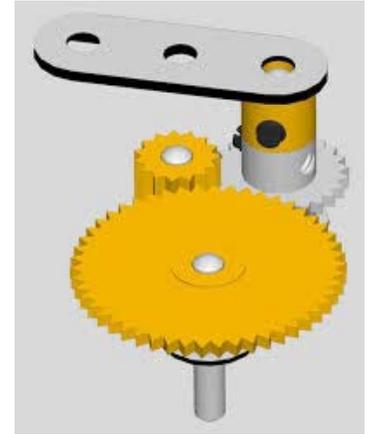


Other Recommendations

1. Timely synthesis of research
2. Enhance national & international connections
3. Improve coordination among disciplines and institutions



Promising Directions



- More mechanistic approach that links water dynamics to ecosystem dynamics
- Identify essential habitat requirements of fish species and how flows change those habitat features
- Recognize both direct and indirect effects on essential fish production processes and vital rates

Other outreach

- November 16 - DPIIC meeting
Brief introduction
- November 19 - Council Meeting
Discussion today with agency and stakeholder managers
- December 11 - Delta ISB meeting
Discussion with agency scientists on fish and flows research and monitoring plans
- IEP? CWEMF? Others?