

# ‘Fish and Flow’

## Status Report to Delta ISB

January 15, 2014

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**Note:** *The ISB ‘Fish and Flow’ report and all material within this presentation are in a DRAFT status and should not be cited.*

## Purpose

Response to the ISB's mandate to "... provide oversight of the scientific research, monitoring, and assessment programs that support adaptive management of the Delta through periodic reviews of each of those programs...."

The ISB is conducting these reviews by thematic areas; this one is on the effect of water flow on Delta fish populations in the context of other stressors.

The primary objective of this report is to improve understanding, scientific collaboration, and communication about the relationships among fishes, flows, and stressors.

## **Title?**

**Direct and Indirect Effects of Flow on Fishes in the Context of Multiple Stressors in the San Francisco Bay-Delta: A Review of the Science Needs**

or

**Fish, Flows, and Stressors in the Sacramento-San Joaquin Delta**

or

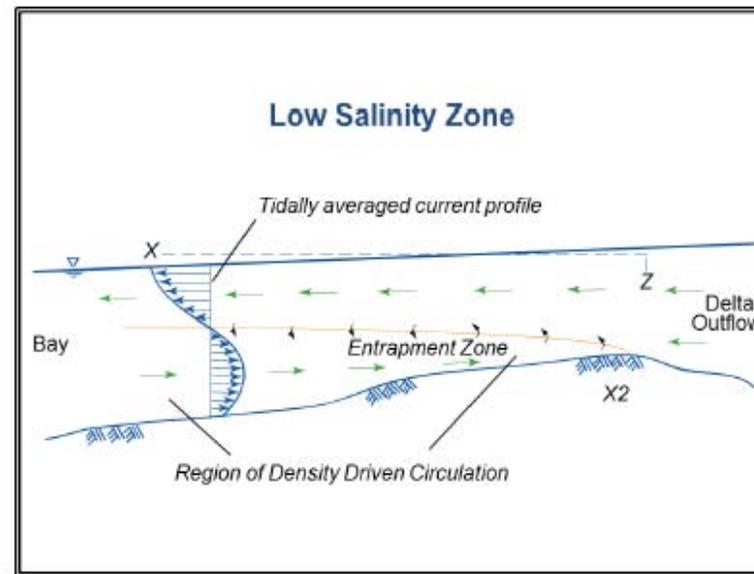
**Fish, Flows, and Stressors in the Sacramento-San Joaquin Delta – A Review of Science Needs**

## Process

- Review published literature on fishes and flows in the Delta and other ecosystems
- Interviewed scientists from state and federal agencies, consulting firms, interest groups, and academia
- Attended key workshops run by the Delta Science Program for the State Water Resources Control Board and reviewed related panel reports
- Received presentations at ISB meetings
- Reviewed relevant agency reports on specific studies
- Requested comments on draft by individual ISB members

## Challenges

- An all-encompassing topic that links the co-equal goals
- A lot of work has been done on this topic, particularly related to correlation/statistical analyses
- Multiple stressors and altered ecosystem
- Some recent excellent reports covering a wide range of these topics
- Important 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



Delta Stewardship Council  
Delta Science Program



## 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



Delta Stewardship Council  
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96pp

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*Management challenges in the Delta*

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### **Recommendations on Critical Science Needs**

*Model development and focus on processes*

*Timescales*

*Monitoring*

*Large-scale flow experiments*

*Broaden species focus*

*Timely synthesis of extensive research*

*National and international connections*

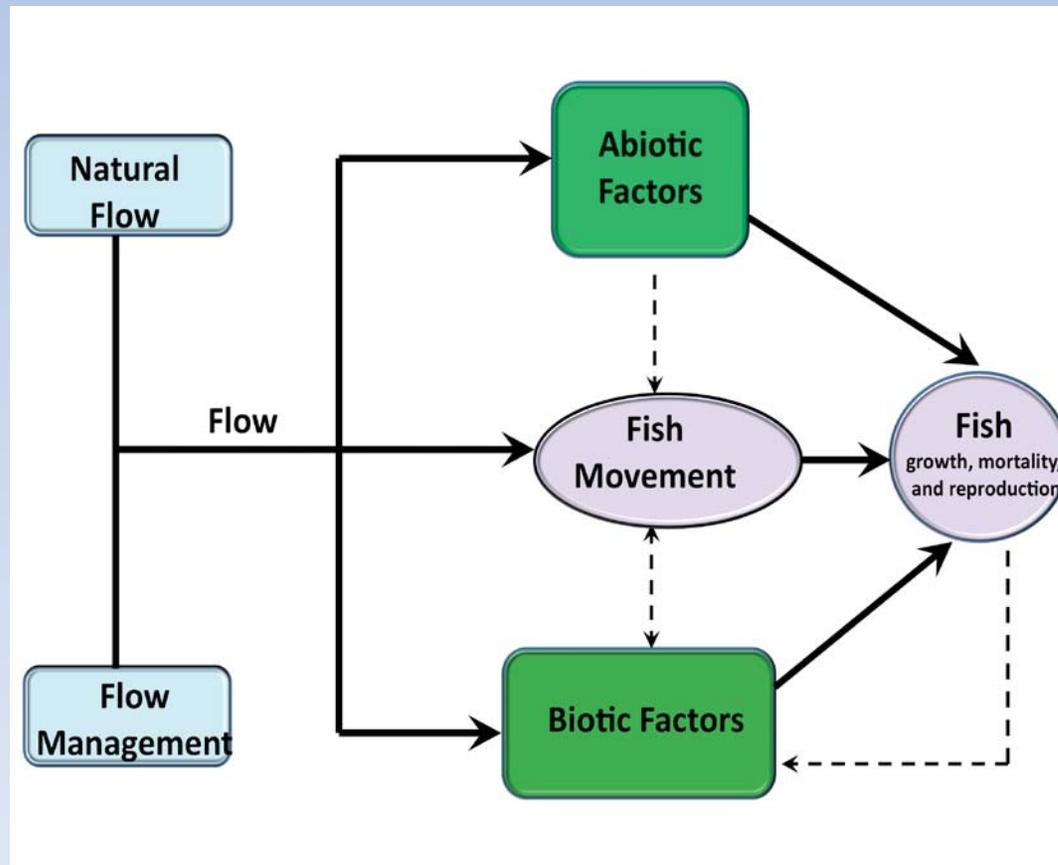
*Enhanced collaboration and reliable funding*

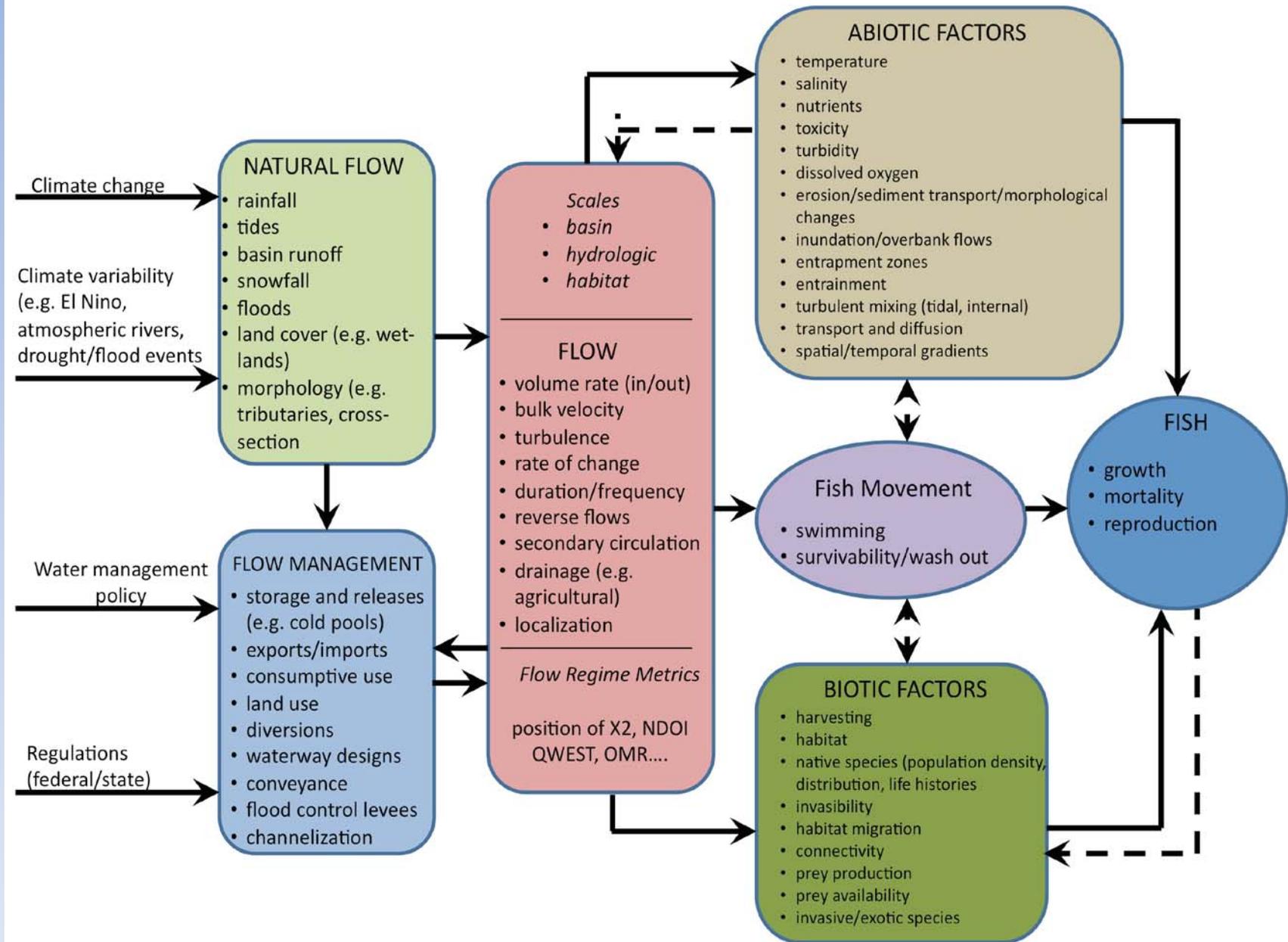
### **References**

### **Appendix A: Interview process**

## Findings:

- 1) Flows affect fish populations directly and indirectly in the context of multiple stressors
- 2) These effects are changing with time, so correlation studies alone will diminish in value with time.





## **Recommendation #1: Model development and focus on processes**

Focus on essential fish production processes (e.g. growth, reproduction, mortality, migrations) using a more mechanistic approach than currently done.

- A sustained, collaborative effort to develop a public 3-D hydrodynamic water-quality model that can be connected to or integrated with models of fish growth, movement and reproduction
- Successful in other ecosystems (Chesapeake)
- Cross-disciplinary teams of hydrodynamic modelers and fisheries experts
- Apply new technologies in 3D modeling and particle tracking, individual-based full life history fish models, underwater acoustic and genetic measures of fish passage and distributions, and new techniques to tag and track fish movements
- Simple steps forward:
  - A modeling summit and
  - Synthesis reports as part of a special proceedings
  - A standing joint working group/program of hydrodynamic and fish modelers.

# Timescales

## Finding

- Timing, frequency, and periodicity of flow changes have important biological consequences that are not necessarily captured with mean monthly flow values nor in annual population estimates.

## Recommendations

- Timing of flow management and monitoring should reflect major mechanisms that affect fish health.
- Measures of fish responses should be done at the time scales of expected responses (e.g., fish movements and fish growth rates might respond rapidly to changes in flow).

## Monitor the Mechanisms of Flow Effects on Fish

### Finding:

We now largely monitor flows and fish populations separately.

### Recommendations:

Increase monitoring on major mechanisms and factors affecting fish health (e.g., growth rates).

Link flow, population, and mechanism monitoring to modeling efforts described above.

Monitored variable should be targeted on factors likely to respond to changes in flow (e.g. growth rates, movement).

## **Less emphasis on large-scale flow experiments**

- Expensive and give little mechanistic insight
- Unlikely to be conclusive without a very wide range of flow conditions and a long experimental period.
- Focus on better understanding mechanisms of flow effects on fishes

## Broaden Species Focus

Focus has been on salmon and smelt, with less information on other species

Little is known about:

- predator and competitor distribution and abundance,
- influence of flow on predators and their predation rates, and
- predator impact on migrating salmon smolts, Delta smelt, and other native species.

## **Other Recommendations:**

- **Timely synthesis of extensive research**
- **Enhance national and international connections**
- **Enhanced collaboration and reliable funding**

## Overall Status and Next Steps

- “Good start” – “needs a lot of work”
- Current emphasis on review of science
- Needs more on adequacy of the science
- Review individual ISB comments and those received today and redraft the document.
- Three alternative structures to the report

## Alternative Format # 1

Introductory background section, setting the stage for why flows are important and defining terms

Sharply focused review of what we know now (i.e., the review of research, but only that directly related to the overall focus and setting the stage for identifying gaps)

What we don't know but need to know (the critical gaps)

How Delta science is positioned (or not) to address the gaps

Some crisp recommendations

## Alternative Format # 2

### **FIVE FRONTIERS**

*Lifetime flows*—

*Dynamic flows*—

*Historical flows*—Stressors in relation to long-term declines;

*Regulatory flows*—X2 and extremes (FLaSH and its drought-year equivalents);

*Information flows*—Communicating complexity;

### **Each frontier discussed can be treated dependably:**

Practical importance

Recent advances

Unresolved problems

Suggested research

Sources of funding and talent

Likely difficulties and potential benefits

# **Alternative Format #3**

**(use current structure but make it crisper)**

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*Monitoring*

*Large-scale flow experiments*

*Broaden species focus*

*Timely synthesis of extensive research*

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