

# RECLAMATION

*Managing Water in the West*

USBR ROC on LTO

Delta Biology and Management Overview

January 19, 2018



U.S. Department of the Interior  
Bureau of Reclamation

# Delta Fish Population Declines

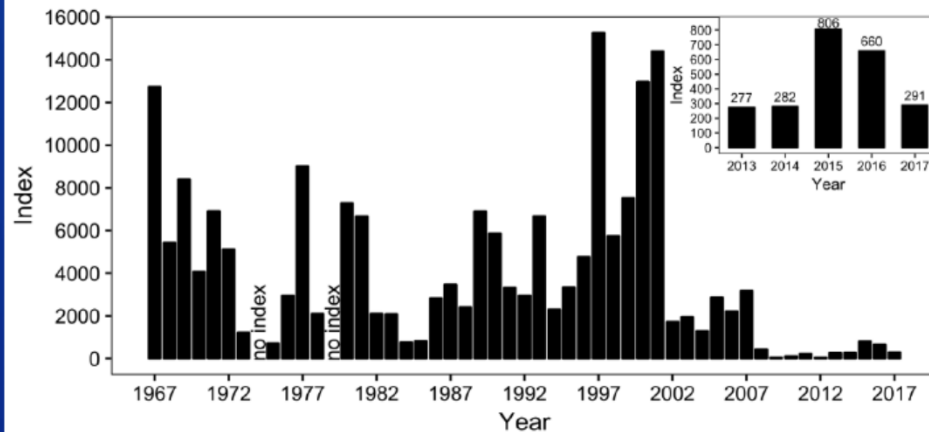


Figure 4. Fall Midwater Trawl Threadfin Shad annual abundance indices (all ages), 1967-2017.

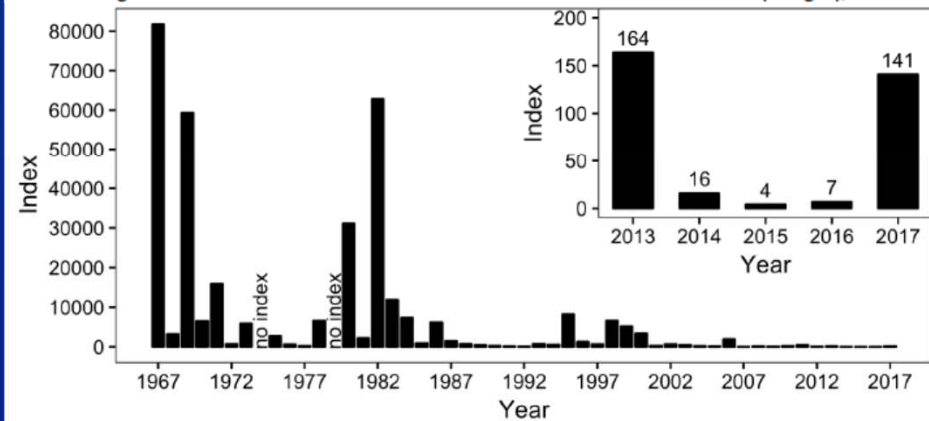


Figure 3. Fall Midwater Trawl Longfin Smelt annual abundance indices (all ages), 1967-2017.

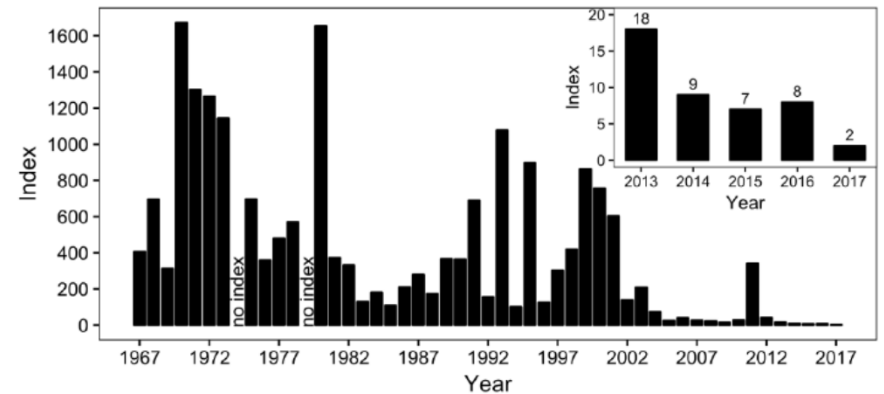


Figure 1. Fall Midwater Trawl Delta Smelt annual abundance indices (all ages), 1967-2017.

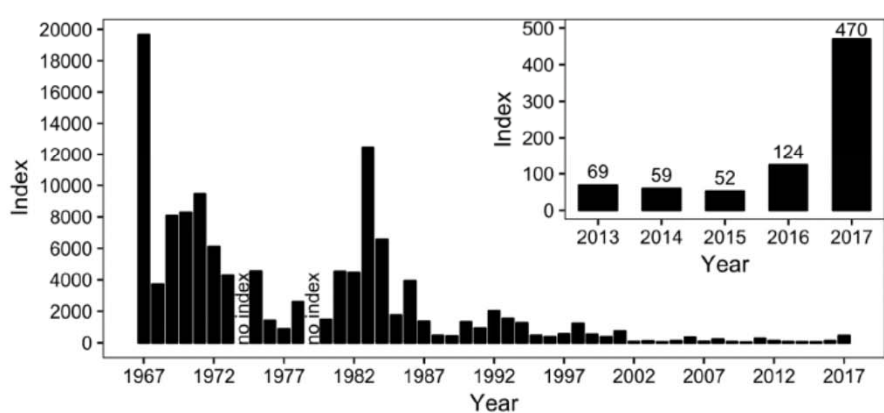
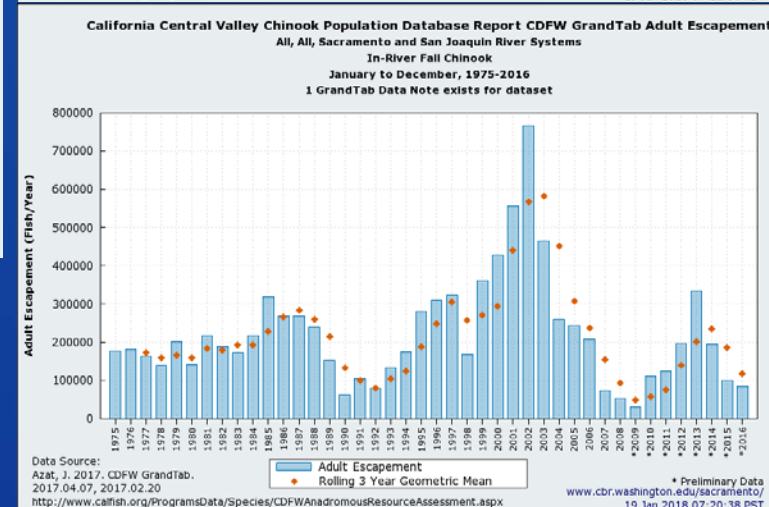
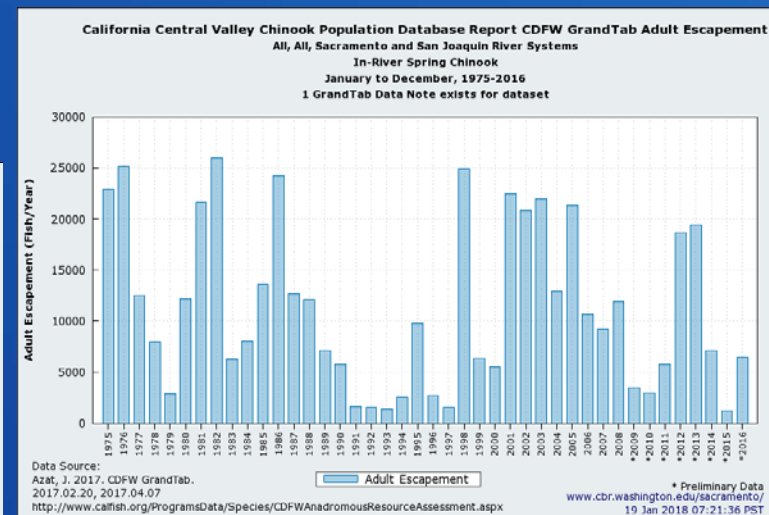
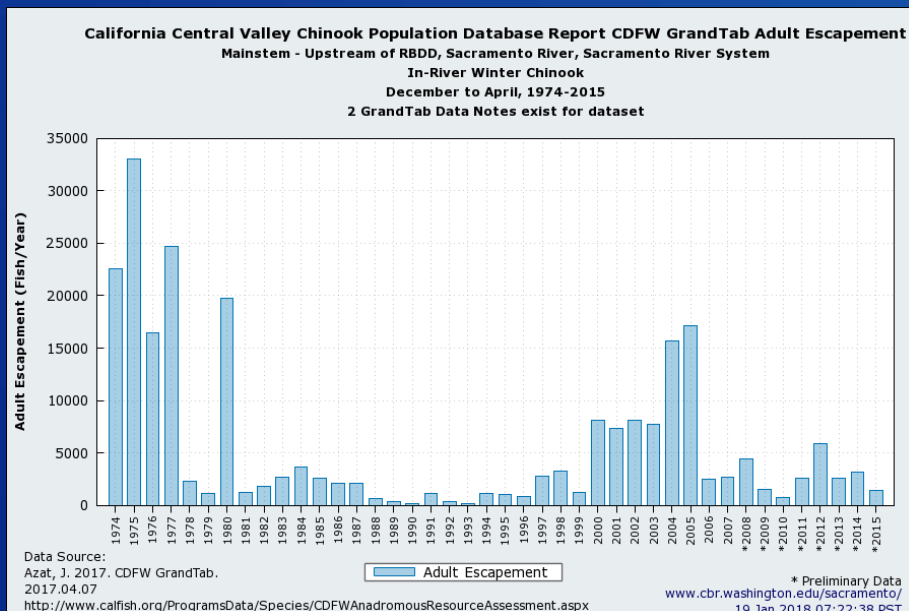


Figure 2. Fall Midwater Trawl Age-0 Striped Bass annual abundance indices, 1967-2017.

# Salmon Populations Too.



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# CVP/SWP Delta Biology Overview

- **The Estuary Past**

- Floodplains
- Tidal Islands
- Distributary Rivers

Conceptual  
Models

- **Species of Interest**

- Residents
- Anadromous

Monitoring  
Information

- **Challenges**

- Loss of Habitat
- Altered Flow
- Water Quality
- Nonnative Species
- Hatcheries and Harvest Management

Programs and  
Projects



# Historic Delta regions

## Northern, Central, and Southern

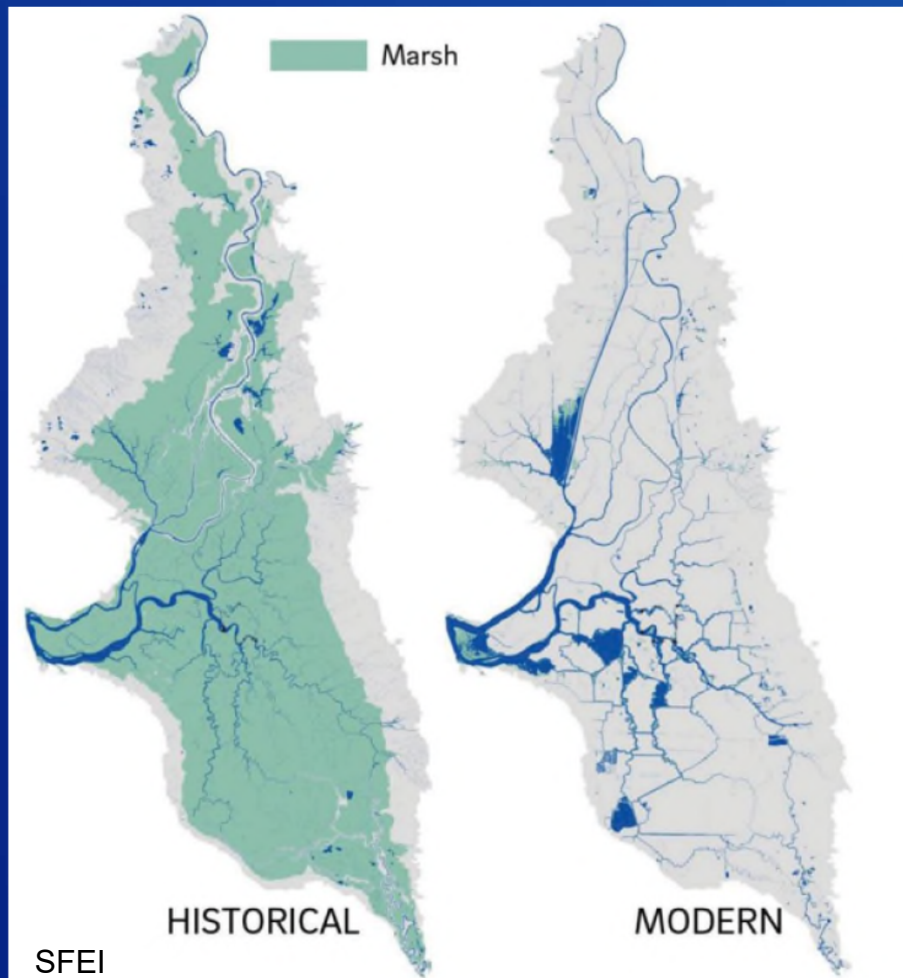


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# Habitat Loss

## >95% of wetlands lost



### Plans

*Tidal Marsh and Floodplain Restoration Action in NMFS and USFWS BiOps*

- 8,000 acres of tidal marsh
- 17,000 acres of floodplain

*Delta Smelt Resiliency Strategy*

- 9,000 acres

*Salmon Resiliency Strategy*

- 11,000 acres

### Implementation Groups

- Fisheries Restoration Program
- EcoRestore Program
- Delta Conservancy

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# Challenges Confronting Fish and Water Management in the Bay-Delta

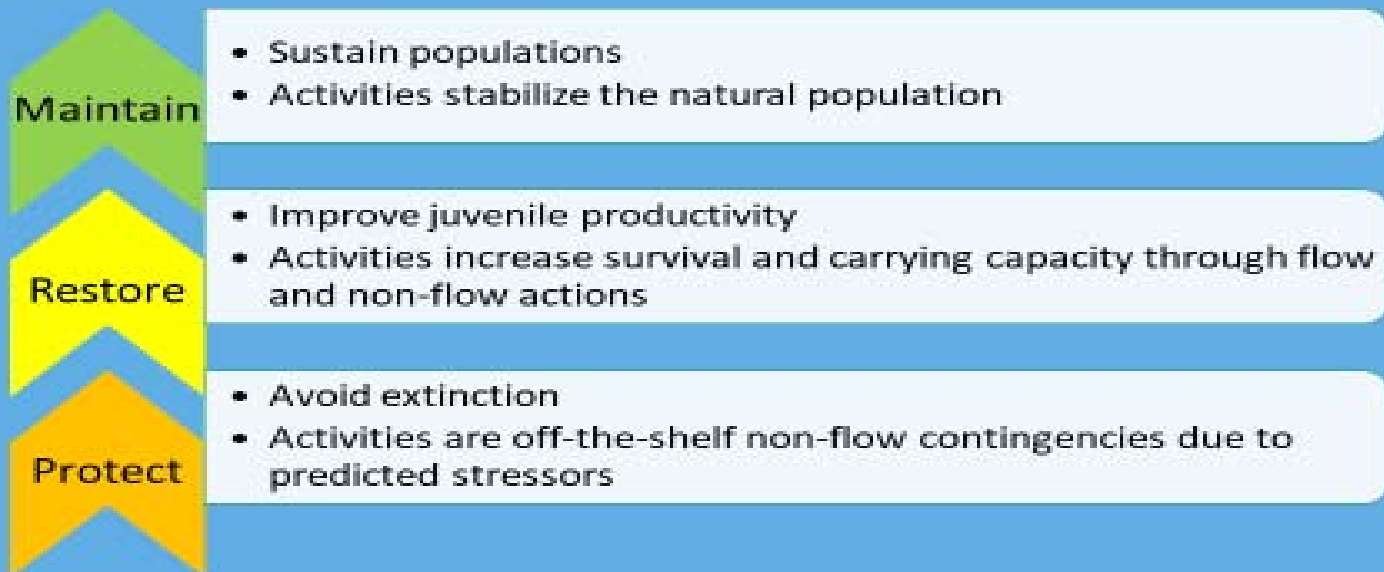
1. Loss of Habitat
2. Altered Flows
3. Ecosystem Water Quality
4. Non-native Species
5. Hatcheries and Harvest Management

Each affects ESA-listed species based on scale and scope?

- What is the magnitude/duration/exposure to each challenge?
- What viability parameter is affected (ie: Population size, growth, distribution, diversity)?

# Can activities be implemented through time to Protect, Restore, and Maintain species in the Bay-Delta?

## Environmental Watering Approaches





# Delta Smelt Conceptual Models

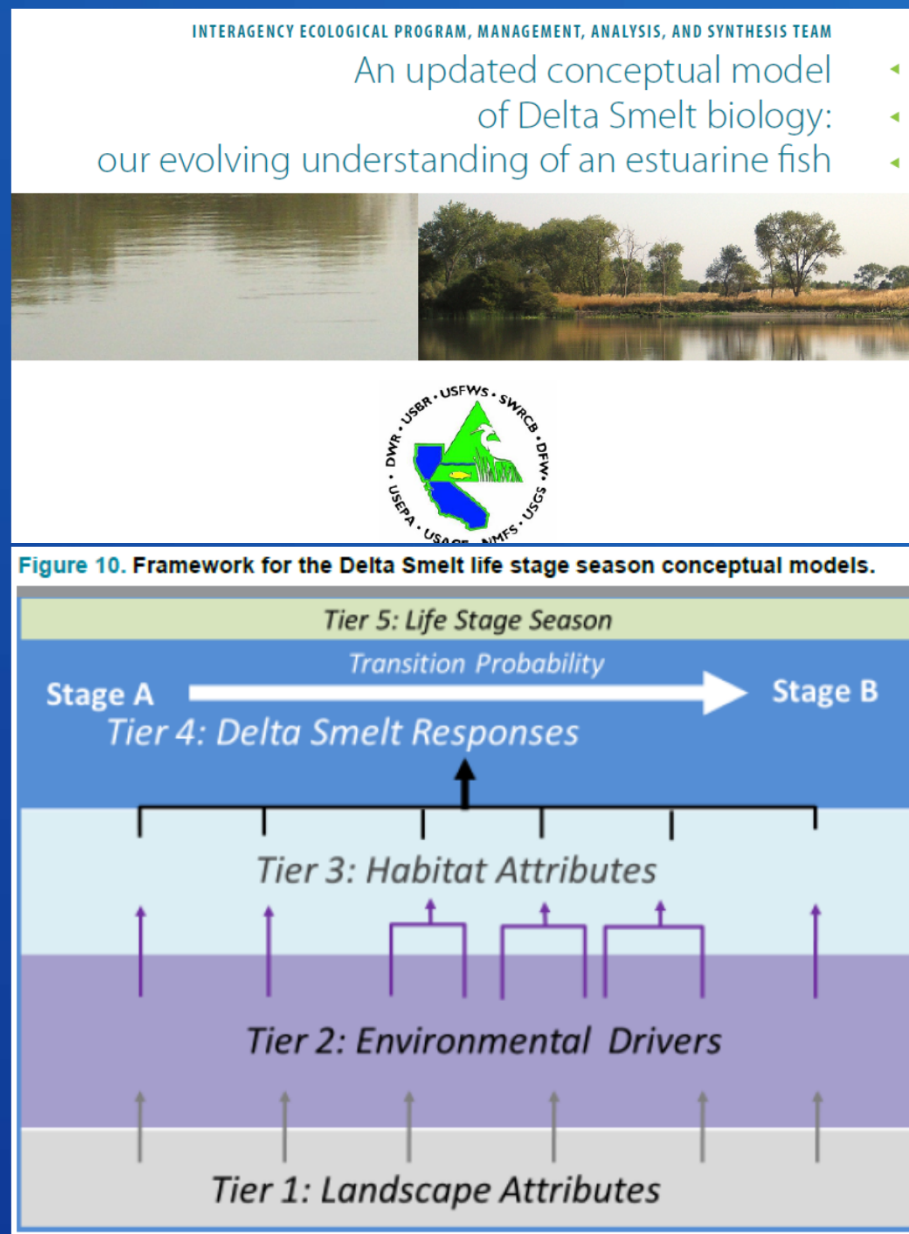
## Habitat Attributes

- Entrainment Risk
- Predation Risk
- Food Availability
- Transport Direction
- Size and Location of LSZ

## Environmental Drivers

- Contaminants
- Food Production
- Predators
- Flows
- Turbidity
- Water Diversions

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# What might be considered for protecting, restoring, and maintaining DSM?

## Habitat Attributes

- Entrainment Risk
- Predation Risk
- Food Availability
- Transport Direction

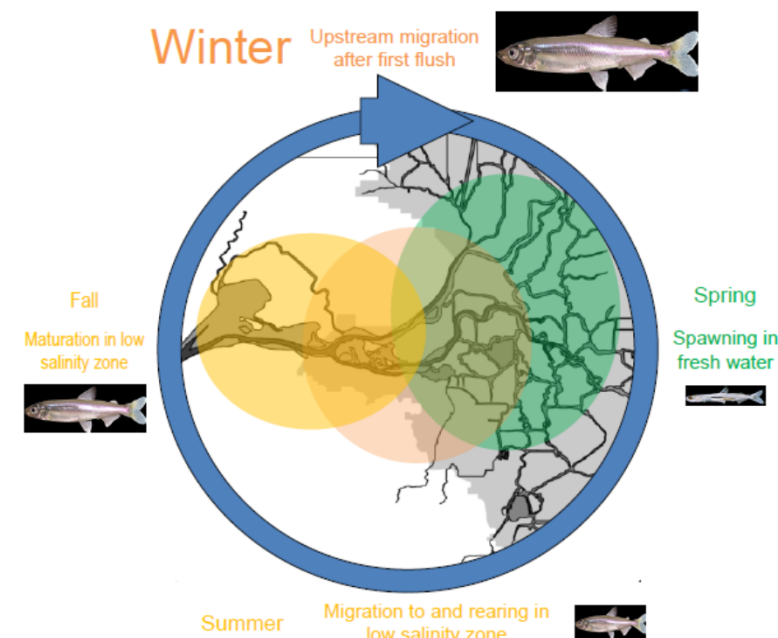
## Environmental Drivers

- Contaminants
- Food Production
- Predators
- Flows
- Turbidity
- Water Diversions

- Export Reductions
- Seasonal Outflow Augmentation
- Aquatic Weed Control
- N Delta Food Web Enhancement
- Reoperation of Suisun Marsh Salinity Gates
- Sediment Supplementation in LSZ
- Spawning Habitat Augmentation
- Suisun Marsh Food Web Enhancement
- Management Wetland Food Web Enhancement
- Adjusting Fish Salvage Operations
- Stormwater Discharge Management
- Rio Vista Research Station
- Delta Smelt Habitat Restoration
- Franks Track Restoration
- Conservation Propagation
- Conservation Supplementation

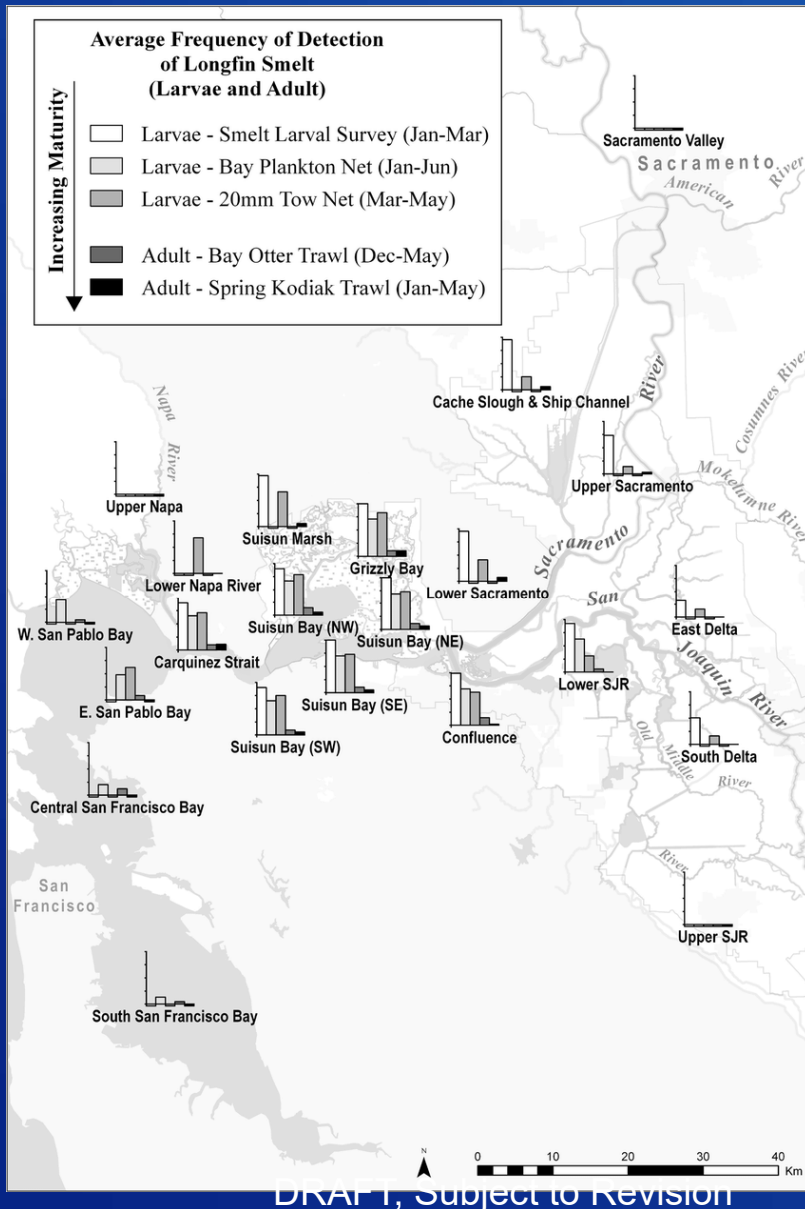
# Where might be considered for protecting, restoring, and maintaining DSM?

**Figure 5.** Simplified life cycle of Delta Smelt (modified from Bennett 2005). Colors correspond to different seasons with the low salinity zone changing position with season.



- Export Reductions
- Seasonal Outflow Augmentation
- Aquatic Weed Control
- N Delta Food Web Enhancement
- Reoperation of Suisun Marsh Salinity Gates
- Sediment Supplementation in LSZ
- Spawning Habitat Augmentation
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- Adjusting Fish Salvage Operations
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- Delta Smelt Habitat Restoration
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- Conservation Supplementation

# Longfin Smelt Conceptual Models



DRERIP model described stressors

Work describing linkages of

1. Fish responses
2. habitat attributes
3. environmental drivers

would benefit evaluation of Delta challenges and opportunities

Potential IEP project in 2018  
(?)

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# Winter-run Chinook Conceptual Model

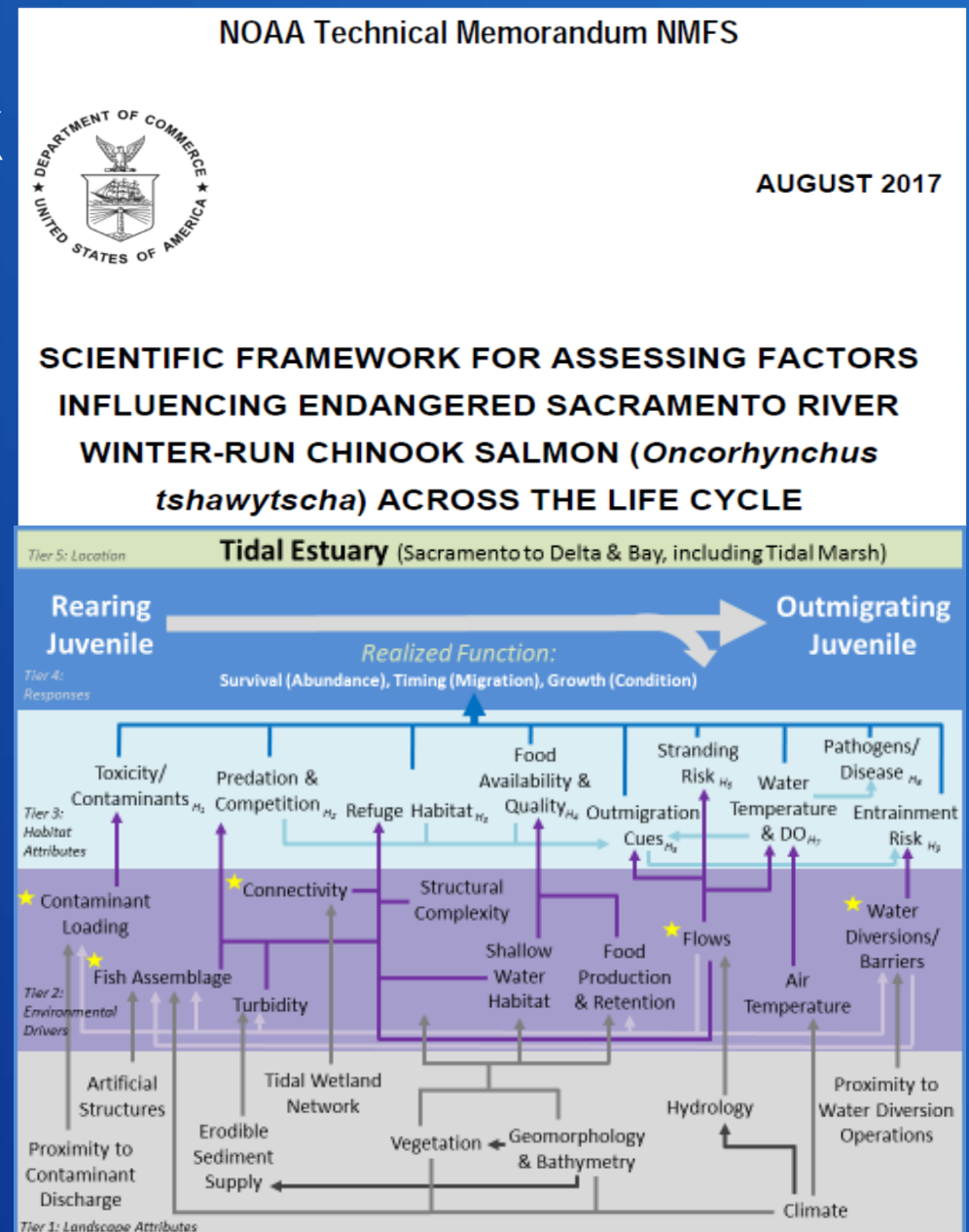
## Habitat Attributes

- Entrainment Risk
- Predation Risk
- Food Availability
- Transport Direction
- Outmigration Cues

## Environmental Drivers

- Contaminants
- Fish Assemblage
- Flows
- Water Diversions
- Barriers

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# What might be considered for protecting, restoring, and maintaining WRCS?

## Habitat Attributes

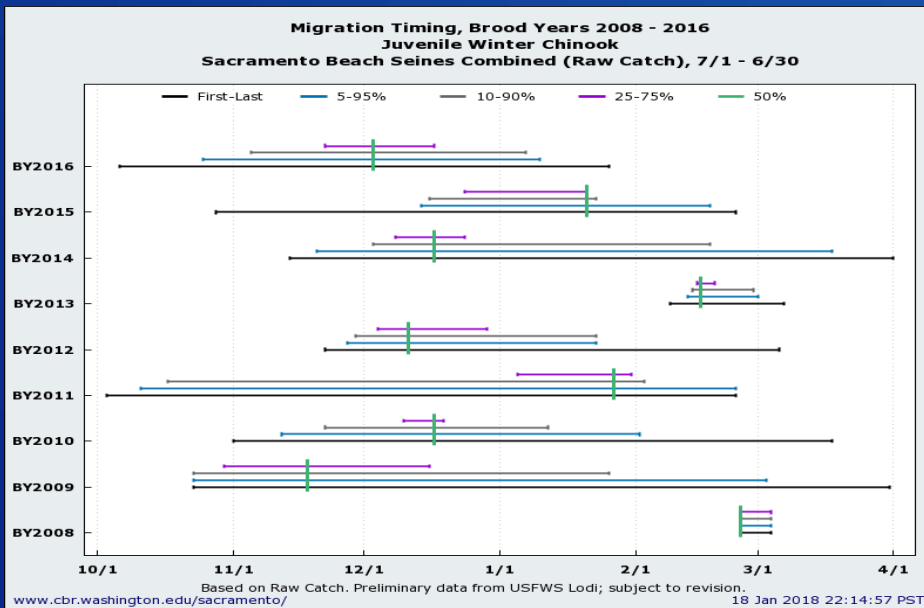
- Entrainment Risk
- Predation Risk
- Food Availability
- Transport Direction
- Outmigration Cues

## Environmental Drivers

- Contaminants
- Fish Assemblage
- Flows
- Water Diversions
- Barriers

- Re-operate Delta Cross Channel
- Export Reductions
- Old and Middle River Reverse Flow Management
- Spring I:E Ratio Management
- Upgrade CVP/SWP Fish Collection, Holding, and Release Facilities
- Reduce Predator Hot Spots
- Restore Tidal Wetlands
- Restore Floodplain Habitats
- Restore Riparian Habitats
- Install South Delta/ HOR Barriers
- Install N. Delta/Georgiana S. Barriers
- Improve In-Delta Diversion Fish Screens
- Manage Winter/Early Spring Delta Conditions to Improve Survival

# When might be considered for protecting, restoring, and maintaining WRCS?



<http://www.cbr.washington.edu/sacramento>

BroodYear	Sampling Dates (MM/DD/YYYY)								
	First	5%	10%	25%	50%	75%	90%	95%	Last
2017 <sup>1</sup> YTD	11/21/2017								01/10/2018
Average (2008 - 2016)	11/21	12/02	12/07	12/23	01/02	01/11	01/31	02/16	03/05
Median (2008 - 2016)	11/01	11/20	11/29	12/10	12/17	12/29	01/25	02/23	03/05
2016	10/05/2016	10/24/2016	11/04/2016	11/21/2016	12/02/2016	12/16/2016	01/06/2017	01/09/2017	01/25/2017
2015	10/28/2015	12/14/2015	12/16/2015	12/24/2015	01/20/2016	01/20/2016	01/22/2016	02/17/2016	02/23/2016
2014	11/14/2014	11/20/2014	12/03/2014	12/08/2014	12/17/2014	12/24/2014	02/17/2015	03/17/2015	03/31/2015
2013	02/08/2014	02/12/2014	02/13/2014	02/14/2014	02/15/2014	02/18/2014	02/27/2014	02/28/2014	03/06/2014
2012	11/21/2012	11/26/2012	11/28/2012	12/03/2012	12/10/2012	12/28/2012	01/22/2013	01/22/2013	03/05/2013
2011	10/03/2011	10/11/2011	10/17/2011	01/04/2012	01/26/2012	01/30/2012	02/02/2012	02/23/2012	02/23/2012
2010	11/01/2010	11/12/2010	11/22/2010	12/10/2010	12/17/2010	12/19/2010	01/11/2011	02/01/2011	03/17/2011
2009	10/23/2009	10/23/2009	10/23/2009	10/30/2009	11/18/2009	12/16/2009	01/25/2010	03/02/2010	03/30/2010
2008	02/24/2009	02/24/2009	02/24/2009	02/24/2009	02/24/2009	03/03/2009	03/03/2009	03/03/2009	03/03/2009
BroodYear	First	5%	10%	25%	50%	75%	90%	95%	Last
	Sampling Dates (MM/DD/YYYY)								

- Re-operate Delta Cross Channel
- Export Reductions
- Old and Middle River Reverse Flow Management
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- Upgrade CVP/SWP Fish Collection, Holding, and Release Facilities
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- Restore Tidal Wetlands
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- Install South Delta/ HOR Barriers
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# Other salmonids have less synthesized information on scope, but lots of information on scale.

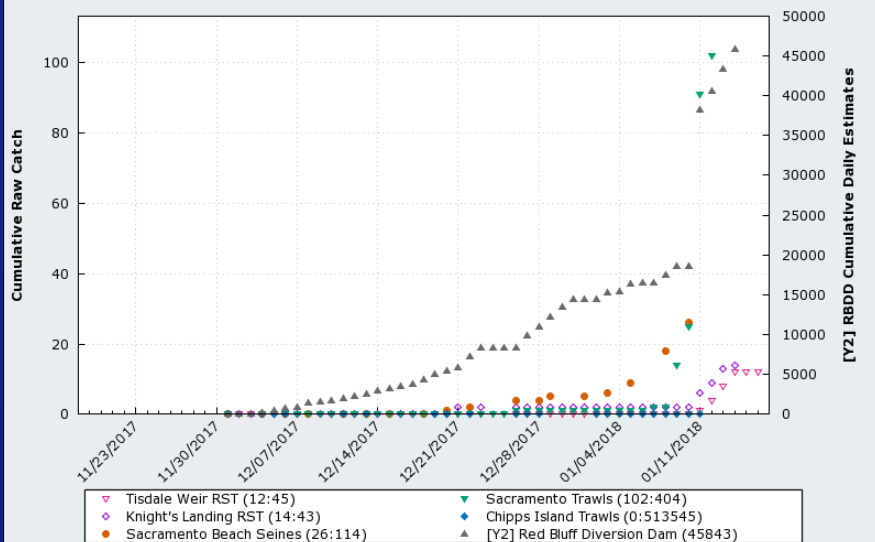
– Spring-run Chinook

– Central Valley steelhead

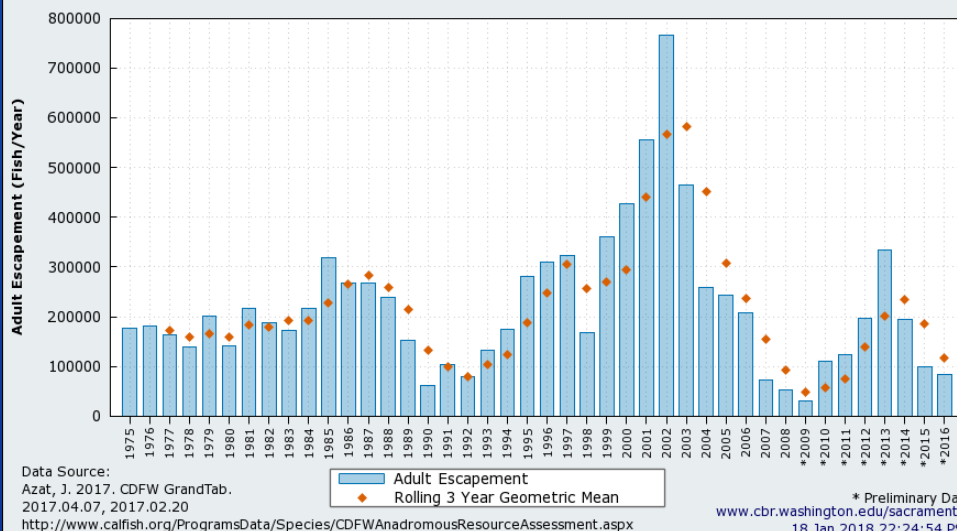
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	NMFS
Juvenile winter-run													
Juvenile spring-run													
Juvenile steelhead													

## Fall Chinook Cohort Juvenile Monitoring (12/1/2017 to 11/30/2018)

Raw Sampling Data 2017-12-01 to 2018-01-16  
Red Bluff Daily Estimates Brood Year 2017



## California Central Valley Chinook Population Database Report CDFW GrandTab Adult Escapement All, All, Sacramento and San Joaquin River Systems In-River Fall Chinook January to December, 1975-2016 1 GrandTab Data Note exists for dataset



Data Source:  
Azat, J. 2017. CDFW GrandTab.  
2017.04.07, 2017.02.20

<http://www.calfish.org/ProgramsData/Species/CDFWAnadromousResourceAssessment.aspx>

\* Preliminary Data  
[www.cbr.washington.edu/sacramento/](http://www.cbr.washington.edu/sacramento/)  
18 Jan 2018 22:24:54 PST

<http://www.cbr.washington.edu/sacramento>  
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# Green Sturgeon Conceptual Model

## Habitat Attributes

- Rearing Habitat
- Flow
- Entrainment Risk
- Water Temperature
- Salinity

## Environmental Drivers

- Contaminants
- Predators
- Water Operations
- Channel Substrate

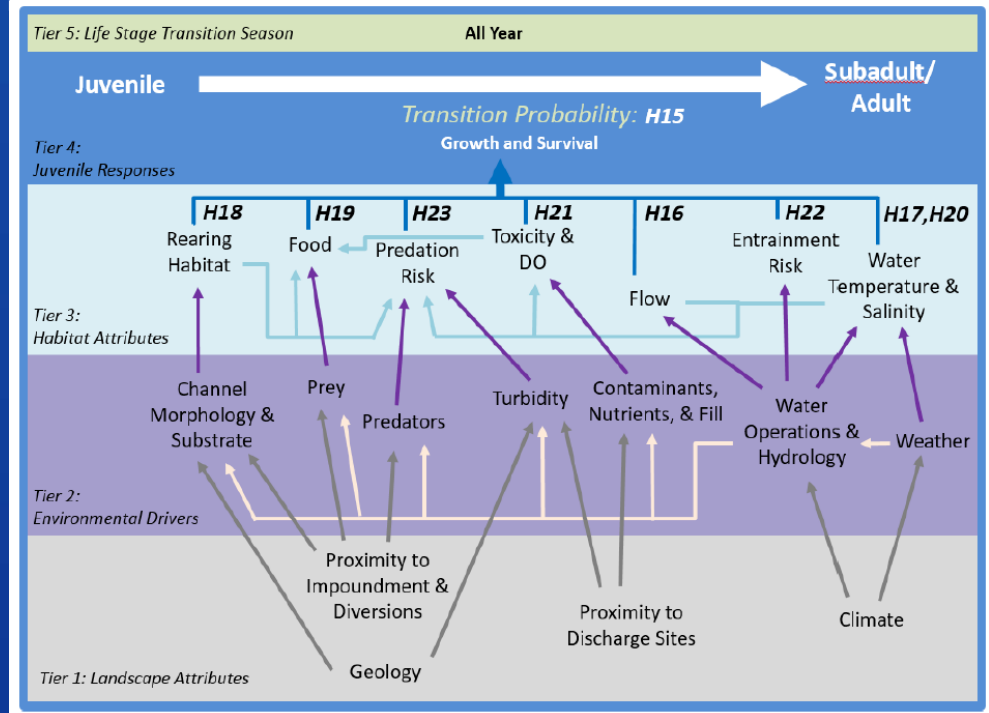
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## NOAA Technical Memorandum NMFS



SEPTEMBER 2017

### IMPROVED FISHERIES MANAGEMENT THROUGH LIFE STAGE MONITORING: THE CASE FOR THE SOUTHERN DISTINCT POPULATION SEGMENT OF NORTH AMERICAN GREEN STURGEON AND THE SACRAMENTO-SAN JOAQUIN RIVER WHITE STURGEON



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# Green Sturgeon Conceptual Model

Information on scope and scale is quite limited for green sturgeon in the Bay-Delta.

DRERIP model described stressors and periodicity

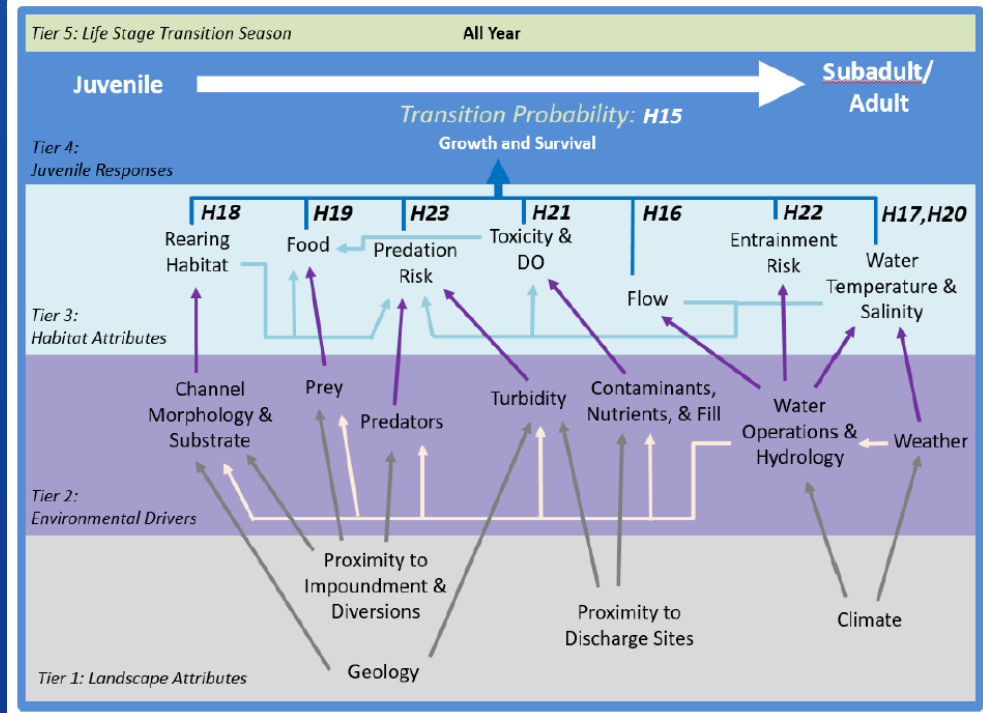
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# New Information Confronting Fish and Water Management in the Bay-Delta

1. Loss of Habitat
2. Altered Flows
3. Ecosystem Water Quality
4. Non-native Species
5. Hatcheries and Harvest Management

Each affects ESA-listed species based on scale and scope?

- What is the magnitude/duration/exposure to each challenge?
- What viability parameter is affected (ie: Population size, growth, distribution, diversity)?

# Habitat Restoration IEP Generating Monitoring and Planning Information

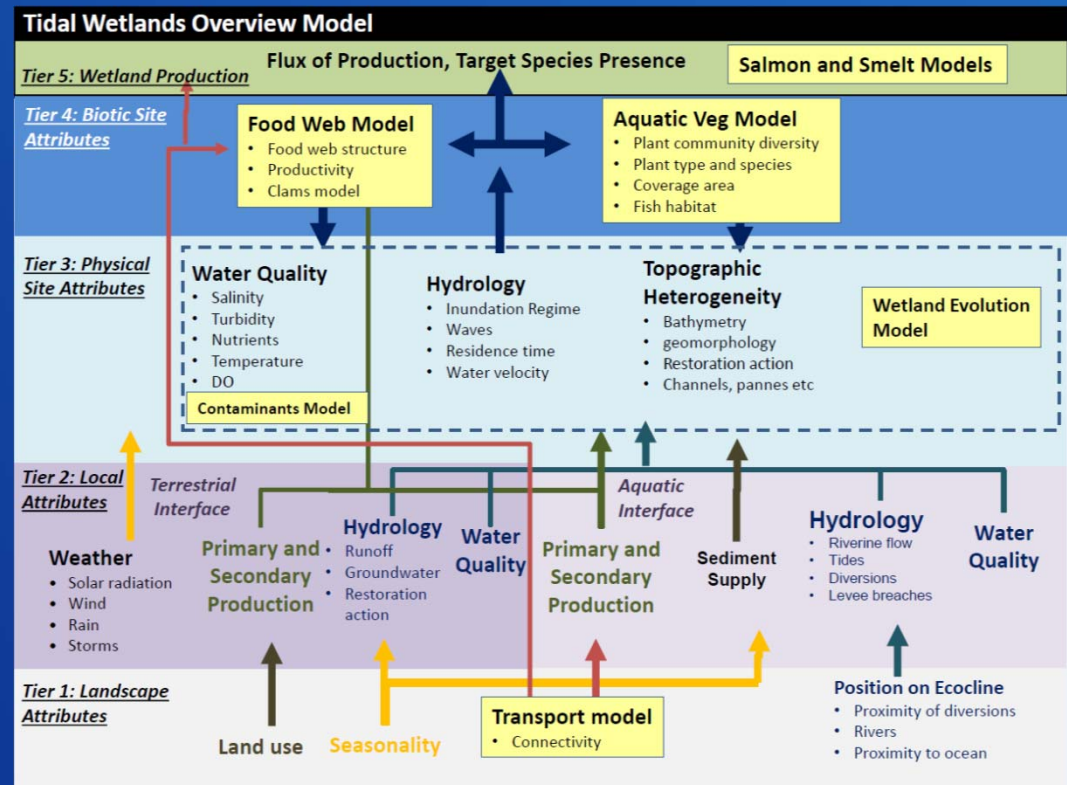
Tidal Wetland Suite of  
Conceptual Models (DFW)

Tidal Wetland Monitoring Pilot  
Project (DFW)

Yolo Bypass Fish Monitoring  
Project (DWR)

Liberty Island Fish Survey  
(USFWS)

Physical and Biological Drivers of  
Fish Populations to Inform  
Habitat Restoration Actions  
(USGS)



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# Altered Flow

How do individual fish movements influence population responses?

## Advancement in PTM models

- Smelt entrainment (3D UnTRIM)
- Salmonid ePTM (DSM2)

## Enhanced Distributional Monitoring

- Enhanced D. Smelt Monitoring
- Enhanced Acoustic Telemetry for Salmon Monitoring

## Operational Experiments?

- Utilizing physical models now, can we get ePTM models integrated into toolbox for adaptive management?
- Do our observations from enhanced monitoring fit our predictions?

# Ecosystem Water Quality

## Nutrients, Flows, and Habitat

### Recent and Planned Experiments

- North Delta Food Web Enhancement
- Suisun Marsh Salinity Gate Reoperation
- Fish Food on Floodplain Farm Fields

Can models be developed from these activities to predict benefits and risks of larger actions?

- Sacramento Deepwater Ship Channel
- Yolo Bypass Juvenile Salmonid Habitat Restoration Program

# Non-native species

Predation and competition in a novel environment

- **Recent scientific synthesis (DSP) and new information (SWFSC South Delta studies)**
- Improved information about predation in association with Clifton Court (SWP) and Primary Channel (CVP)
- **Predation experiments and modeling for CVPIA structured decision model moving forward.**
- Increased interest in monitoring programs (IEP)



# Hatcheries and Harvest Management

- **Salmonids**

- Production of salmonids becoming more dependent on hatcheries following drought.
- CWT data is demonstrating Delta planting of hatchery salmonids can improve survival but affects straying
- Fall flows through the Delta may influence salmonid straying between San Joaquin and Sacramento Rivers

- **Delta Smelt**

- Delta smelt conservation supplementation beyond ongoing efforts may not be implemented before species rarity affects broodstock collection

# What would you do?

- Lots of lists, do you have new ideas?

# Why would you do it?

- How does it affect scale and scope?
- Do the habitat attributes affect fish responses directly or indirectly?
- Are the environmental drivers affected by CVP/SWP?

# When would you do it?

- Can it be accomplished in a year?
- Can it be accomplished in 5 years?