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

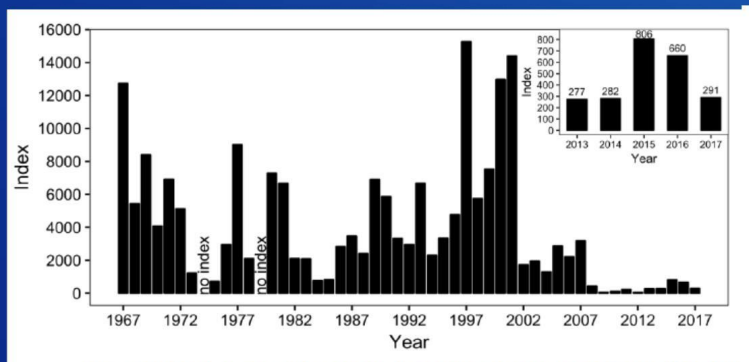

Figure 4. Fall Midwater Trawl Threadfin Shad annual abundance indices (all ages), 1967-2017.

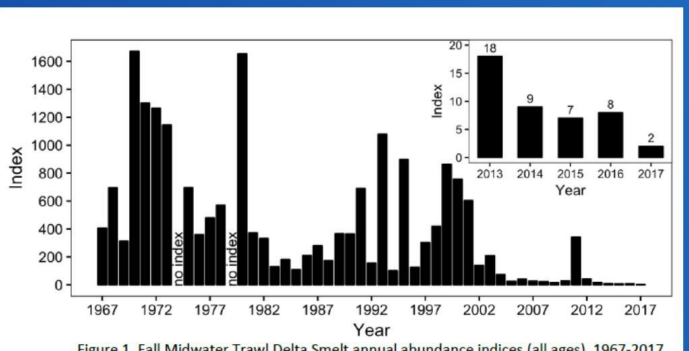

Figure 1. Fall Midwater Trawl Delta Smelt annual abundance indices (all ages), 1967-2017.

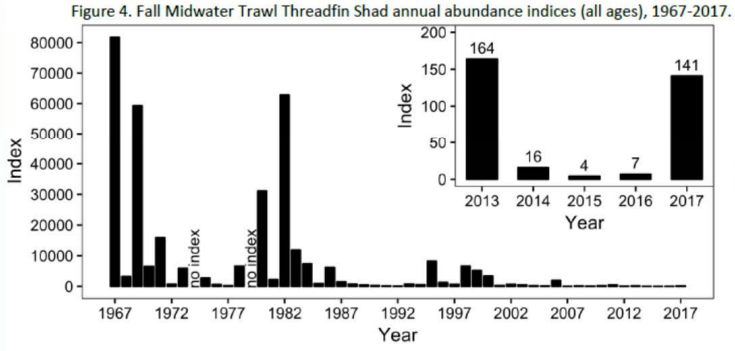

Figure 3. Fall Midwater Trawl Longfin Smelt annual abundance indices (all ages), 1967-2017.

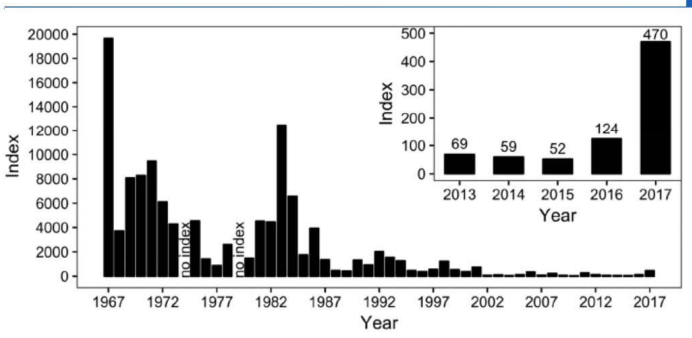

Figure 2. Fall Midwater Trawl Age-0 Striped Bass annual abundance indices, 1967-2017.

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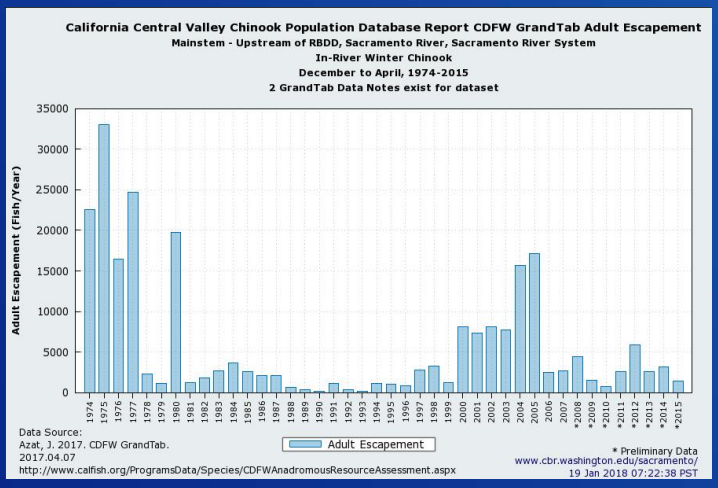
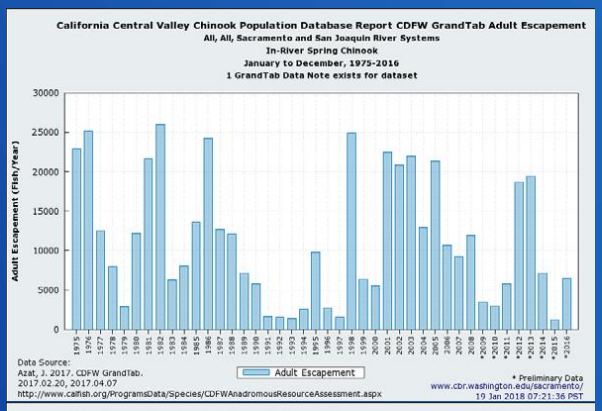
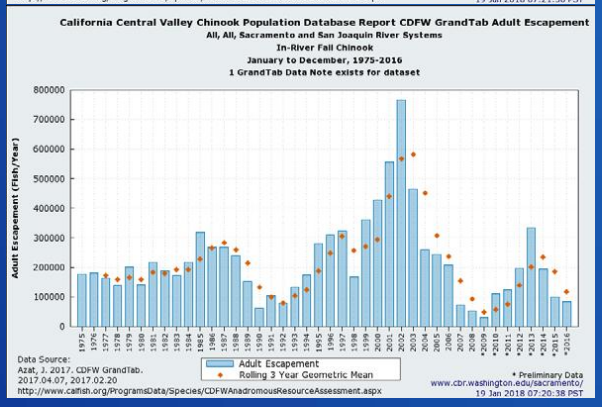
Salmon Populations Too.







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CVP/SWP Delta Biology Overview

- **The Estuary Past**
  - **Floodplains**
  - **Tidal Islands**
  - **Distributary Rivers**
- **Species of Interest**
  - **Residents**
  - **Anadromous**
- **Challenges**
  - **Loss of Habitat**
  - **Altered Flow**
  - **Water Quality**
  - **Nonnative Species**
  - **Hatcheries and Harvest Management**

Conceptual Models

Monitoring Information

Programs and Projects

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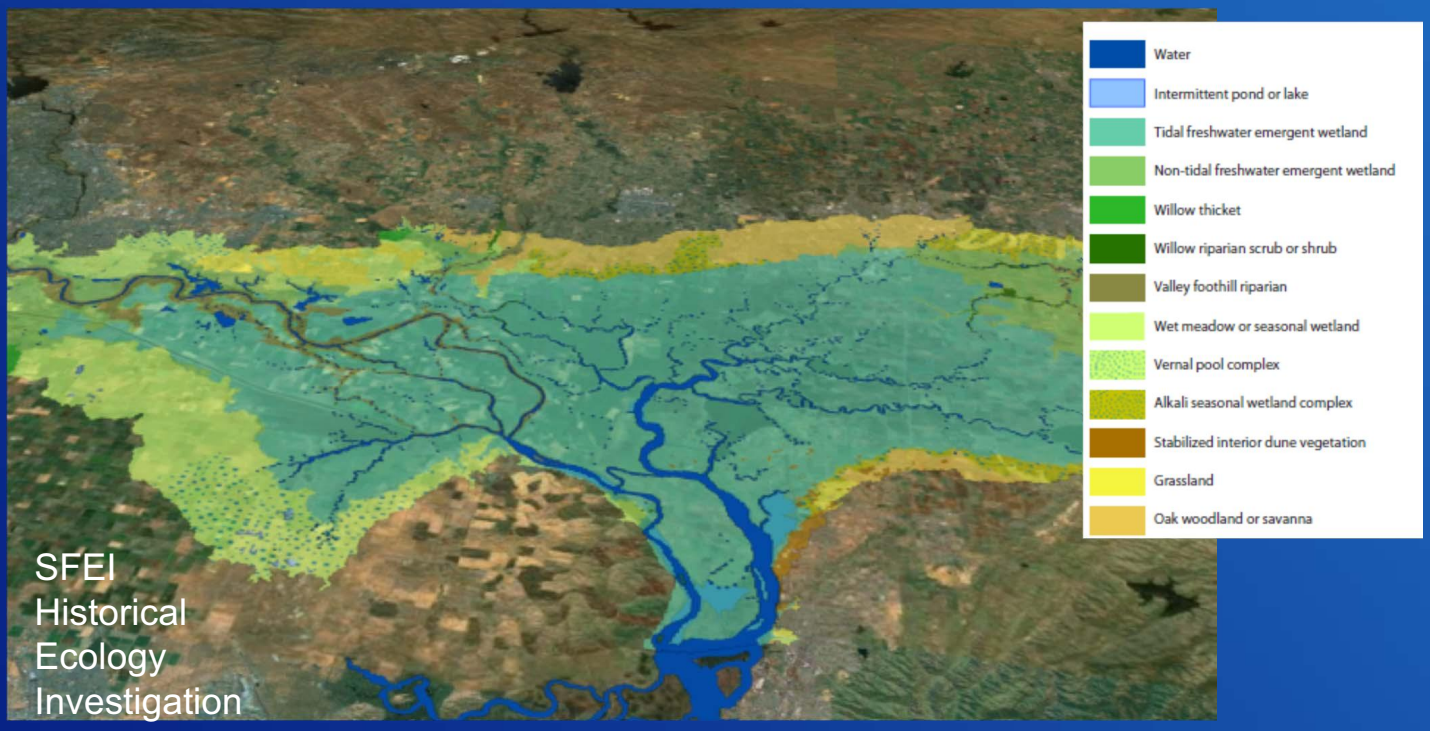
Historic Delta regions
Northern, Central, and Southern



SFEI Historical Ecology Investigation

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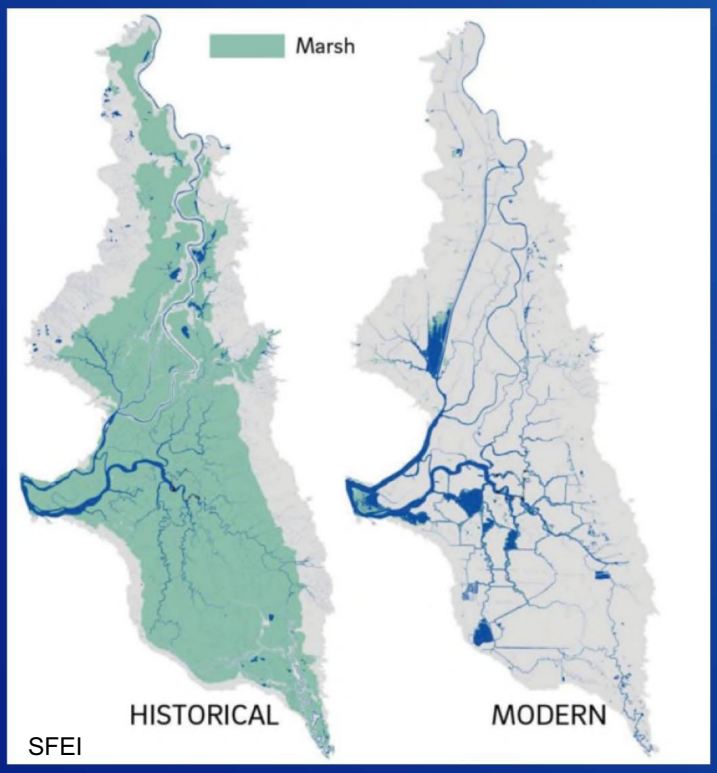
Habitat Loss
>95% of wetlands lost



SFEI

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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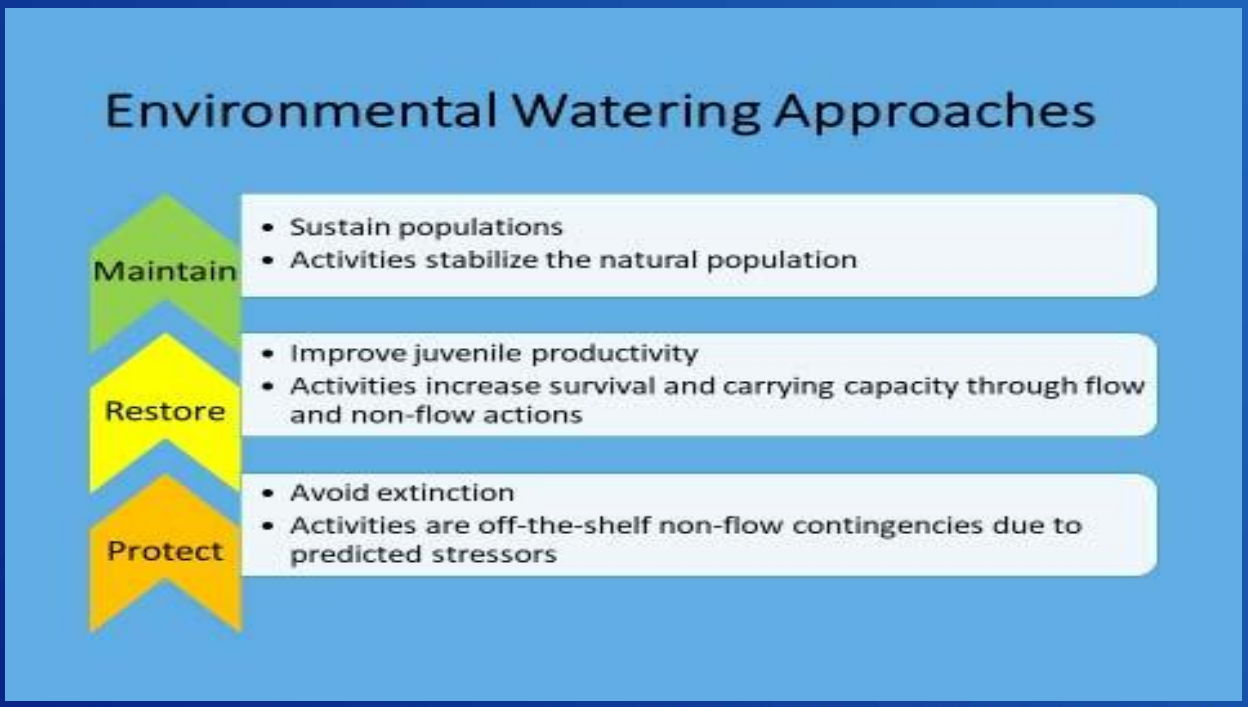
Challenges Confronting Fish and Water Management in the Bay-Delta

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?



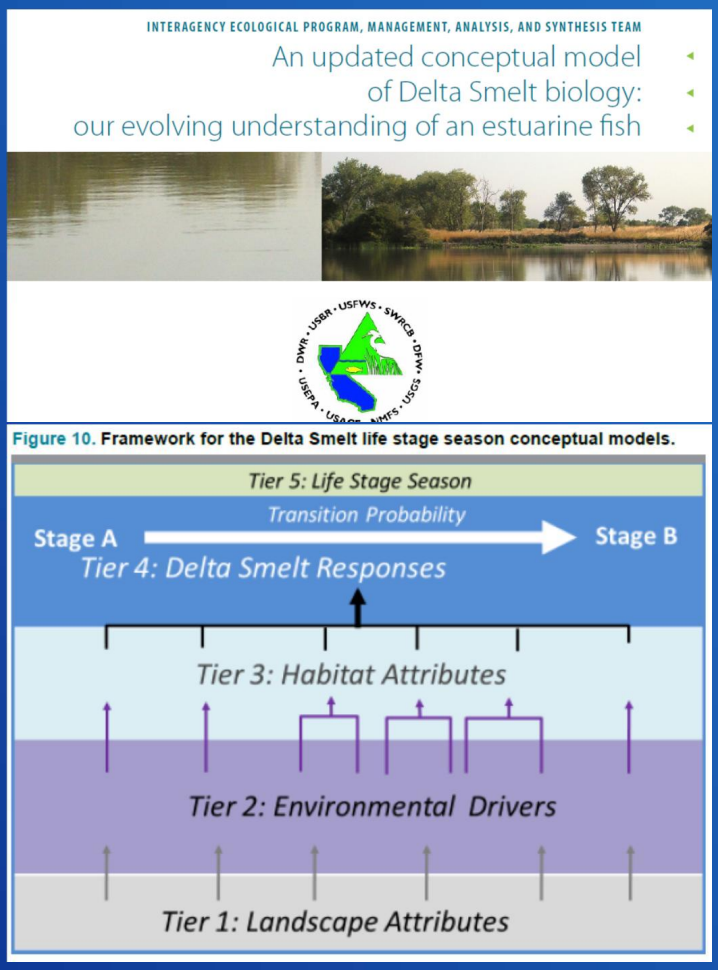
Delta Smelt Conceptual Models

<u>Habitat Attributes</u>

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

<u>Environmental Drivers</u>

- 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

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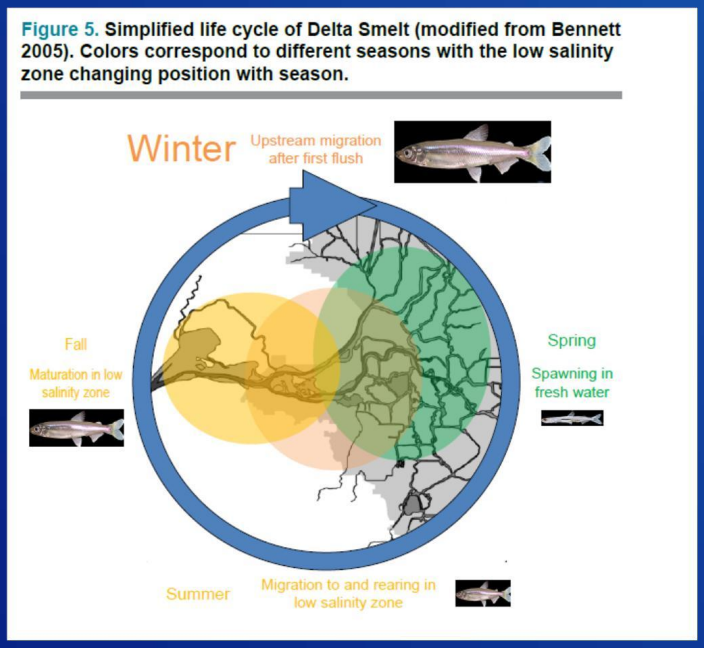
- Export Reductions
- Seasonal Outflow Augmentation
- Aquatic Weed Control
- N Delta Food Web Enhancement
- Reoperation of Suisun Marsh Salinity Gates
- Sediment Supplementation in LSZ
- Spawning Habitat Augmentation
- Suisun Marsh Food Web Enhancement
- Management Wetland Food Web Enhancement
- Adjusting 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?



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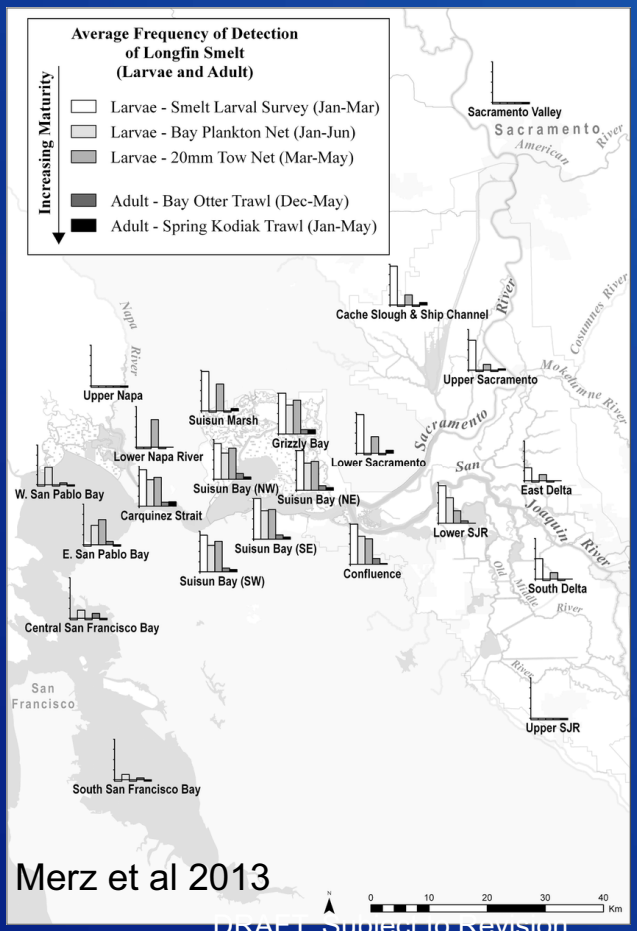
Longfin Smelt Conceptual Models



Merz et al 2013

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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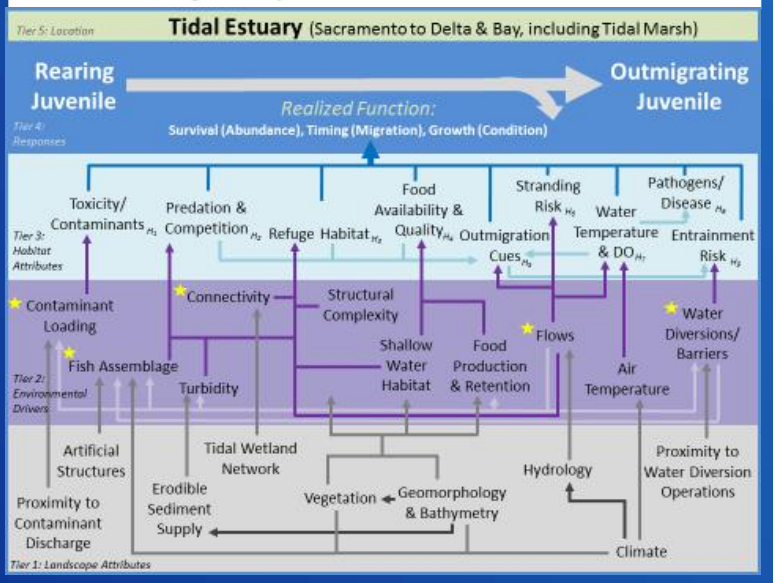
NOAA Technical Memorandum NMFS

AUGUST 2017

SCIENTIFIC FRAMEWORK FOR ASSESSING FACTORS INFLUENCING ENDANGERED SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON (*Oncorhynchus tshawytscha*) ACROSS THE LIFE CYCLE



RECLAMATION

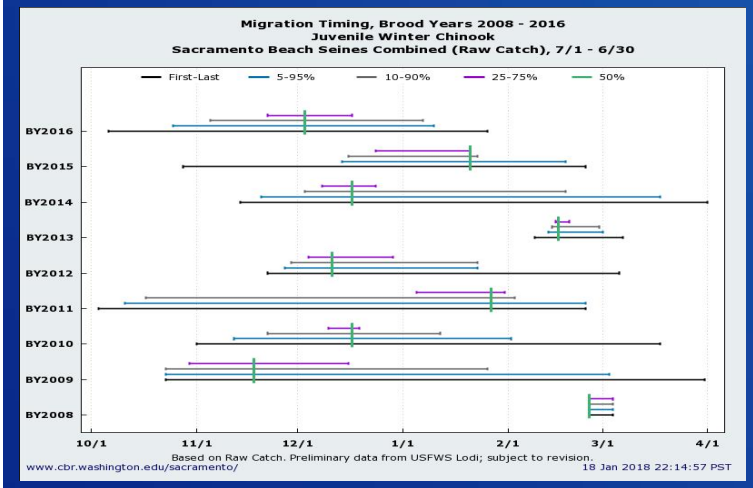
What might be considered for protecting, restoring, and maintaining WRCS?

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 [1] 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
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	Sampling Dates (MM/DD/YYYY)								

- Re-operate Delta Cross Channel
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- Improve In-Delta Diversion Fish Screens
- Manage Winter/Early Spring Delta Conditions to Improve Survival

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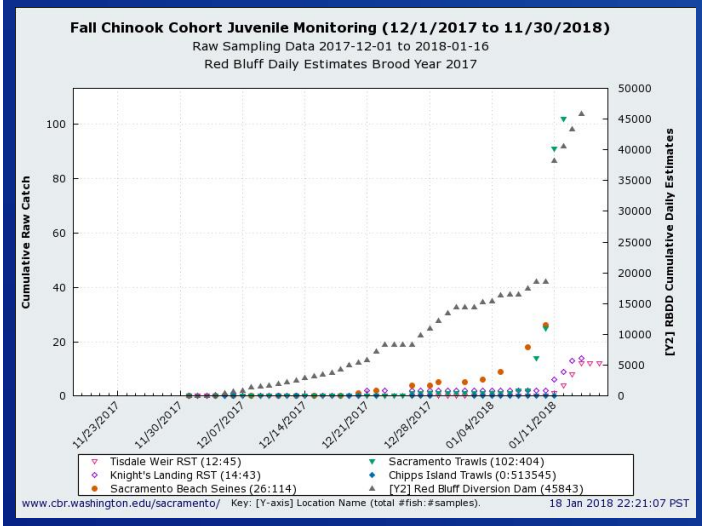
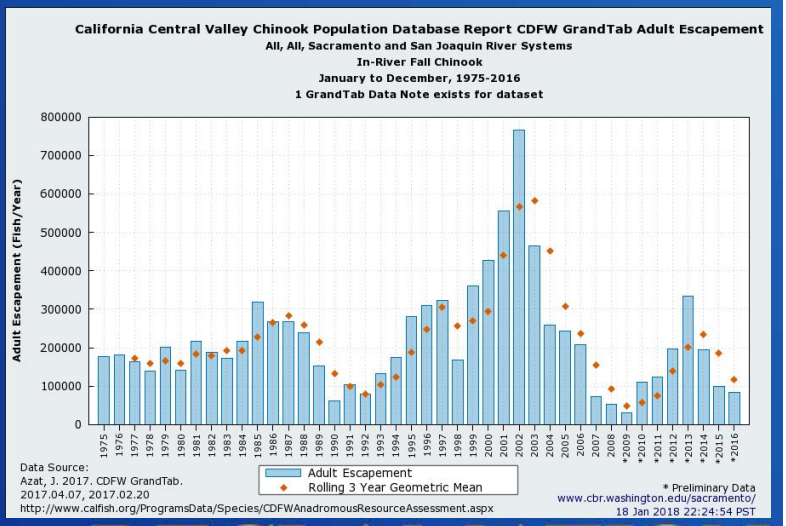
Other salmonids have less synthesized information on scope, but lots of information on scale.

- Spring-run Chinook
- Central Valley steelhead

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

NMFS





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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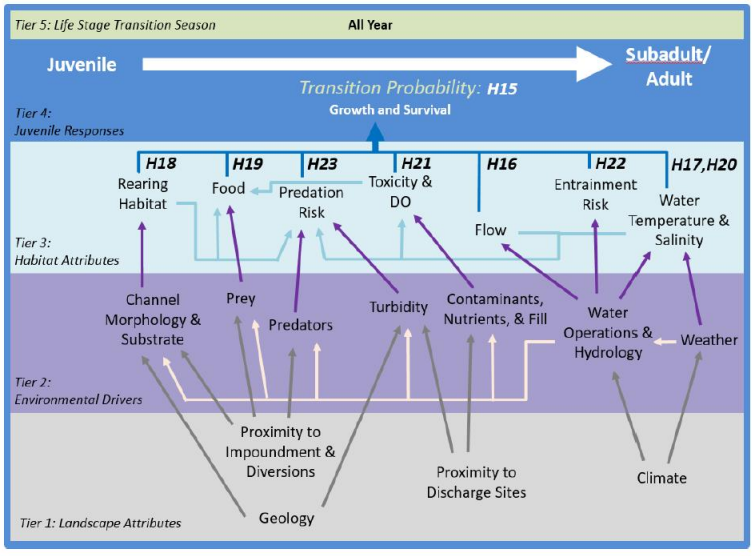
NOAA Technical Memorandum NMFS

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

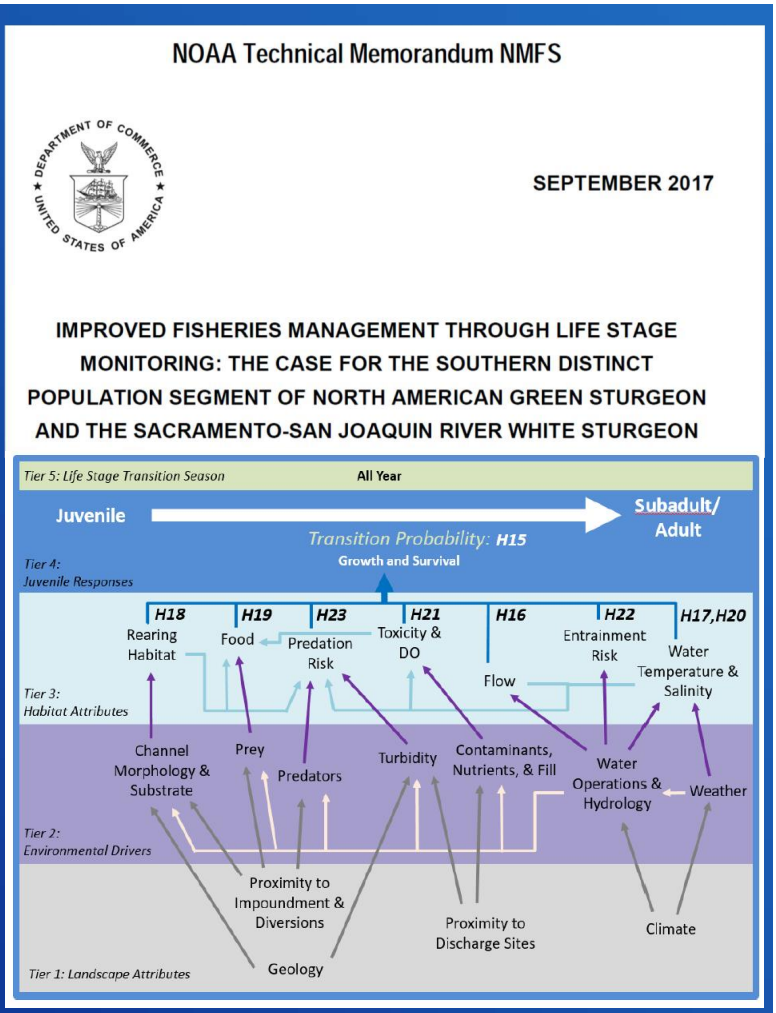


RECLAMATION

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

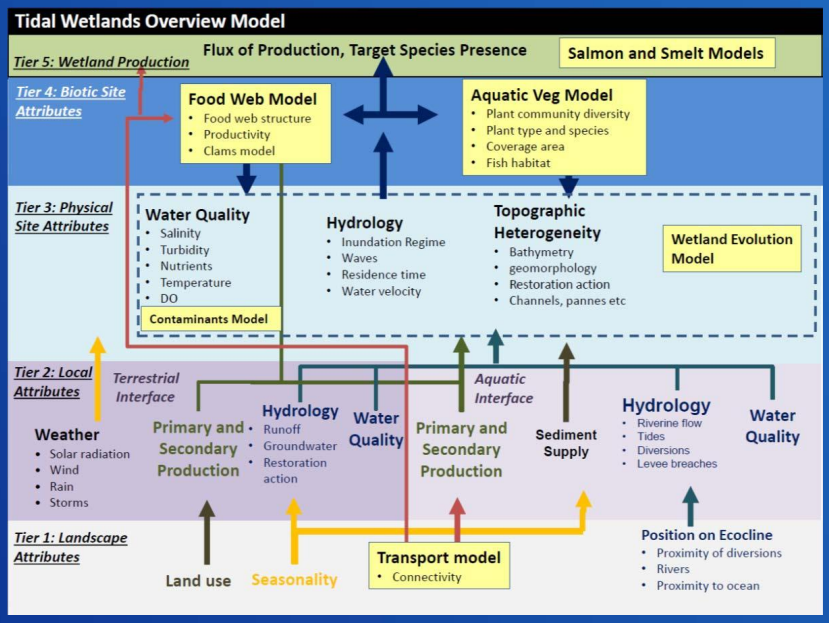
Tidal Wetland Suite of Conceptual Models (DFW)

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?

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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

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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?