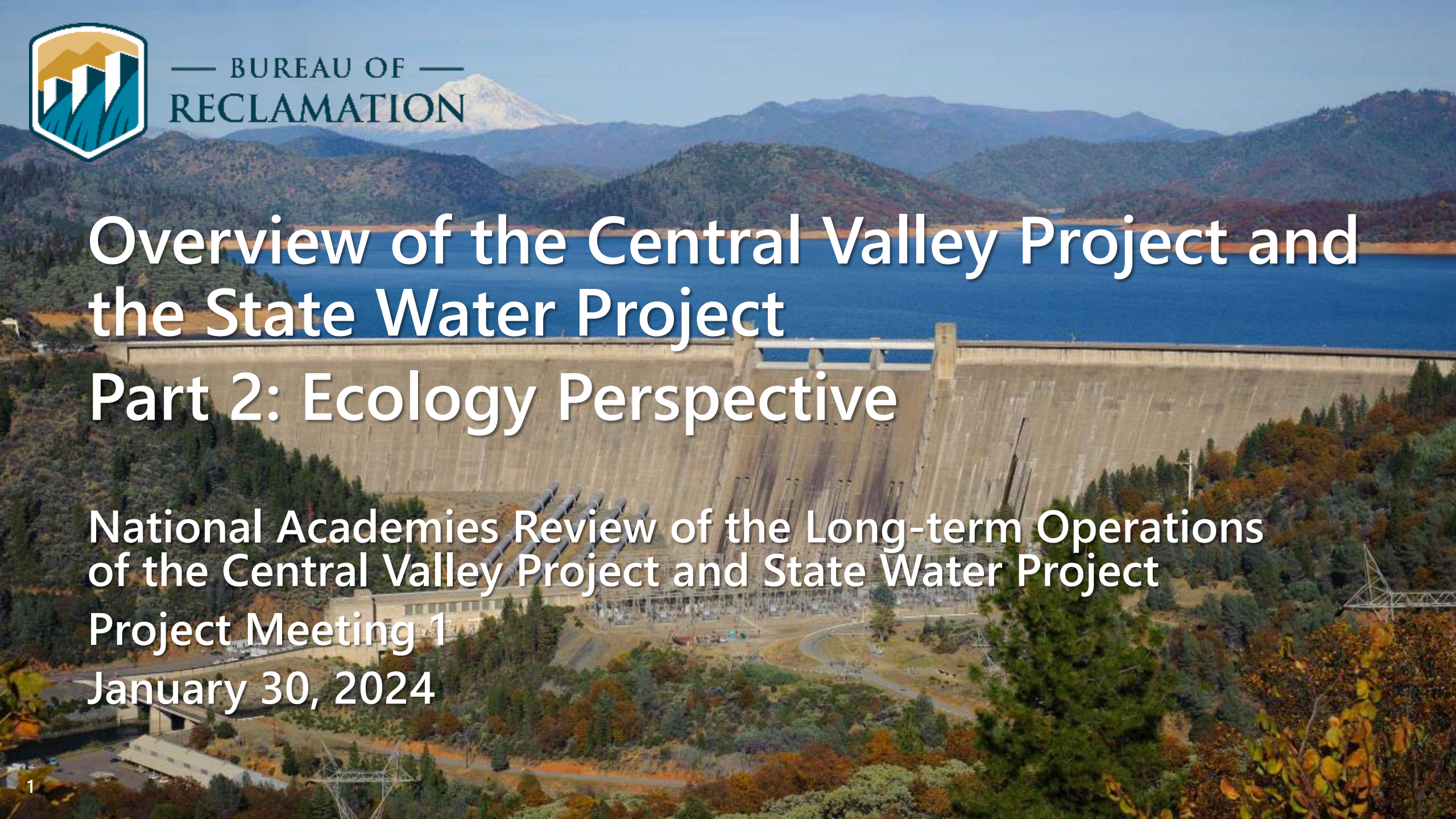


BUREAU OF RECLAMATION

Overview of the Central Valley Project and the State Water Project
Part 2: Ecology Perspective

National Academies Review of the Long-term Operations of the Central Valley Project and State Water Project

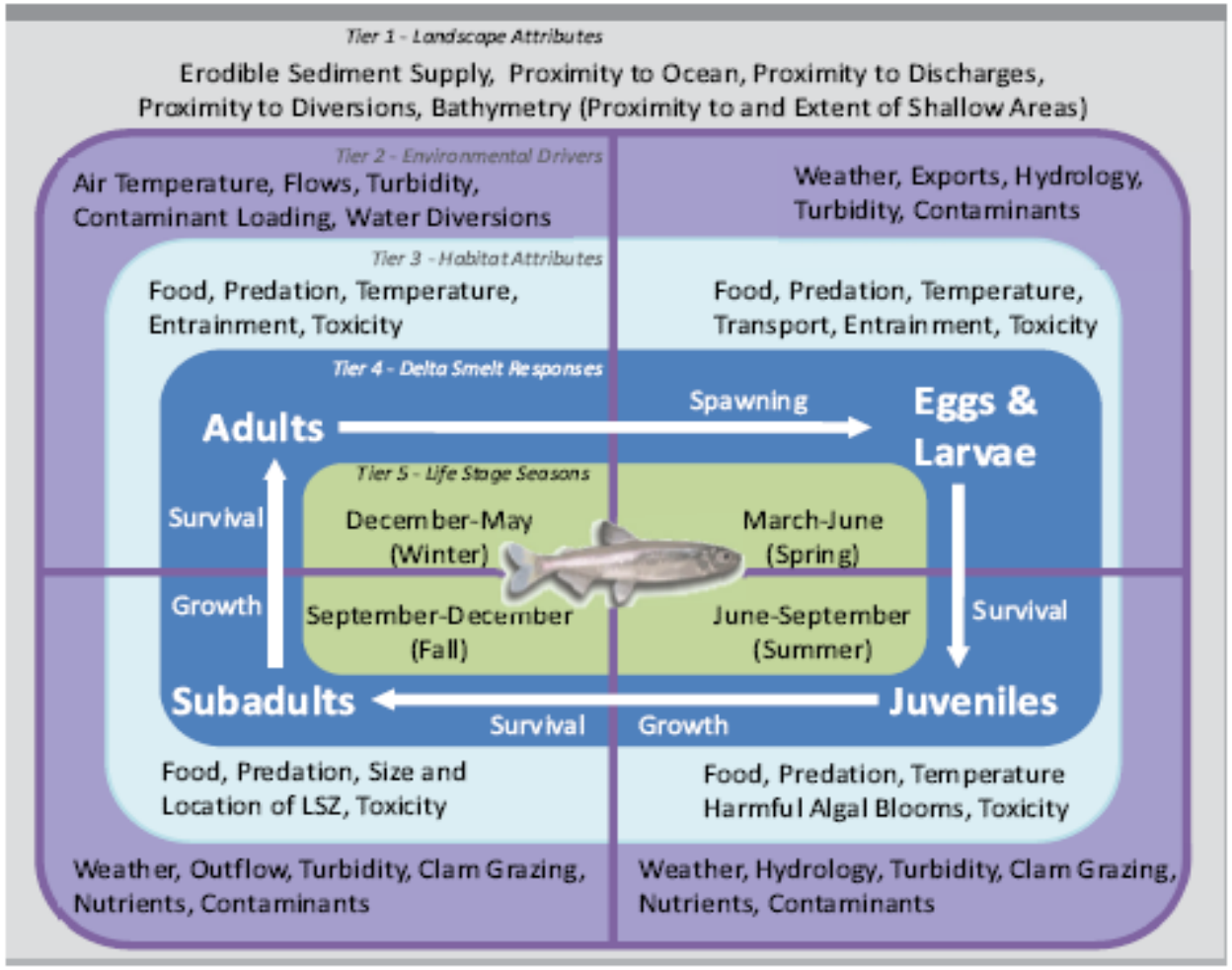
Project Meeting 1

January 30, 2024

Delta smelt conceptual model identifies stressors, threats, and limiting factors

IEP.

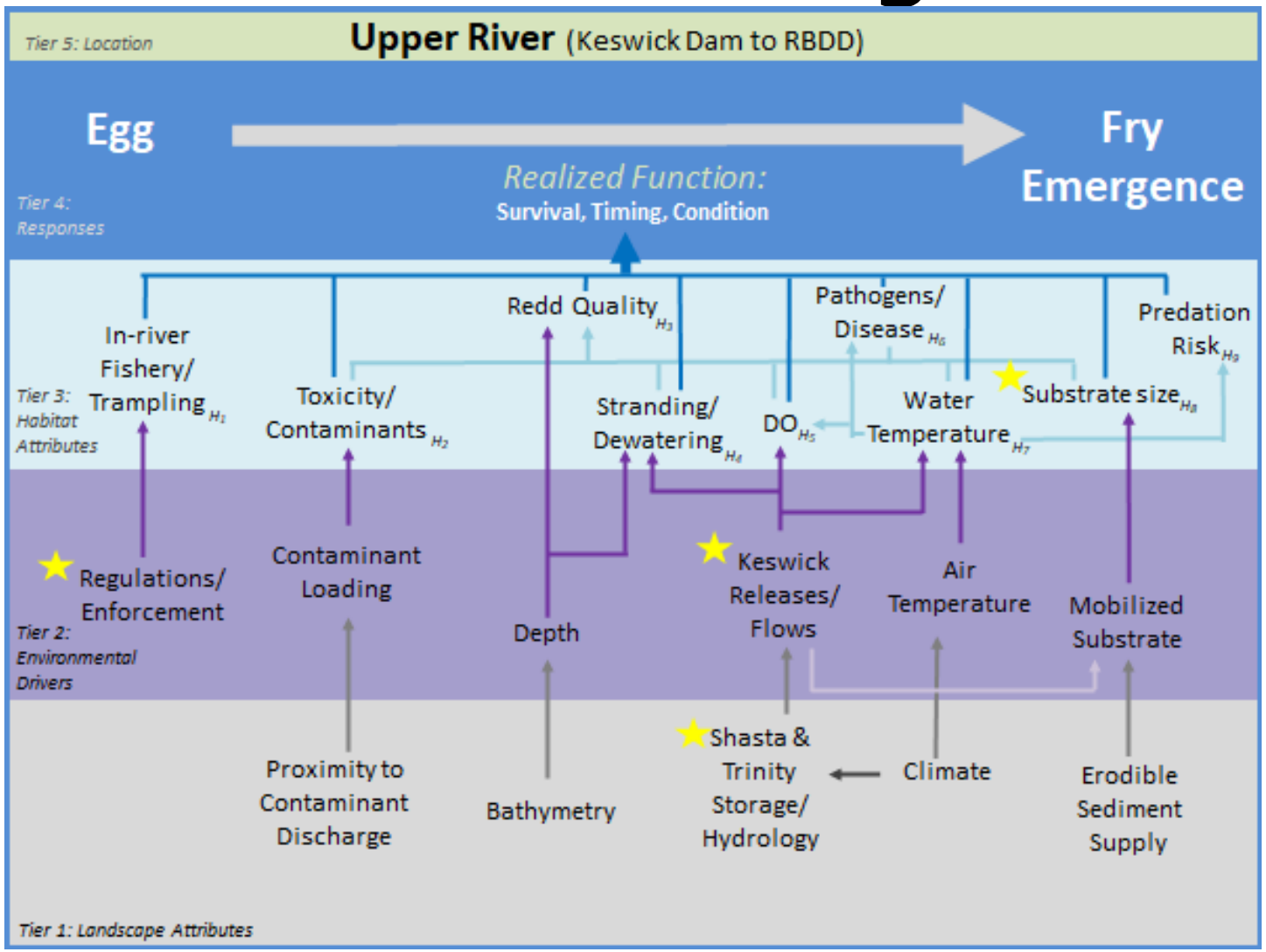
2015. (MAST) Updated Conceptual Model of Delta Smelt biology



IEP 2015

Salmonid conceptual model identify stressors, threats, and limiting factors

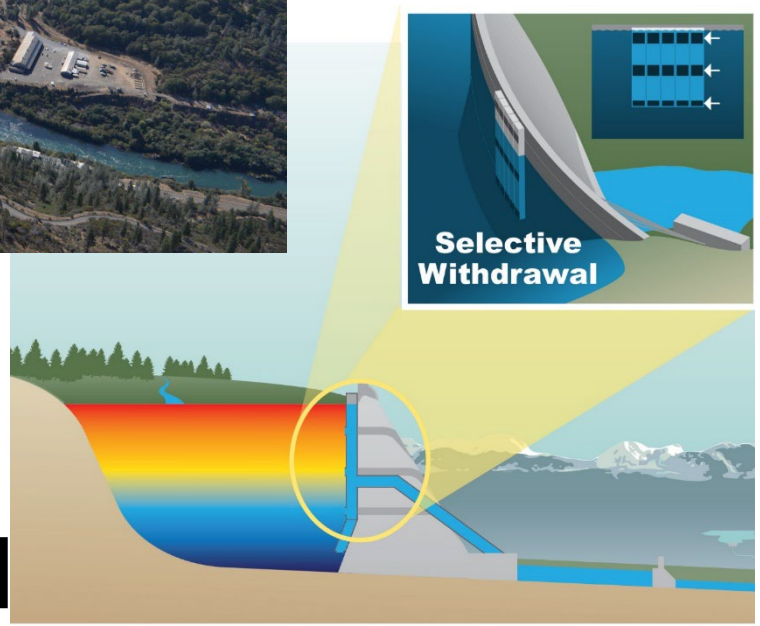
NMFS. 2017.(SAIL) Framework for assessing factors influencing Winter-run Chinook salmon



CVP Operations

Store

Release



Blend

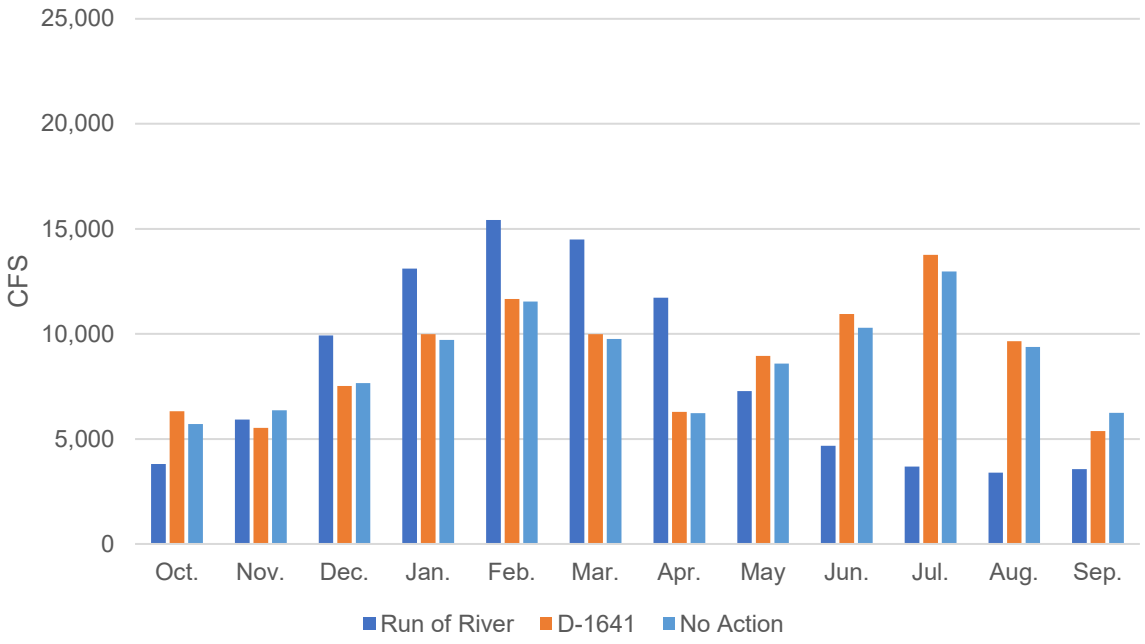
Route

Divert

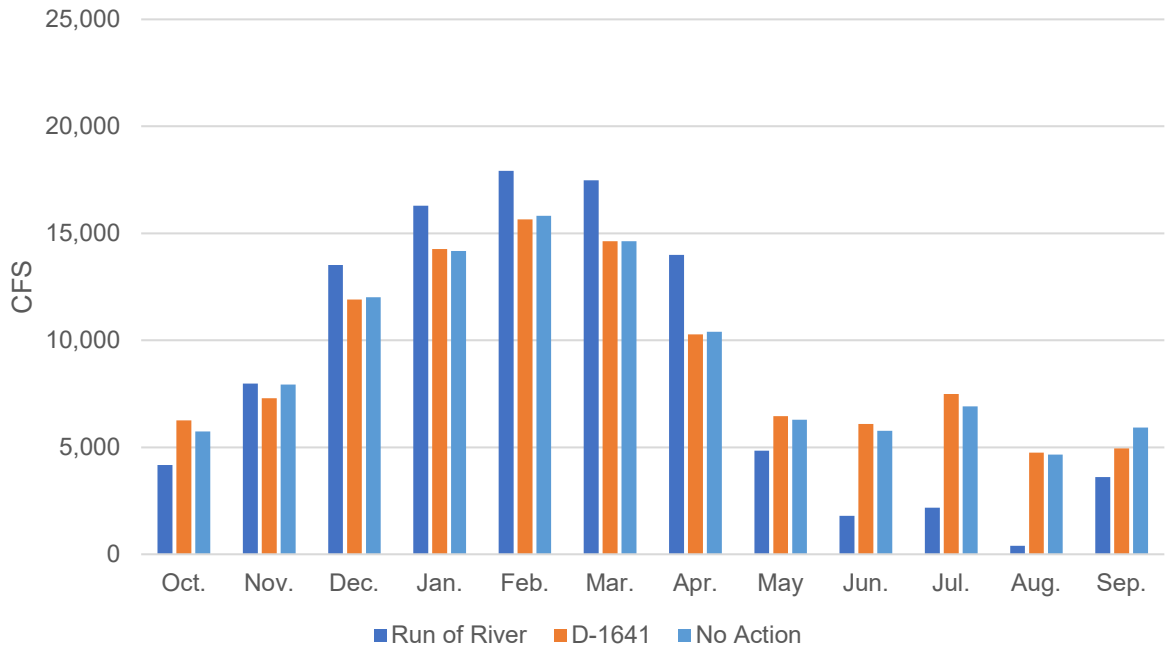
Operations cause hydrologic alteration

- Run of the River: Impaired inflows into CVP reservoirs that are passed downstream subject to the channel capacity of downstream reaches.
- D-1641: Operation of the CVP and SWP under the assignment of responsibilities for the 1995 Bay-Delta Water Quality Control Plan and contracts for water deliveries.
- No Action: Operating rules for the CVP and SWP under the 2020 Record of Decision (ROD) and operating rules for the SWP under the SWP 2020 Incidental Take Permit.
- water year types are the 40-30-30 index, as defined by D-1641

Sacramento River operations- storing & releasing

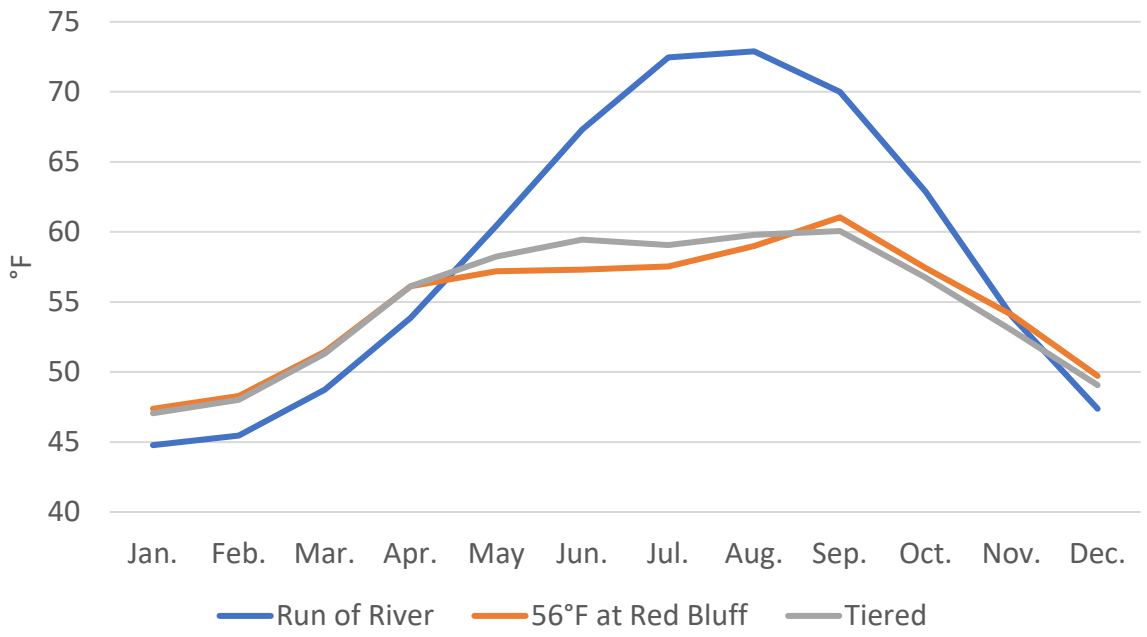


Keswick Dam Monthly Flows, All Water Year Types

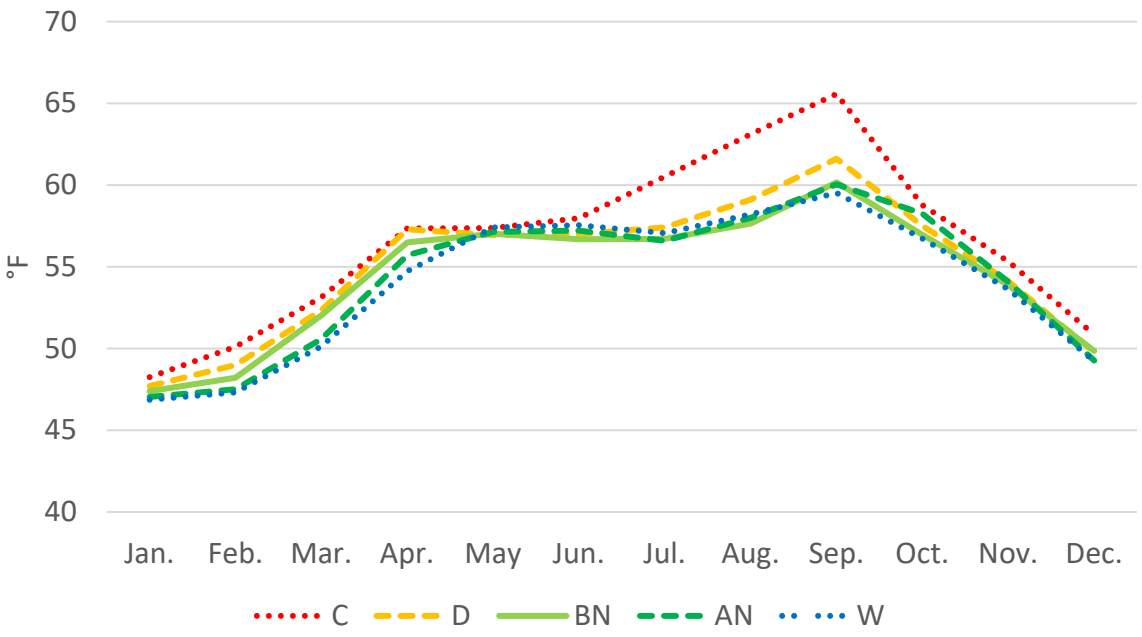


Wilkins Slough Monthly Flows, All Water Year Types

Sacramento River water temperatures - blending

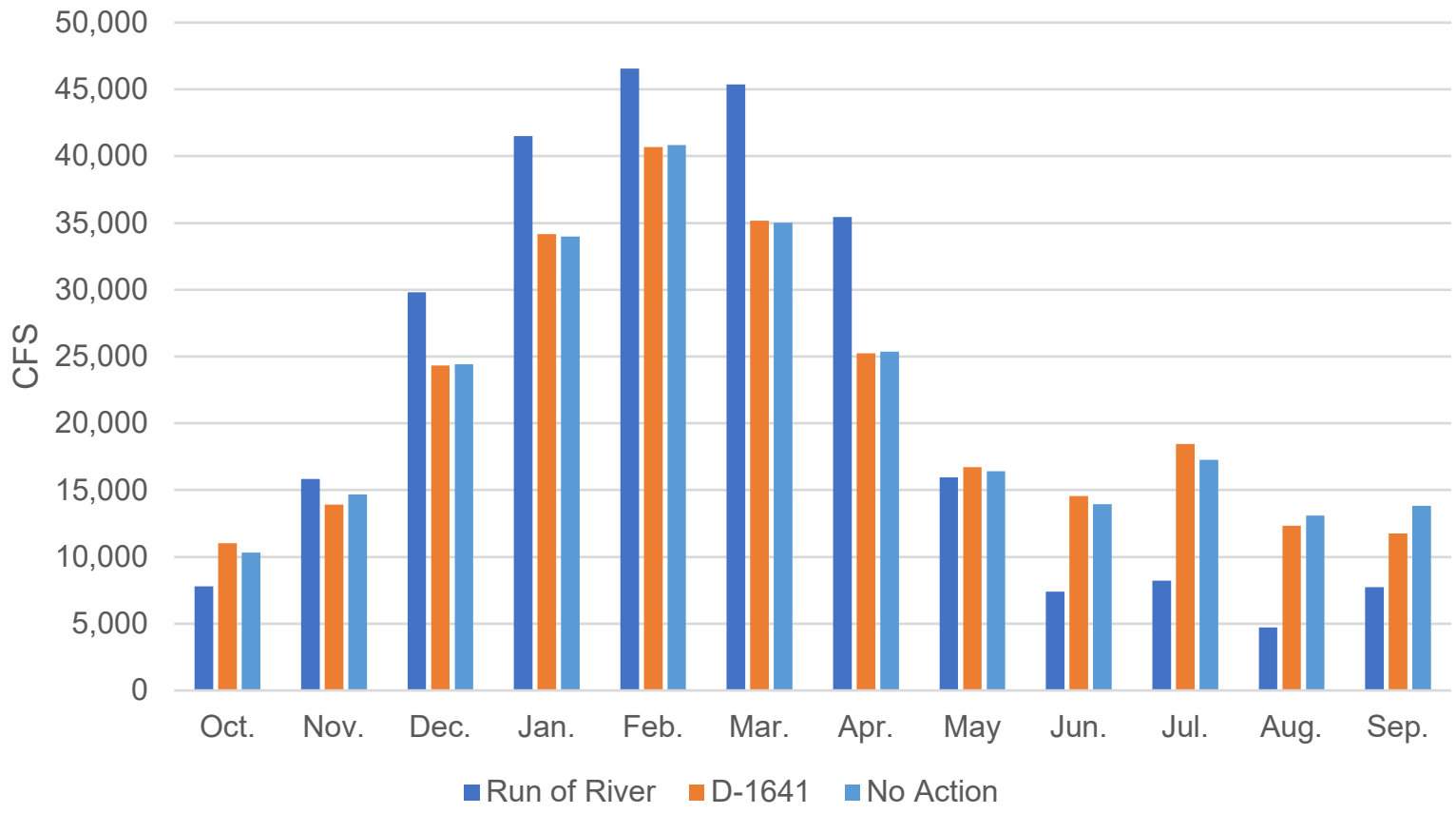


Below Red Bluff Diversion Dam, All Water Year Types



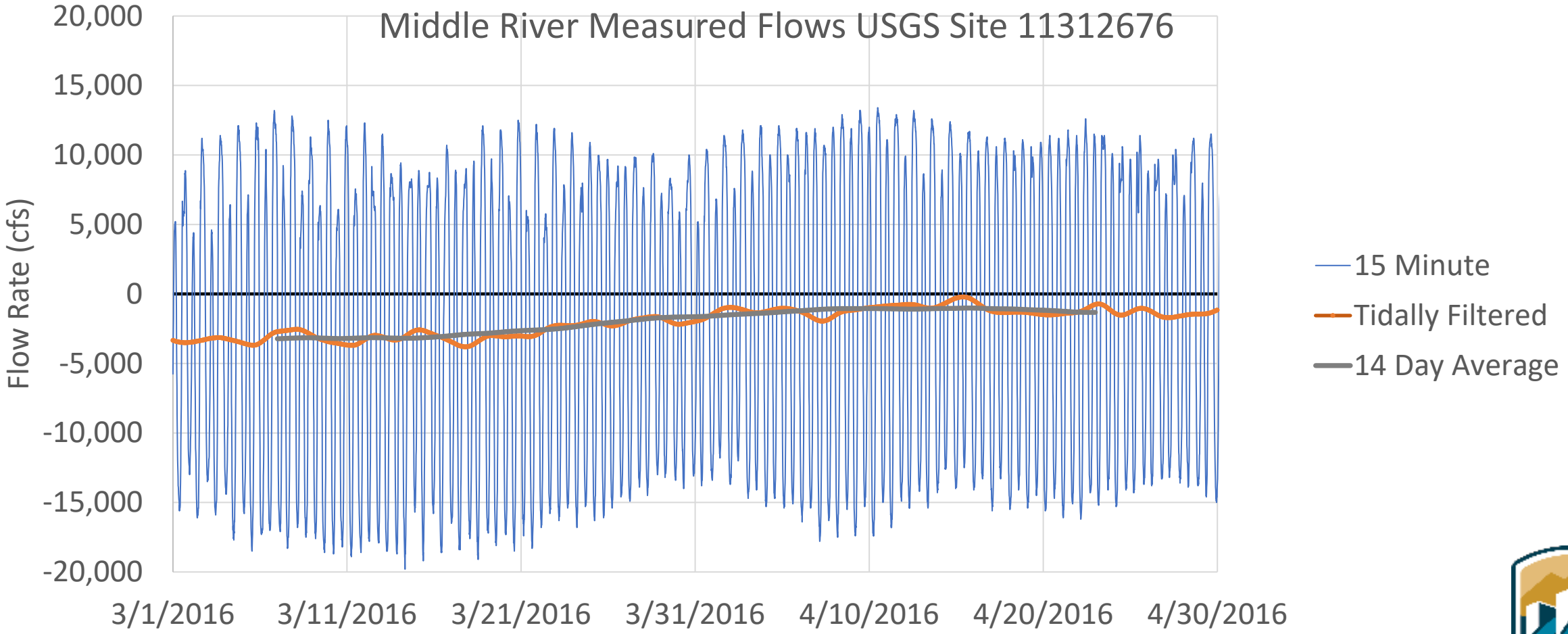
Below Red Bluff Diversion Dam when Targeting 56°F at Red Bluff Diversion Dam by Water Year Type

Delta water operations- releasing

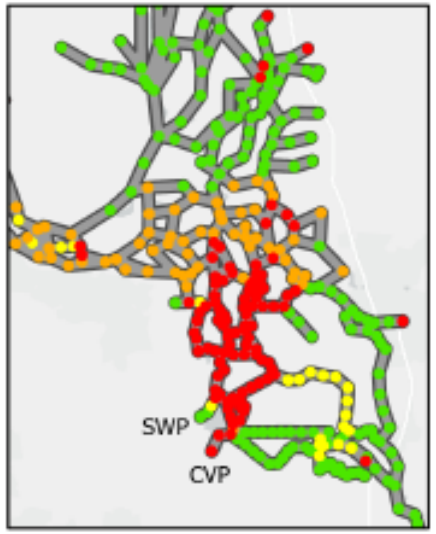


Sacramento River at Freeport

The Delta is tidally driven with flows summarized over various averaging periods.



Suitable habitat in zone of exports influence varies



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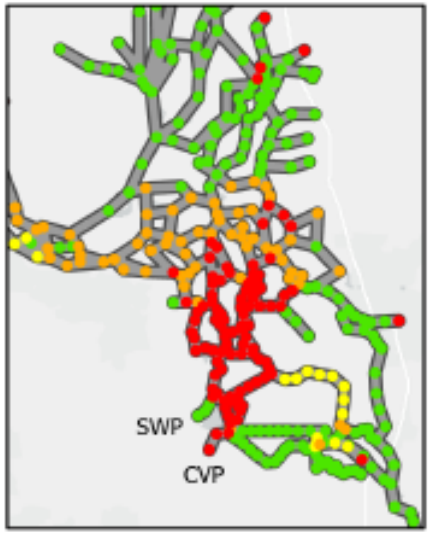

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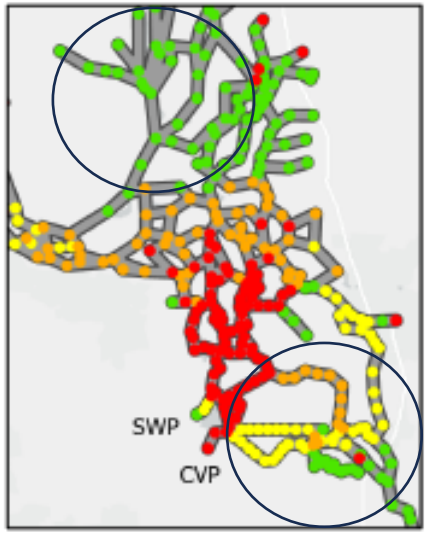

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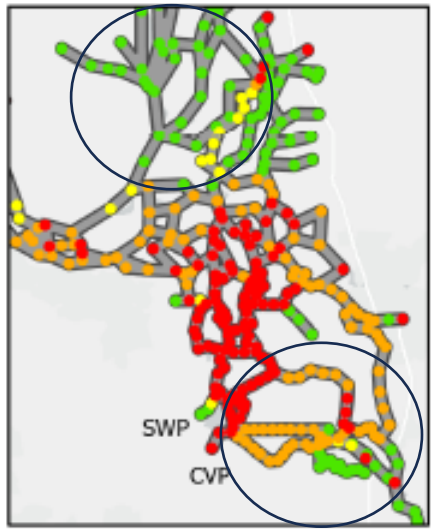

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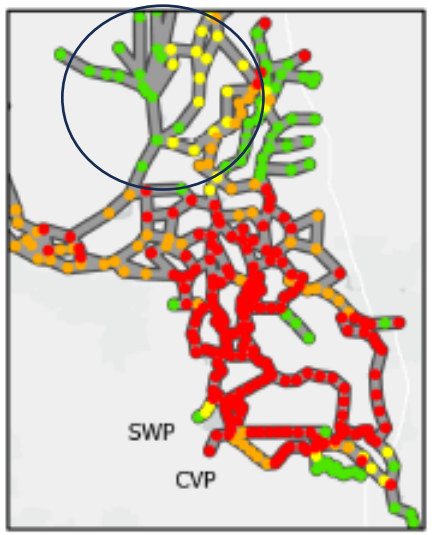


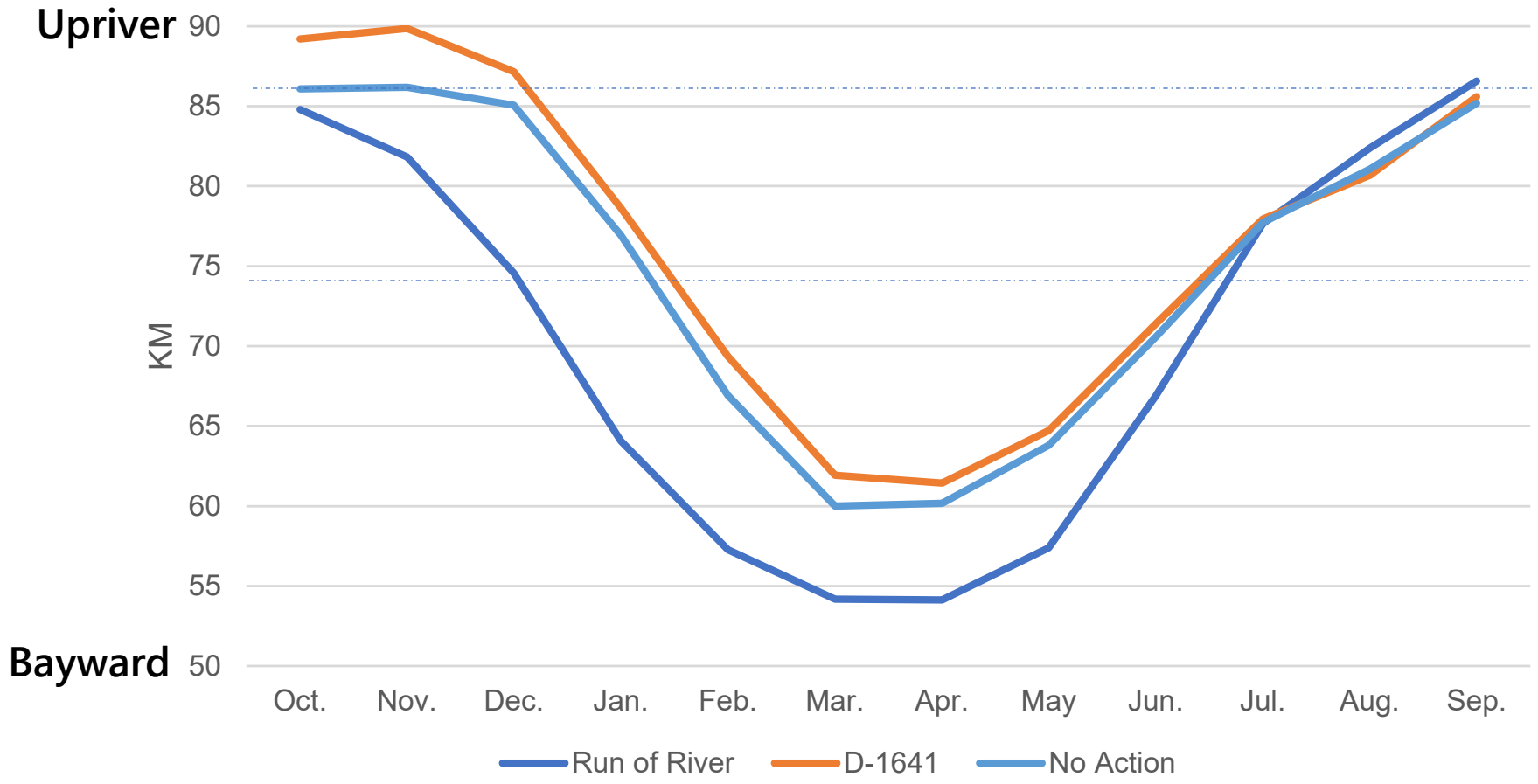
-5000 cfs

with and without exports model comparison identifies a zone of influence for regions where habitat is affected

Proportional Overlap

- 0.00 - 0.50
- 0.50 - 0.90
- 0.90 - 0.95
- 0.95 - 1.00

Estuarine habitat varies with salinity



Monitored and measured effects of hydrologic alteration

Biological Effects

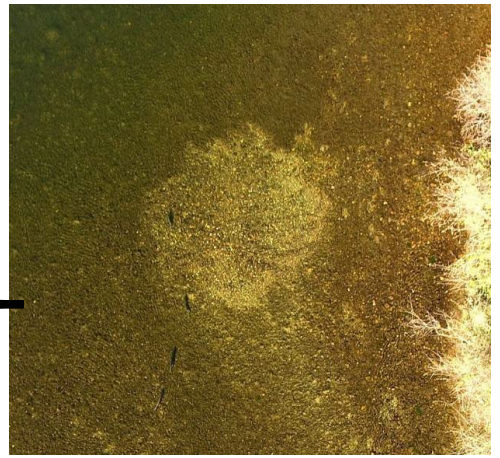
- Adult abundance
- temperature dependent mortality
- Egg to fry survival
- Proportion of redds dewatered
- Outmigration survival probability
- Through-Delta survival probability
- Juvenile production
- Facility Salvage & Loss
- Population Growth

Habitat Effects

- Suitable habitat availability
- Routing Probability
- Zone of Influence
- Food quantity and quality
- Abiotic habitat attributes
  - Delta salinity
  - Delta Turbidity
  - Delta Current speed
  - Water temperatures (various locations)

Salmon model habitat attributes potentially influenced by operations

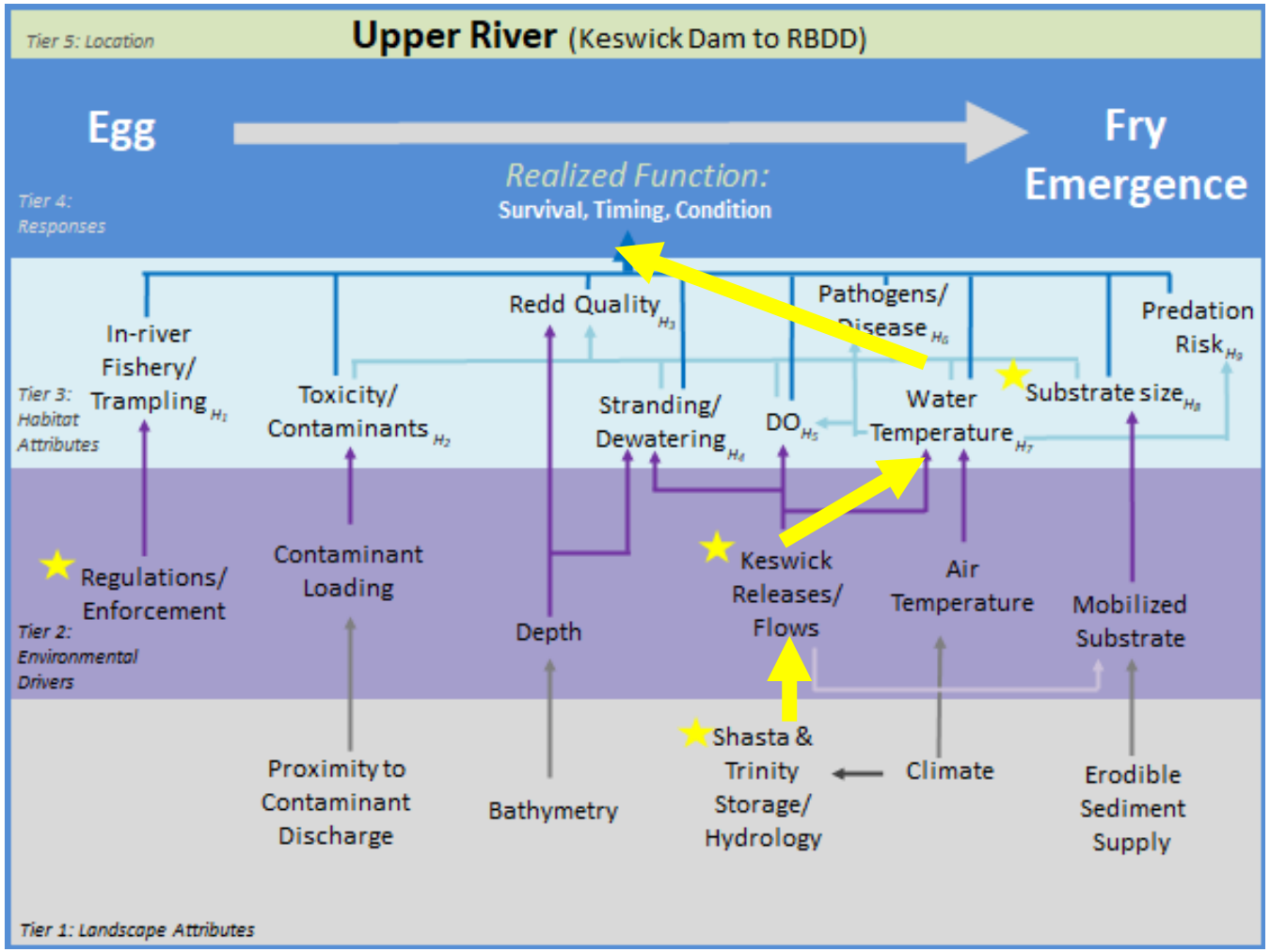
Pathogens and disease*
Toxicity from contaminants*
Spawning habitat quality
Water temperatures
Dissolved oxygen
Sedimentation and gravel quantity
Redd stranding and dewatering
Redd habitat quality



Stranding risk
Outmigration cues
Entrainment risk
Refuge habitat
Food availability and quality
Predation and competition

*may affect all 3 life stages

Stressor: Water temperature



NMFS 2017

CVP influence on Water Temperature

Store water

Reduces downstream flows, builds storage of cold water

Release water

Depletes cold water storage, adds thermal mass

Divert water

Reduces outflow to the Delta, probably not applicable

Route water

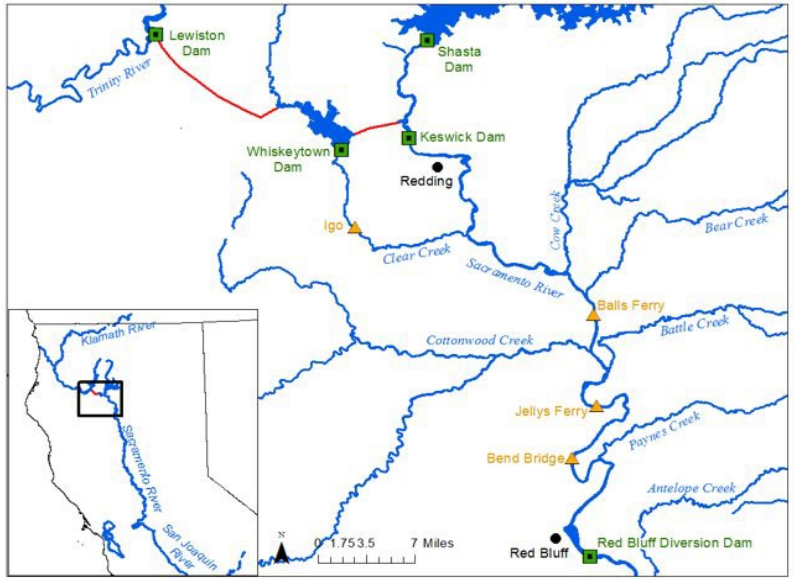
Moves flows into different locations, probably not applicable

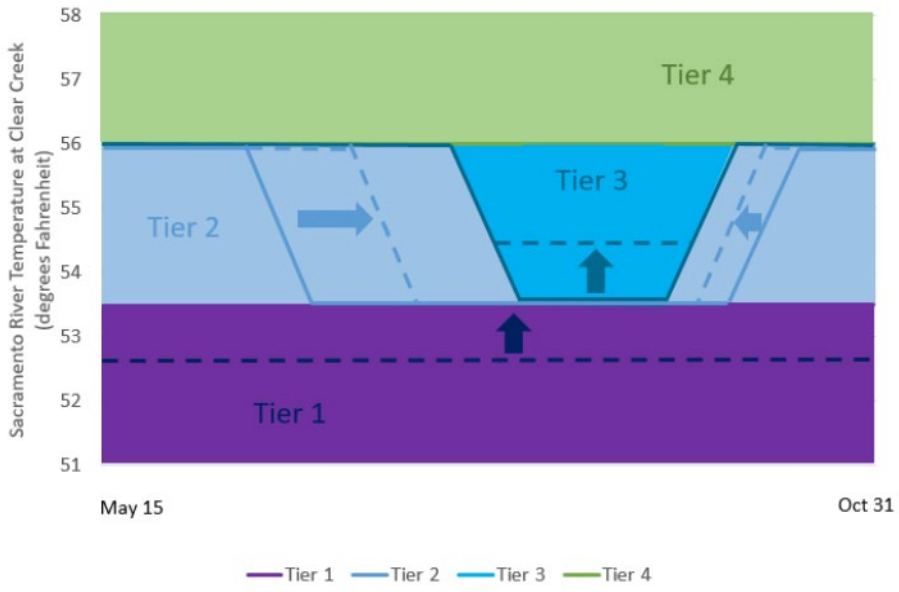
Blends water

Preserves coldwater for release at later time

Varied approaches for addressing temperature

- Manage to target location for 56°F
- Manage for EOS storage objectives to meet 56°F
- Manage for tiers for when cold water <53.5°F is limited
- Manage multiple actions guided by storage objective bins including reduced diversions by contractors





Tools for evaluating temperature stressor

Planning Tools

Temperature models
- Hec5Q
- Water Temp Modeling Platform

Early Life Stage Survival Models
- SALMOD
- inSalmo
- Juvenile Production Model

Mortality Models
- life stage independent (Martin 2017)
- life stage dependent (Anderson 2022)

Real-time tools

Redd and carcass surveys
Rotary screw traps
Continuous temperature monitoring
Reservoir temperature monitoring

Reclamation's water temperature interests

- Protect fish and wildlife
  - Environmental conditions that support multispecies' survival and recruitment
  - Defensible criteria for protecting winter-run Chinook salmon
- Minimize uncertainties that impacts delivering water
  - Reduce delayed allocations because of cold water pool and meteorology forecasts
  - Carryover storage that spills, when it could be delivered
- Maximize power generation

Delta Smelt conceptual model habitat attributes potentially linked to operations

adult

Egg/ larvae

Predation*

Toxicity*

Water temperature*

Food visibility

Food availability and quality

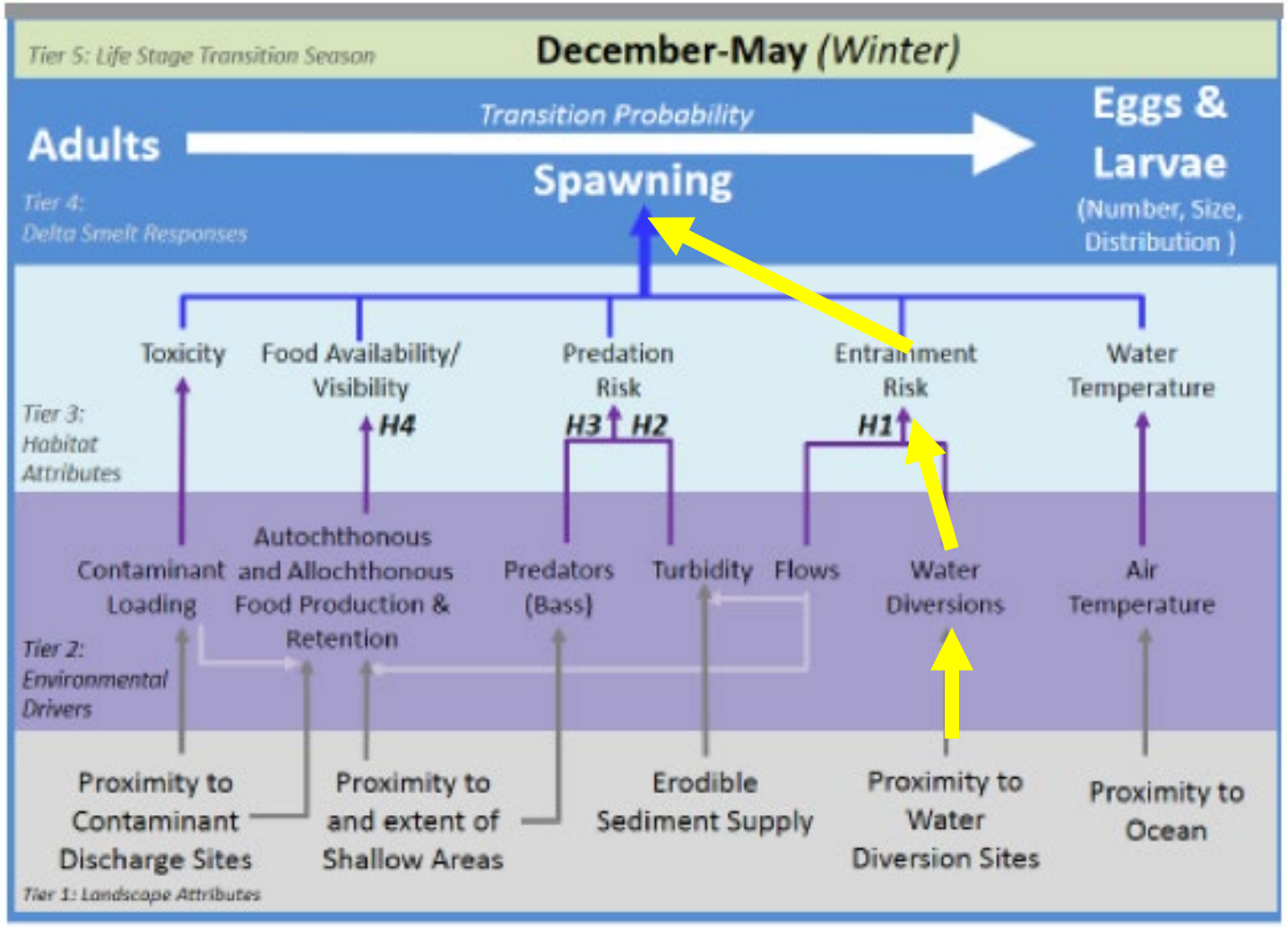
Entrainment risk

Size and location of low salinity zone

Juveniles

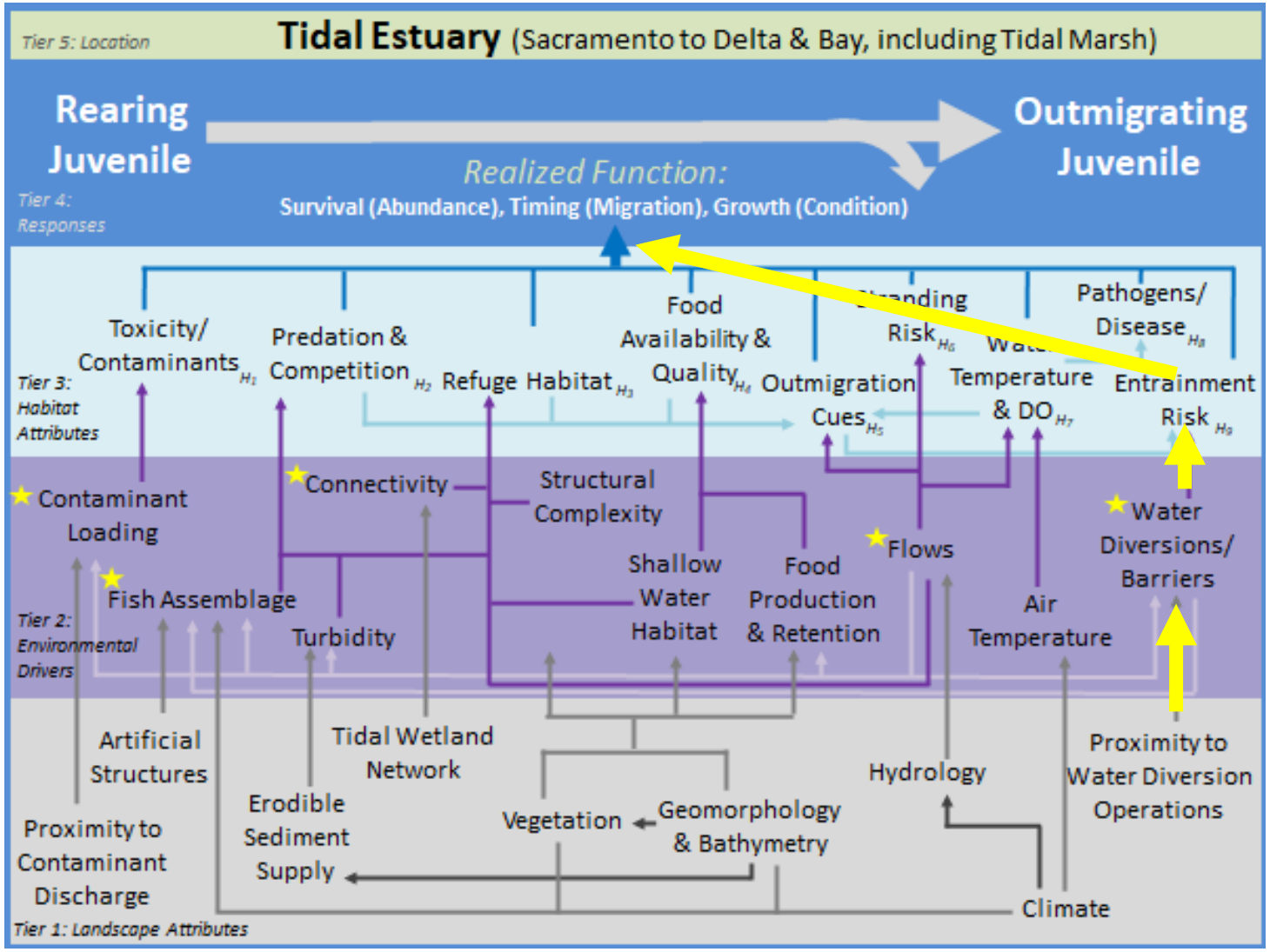
*may affect all 3 life stages

Stressor: Adult Delta Smelt Entrainment Risk



IEP 2015

Stressor: Juvenile Salmonid Entrainment Risk



NMFS 2017

CVP and SWP influence on Entrainment Risk

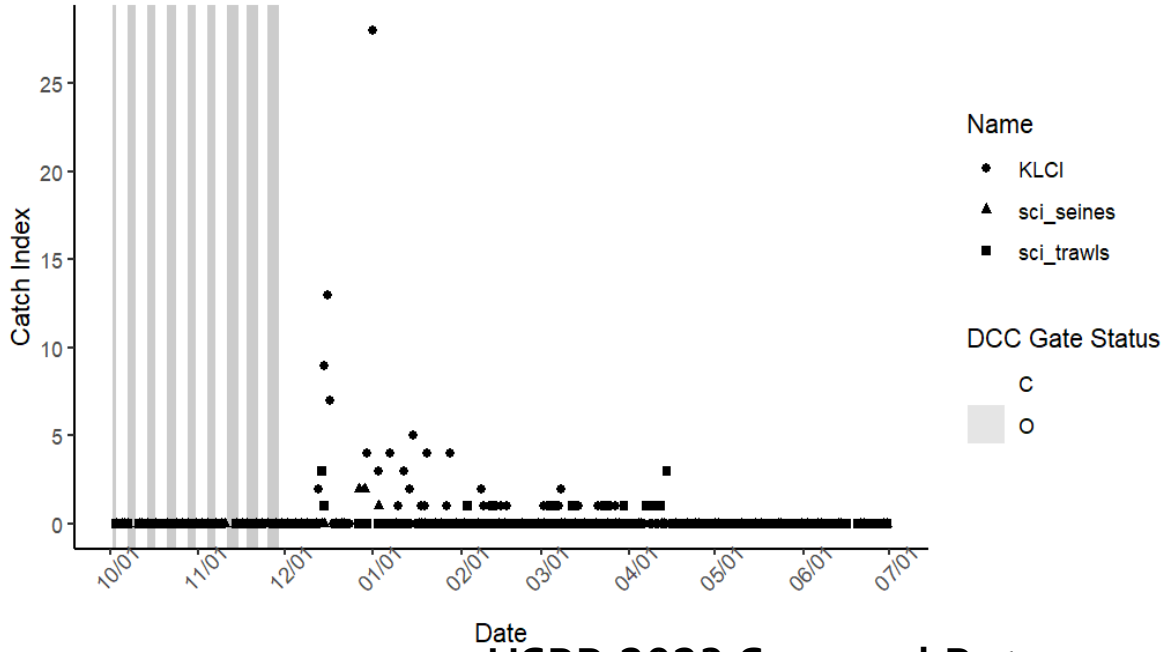
Store water
reduces Delta inflows

Release water
doesn't typically occur in the winter and spring, probably not applicable

Blend water
probably not applicable in Delta

Divert water
reduces outflows from the Delta

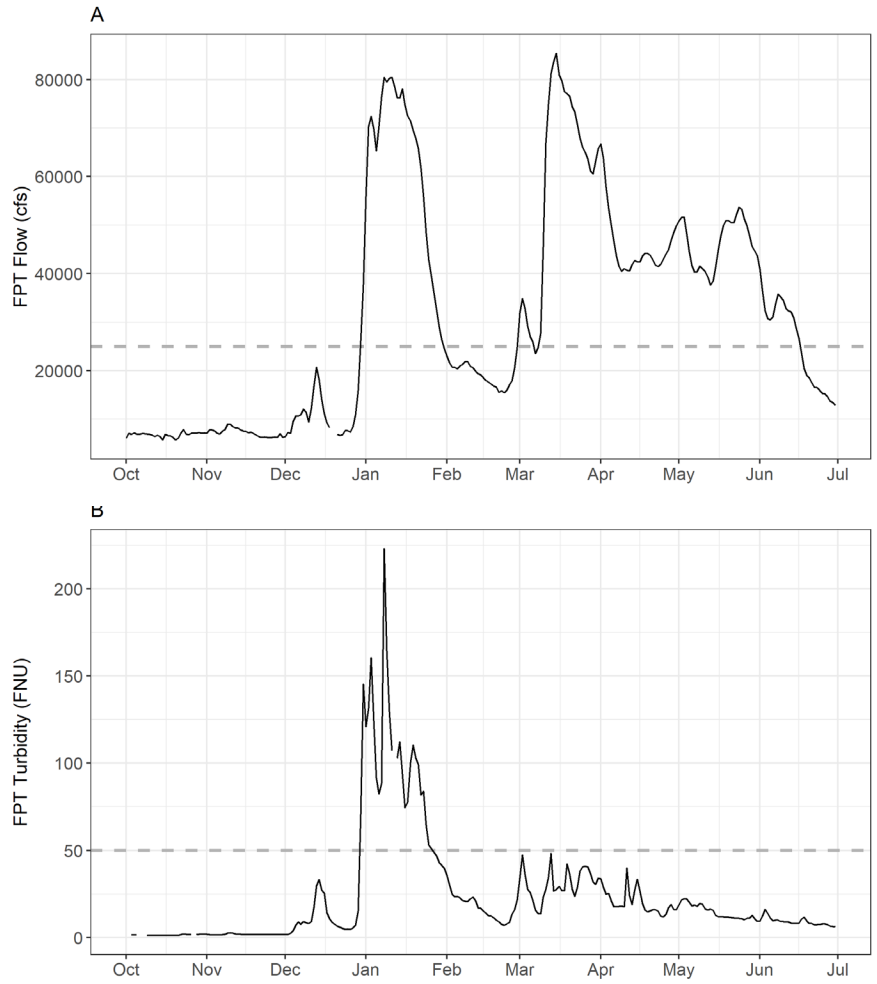
Route water
moves flows into different locations



USBR 2023 Seasonal Rpt

Varied approaches for addressing entrainment risk

- Change routing through Delta Cross Channel gate closures & Georgiana Slough non-physical barrier
- Reduce diversions based on inflow
- Reduce diversions based on Old and Middle River flows
- Reduce diversions based on salvage of fish
- Reduce diversions based on environmental conditions (e.g. turbidity, temperature)
- Reduce diversions based on modeled risk



USBR 2023 Seasonal Rpt

Tool for assessing entrainment risk

Real-time tools

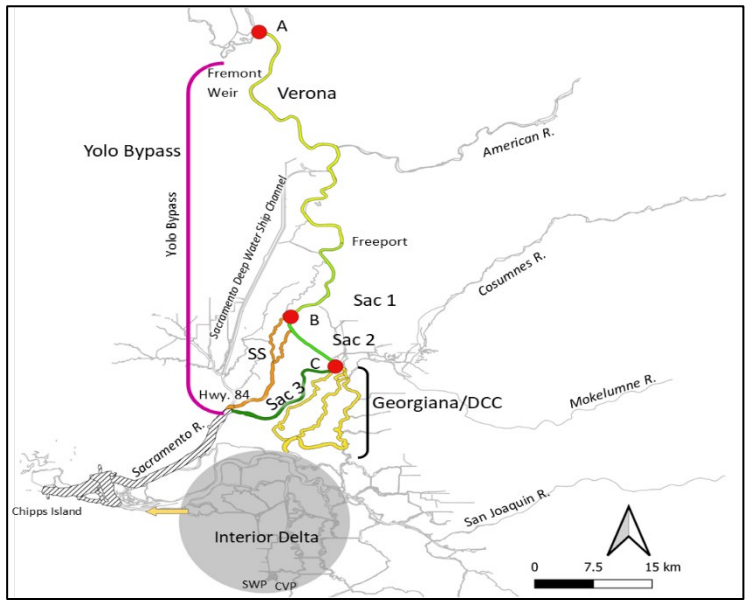
- Tributary and Delta evt'l monitoring
- Upstream and Delta bio. monitoring
- Genetic monitoring of fish
- Hydrodynamic models
  - DSM2
  - PTM
  - Zone of Influence
- Survival models
  - STARS
- Loss models
  - Winter-run Chinook salvage Machine Learning model
  - Winter-run Chinook and Steelhead boosted regression tree models

USBR 2023 Seasonal Rpt

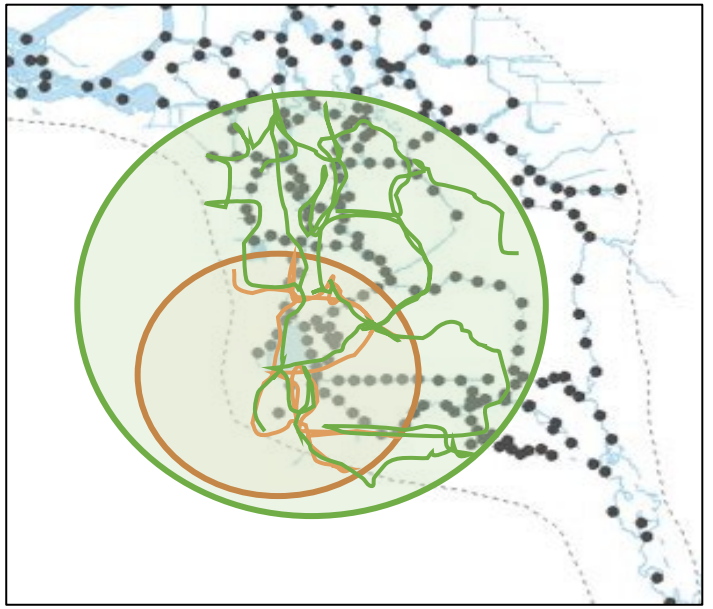
Tools for evaluating entrainment risk

Planning tools

- Hydrodynamic Models
  - DSM2
  - PTM
  - Zone of Influence
- Survival models
  - Delta Passage Model
  - Eco-PTM
- Life cycle models
  - IOS
  - OBAN
  - NMFS WCS LCM
  - CVPIA SIT LCMs
  - Delta Smelt LCM



Delta passage model schematic
USBR 2022 IA Report



Zone of influence schematic

Reclamation's entrainment risk interests

- Protect Fish and Wildlife
  - Broad environmental conditions that promote Delta fish recruitment
  - Defensible criteria to avoid ESA-listed species population effects
- Water Supply
  - Maximize the use of unstorable/excess water
  - Convey stored water
- Power schedule predictability

Delta Smelt model habitat attributes potentially linked to operations

adult

Egg/ larvae

Predation*

Toxicity*

Water temperature*

Food visibility

Food availability and quality

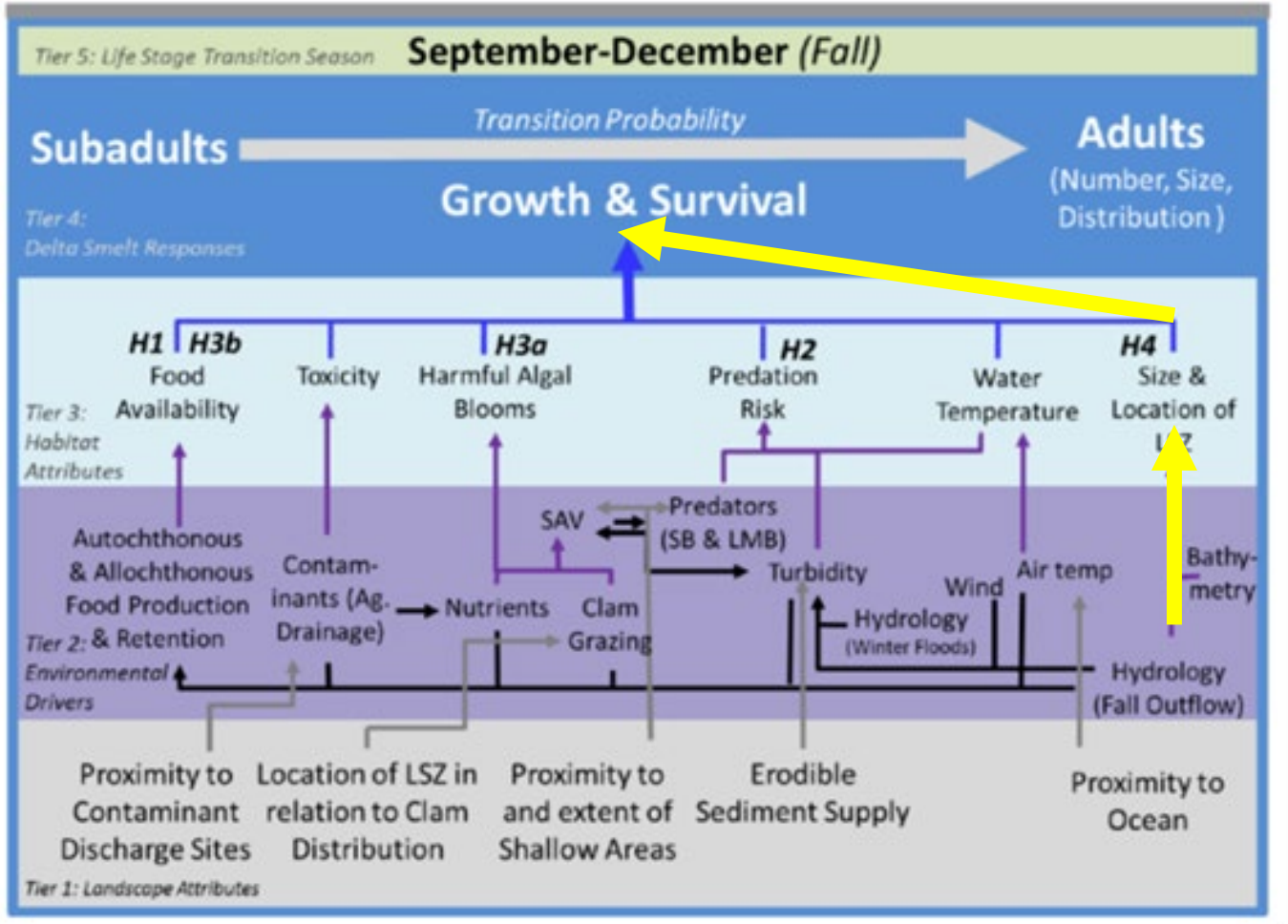
Entrainment risk

Size and location of low salinity zone

Juveniles

*may affect all 3 life stages

Stressor: Size and Location of Low Salinity Zone



IEP 2015 MAST

CVP influence on Summer Fall habitat

Store water

not storing water in summer and fall, probably not applicable

Release water

Increases inflow to Delta

Divert water

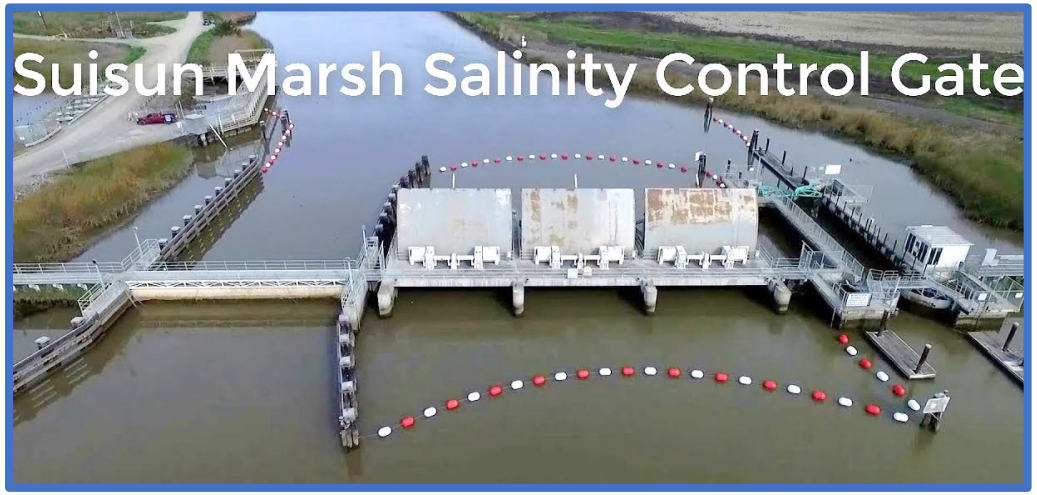
Reduces outflow from the Delta

Route water

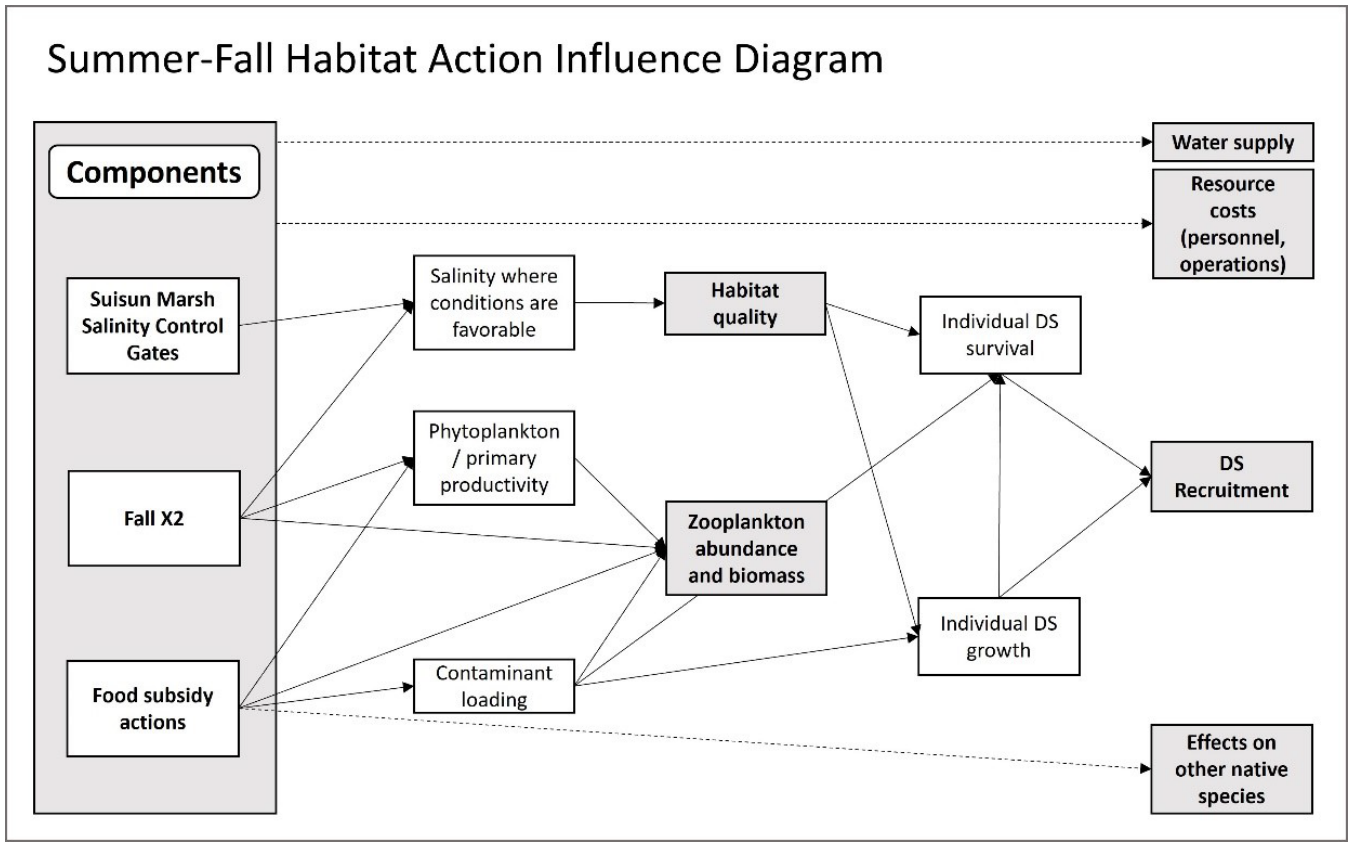
Moves flows to different locations

Blends water

probably not applicable



Different approaches for addressing summer fall low salinity zone



DWR 2022

- Manage releases and exports to meet X2 location
- Manage releases and exports to meet Suisun Marsh salinity criteria
- Manage flow routing to maintain water quality
- Supplementation

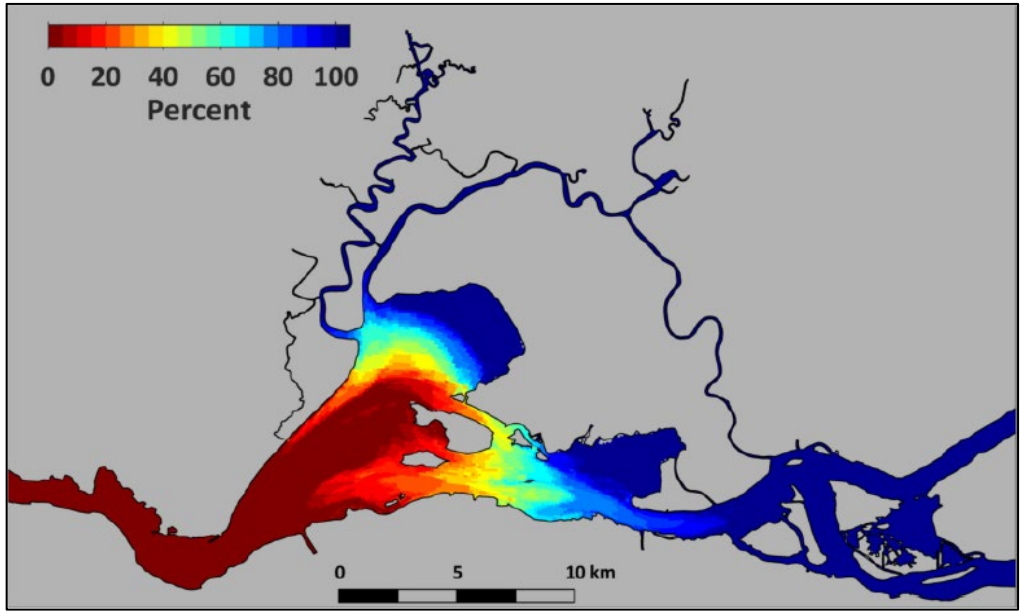
Tools for evaluating summer fall habitat

Real-time tools

- Delta environmental monitoring
- Delta biological monitoring
- Food web monitoring

Planning tools

- Hydrodynamic Models
  - SCHISM
- Life cycle models
  - Delta Smelt IBMR
- Special studies
  - Directed Outflow Project



Salinity <6 ppt at an 80 km X2 with SMSCG Operation. Low saline habitat occurs in Grizzly and Honker Bays, but does not freshen all of Suisun Bay.

Reclamation's Summer Fall Habitat Action interests

- Protect Fish and Wildlife
  - Defensible seasonal habitat criteria for Delta smelt survival and recruitment
- Water Supply
  - Minimize additional release of stored water
  - Convey any released storage
  - Divert excess flows, when available
- Power- unclear nexus

Summary

- Conceptual model link fish and water management
- Operations of the CVP alters hydrology and physical environment
- Varied actions have been taken over time to address these stressors
- Many tools are available and used for real time operations and planning activities to evaluate impacts of operations
- Improvements in conceptual models, description of stressors, and tools will help us develop and evaluate actions

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www.usbr.gov/mp/bdo

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