# Delta Smelt Summer and Fall Habitat Action

Monitoring and Scientific Studies

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# Conceptual Model

- Smelt are food and habitat limited in the Fall
- Food and habitat are better in Suisun
- Freshening Suisun will be better for smelt

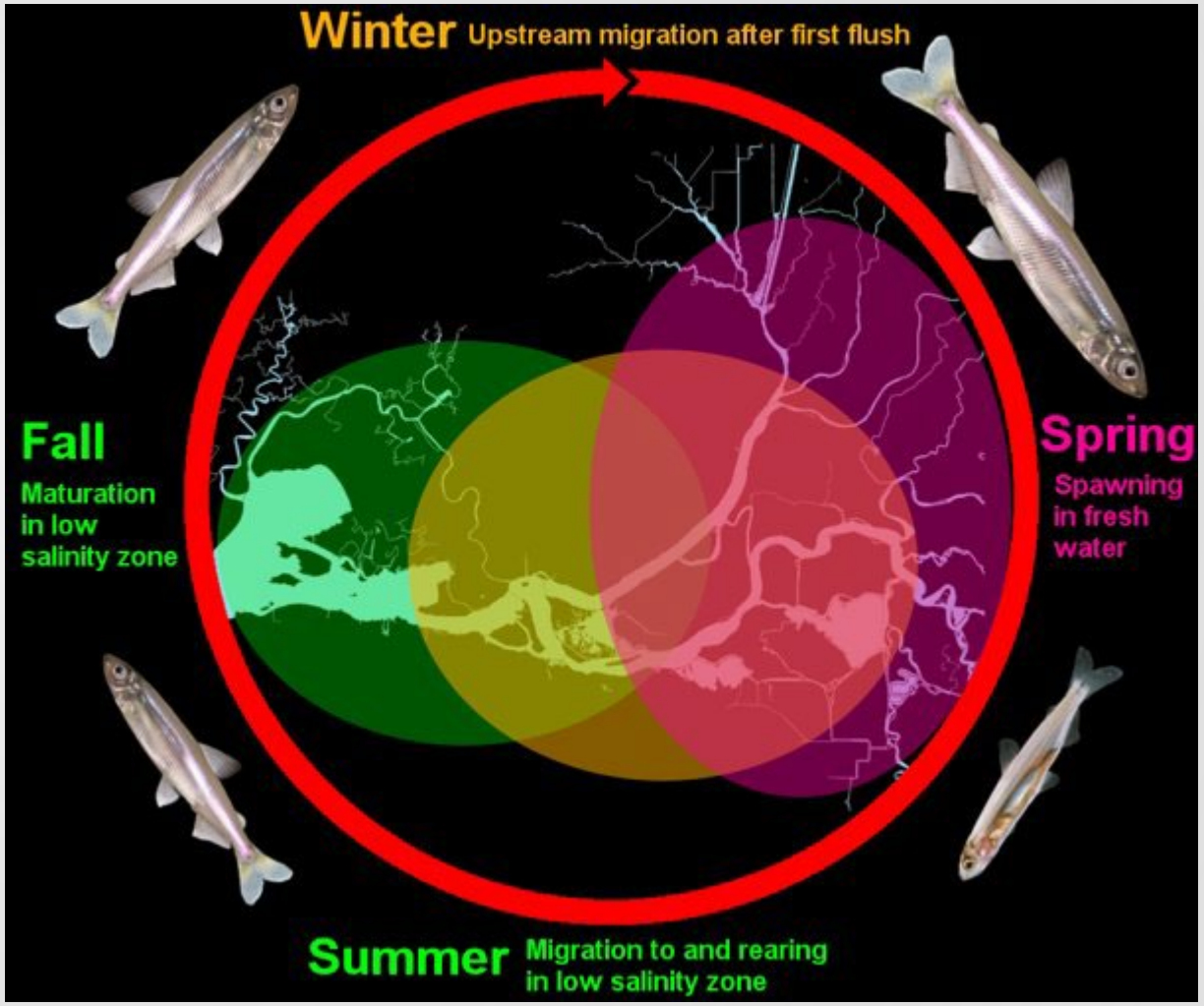
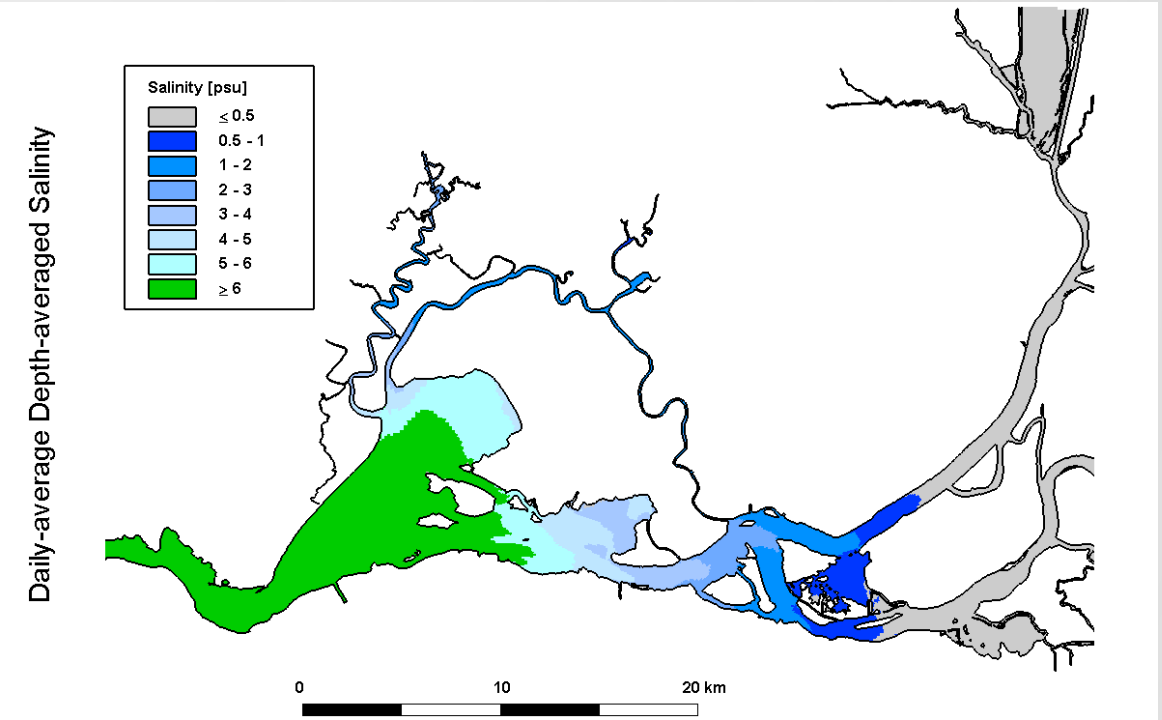



Image from wildlife.ca.gov modified from IEP MAST Technical Report 90 (2015)

# Fall X2

- Action – X2 at 80 km September and October
- Hypotheses:
  1. Low X2 maximizes overlap of appropriate temperatures, turbidity, and salinity
  2. Low X2 increases calanoid copepods in the low salinity zone
  3. Better habitat and more food will mean better Delta Smelt growth and survival

X2=80

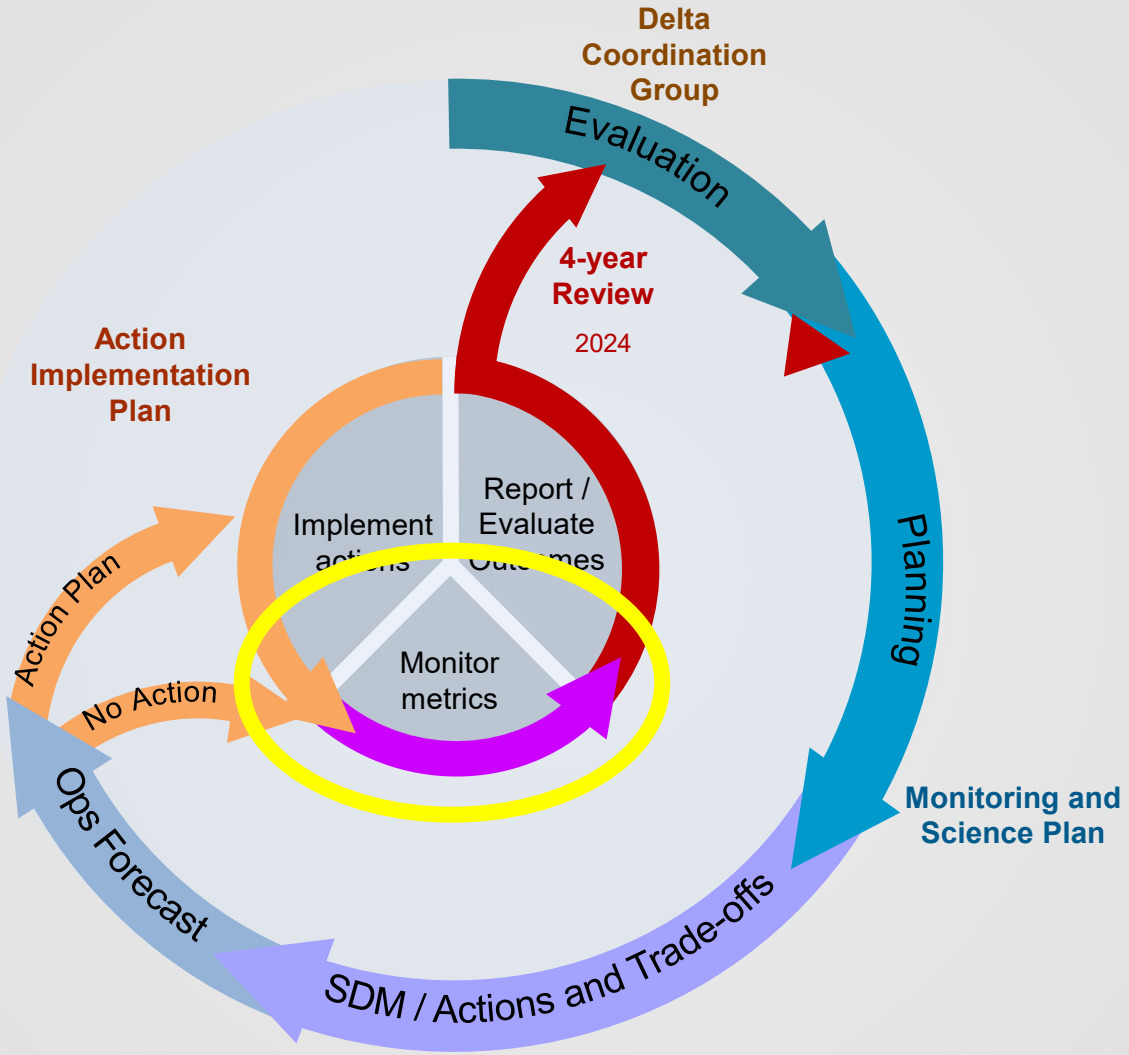



Delta Monitoring Associates (2014)

# Suisun Marsh Salinity Control Gates (SMSCG)

- Action: Operation of the SMSCG for 60 days, June-November
- Hypotheses:
  1. SMSCGs maximize overlap of appropriate temperatures, turbidity, and salinity
  2. SMSCGs increases calanoid copepods in the Suisun Marsh
  3. Operating the SMSGs will increase the area of appropriate Delta Smelt Habitat in Grizzly Bay. (lower temperatures)
  4. Better habitat and more food will mean better Delta Smelt growth and survival

Photo credit: DWR

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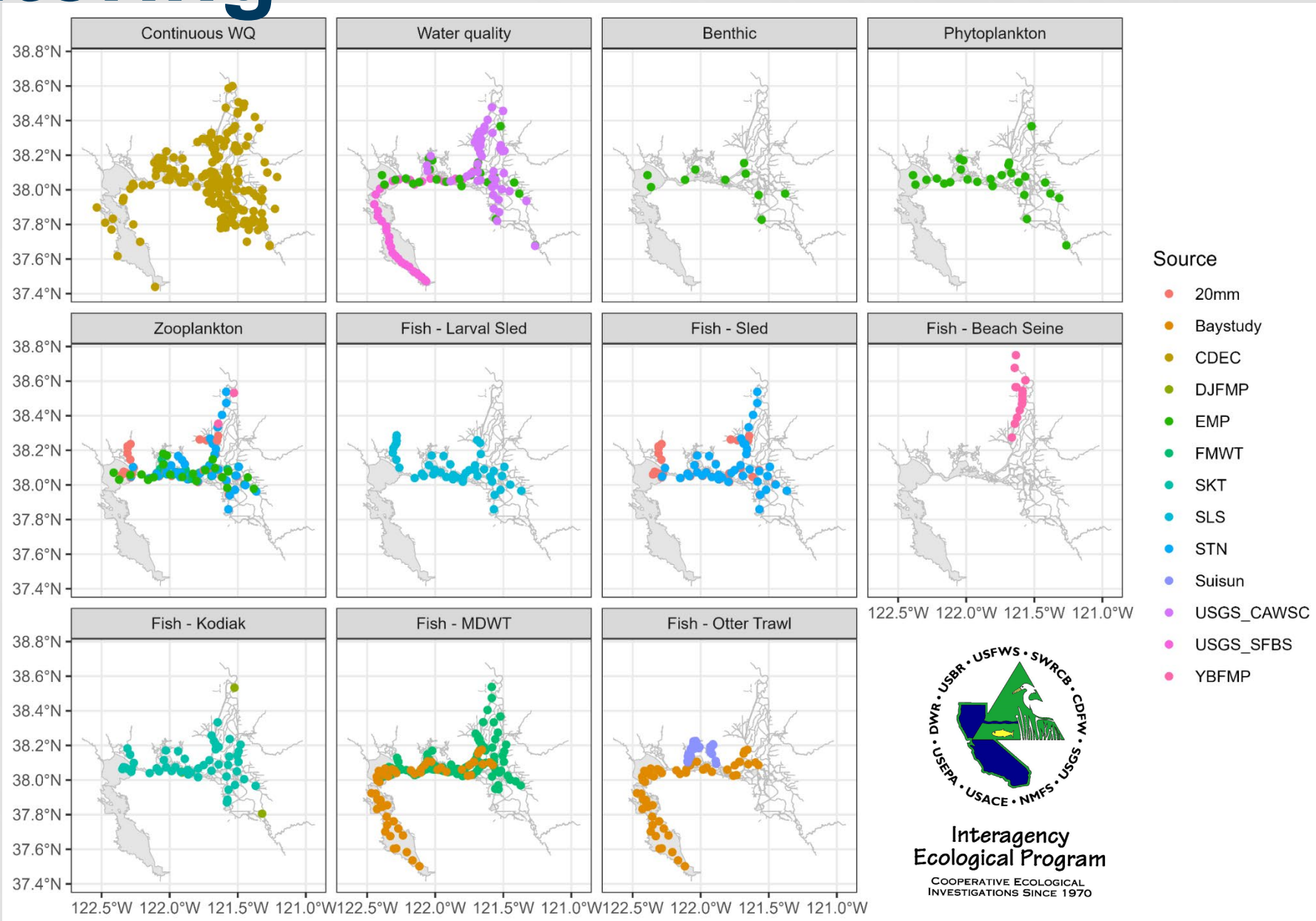
# Delta Monitoring

- Water Quality
- Benthic
- Phytoplankton
- Zooplankton
- Fishes




## State IEP Member agencies

## Federal IEP Member agencies

US Army Corps of Engineers.

## IEP Partner

Delta Stewardship Council
A CALIFORNIA STATE AGENCY

Interagency Ecological Program
Cooperative Ecological Investigations Since 1970

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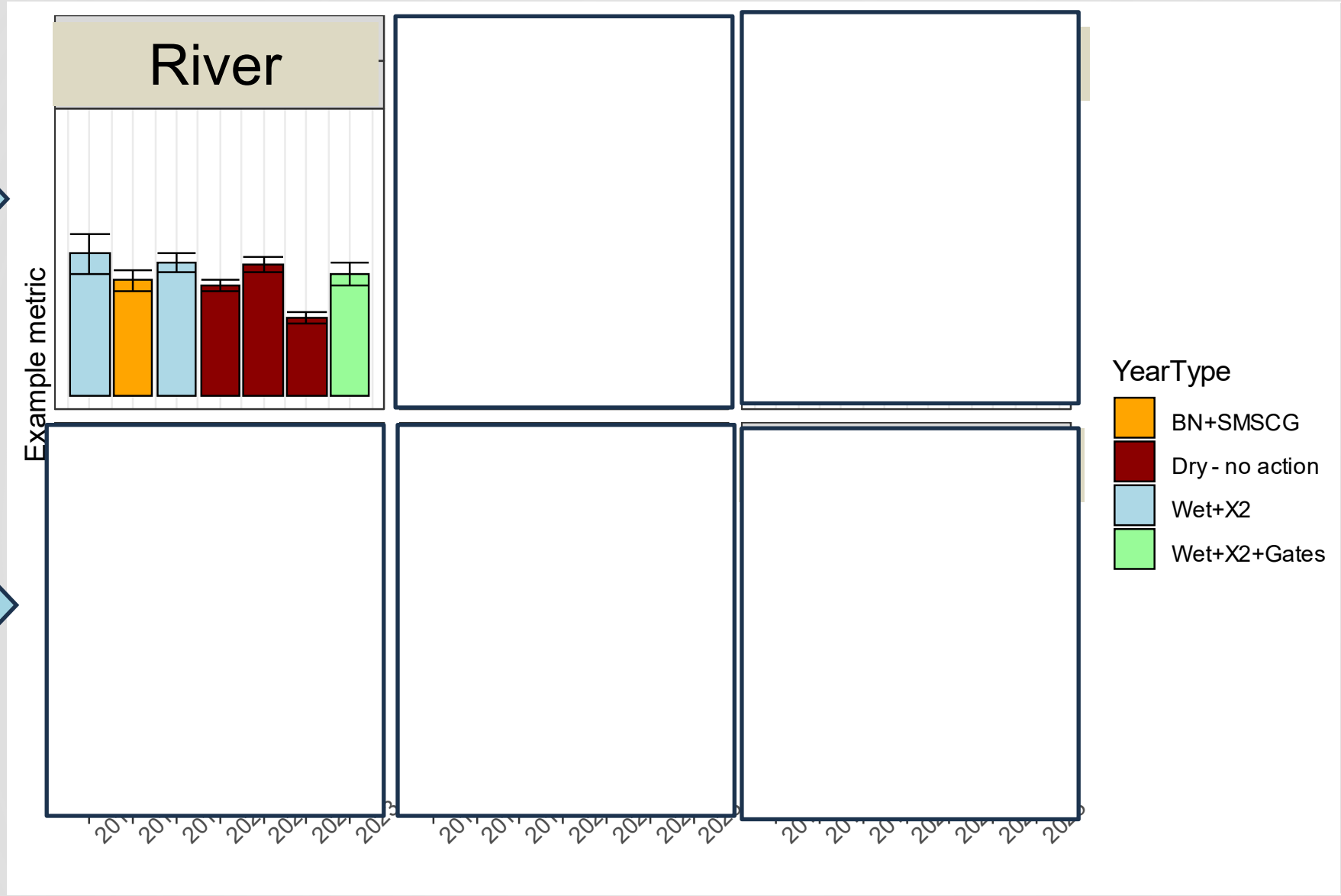
# Analysis structure

| Inter-annual comparisons | | | |
|---|---|---|---|
| SMSCG+ X2 (2023) | X2 Action (2017,2019) | SMSCG Action (2018) | Dry (2020,2021,2022) |

| Regional comparisons | | |
|---|---|---|
| **Suisun Bay** better with X2 actions | **Suisun Marsh** better with SMSCG actions | **Lower Sac River** no change, always worse |

SMSCG Action

X2 Action




- Response ~ Region*Year + (1|Station)+ (1|Month)

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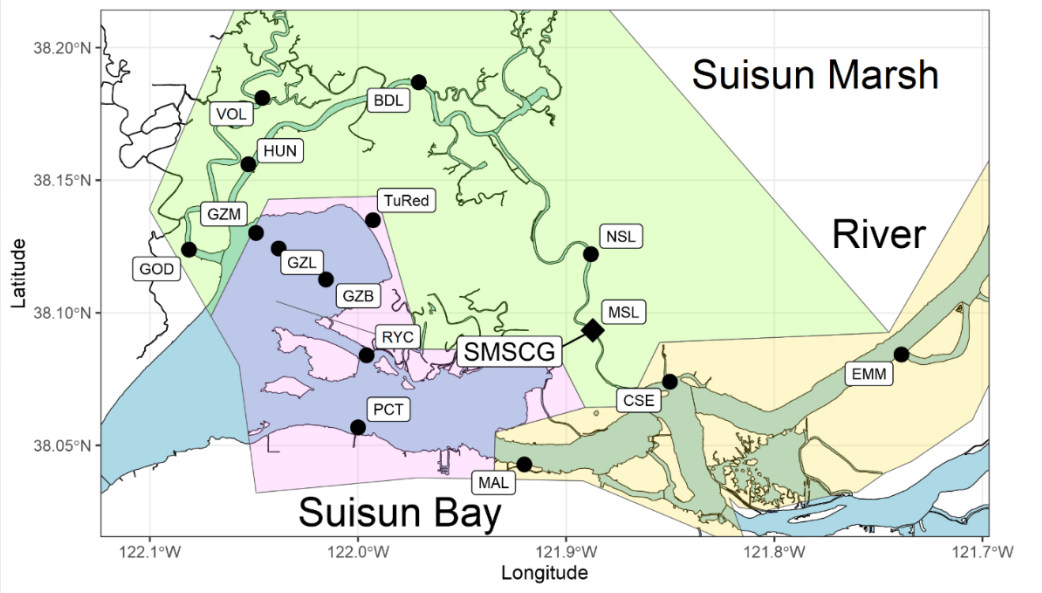
# Hypothesis 1 – Maximize Habitat

- Continuous water quality stations
  - Temperature
  - Turbidity
  - Salinity
- Hindcast models

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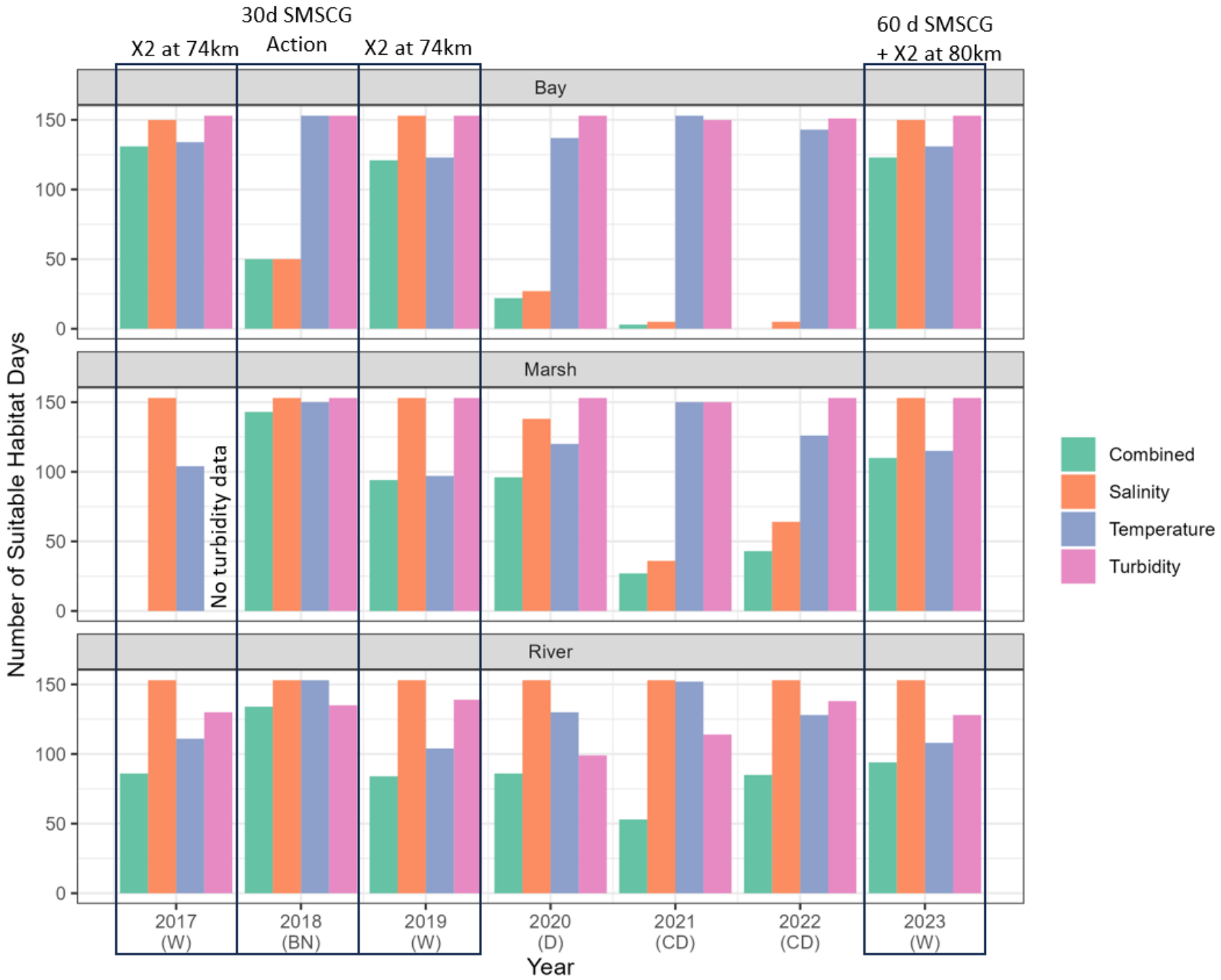
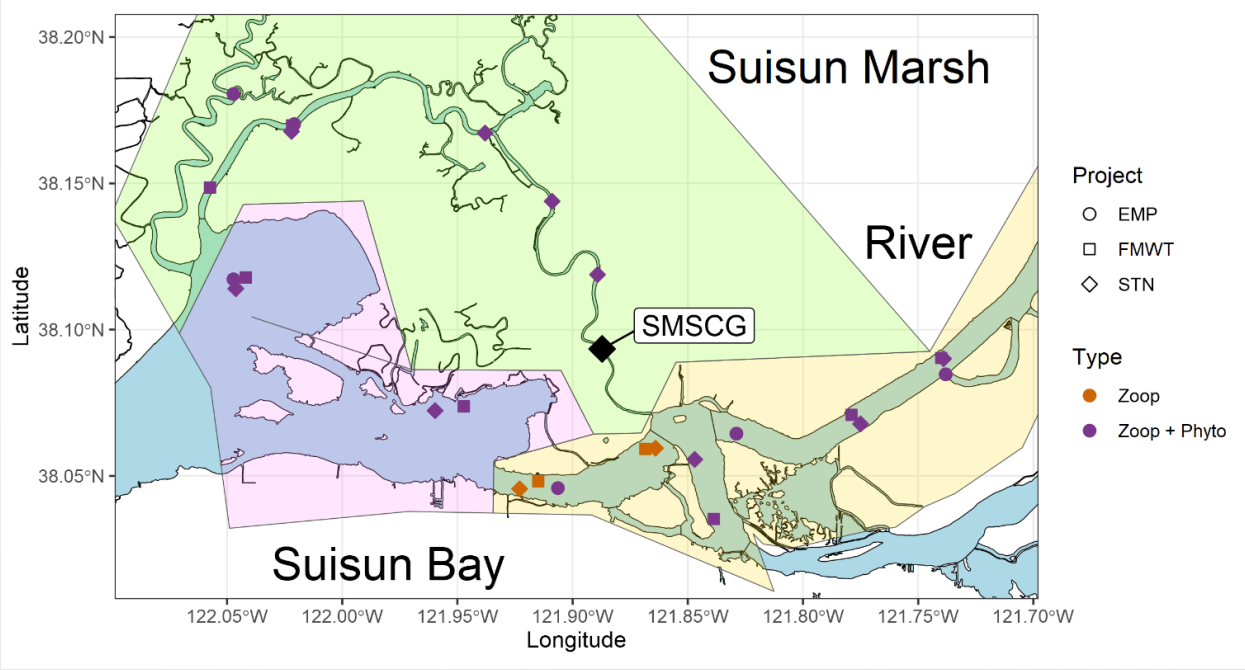



# Data analysis

- Graphical analysis of appropriate habitat
- Comparisons to previous years
- Modeled action/no action

# Hypothesis 2 – Increase zooplankton

- Zooplankton biomass and community composition
- Phytoplankton & Chlorophyll
- EMP, FMWT, STN, DOP

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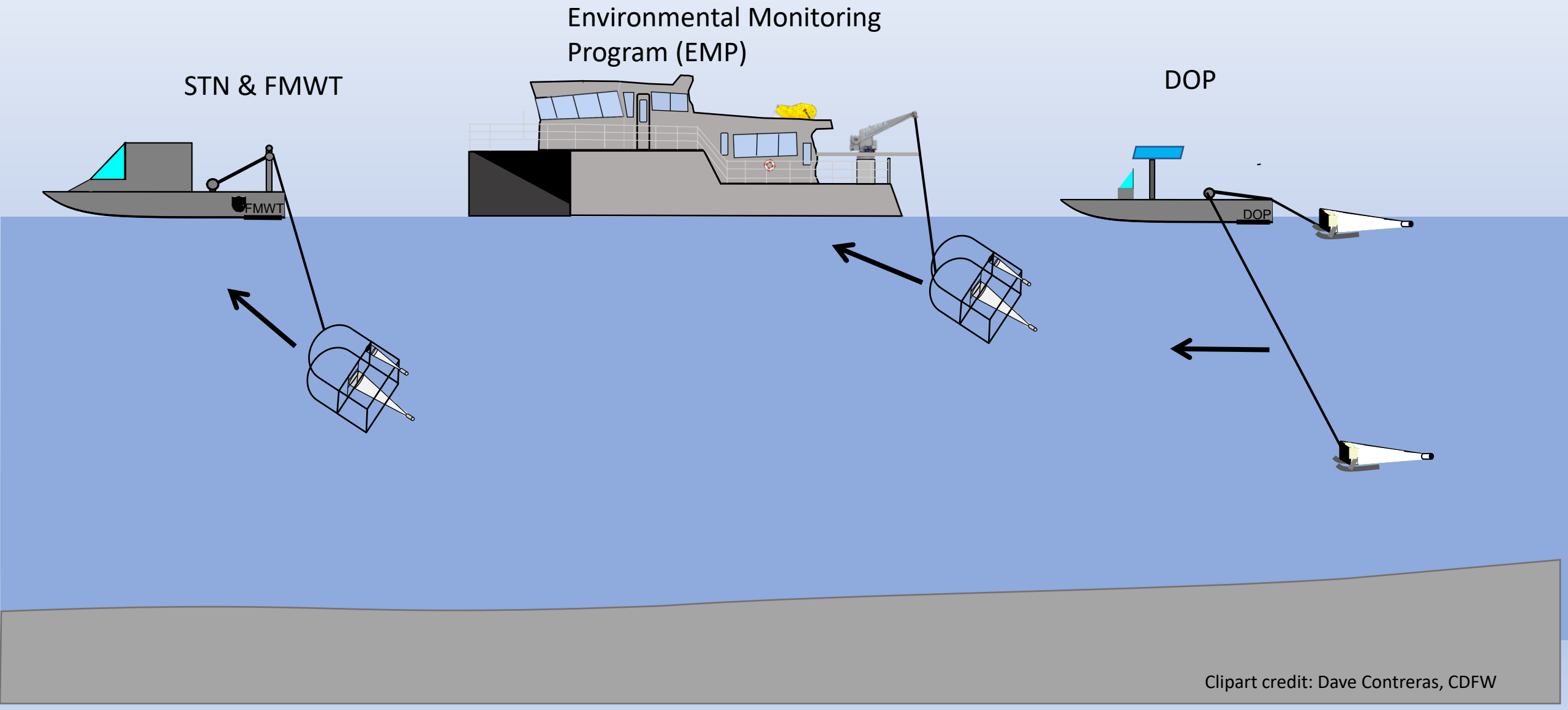
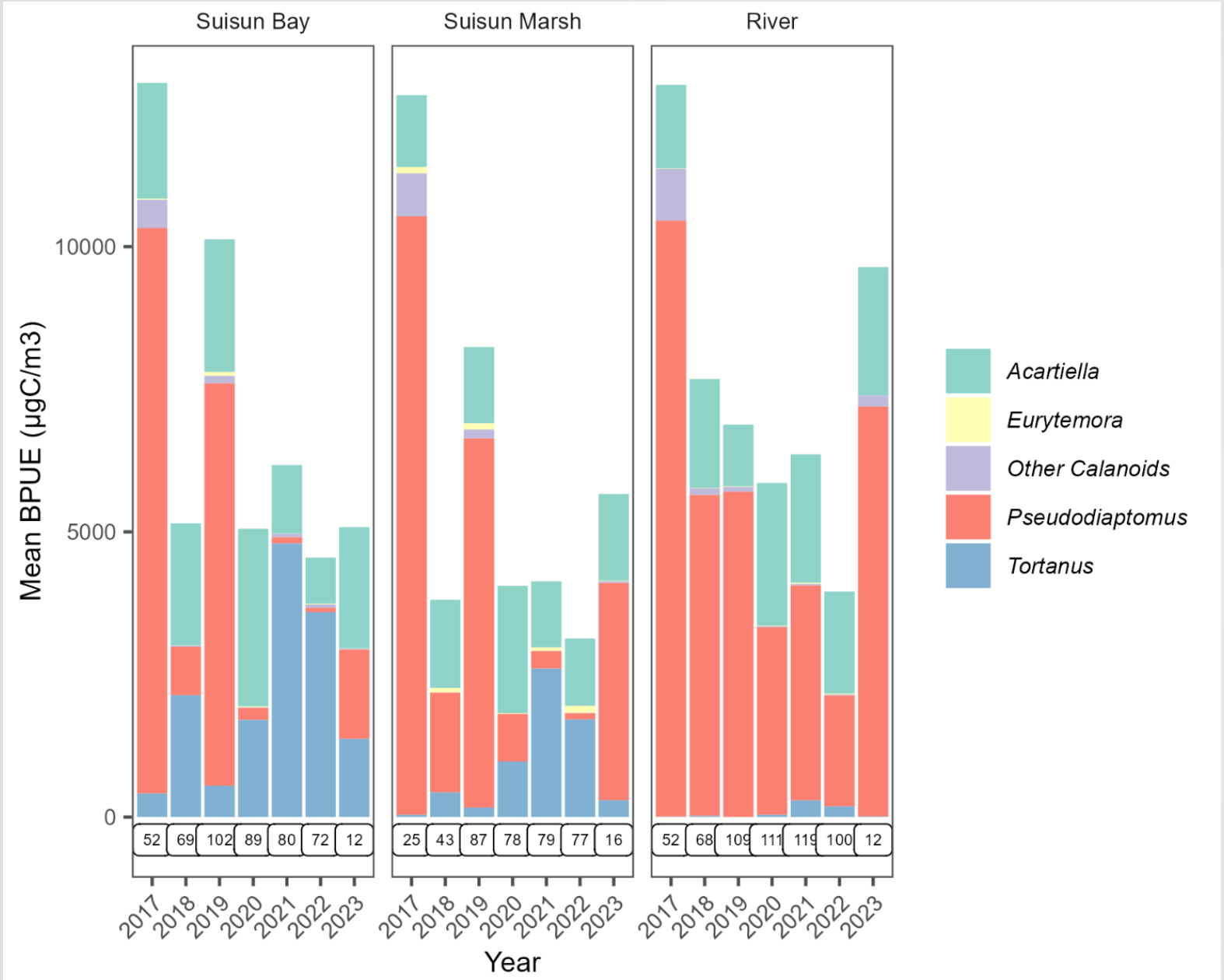
# Zooplankton Methods

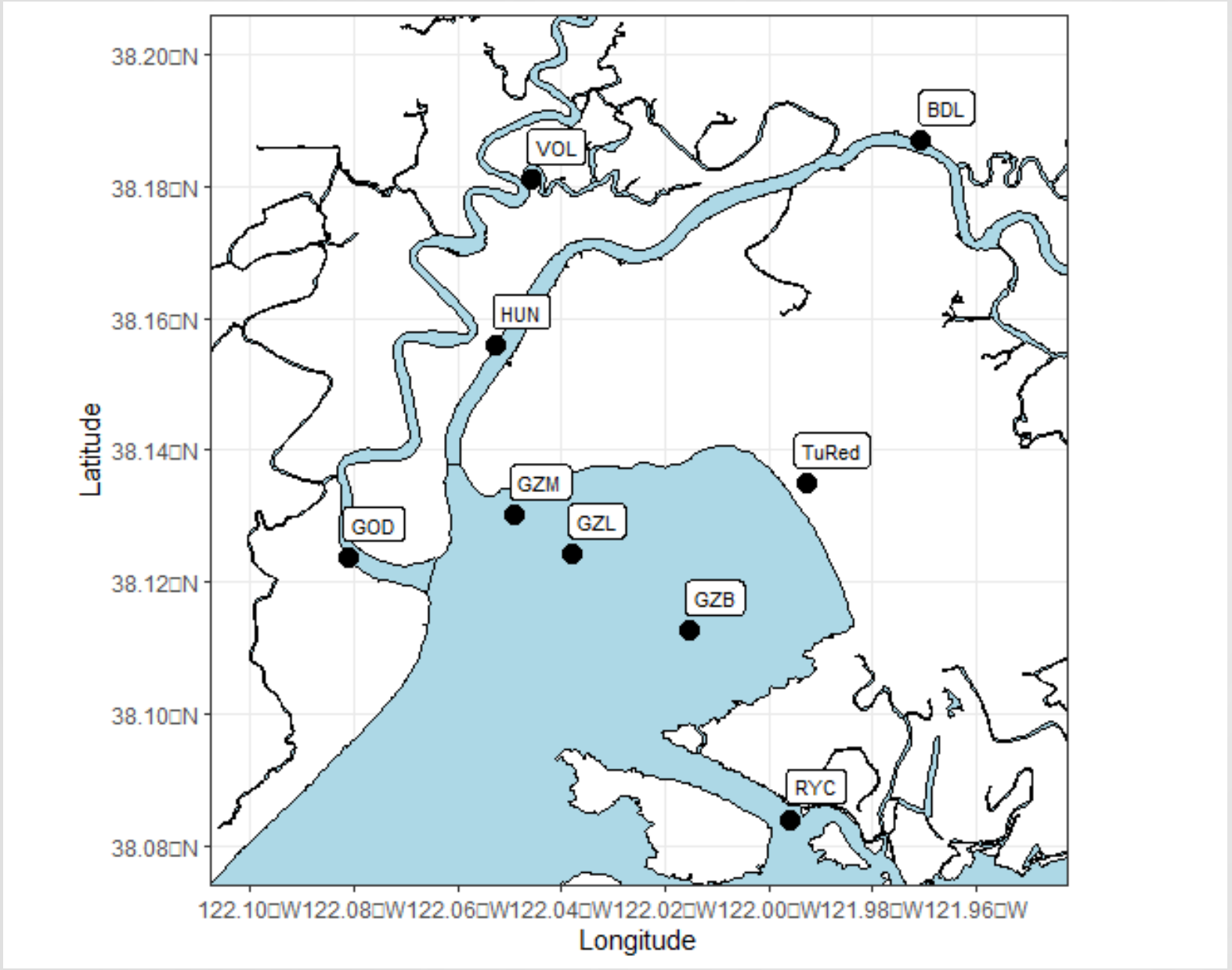



Clipart credit: Dave Contreras, CDFW




# Data Analysis

- Biomass of smelt prey in Suisun Bay, Suisun Marsh, versus upstream
- Biomass in other years with and without actions




# Hypothesis 3 – Grizzly Bay habitat

- Salinity, turbidity, temperature at Grizzly Bay sondes
- Hindcast modeling

# Ultimate hypothesis – improve smelt growth

- EDSM – smelt distribution
  - Kodiak trawls at random sites
- Experimental release
  - 190,926 smelt over 3 years

Image credit: Lodi FWS office


Image credit: DWR

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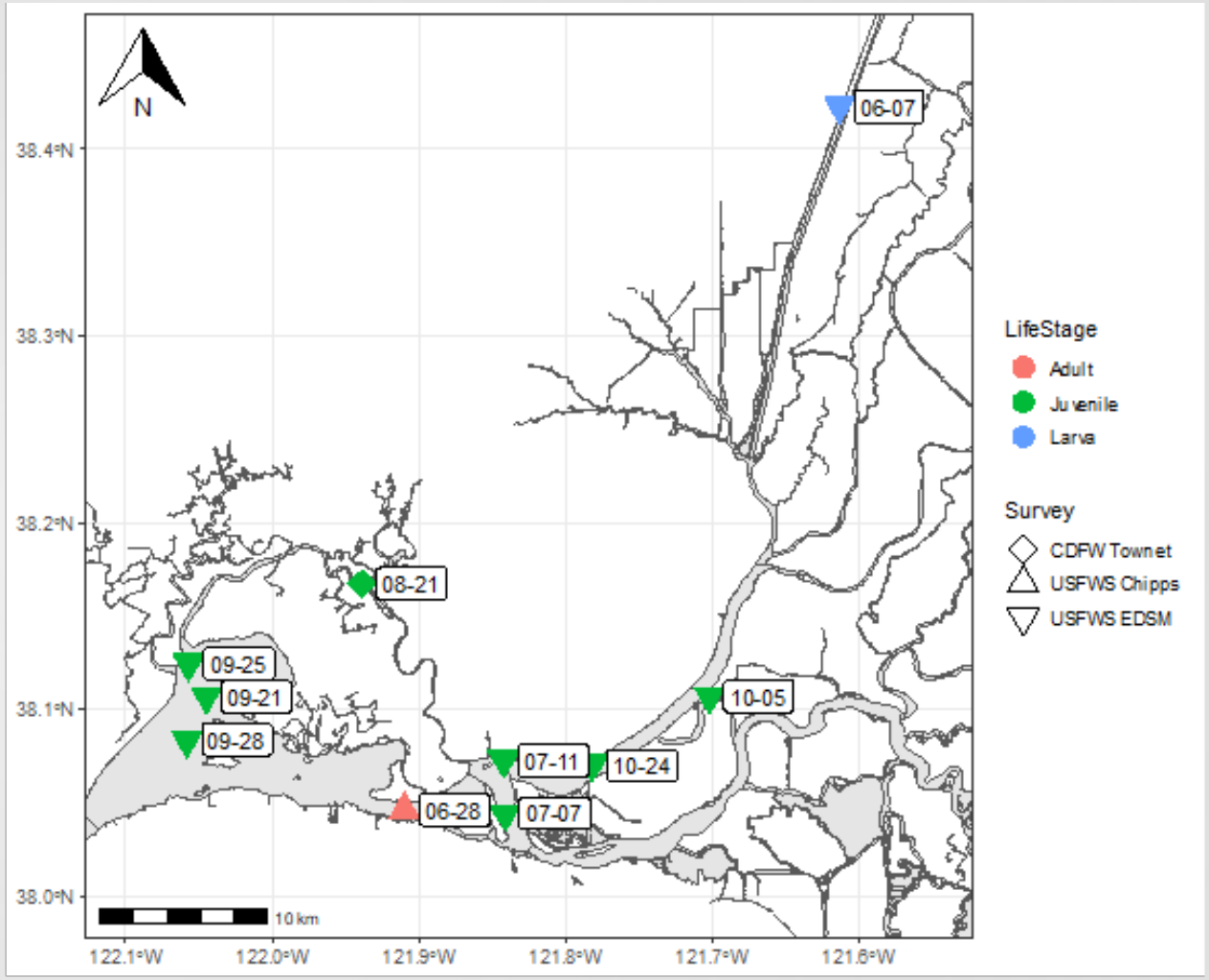
# Data analysis

- Distribution – inter-annual comparisons
- Differences in health metrics
- Stomach fullness

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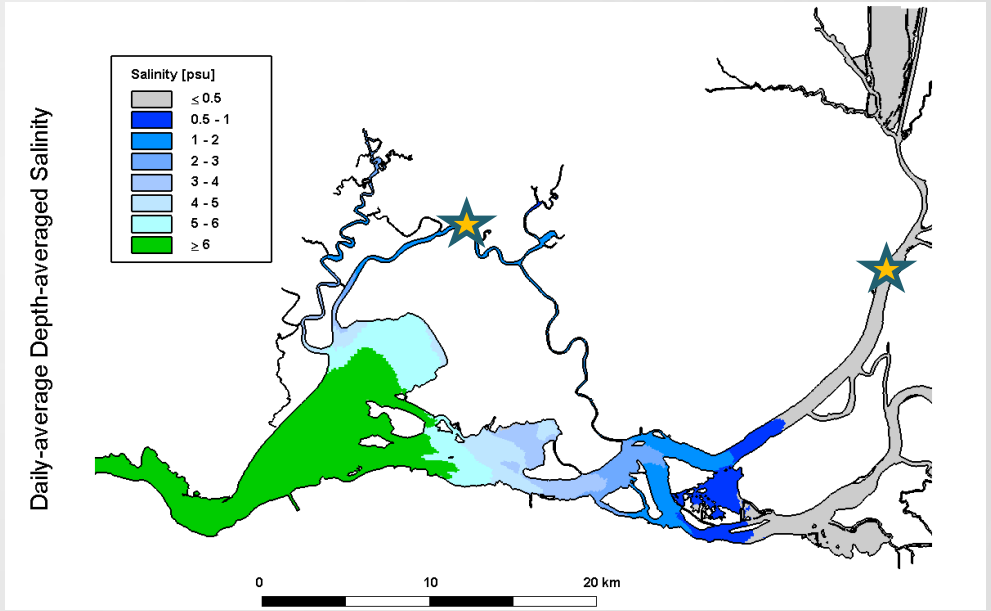
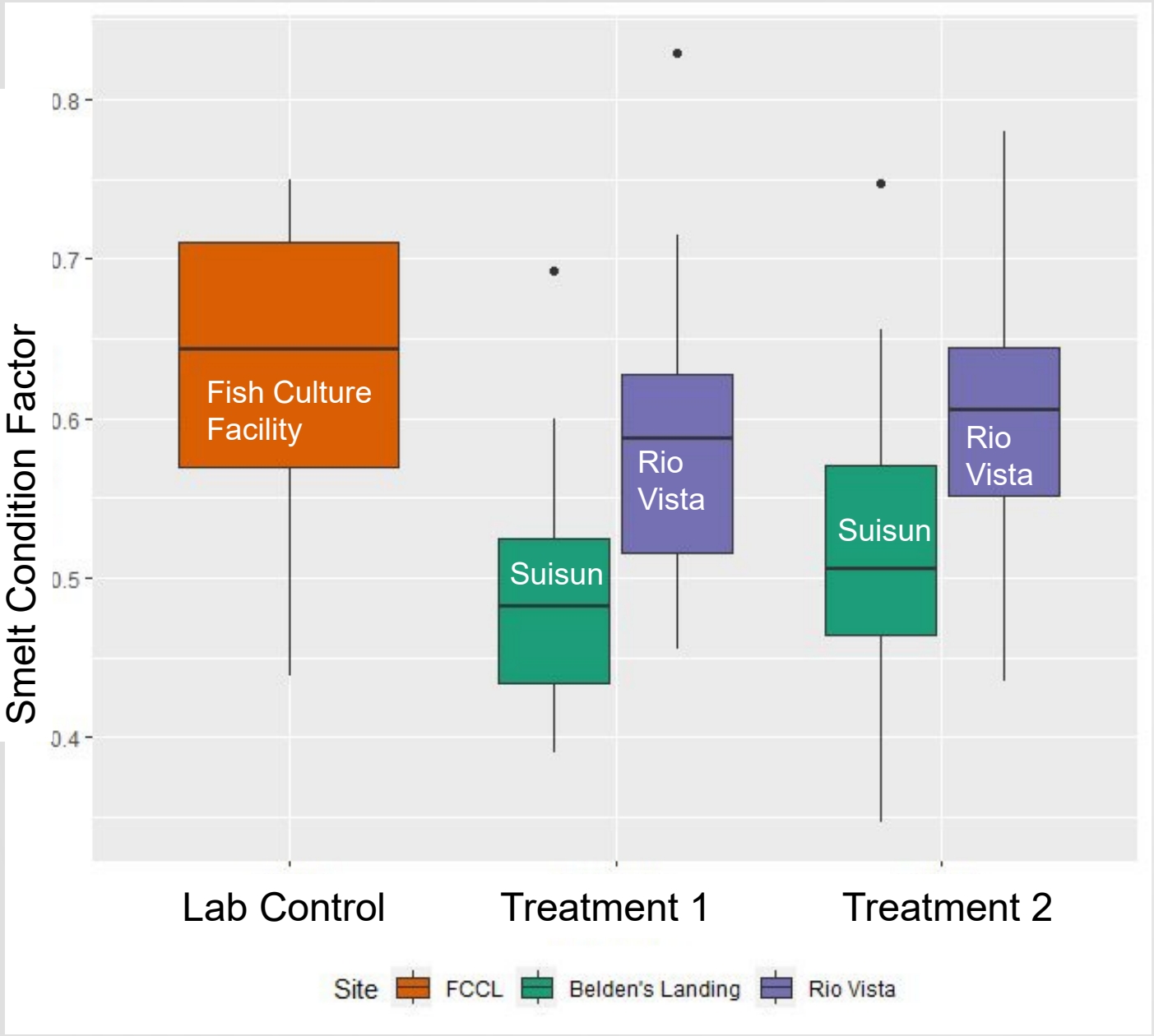
# Enclosure studies

- Two locations
  - Rio Vista (Sacramento River)
  - Belden's Landing (Suisun Marsh)
- After six weeks measured
  - Growth
  - Survival
  - Liver Glycogen
  - Critical Thermal Maxima
  - Diets

X2=80




Delta Monitoring Associates (2014)

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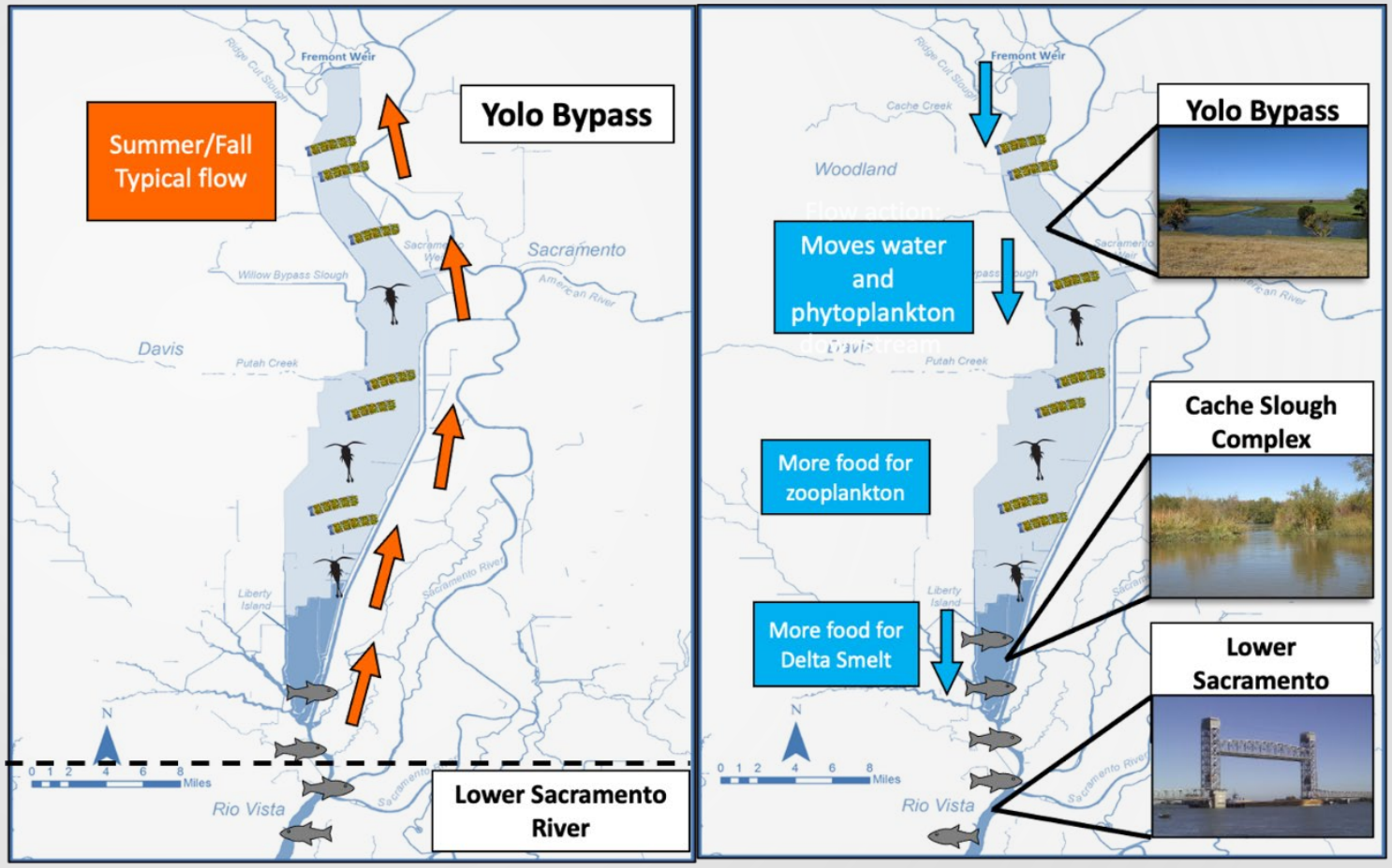
# Future directions for flow action monitoring

- Repeat Delta Smelt enclosure study
- Re-assess phytoplankton data collection
- Re-assess number and location of sondes
- Potential increase in flow monitoring stations

# Food Subsidy Actions

# North Delta Food Subsidy

- Do augmented flow pulses transport productive upstream water downstream increasing food availability in Delta Smelt habitat?

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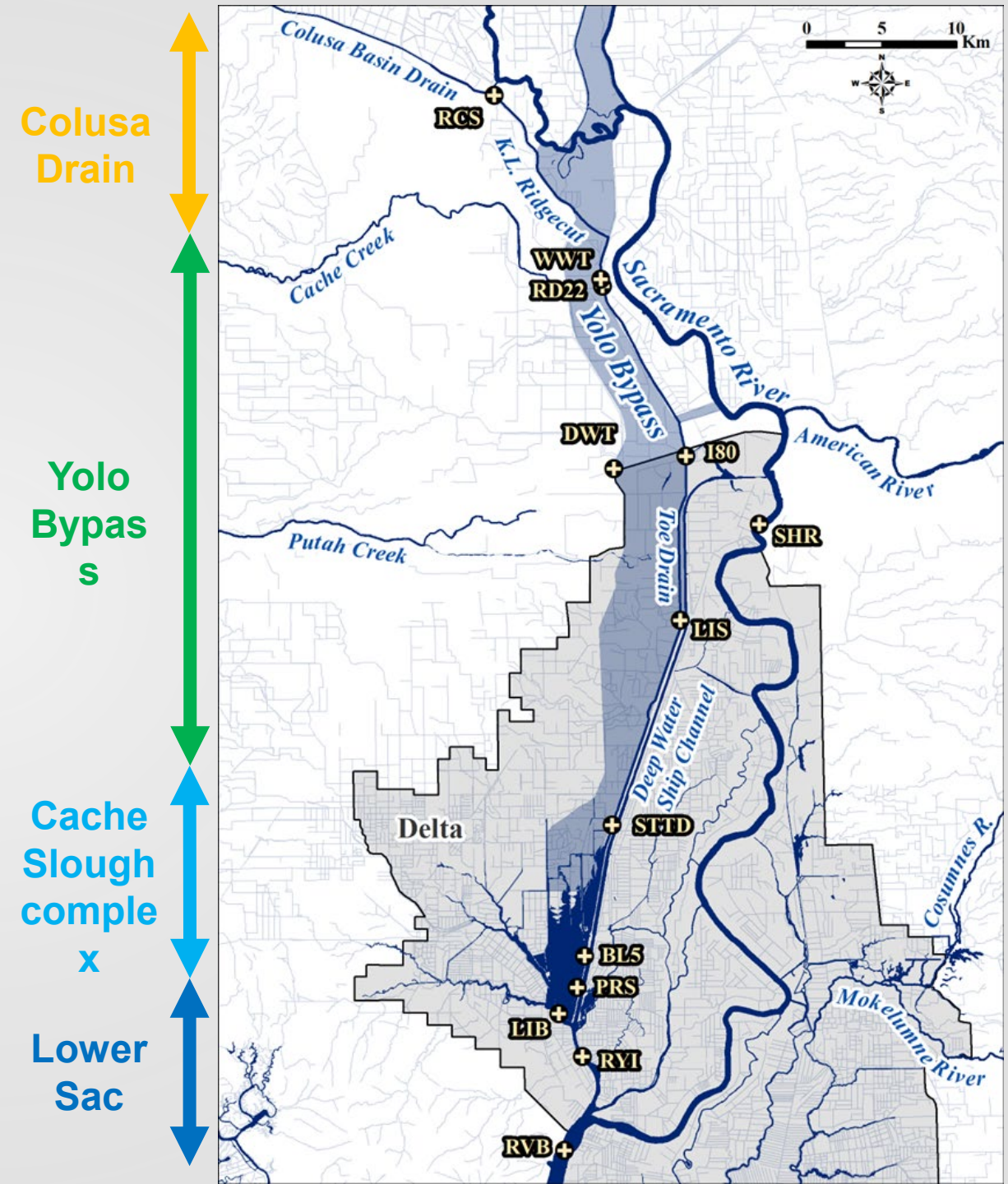
# North Delta Food Subsidy

## Monitoring

- Continuous and discrete water quality, phytoplankton, zooplankton
- Colusa Basin and Yolo Bypass (upstream) to Cache Slough Complex and Lower Sacramento River (downstream)
- Before, During, After flow pulses
- July-November

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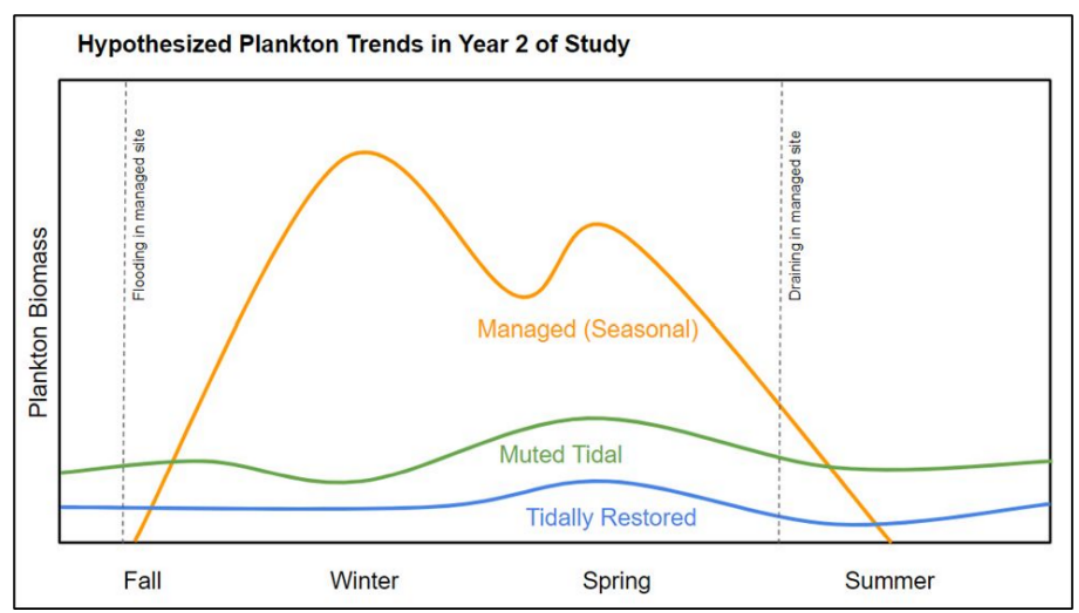
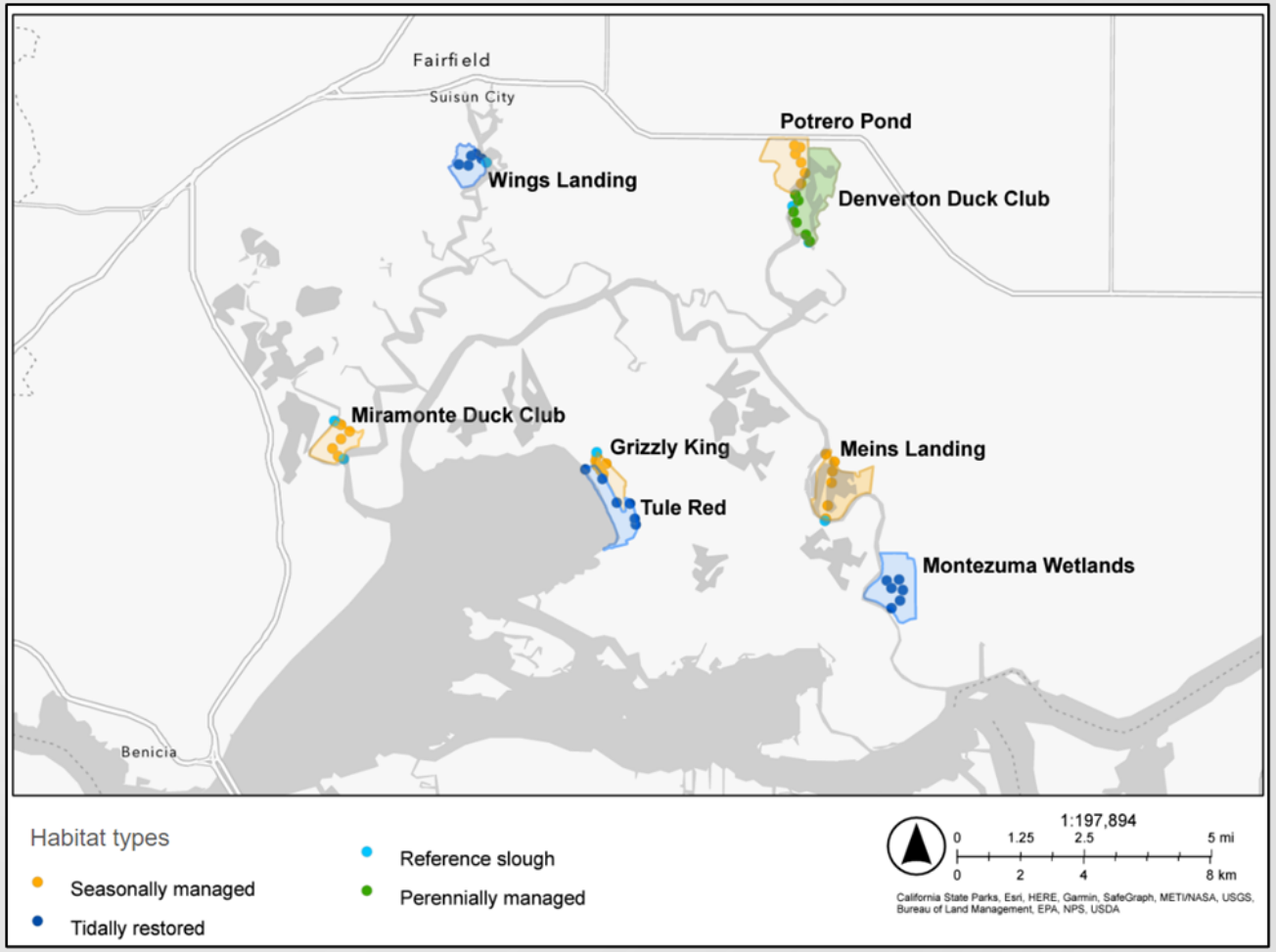
# Managed wetlands special study

- Can managed wetlands provide a food subsidy for smelt?




Slide courtesy of Alice Tung, UC Davis

# Monitoring

- Monthly zooplankton, phytoplankton, water quality
- Growth rates
- Connectivity and seasonality

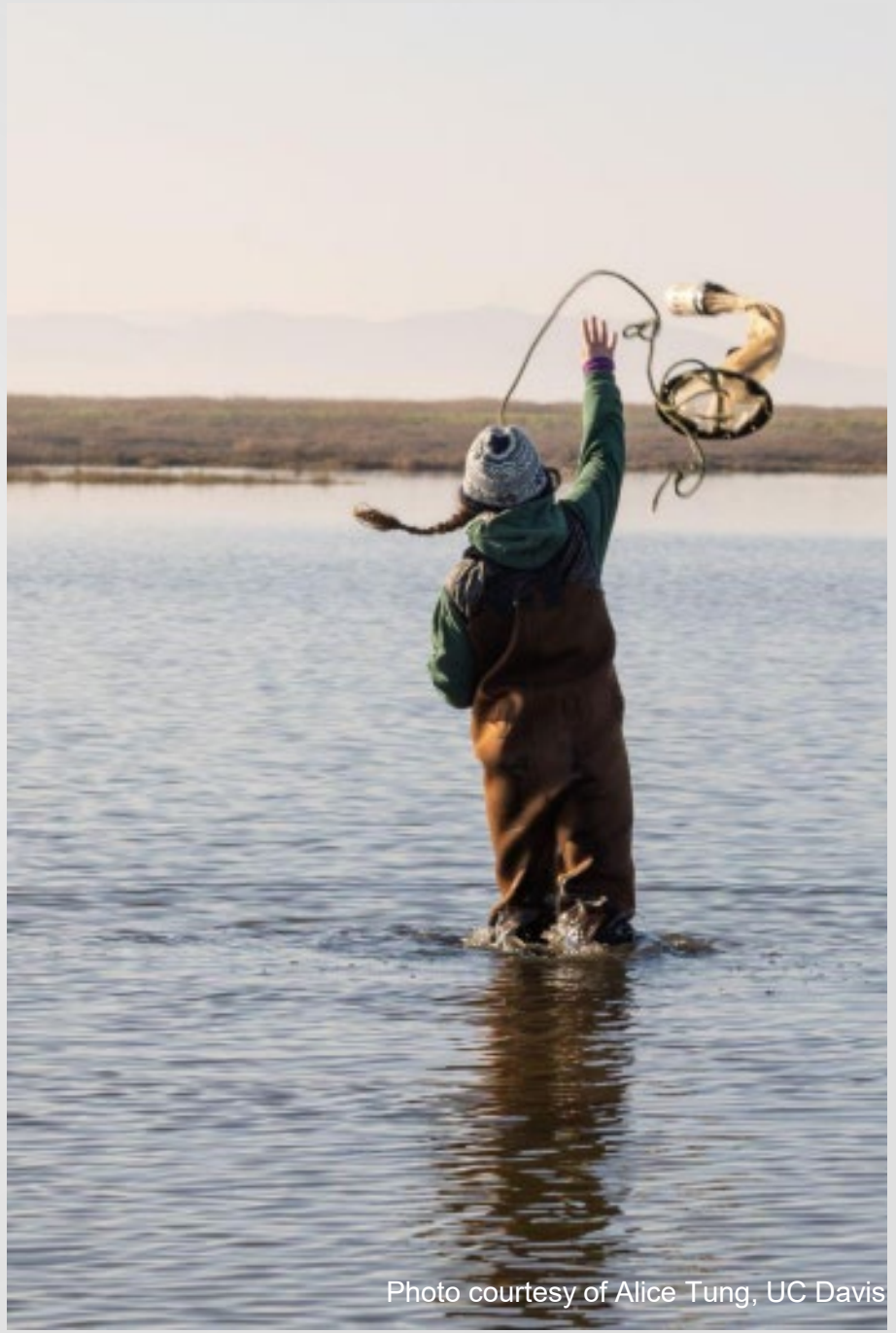
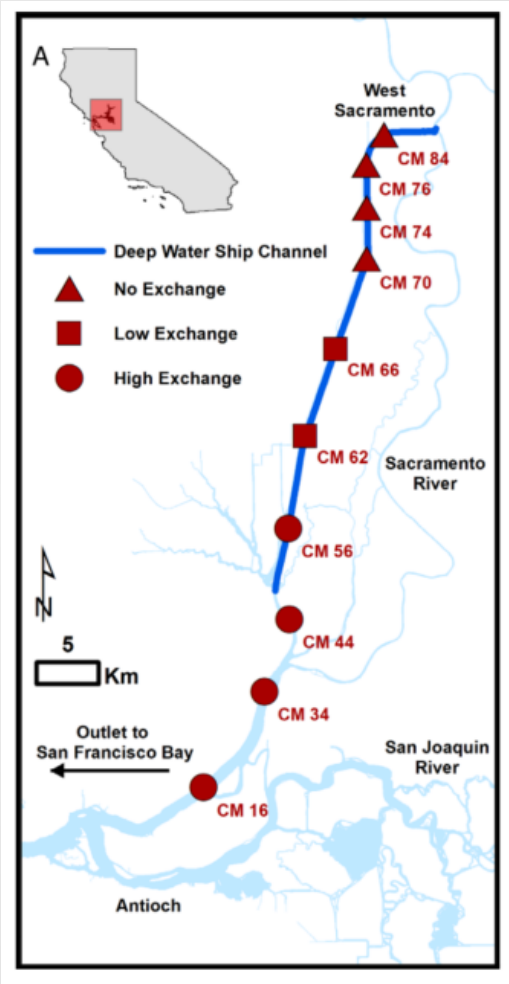


Photo courtesy of Alice Tung, UC Davis

# Sacramento Ship Channel Special Study

- Can the SDWSC be used as a food subsidy for Delta Smelt?
  - Dead-end slough
  - High zooplankton
  - Smelt live there year-round
  - Fertilization experiment




Smits et al. 2023

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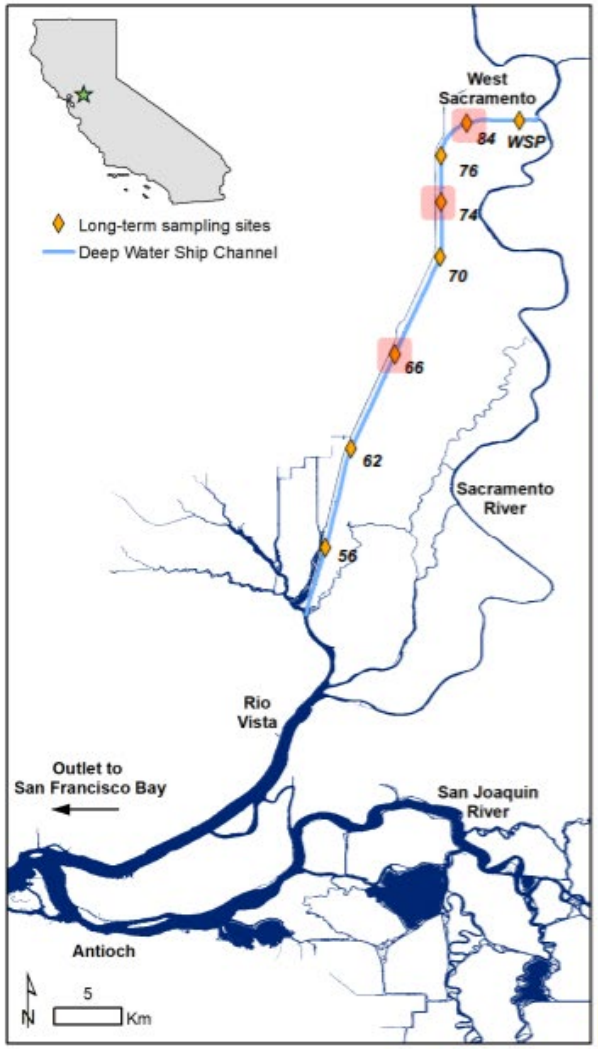
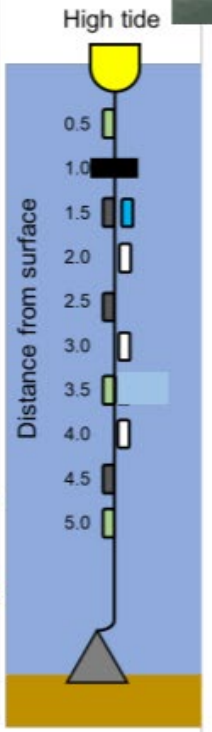
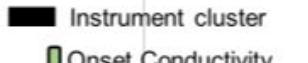
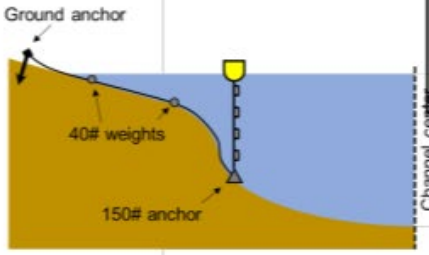
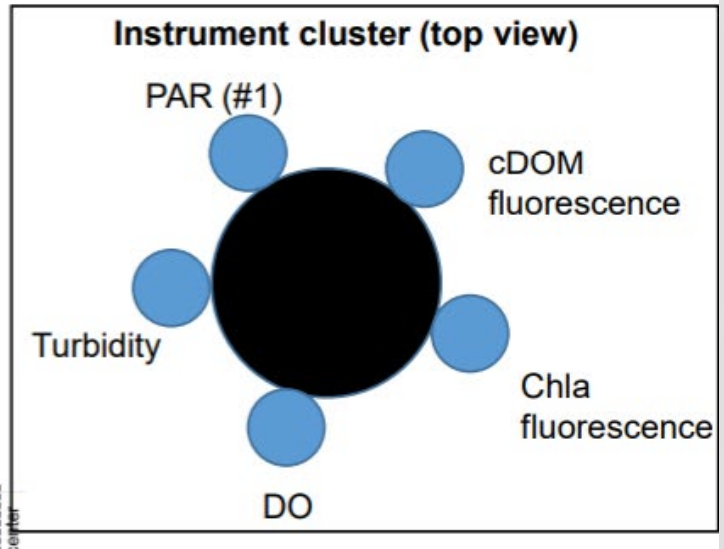
# Measuring Primary production between low and high exchange zones




**Three stations with long term continuous moorings deployed**

- 84 –no exchange zone
- 74 –transition between low and no exchange zone
- 66 –turbidity max

Slide from Steve Sadro, UC Davis

# Characterizing primary producer and consumer food webs

Every other week characterize community structure and biomass distribution of the basal food web

- phytoplankton
- net zooplankton
- picoplankton
- ciliates
- flagellates

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Slide from Steve Sadro, UC Davis

# Next steps for food subsidies

## North Delta Food Subsidy

- Stable isotope study
- Smelt cages and thermal suitability study

## Managed wetlands

- Finish special study
- Landowner outreach
- Identify potential management tweaks

## Ship channel

- Bioenergetics modeling project
- West Sacramento design alternatives

# Questions?

Photo credit - CDFW

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