APRIL 2024

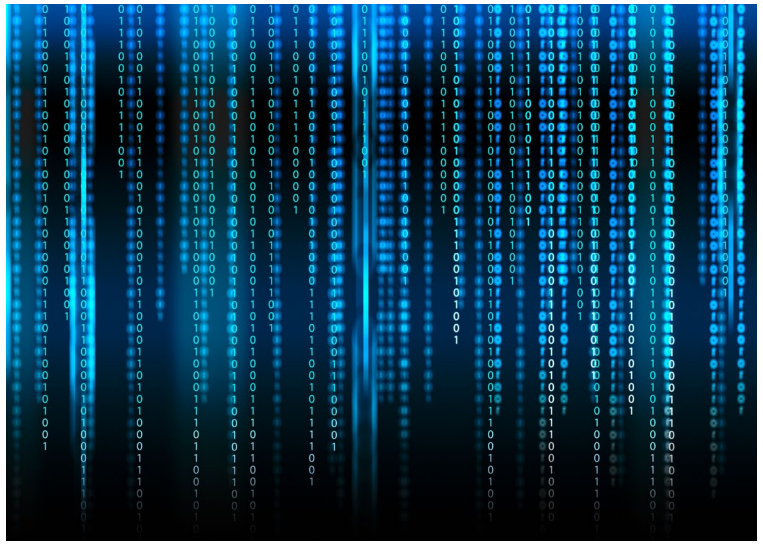
Agenda Item: 7
Meeting Date: April 25, 2024

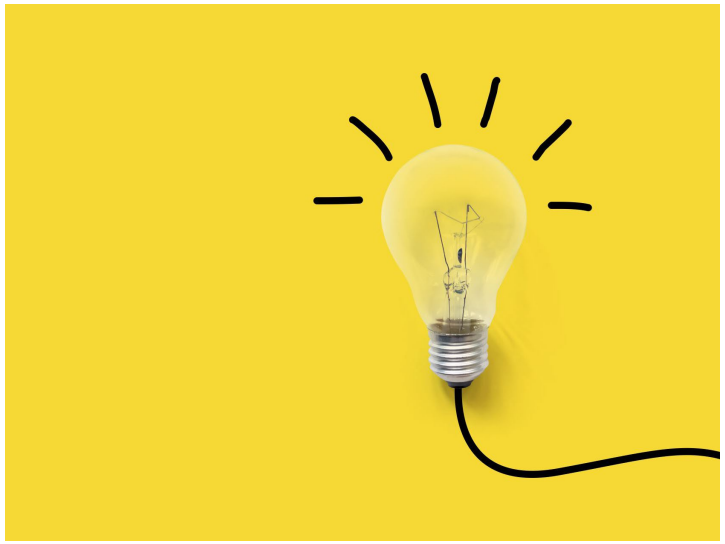
# DSP-NCEAS synthesis working group

Delta Science Program

DELTA STEWARDSHIP COUNCIL

# What is synthesis?

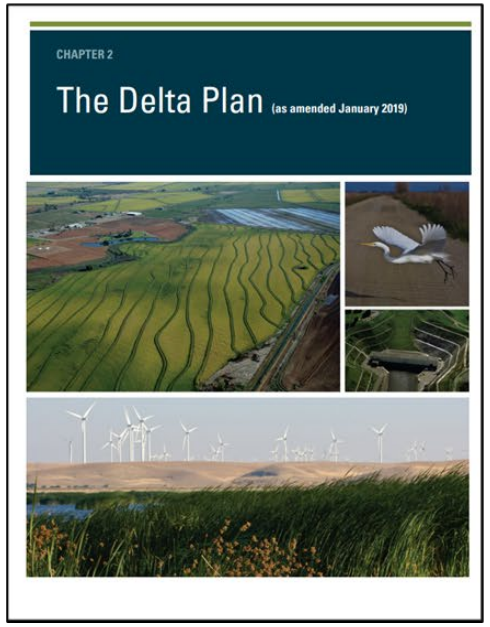


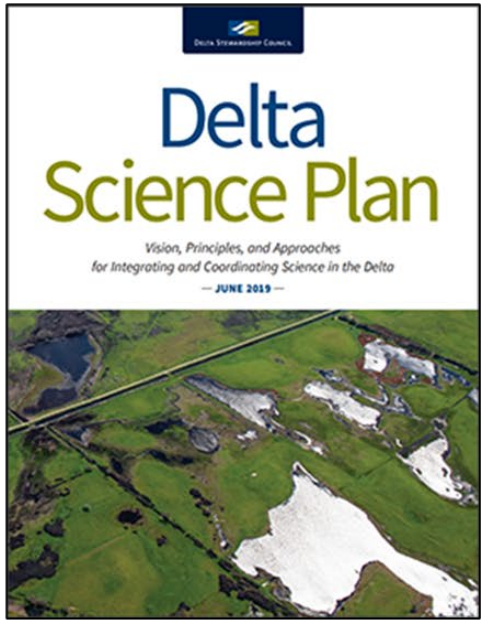


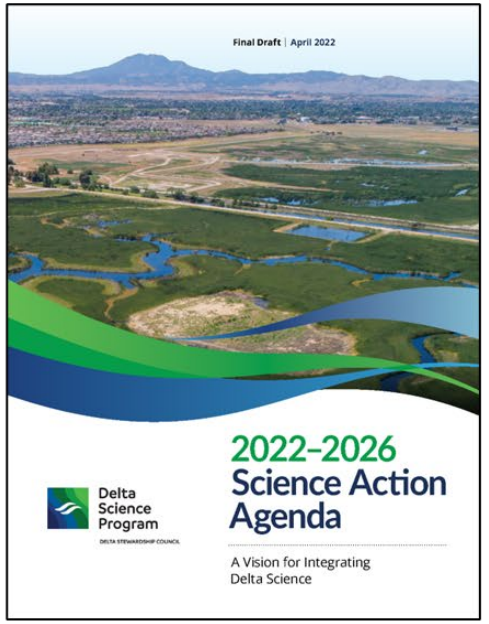
The process of combining disparate sources of information/data to see the bigger picture and gain new insights

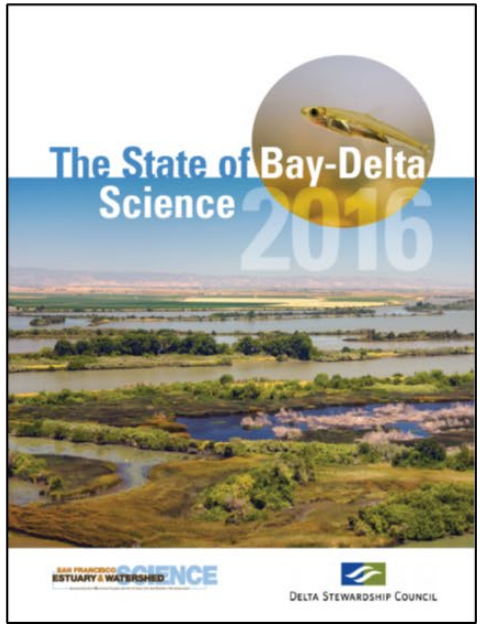
# Why is synthesis important?

- Key component of how we conduct science in the Delta
  - Informed decision-making and ecosystem-based management
- Cost-effective strategy
  - FY20-21 Delta Budget Crosscut: Synthesis only 4% of science expenditures (~$4.4M)



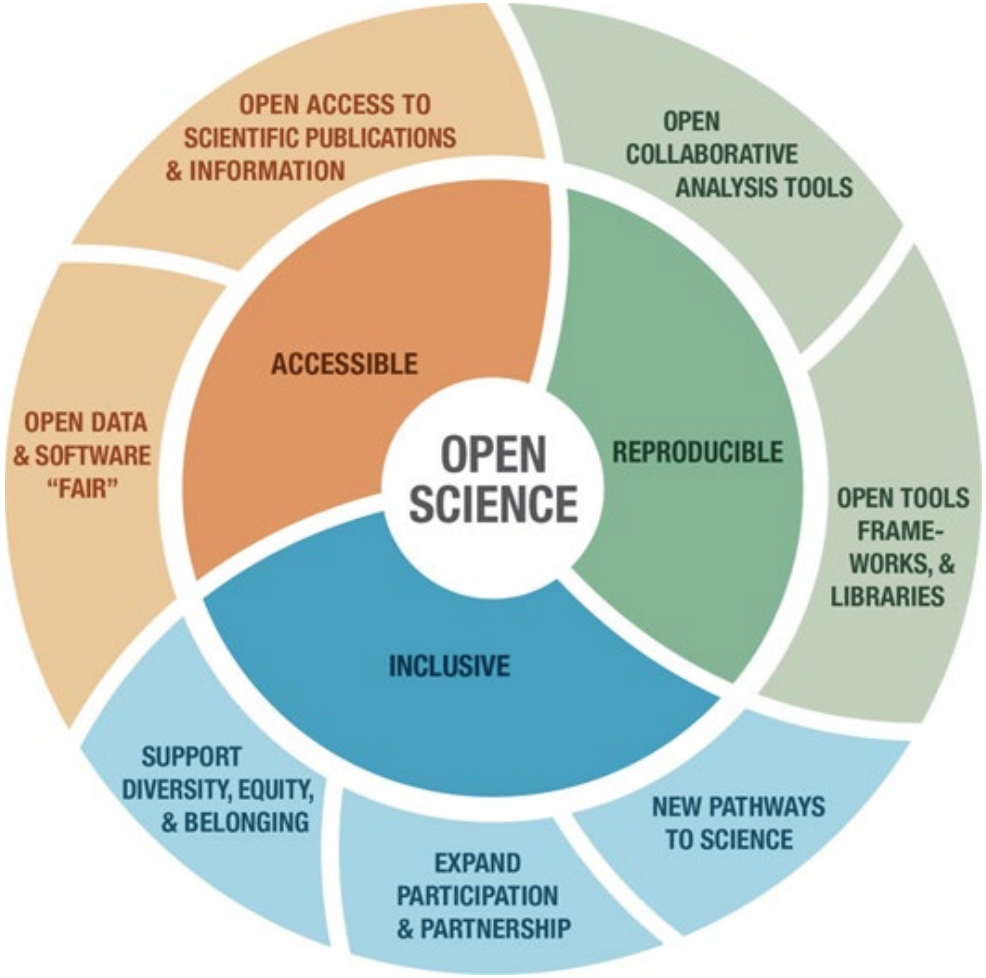



# How are we advancing synthesis?

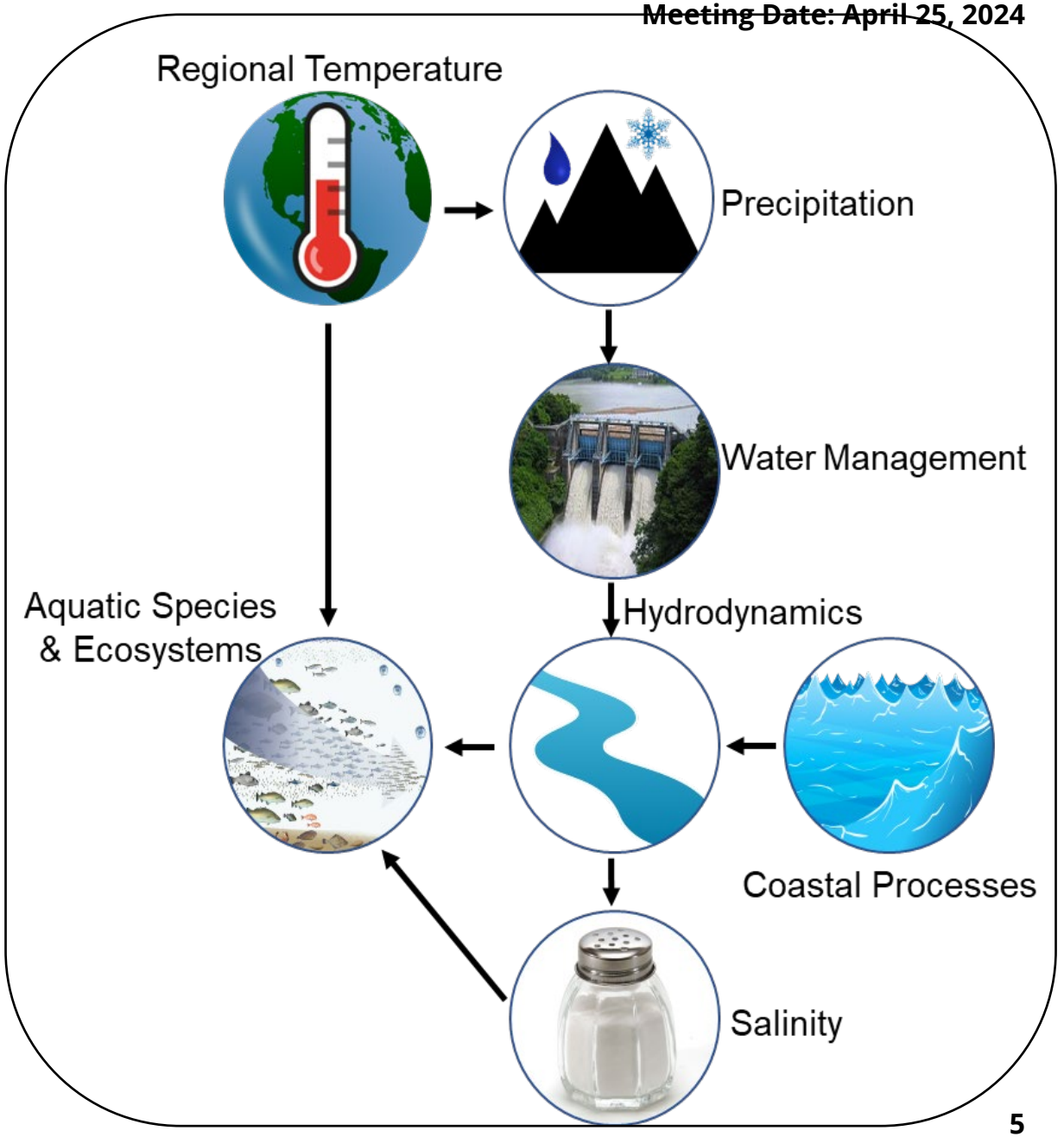
- Partnership with the National Center for Ecological Analysis and Synthesis (NCEAS)
- High quality training in data science and statistics using ‘open science’
- Apply new skills to synthesis topic, produce new insights




*earthdata.nasa.gov*

# Drivers of the estuary food supply

*Critical knowledge gap identified by DISB*



# Interagency and academic collaboration

# Hot off the press…

ARTICLE

ECOLOGY
ECOLOGICAL SOCIETY OF AMERICA

## Evaluating top-down, bottom-up, and environmental drivers of pelagic food web dynamics along an estuarine gradient

Tanya L. Rogers[1] | Samuel M. Bashevkin[2] | Christina E. Burdi[3] | Denise D. Colombano[4] | Peter N. Dudley[1,5] | Brian Mahardja[6] | Lara Mitchell[7] | Sarah Perry[8] | Parsa Saffarinia[9]

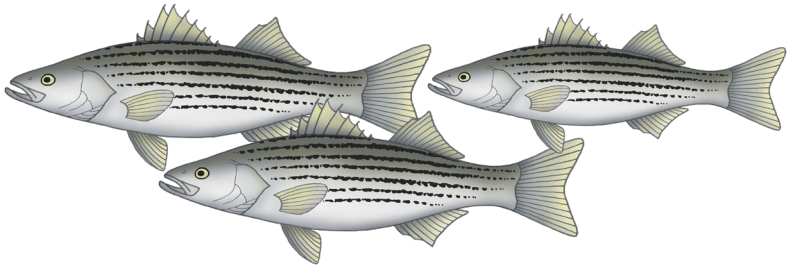
https://doi.org/10.1002/ecy.4274

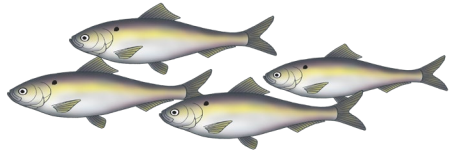
# What is top-down control?

Predator

Prey

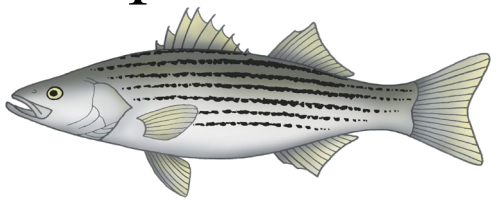
Many predators

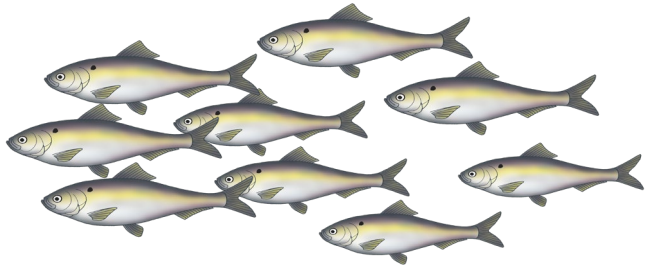




vs.

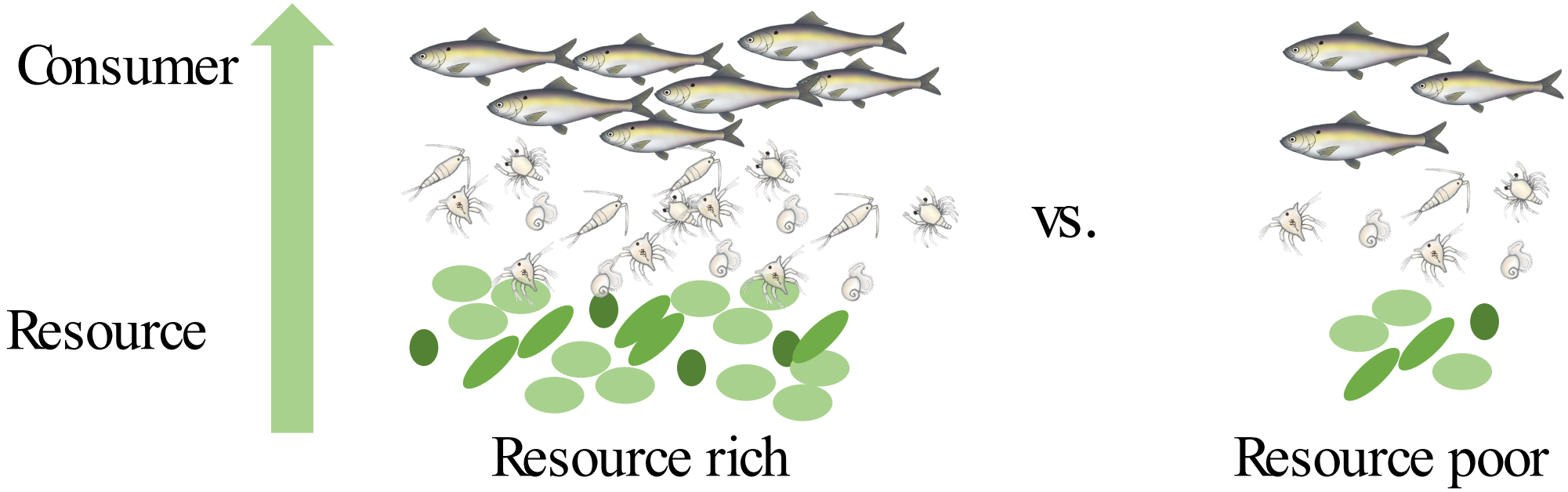
Few predators





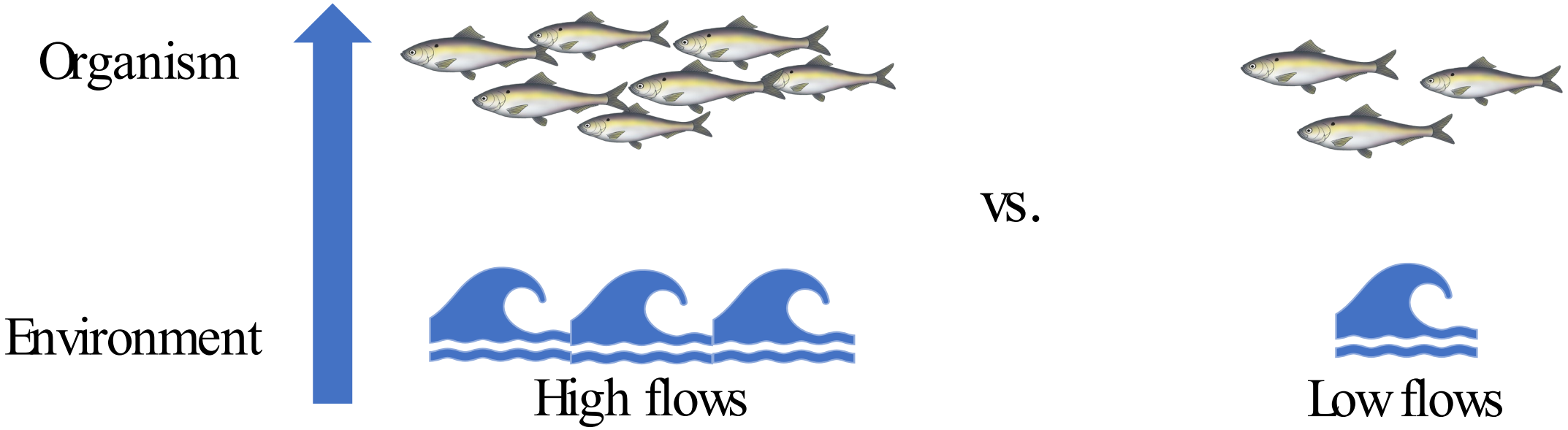
The number of predators controls the number of prey through direct consumption

# What is bottom-up control?




The availability of food resources controls the number of consumers that can eat and survive

# What is environmental control?

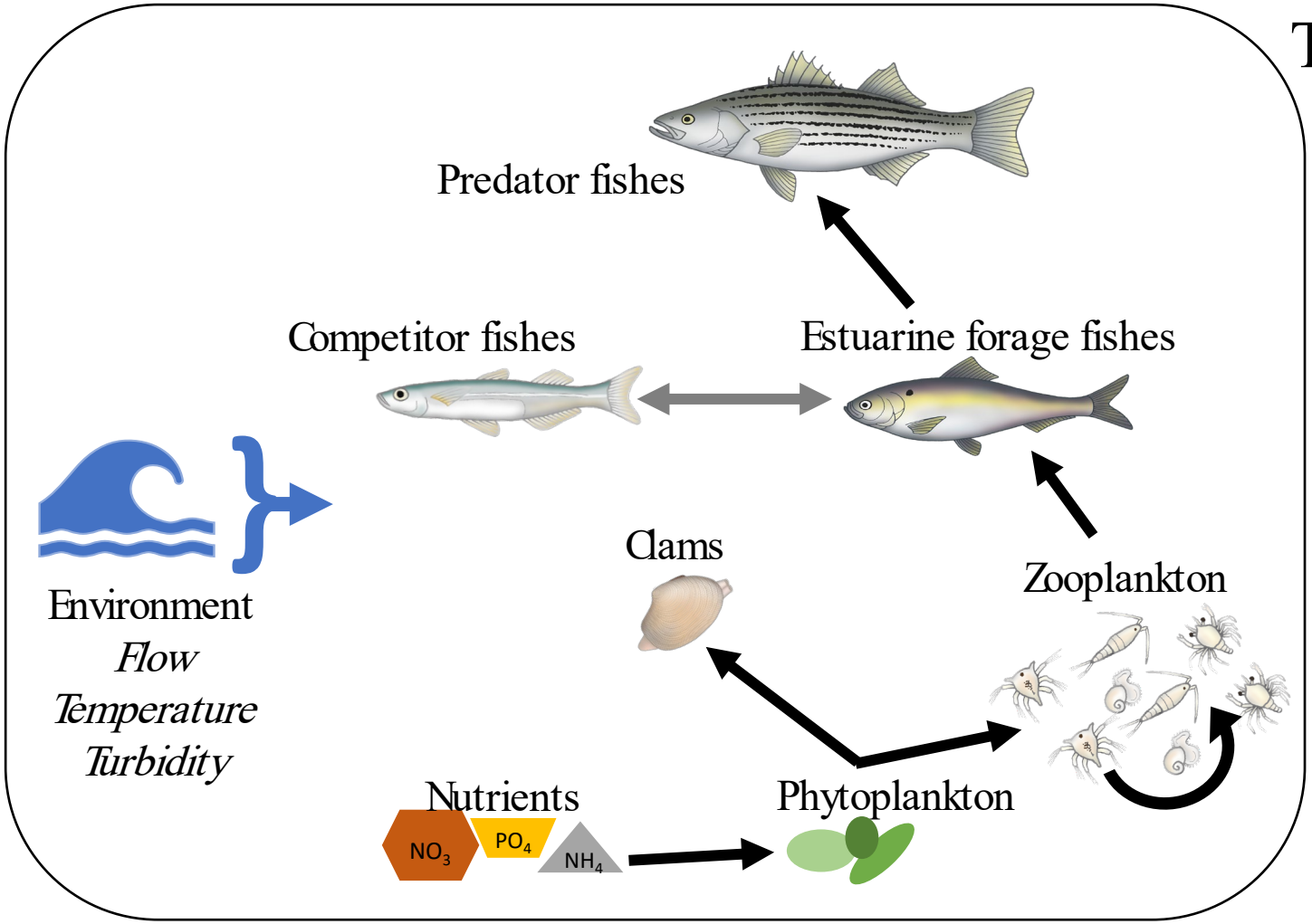



Prevailing environmental conditions directly control the number of organisms based on physiology or behavior

# Food web conceptual model

## Modeled relationships:

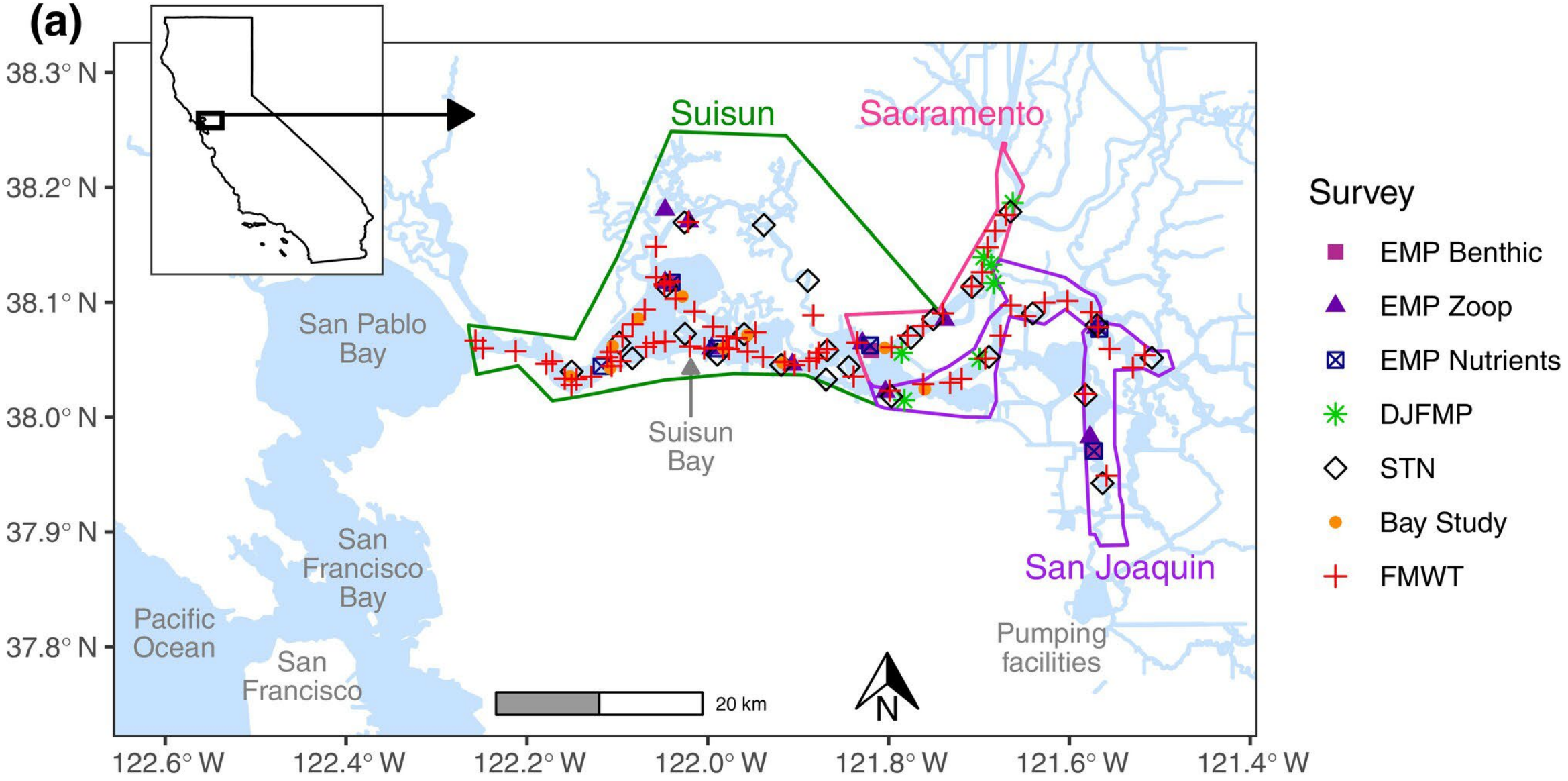
- Environment
- Direct interaction
- Other interaction



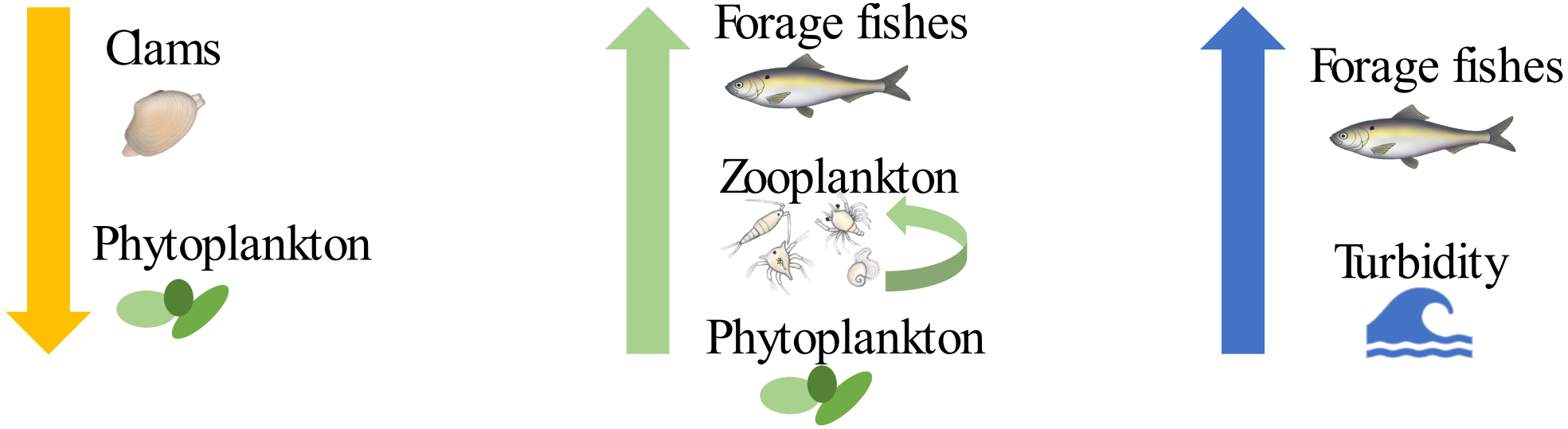
# Synthesis in action: 8 different datasets 1980-2020

**TABLE 1** Variables and data sources.

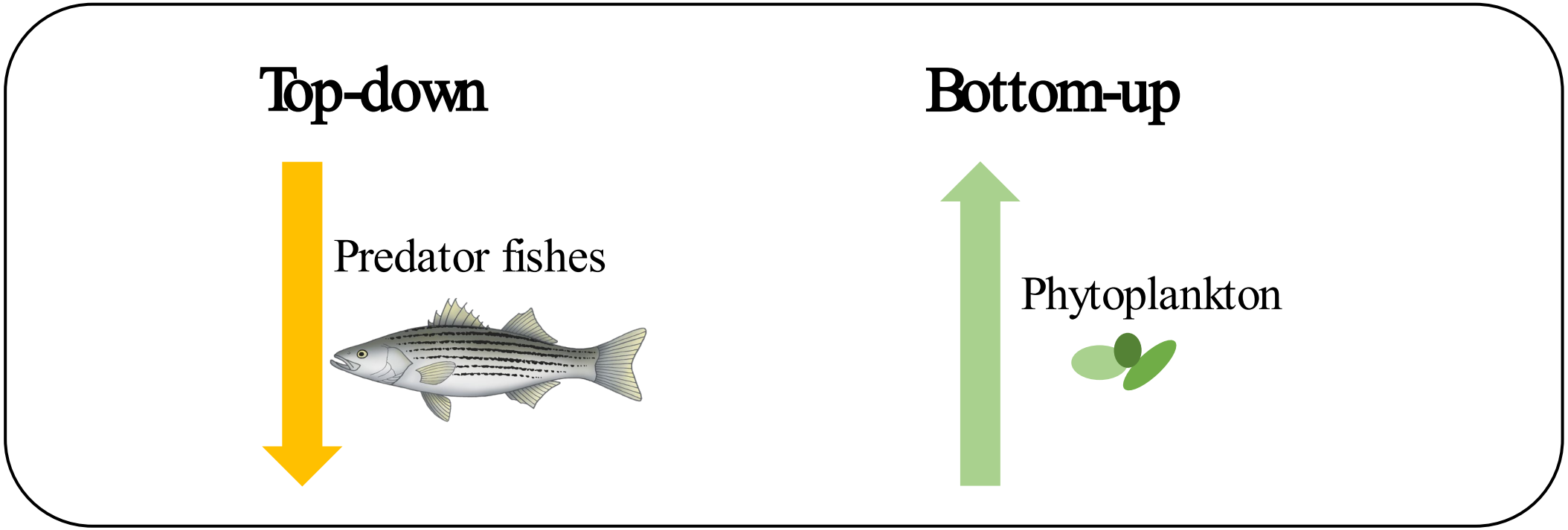
| Variables | Data source | Citation |
|---|---|---|
| Zooplankton (cladocerans, herbivorous copepods, mysids, predatory copepods, rotifers) | Environmental Monitoring Program (EMP Zooplankton) | Barros (2021) |
| Benthic invertebrates (clams, amphipods) | Environmental Monitoring Program (EMP Benthic) | Wells and Interagency Ecological Program (2021) |
| Fish (estuarine fishes, marine fishes, age 1+ striped bass) | San Francisco Bay Study Midwater Trawl (BSMT) | https://wildlife.ca.gov/Conservation/Delta/Bay-Study |
| Fish (estuarine fishes) | Fall Midwater Trawl Survey (FMWT) | https://wildlife.ca.gov/Conservation/Delta/Fall-Midwater-Trawl |
| | Summer Townet Survey (STN) | https://wildlife.ca.gov/Conservation/Delta/Townet-Survey |
| Fish (Mississippi Silverside, centrarchid species) | Delta Juvenile Fish Monitoring Program (DJFMP) | Interagency Ecological Program, McKenzie, et al. (2021) |
| Chlorophyll-*a*, Temperature, Secchi depth, Nutrients | Environmental Monitoring Program (EMP Water Quality) | Interagency Ecological Program, Martinez, et al. (2021) |
| Flow | Dayflow, California Department of Water Resources | https://data.cnra.ca.gov/dataset/dayflow |


(a)
38.3° N
38.2° N
38.1° N
38.0° N
37.9° N
37.8° N
122.6° W
122.4° W
122.2° W
122.0° W
121.8° W
121.6° W
121.4° W
Suisun
Sacramento
San Joaquin
San Pablo Bay
Suisun Bay
San Francisco Bay
Pacific Ocean
San Francisco
Pumping facilities
20 km
N
Survey
EMP Benthic
EMP Zoop
EMP Nutrients
DJFMP
STN
Bay Study
FMWT

# Key finding #1:
# All three drivers were important in the models (net effects had similar magnitudes)



# Key finding #2:
# Data quality or quantity issues

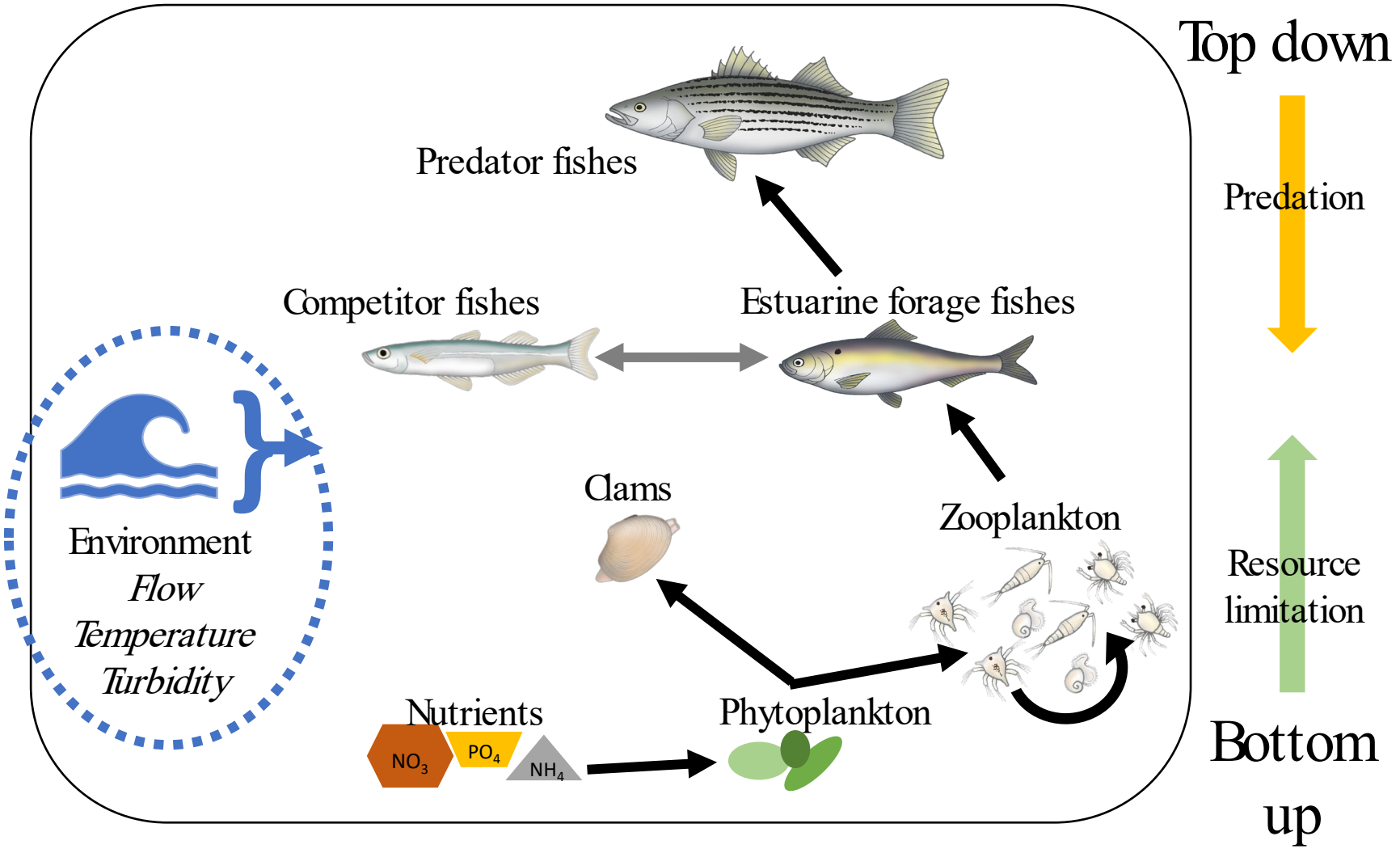



Not enough data to determine effects of large fishes

Low resolution data; need to identify species

# Key takeaways for research and management

- Synthesis revealed new insights not previously known
- Model support for ecosystem-based management solutions



# Upcoming DSP-NCEAS products

- 2021
  - Modeling food web responses to floodplain inundation patterns in the Yolo Bypass
- 2023
  - Benefits vs. burdens of ecosystem restoration on human communities
  - Costs vs. benefits of invasive species management strategies and recreational uses

# Check out the Earth Day blog!

Delta Stewardship Council
A CALIFORNIA STATE AGENCY

The Council | Delta Plan | Science Program | Science Board | DPIIC | Events

## Making Every Day Earth Day: Analyzing Data with the National Center for Ecological Analysis & Synthesis

April 22, 2024

By Senior Environmental Scientist Miranda Tilcock

Every year on April 22, we celebrate Earth Day, which originally started in the 1970s with a focus on recycling, using less electricity, and conserving water. Fast forward to today, Earth Day has become so much more and is everything from mitigating the impacts of climate change to environmental justice. For environmental scientists like me, doing research in various ecosystems on all sorts of species, every day can begin to feel like Earth Day. After all, in the Sacramento-San Joaquin Delta, we are doing everything we can to improve our corner of the world. This can feel tedious at times, and like we are not making much progress, but every bit counts, or in my case, every piece of data collected and analyzed is an important step forward.

**One way to make a difference in the science community is by synthesizing long-term data sets.** In ecology, data synthesis refers to integrating and combining data sets, tools, and theories from a variety of disciplines to identify important knowledge gaps. Data synthesis has become increasingly important as open science becomes more commonplace. Open science is a global movement to make scientific research processes and products accessible to all. Resources such as R statistical software and many publicly available long-term data sets support open science and allow many advances in the scientific community by creating opportunities for these large data sets to be synthesized by researchers.

**Such access to long-term data sets is critical to understanding the environment of the past so that we can make more informed decisions**