Operation Baseline Update

Delta Science Program

DELTA STEWARDSHIP COUNCIL

Out of many possible stressors, nutrients were chosen as a potential key contributor to the Pelagic Organism Decline (Native and Non-Native).

Climate Change

Nutrient Imbalance

Habitat Loss

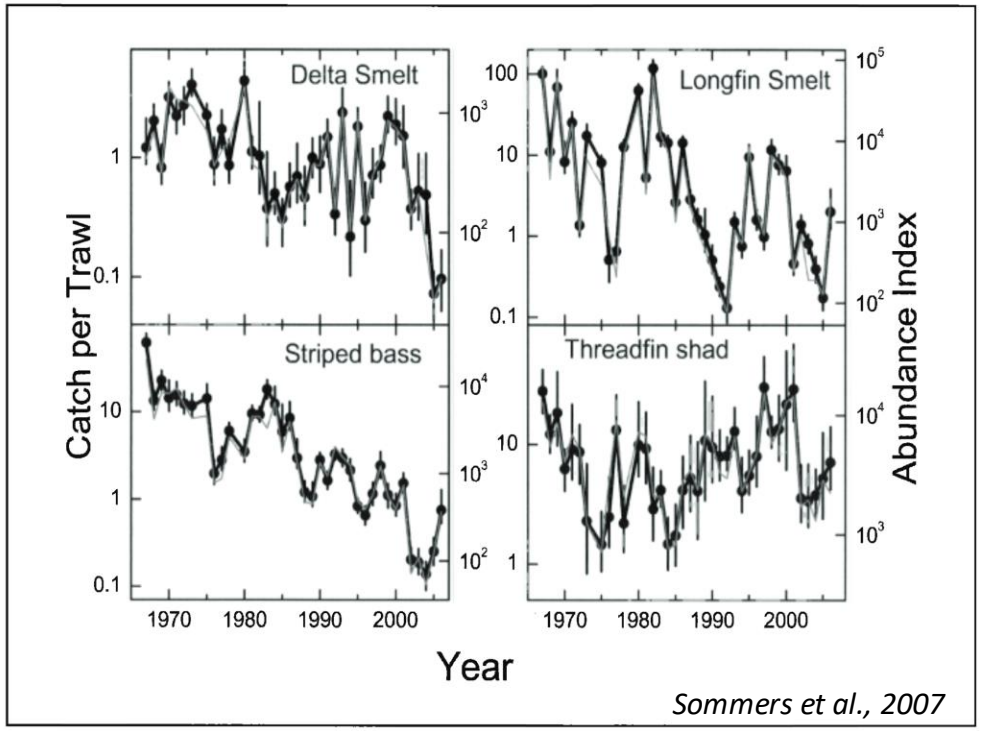
Invasive Species

Water Diversions

Chemical Toxicity

Fish Population Decline

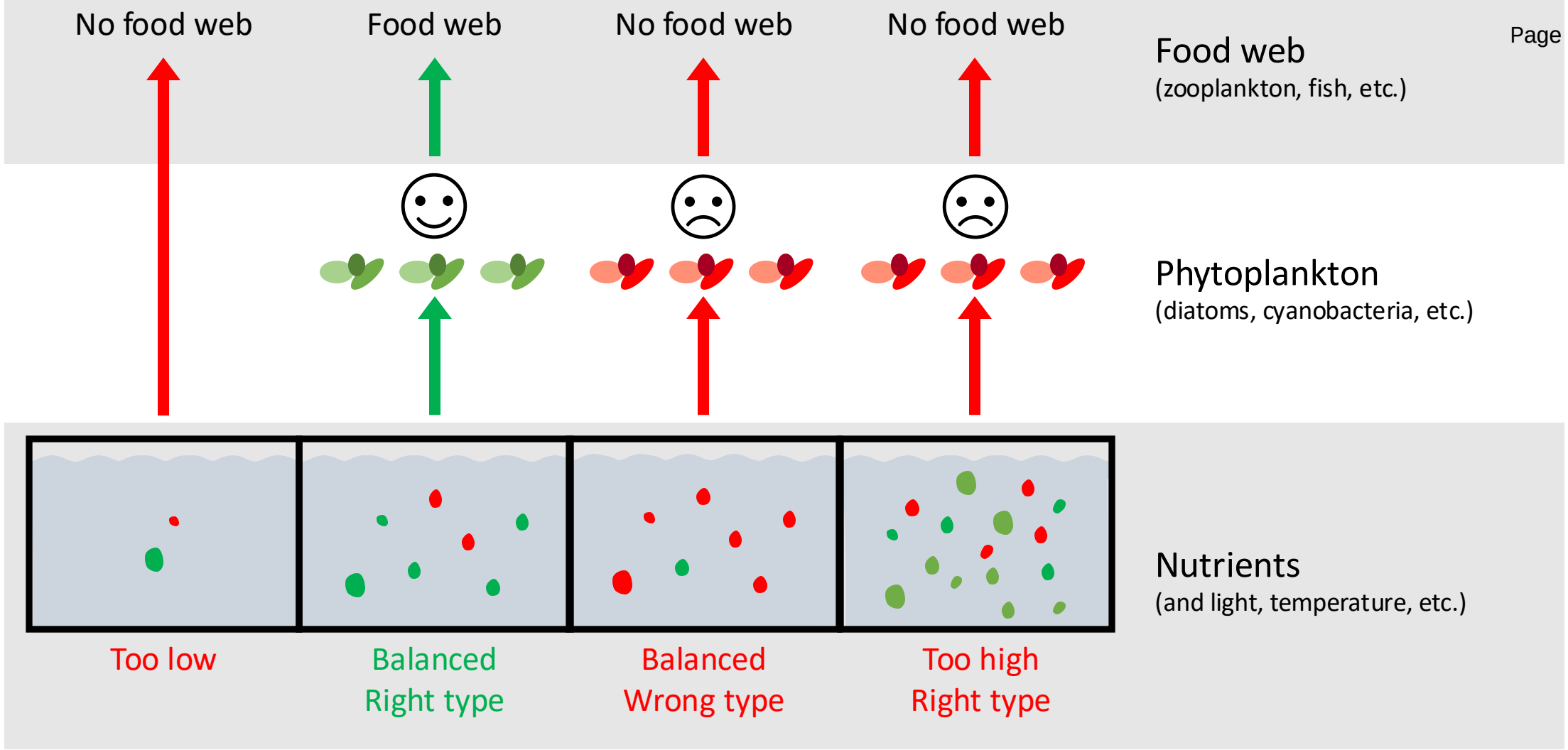
Figure 4. Trends in four pelagic fishes during 1967–2006 based on the fall midwater trawl, a DFG survey that samples the upper San Francisco estuary. Symbols with heavy lines and error bars (left y axis) show mean catch per trawl (all stations) with approximate 95% confidence intervals determined by bootstrap analysis (Kimmerer and Nobriga 2005), and the thin lines (right y-axis) show abundance indices. No sampling occurred in 1974 or 1979. Development of abundance indices from catch data is described by Stevens and Miller (1983). Note that the y-axes are on logarithmic scales.



Sommers et al., 2007

NOTE: Log scale

The amount and type of nutrients & phytoplankton matter



Enter Operation Baseline…

Collaborative science effort beginning in 2016 to:

- Establish a baseline of water quality in the entire Delta
  - Focusing on nutrients and phytoplankton
- Assess the effects of a $1.7B upgrade to reduce nutrients going into the Delta

To achieve all this, we needed to ***modernize monitoring***

Monitoring Modernization Journey: How did it work?

Experts met to identify gaps in monitoring

↓

Early community workshops to develop conceptual models

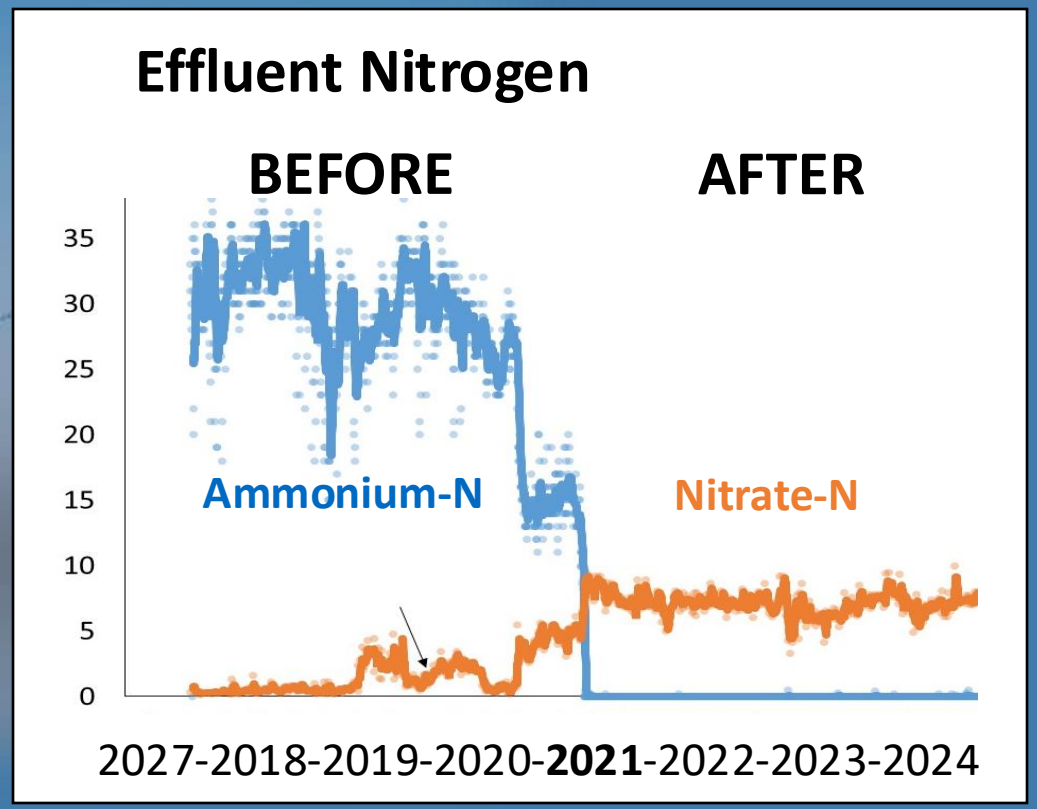
↓

Collaborative study design and implementation

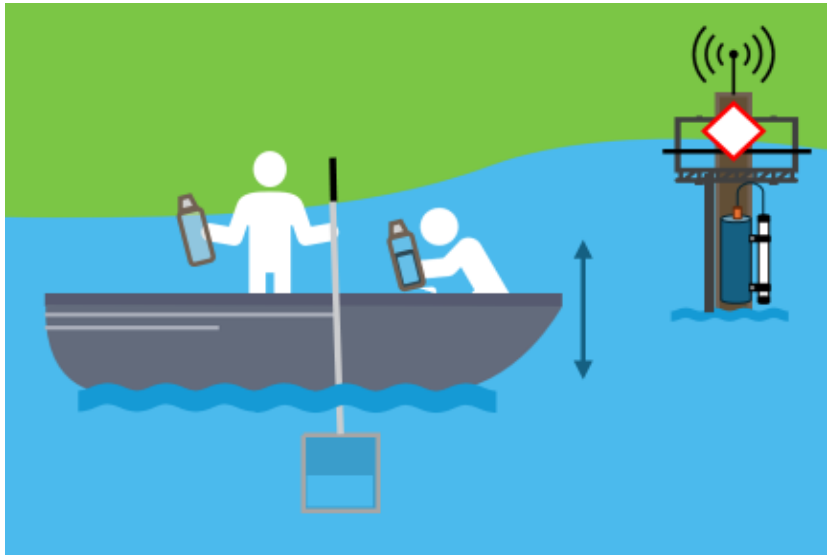
- New tools are still in use
- Baseline conditions – tons of data
- Supported collaborations that would not have happened
- Spawned other research that received $10s of millions

Upgraded Wastewater Treatment Facility

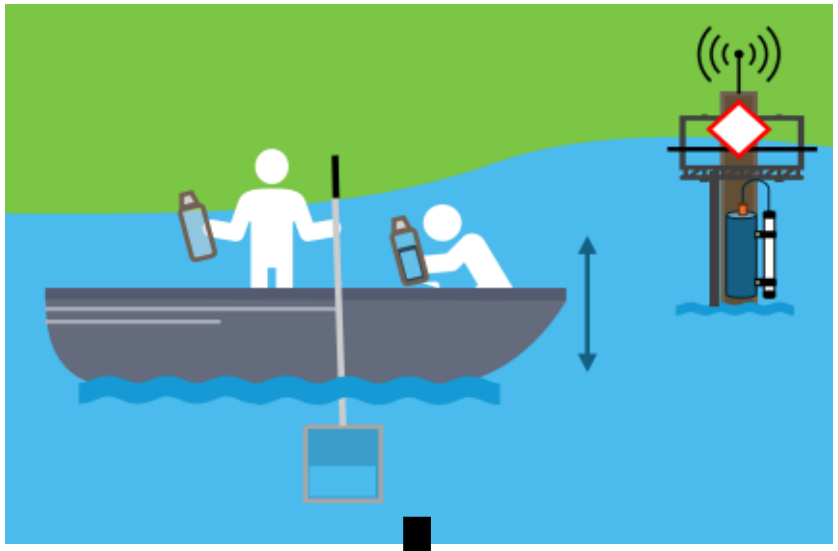
Large reduction in nutrients



Operation Baseline modernized water quality monitoring by improving the collection of over space and time.



UPGRADED



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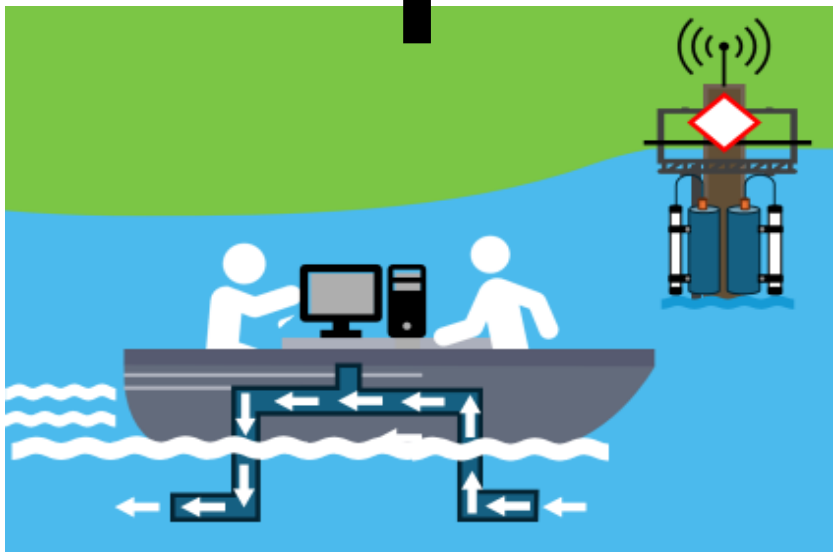


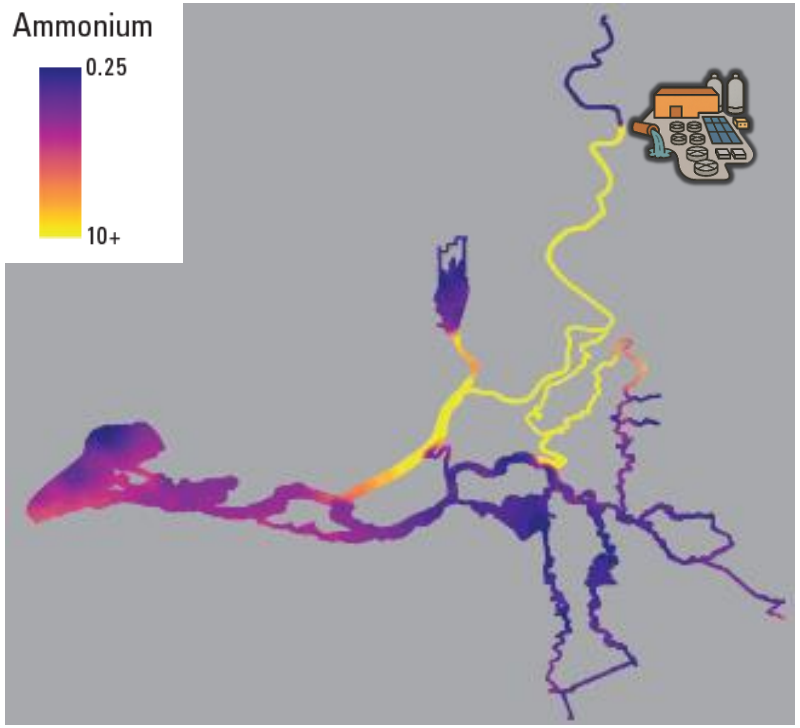
New Instrumentation measures not only how much phytoplankton but also which kinds.

BEFORE	NEW ADDITION
 Phytoplankton	 Diatoms  Green Algae Cryptophytes Cyanobacteria 
✓ Amount ✗ Type	✓ Amount ✓ Type

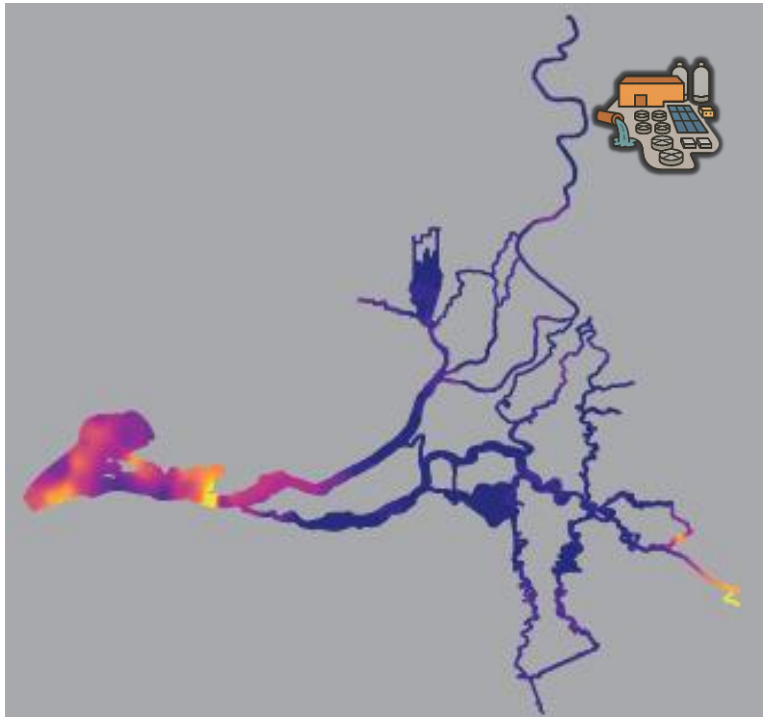
Operation Baseline produced high resolution mapping surveys.

Surveyed in Spring, Summer, Fall of 2018, 2020, 2021, 2022, 2023, 2024.

BEFORE Upgrade
Spring 2020



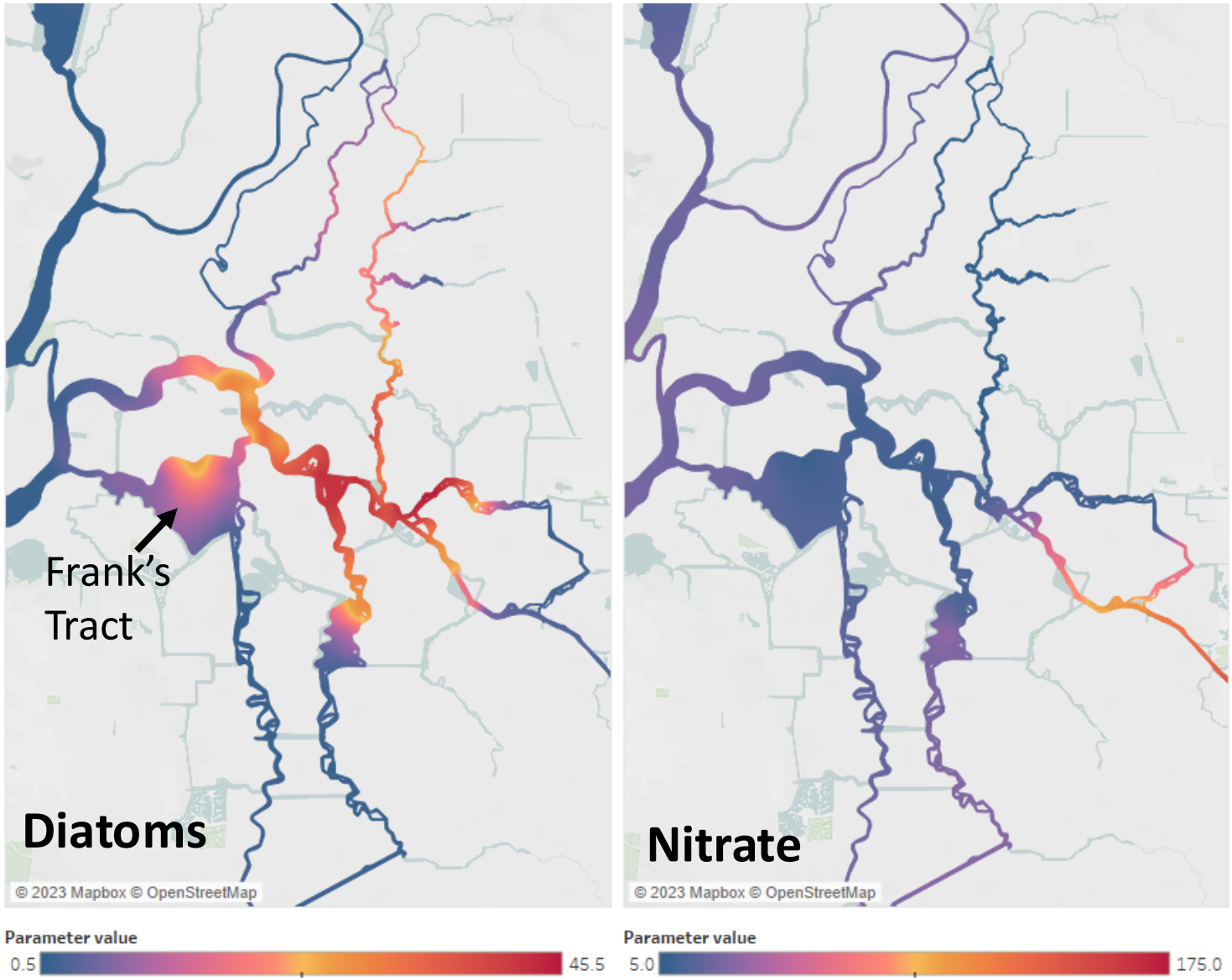
AFTER Upgrade
Spring 2022



Data source: Richardson and others 2025

Ammonium is only 1 out of over 15 environmental parameters mapped in the surveys!

Mapping surveys captured spatial information that were missed by fixed stations.



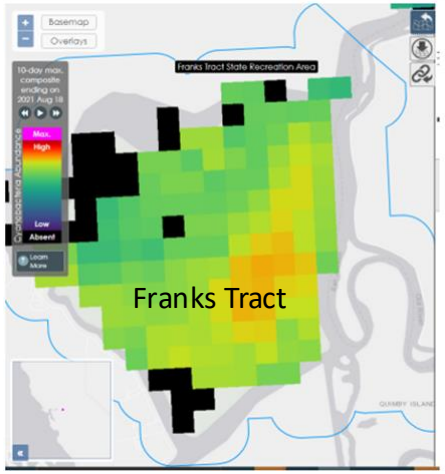
Beneficial diatom bloom

Data source: USGS ScienceBase

Operation Baseline expanded HABs cyanotoxin monitoring.

Consortium of Funding

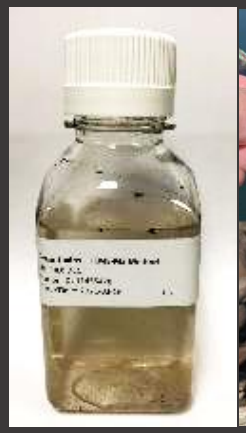
- Delta Science Program
- Delta Regional Monitoring Program
- State Water Contractors
- State Water Board
- USGS HABs Program, Cooperative Match



Fixed Locations

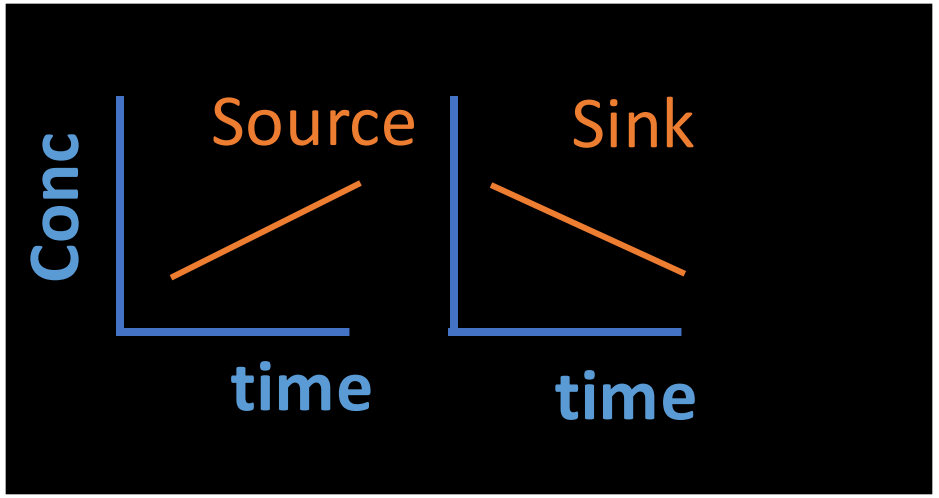
Mapping Surveys

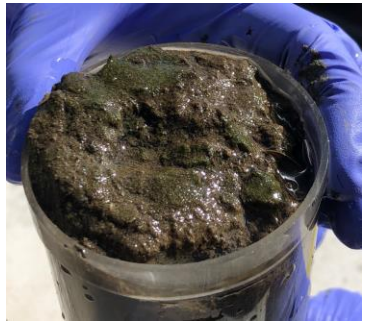
Collection & Analysis of Samples for Cyanotoxins



Operation Baseline expanded nutrient sediment monitoring.

Sediment nutrient exchange



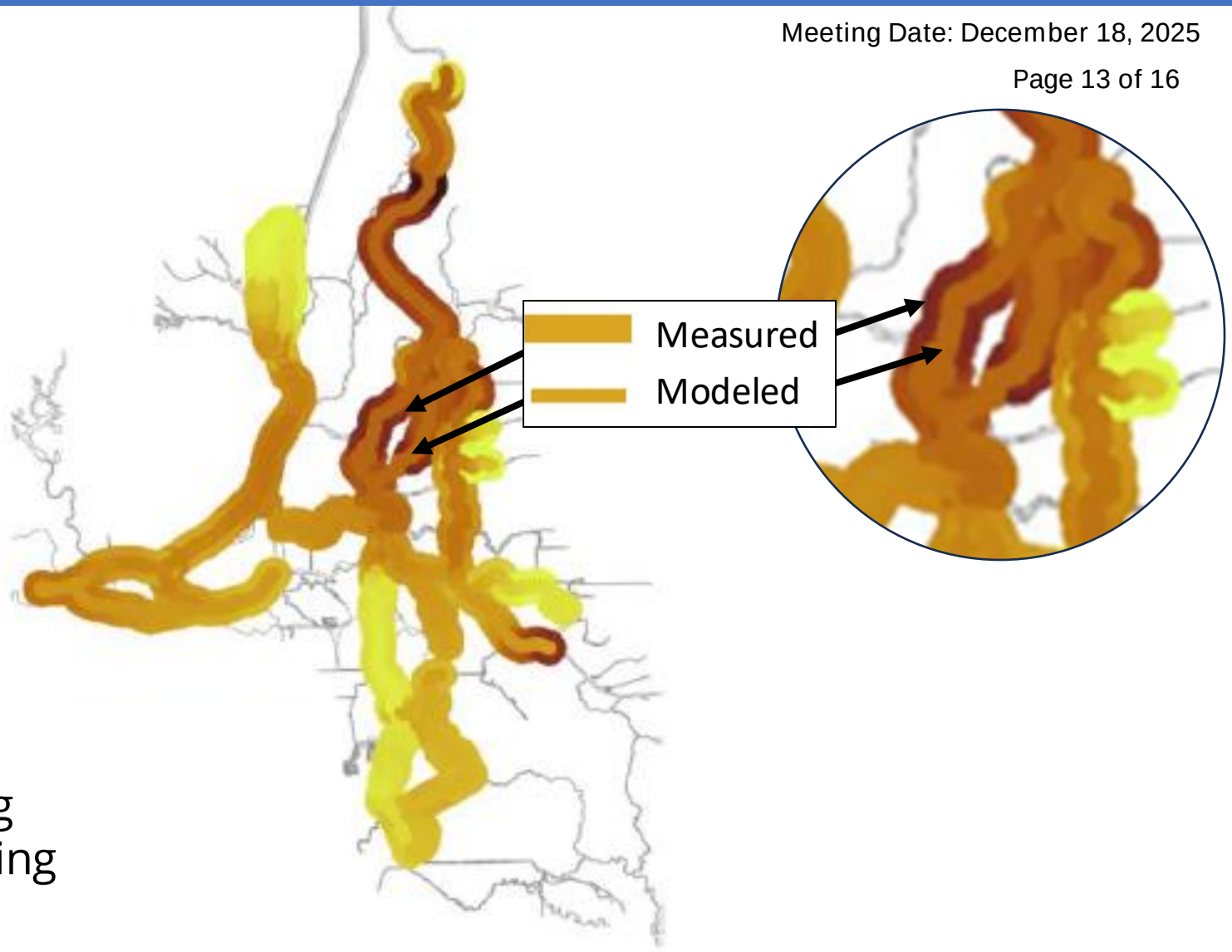


Operation Baseline generated data that can develop and ground-truth models.

Observational Water Quality Data

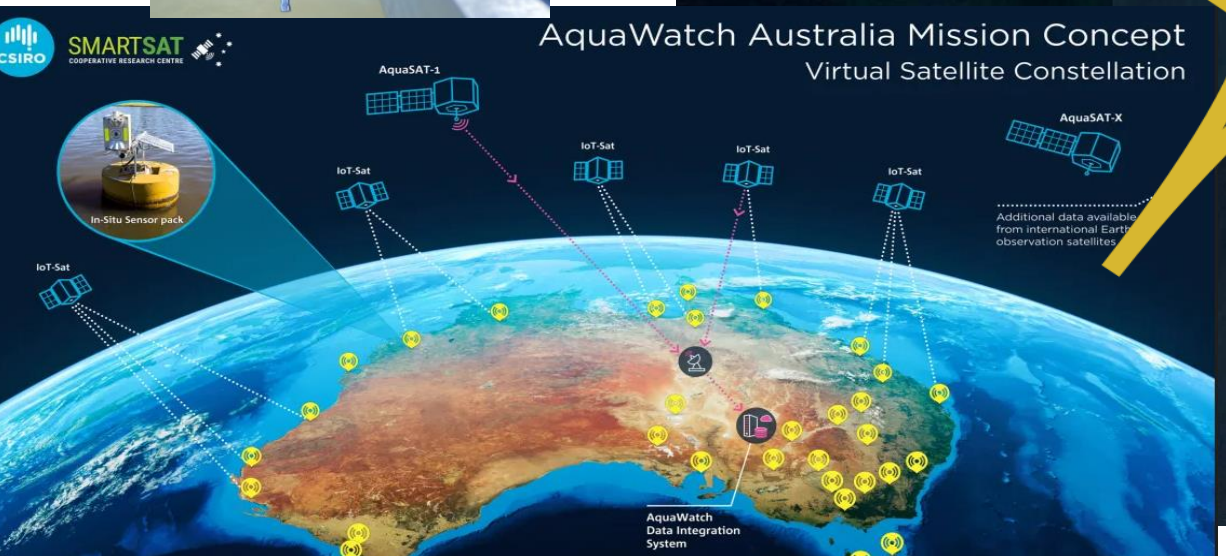
Computer Models

- ✓ Forecasting
- ✓ Hindcasting
- ✓ Mechanistic Understanding
- ✓ Scenarios testing



Data source: Gross et al. 2024

Develop integrated monitoring systems that provide system-wide information in near real-time.

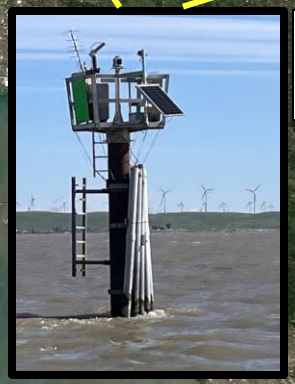


Satellite Imagery

Low-Cost Radiometers

Low-Cost Sensors

Mapping Surveys



Fixed Stations

Looking into the Future: Shifting Baselines

- The Delta is changing
  - Climate
  - Invasive species
  - Policy
  - Infrastructure
  - Restoration
- We now have a baseline and new approaches
- Need to sustain efforts to measure changes and the ecosystem response

Photo from DWR NCRO

Thank you

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