San Francisco Bay Regional Water Quality Control Board

Nutrient Watershed Permit –
BACWA Annual Meeting

Walkthrough permit and basis of final limits

May 3, 2024

Overview – Nutrients Regulation

1. Background
2. Algae Blooms – Fish Kills
3. Nutrients Fueled Bloom
4. Science Behind Bloom
5. How to Regulate Nutrients
6. Considerations

Management Questions

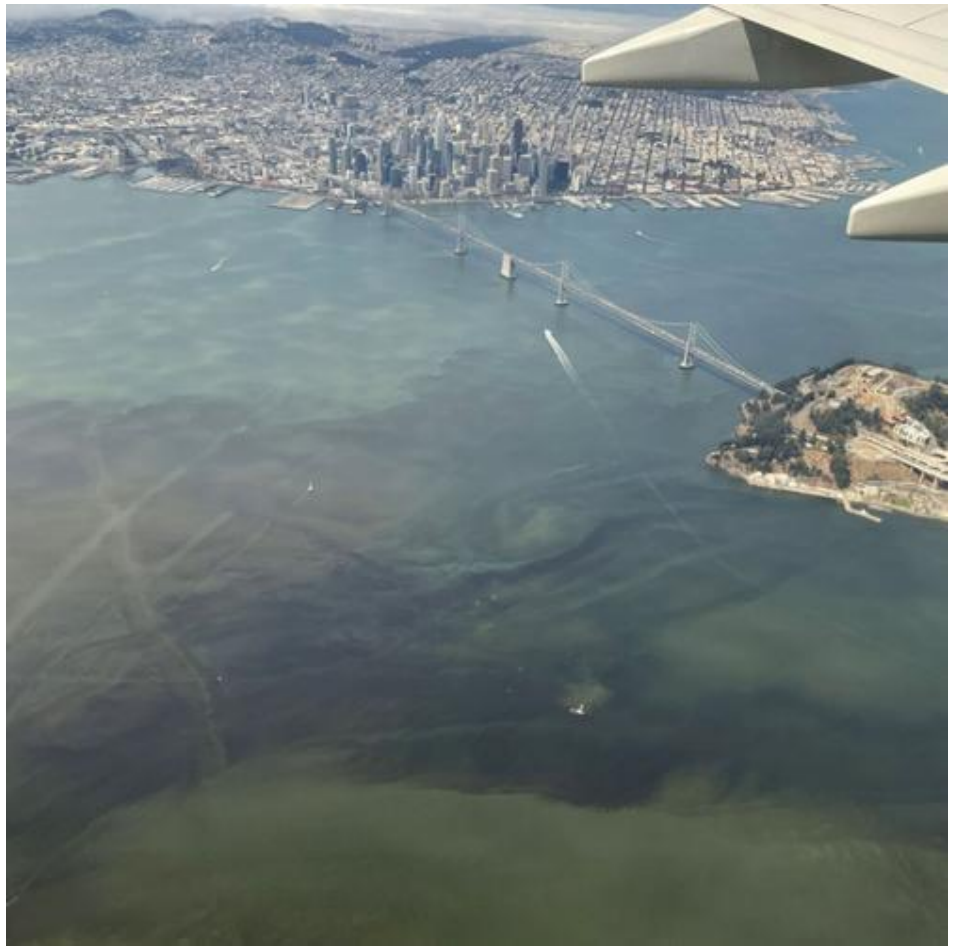
Do nutrient loads result in adverse impacts now or under future scenarios?

What management actions will prevent or mitigate current or future impacts?

San Francisco Bay – Nutrients not Used

1. High Suspended Sediment 
2. Strong Tidal Mixing 
3. Filter-feeding clams 

Harmful Algae Bloom (2022)



Photos by Damon Tighe

1. Monitoring and Reporting

2. Fund Science Program

Key Tenets for NWP 3.0

3. Interim and Final Limits, Report on actions to meet final limits

4. Regional Planning and Multi-Benefit Solutions for Nutrient Reduction

Developing Effluent Limits without numeric water quality objectives

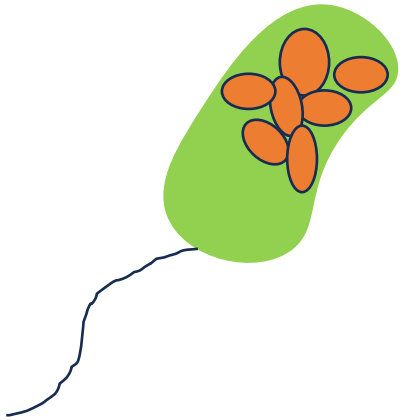
40 C.F.R. Section 122.4(d)

- U.S. EPA criteria guidance under CWA section 304(a)
- Indicator parameter for pollutant of concern, or
- Calculate a numeric criterion that interprets the narrative objective for the pollutant of concern

Meet the Cast

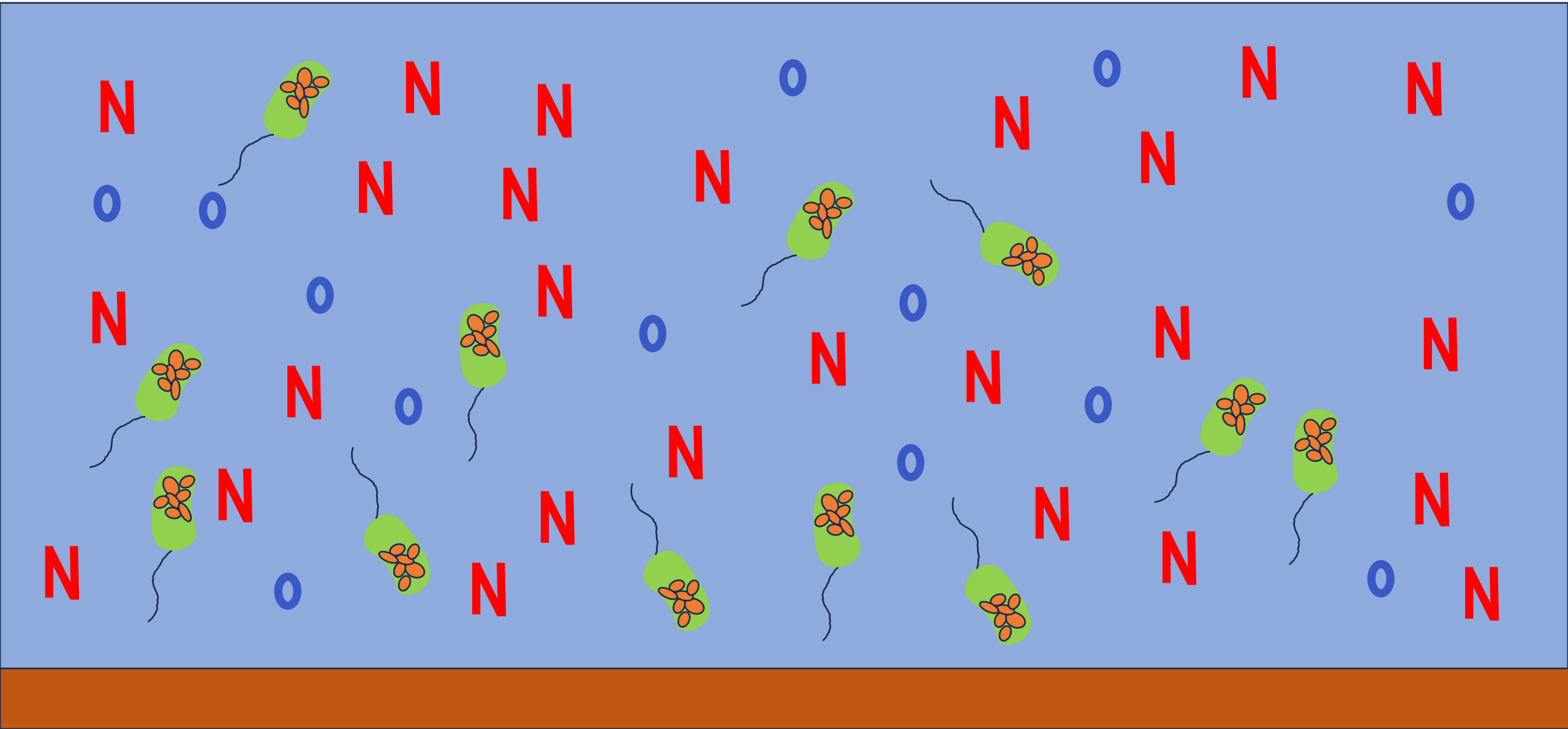
N Nitrogen: the “fuel” for the 2022 algae bloom

O Oxygen: critical for aquatic life, was reduced at end of bloom

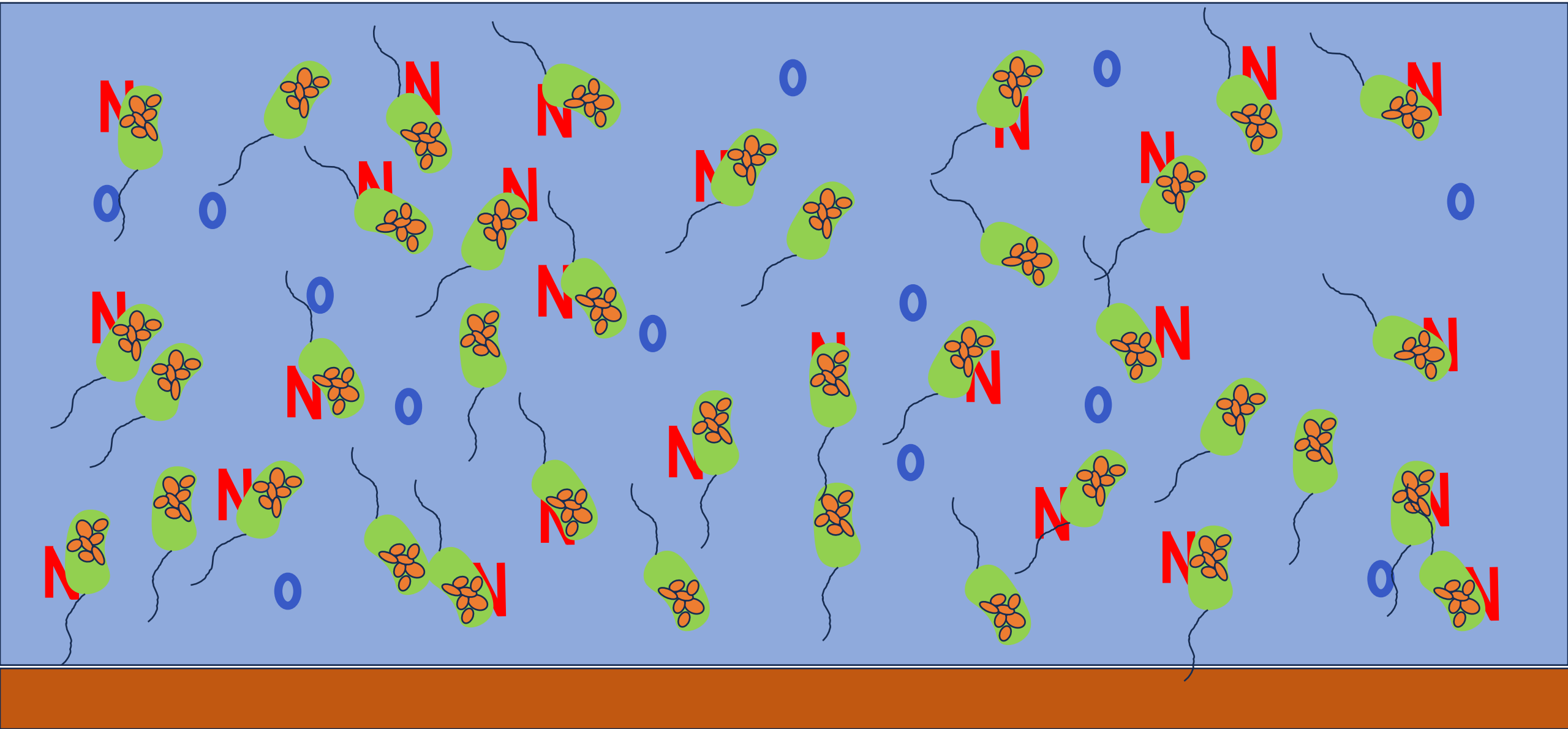


Heterosigma Akashiwo: the harmful algal species involved in the 2022 bloom

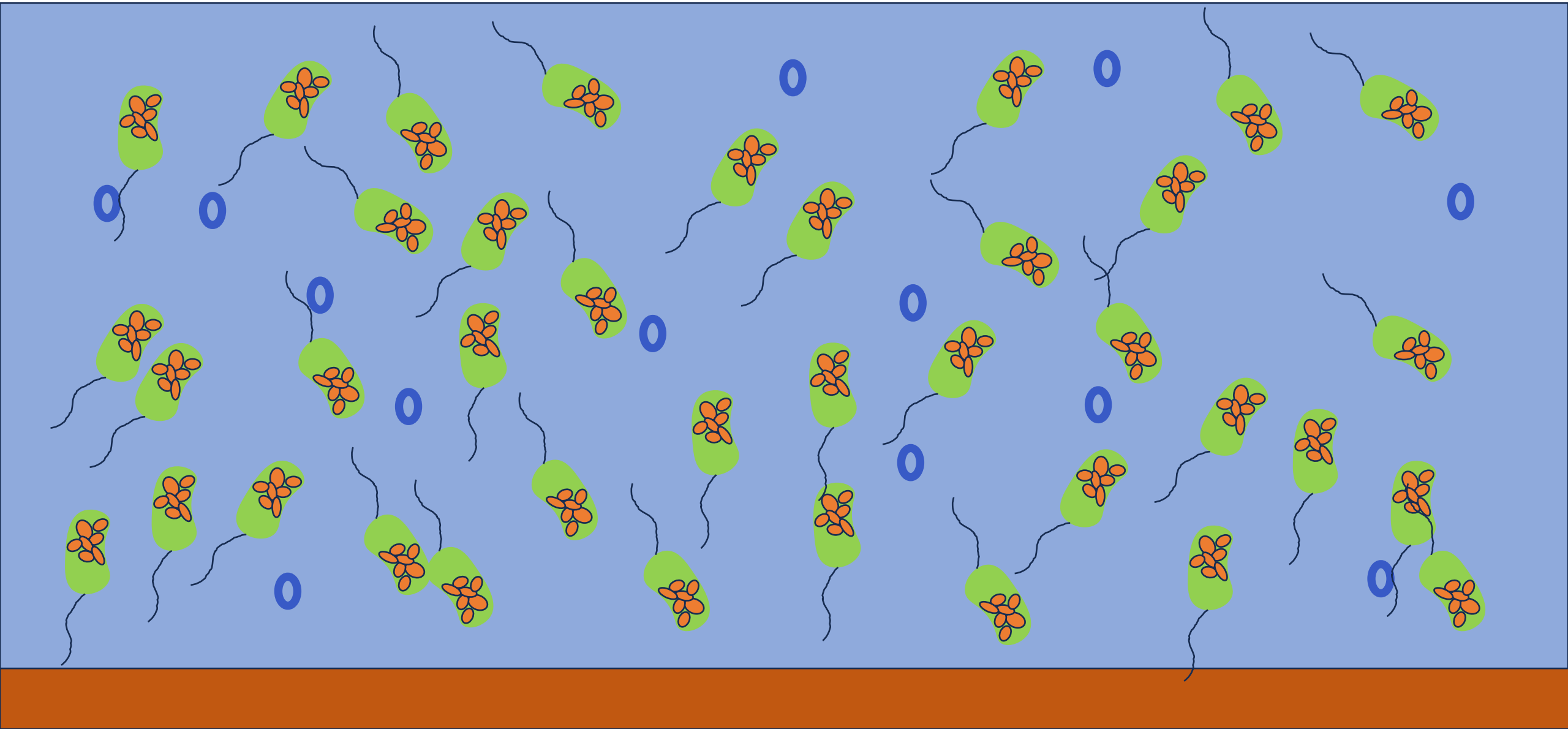
2022 bloom: algae and plentiful nitrogen available



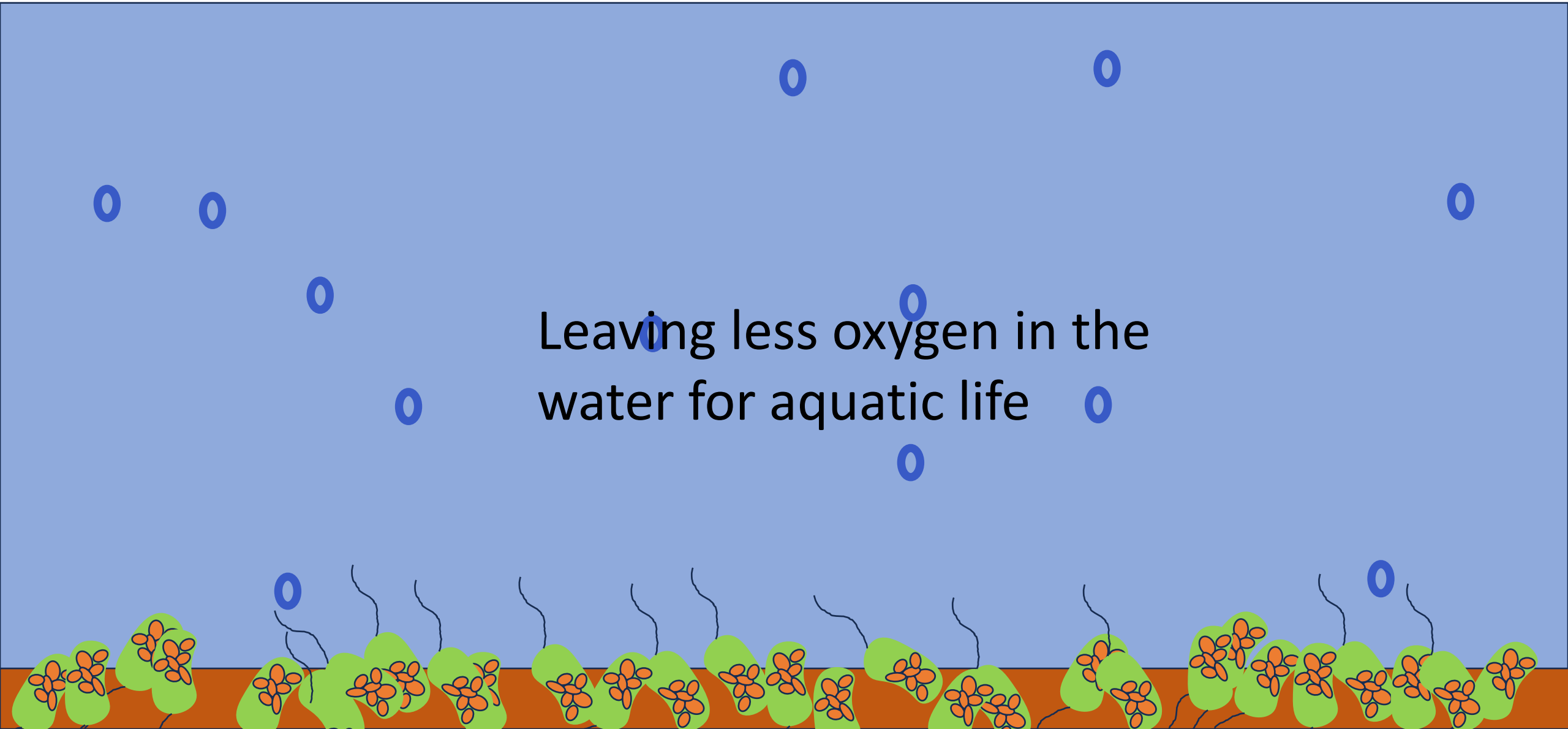
2022 bloom: algae use all nitrogen and multiply



2022 bloom: …..and then algae finally die

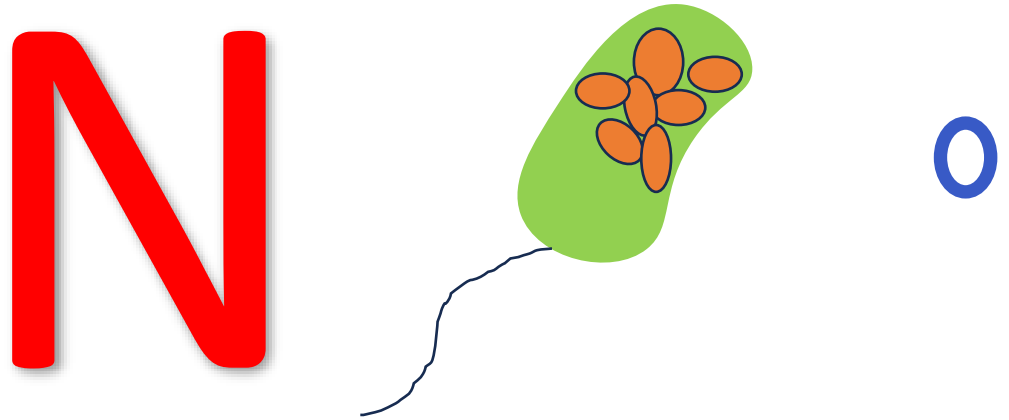


2022 bloom: oxygen consumed during digestion

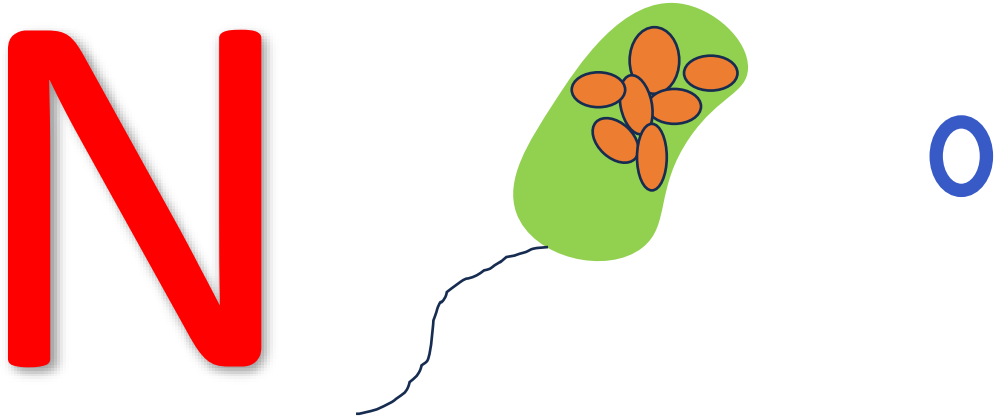


Lower loads → less algae → more oxygen

Current nitrogen loads provide ample fuel for algae growth, and oxygen was consumed after algae died



Reduced nitrogen loads will lead to less algae growth and higher oxygen concentrations at end of bloom



4 mg/L DO from U.S. EPA calculation methodology

Striped Bass

Sturgeon

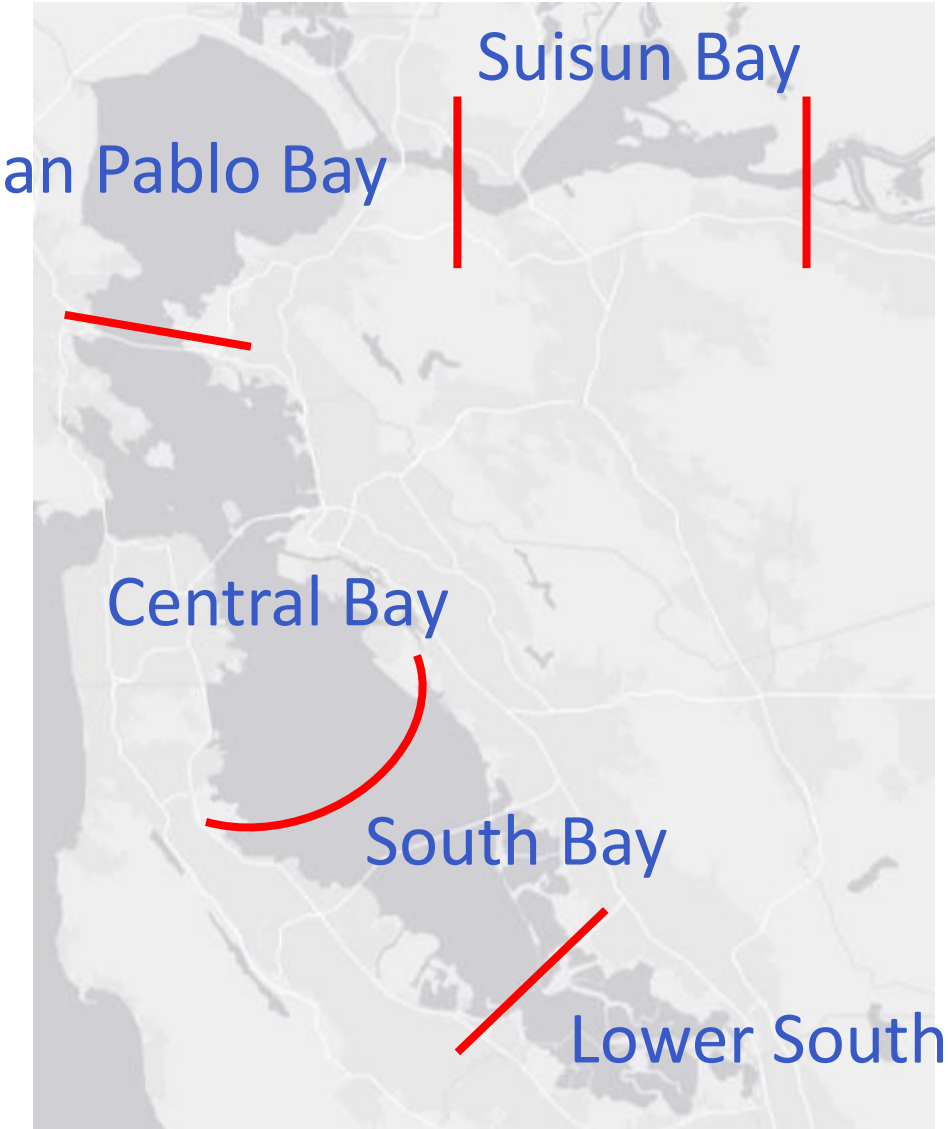
Calculated acute endpoint is less than 4 mg/L

American Shad

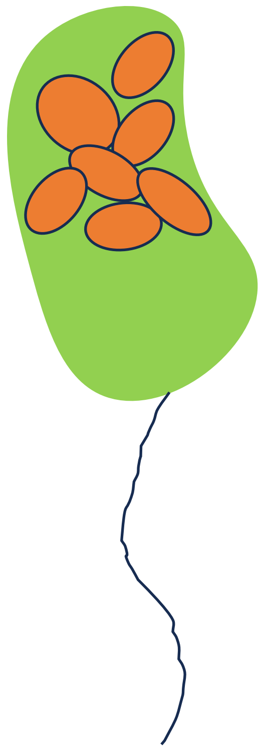
Mississippi Silversides

90% of every part of the Bay must be > 4 mg/L

- U.S. EPA recognizes that uses can be protected even if objectives are not met all the time
- U.S. EPA guidance suggests a 10% exceedance frequency for pollutants like dissolved oxygen
- We apply to each part of the Bay



We know chemical composition of algae



=

c c c c c c c c c c c c c c c c c c c c
c c c c c c c c c c c c c c c c c c c c
c c c c c c c c c c c c c c c c c c c c
c c c c c c c c c c c c c c c c c c c c
c c c c c c c c c c c c c c c c c c c c
c c c c c c

106 carbons

N N N N N N N N N N N N N N N N

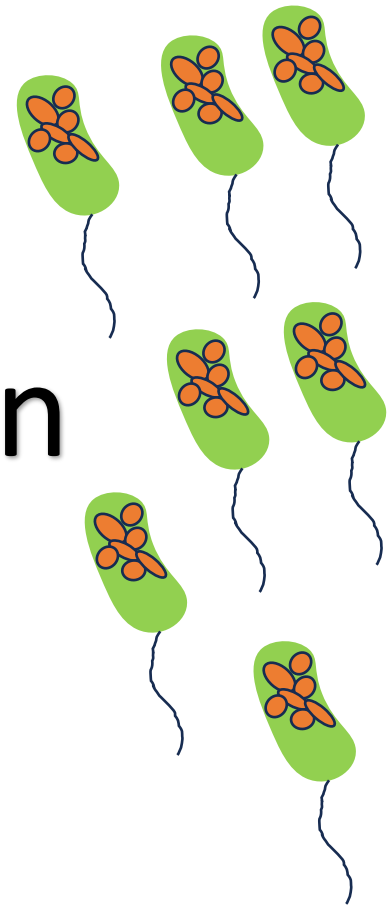
16 nitrogens

P

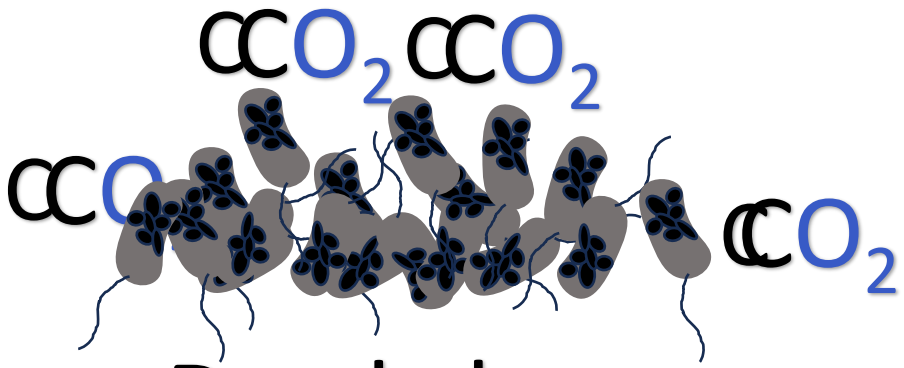
1 phoshorus

Note the 106:16 ratio or 6.6 carbons per nitrogen

Nitrogen in the water x 6.6 C:N = carbon in algae

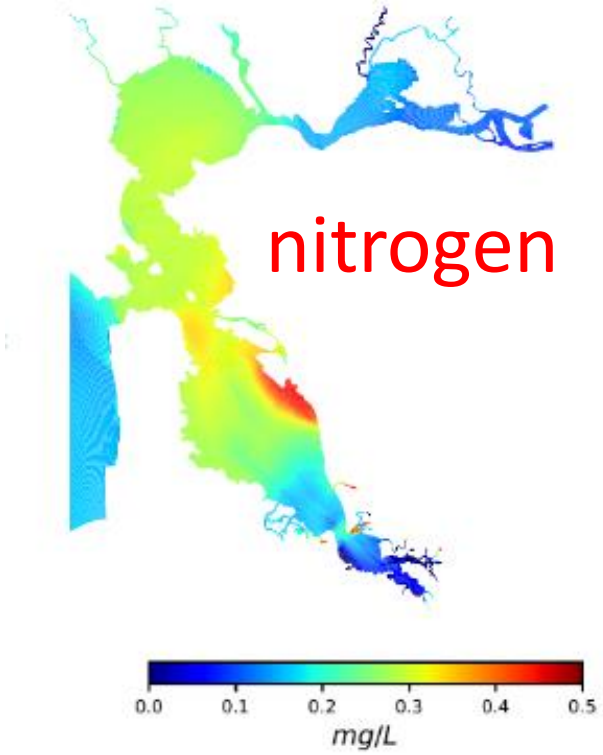


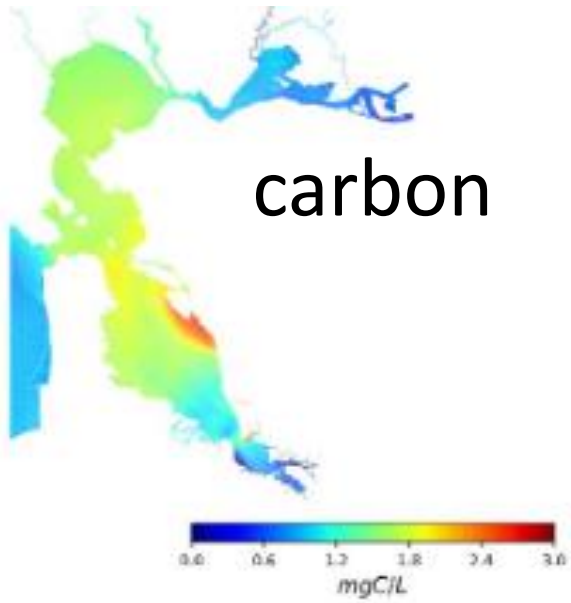
O_2 O_2 O_2 O_2

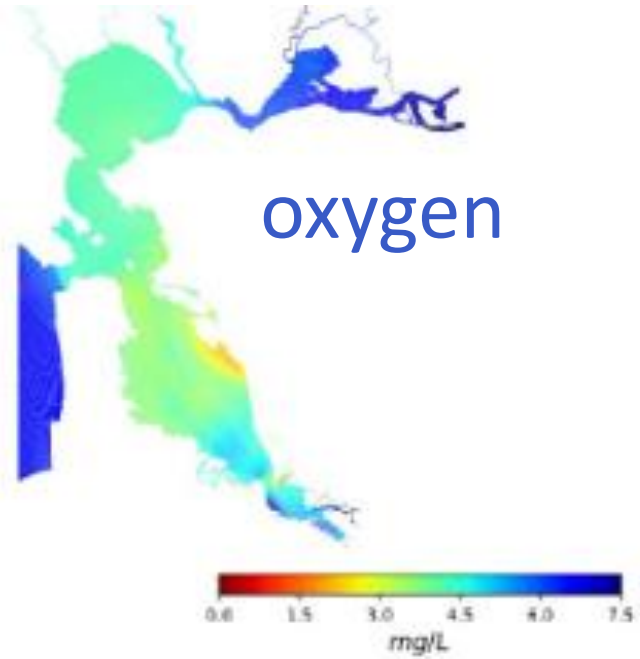


Oxygen debt: during digestion 1 molecule of O_2 is required to produce CO_2 for every carbon in dead algae

Modeled nitrogen ….to phytoplankton…. to oxygen





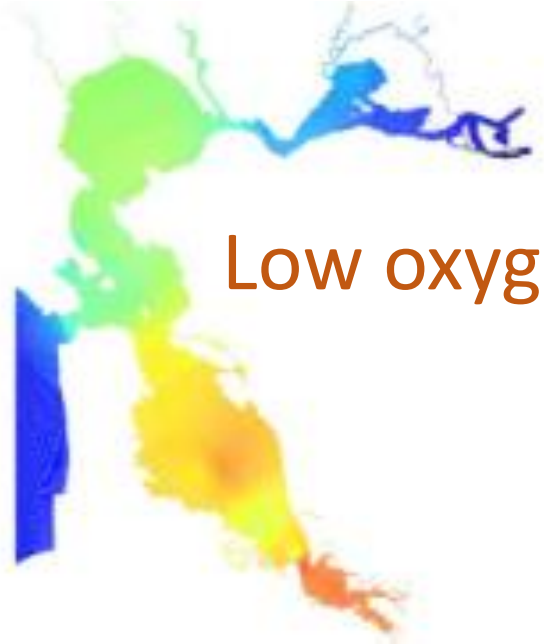


computed dissolved inorganic nitrogen throughout Bay3

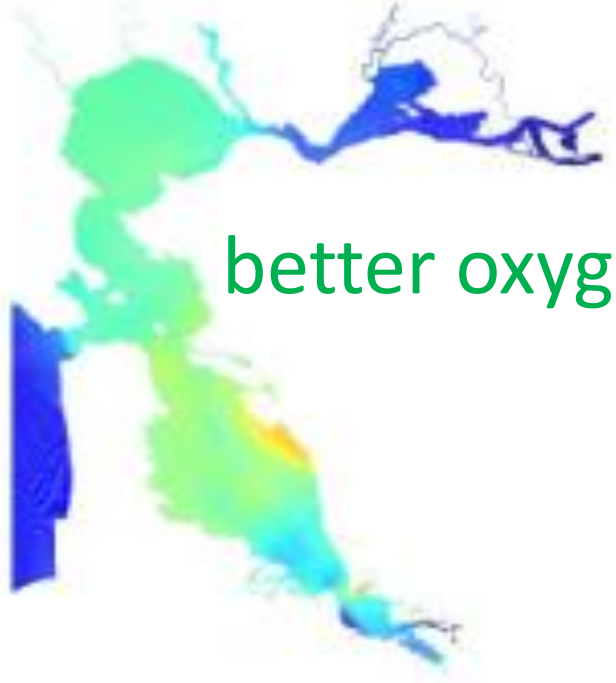
x 6.6 to get carbon contained in phytoplankton

Subtracted the digestion “oxygen debt” from starting oxygen

Reduced nitrogen loads → more oxygen left in water



Low oxygen

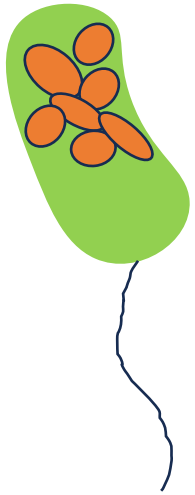


better oxygen

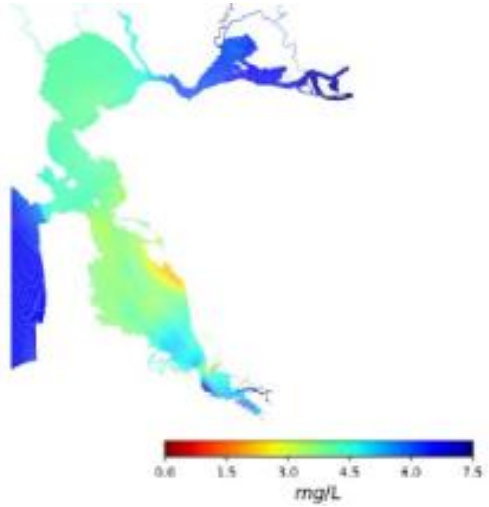
more oxygen

40% Reduction is Enough to Achieve Objective

40% municipal wastewater load reduction

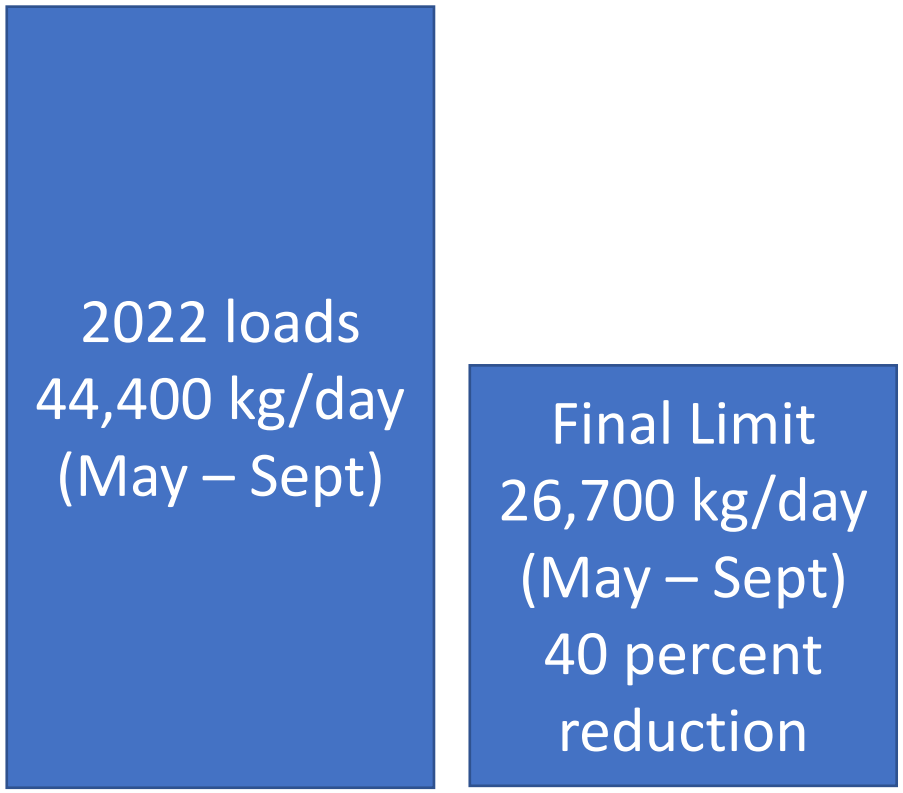


Which will reduce the fuel available for phytoplankton growth during a bloom



So that, even if all nitrogen is converted to biomass, we maintain oxygen above 4 mg/L in 90% of every portion of Bay

Protective Nitrogen Loads



- For minor dischargers, final limits are based on past loadings.
- For major dischargers, final limits are based on a nitrogen concentration of ~ 20.5 mg/L & 2022 flows. This equates to an overall 40 percent load reduction.

Compliance Schedules

State Water Board Resolution 2008-0025

- New interpretation of narrative water quality objective allows for a compliance schedule
- Compliance must be attained as soon as possible and within a maximum of 10 years

Permit Requirements for Compliance Schedules

Interim limits	Based on current treatment performance from May through September (95th percentile). Apply to each treatment plant individually.
Interim Requirements	Document efforts to minimize nutrient discharges to the Bay and progress on achieving compliance with final limits.
Final Limits	Include final limits (May through September) that will demonstrate attainment with the narrative biostimulatory substances objective.

Regional Planning and Multi-Benefit Solutions to Reduce Nitrogen Loads

- Schedule that ensures regional coordination to implement projects as soon as possible
- Identify how further reductions in nitrogen loadings beyond those required can be achieved by focusing on water recycling and nature-based solutions
- Propose long-term multi-benefit solutions and intent to pursue them even if compliance within 10 years is infeasible
- Develop Nutrient Trading Program

Timeline for Permit Consideration