

# N:P uptake ratios to infer optimal conditions for HABs Lake Superior tributaries to open lake

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USEPA-ORD-CCTE\_GLTED

- Understanding of nutrient stoichiometry necessary to support HABs, HABs ecology.
- Conduct nutrient uptake assays in the Great Lakes: Erie, Michigan, & Superior in areas where HABs are probable.
- Methodology for understanding nutrient dynamics in large lakes.
- Understanding of the underlying nutrient requirements for HAB to better target nutrient reduction practices.
- Partners/stakeholders: GLNPO, OW, Region 5, WIDNR

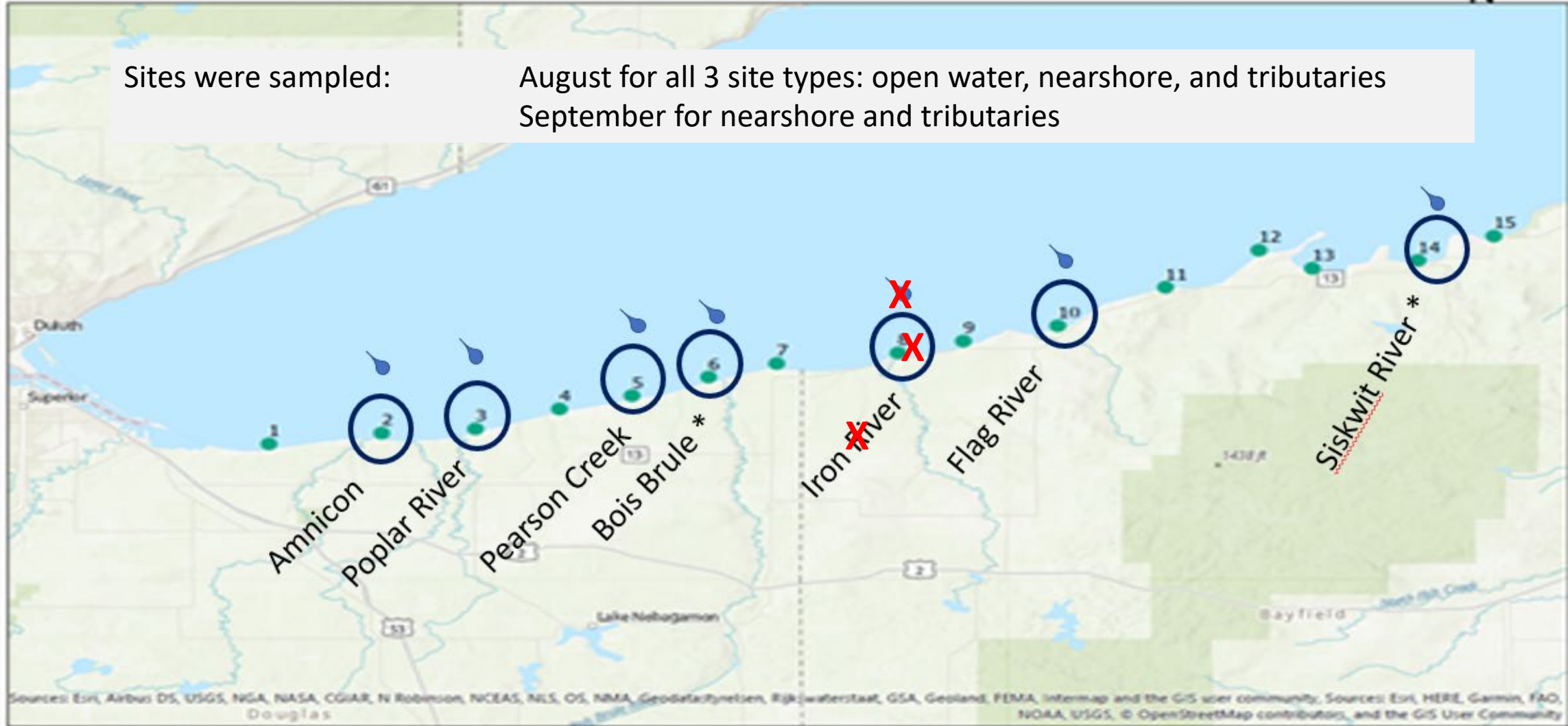
# 2021 WDNR CSMI Sampling

Thank you to WiDNR for sampling the nearshore for us





Sites were sampled:

August for all 3 site types: open water, nearshore, and tributaries  
September for nearshore and tributaries



• Sites are along 5m contour, will be sampled every two weeks from Mid-June till Mid-September WIDNR

 Open water sites (LEII)  
 USEPA NUA nearshore sites



## Bioassays:

- Conducted the following day between 10 am 2pm
- 5L biotainers
- Added nutrients:  $\text{NH}_4$ ,  $\text{NO}_3$ ,  $\text{PO}_4$  to 100ppb above background
- Sampled hourly over 4 hours
- $\text{NH}_4$ ,  $\text{NO}_3$ ,  $\text{PO}_4$ , Si, Fe, DOC, cations and anions
- Ambient and final NUA assay: Chlorophyll a, phycocyanin, microcystin (ELIZA)

## On LEII deck for open water sites:

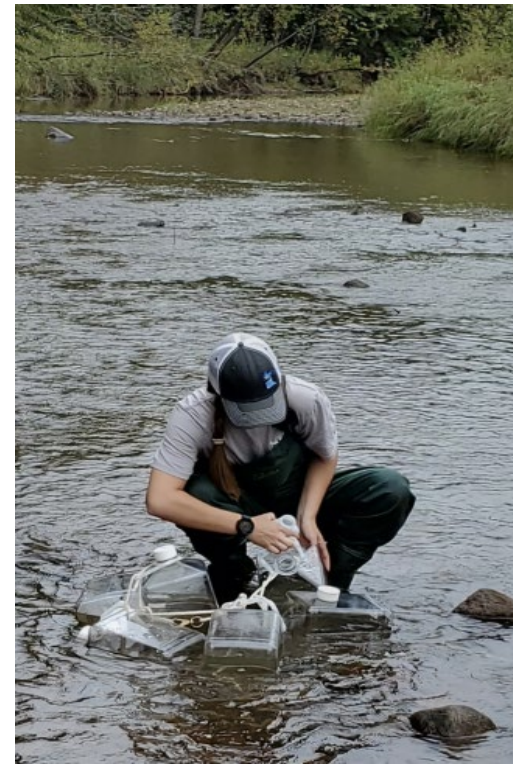
- Tank flow through lake water to incubate at lake temperature
- under natural density film to mimic in situ light conditions (on deck only)

## Tribs and Nearshore

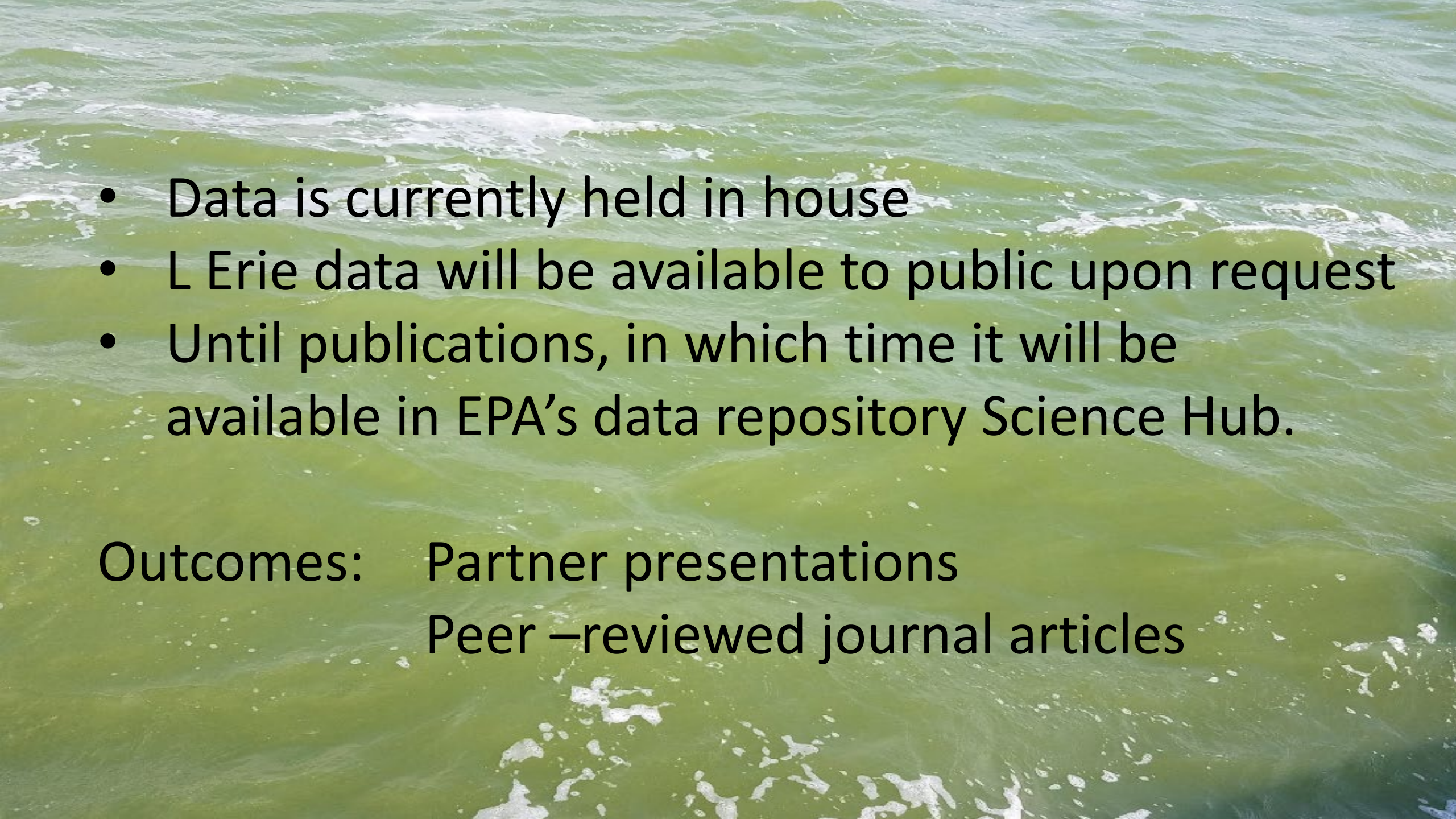
- In situ at Trib site or beach location

Phytoplankton samples also collected at each site for taxonomy.

Tributary sediment: Denitrification enzyme assay, nitrification, ammonification, extractable  $\text{No}_x$ ,  $\text{NH}_x$  and  $\text{Po}_x$ , 12 ecoenzyme suite,



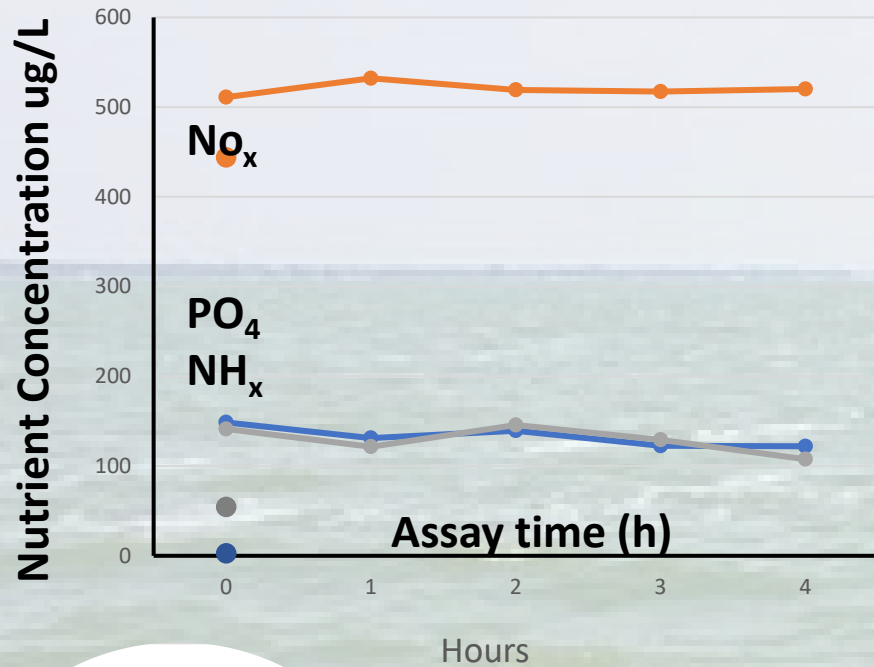


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- Data is currently held in house
  - L Erie data will be available to public upon request
  - Until publications, in which time it will be available in EPA's data repository Science Hub.

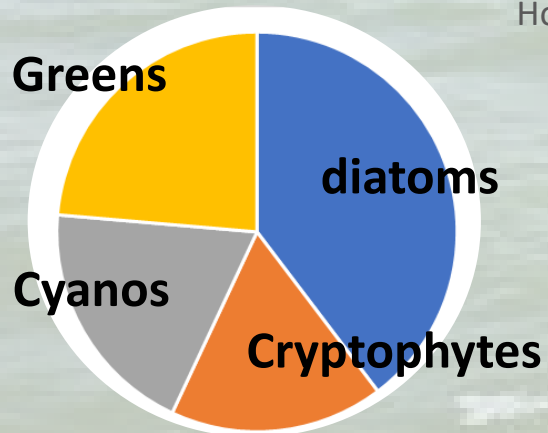
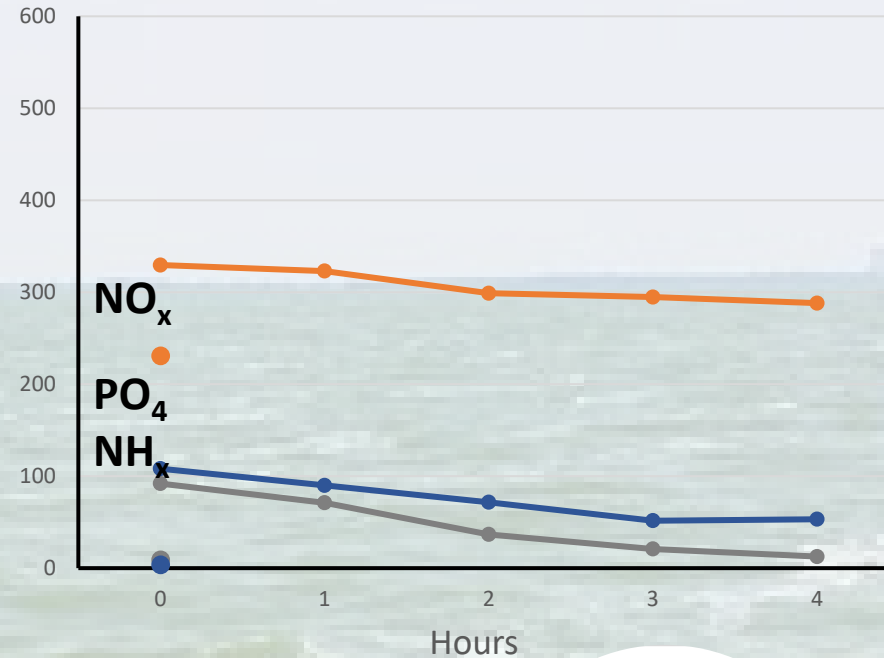
Outcomes: Partner presentations  
Peer –reviewed journal articles

# Nutrient uptake dynamics in Lake Erie (CSMI 2019)

## Low Chl a (2.6 ug/L)



## High Chl a (40 ug/L)



Nutrient uptake assays show minimal nutrient uptake in low Chlorophyll a sites, while high Chlorophyll a sites show Ammonium and Phosphate as the preferred nutrients, possibly co-limiting.

