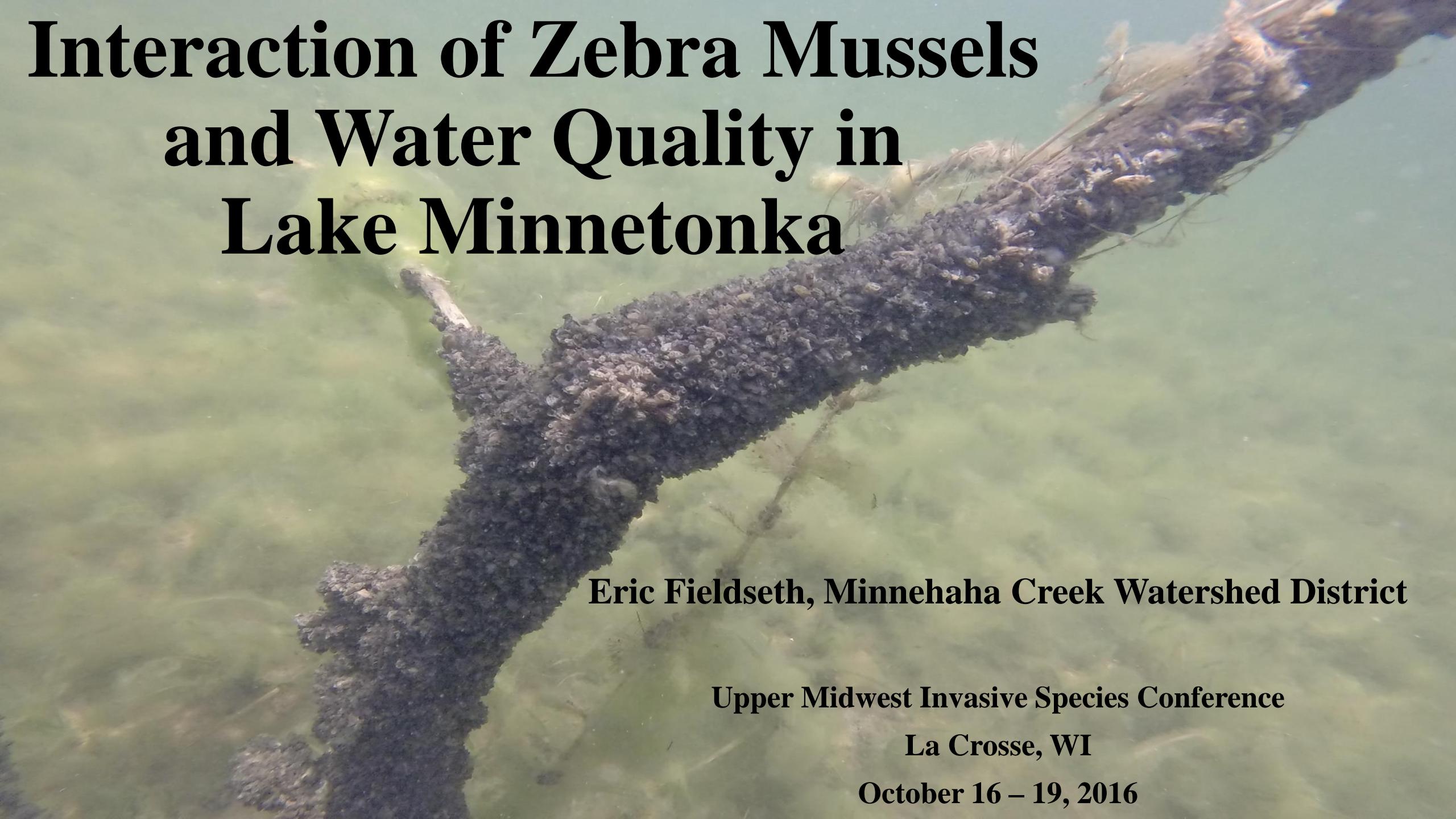


Interaction of Zebra Mussels and Water Quality in Lake Minnetonka

A photograph taken underwater showing a log that is completely covered in a dense, dark, and textured layer of zebra mussels. The log is positioned diagonally across the frame, extending from the bottom left towards the top right. The water is a murky, greenish-brown color, and the background is filled with similar aquatic plants and debris. The overall scene illustrates the significant impact of zebra mussels on the lake's ecosystem and water quality.

Eric Fieldseth, Minnehaha Creek Watershed District

Upper Midwest Invasive Species Conference

La Crosse, WI

October 16 – 19, 2016

Collaborators

Eric Fieldseth, Minnehaha Creek Watershed District

Steve McComas, Blue Water Science



MINNEHAHA CREEK
WATERSHED DISTRICT



Special thanks!

Jill Sweet, Minnehaha Creek Watershed District

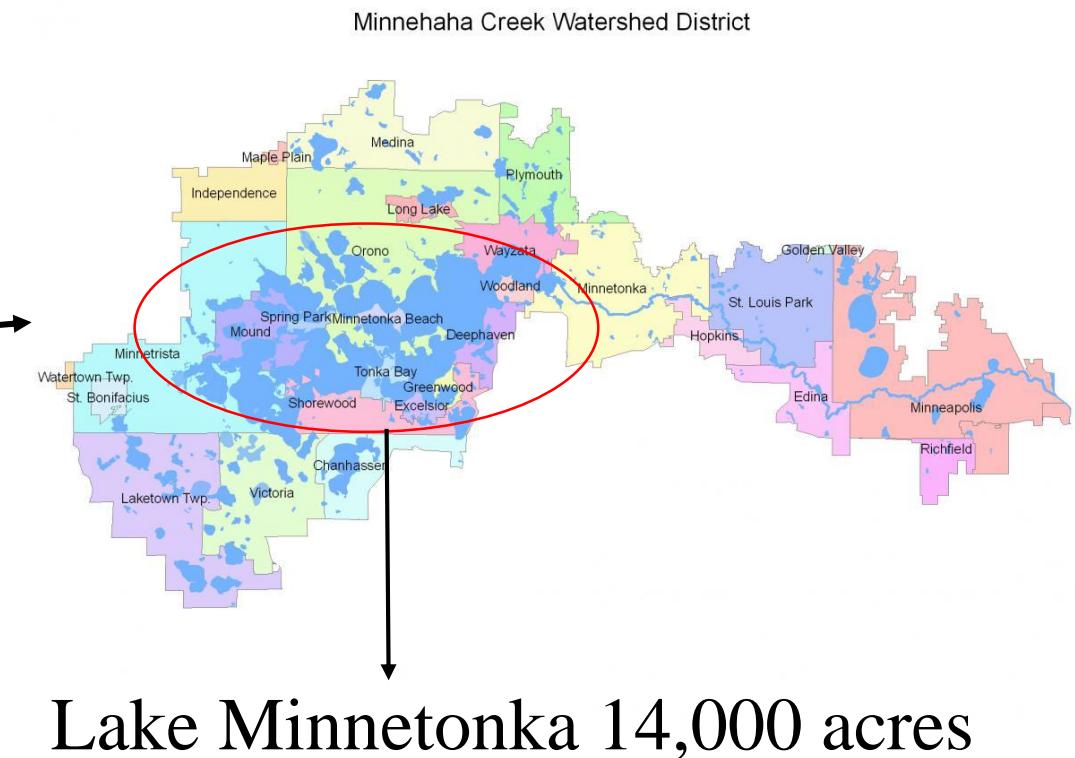
Marcie LaPointe, Minnehaha Creek Watershed District

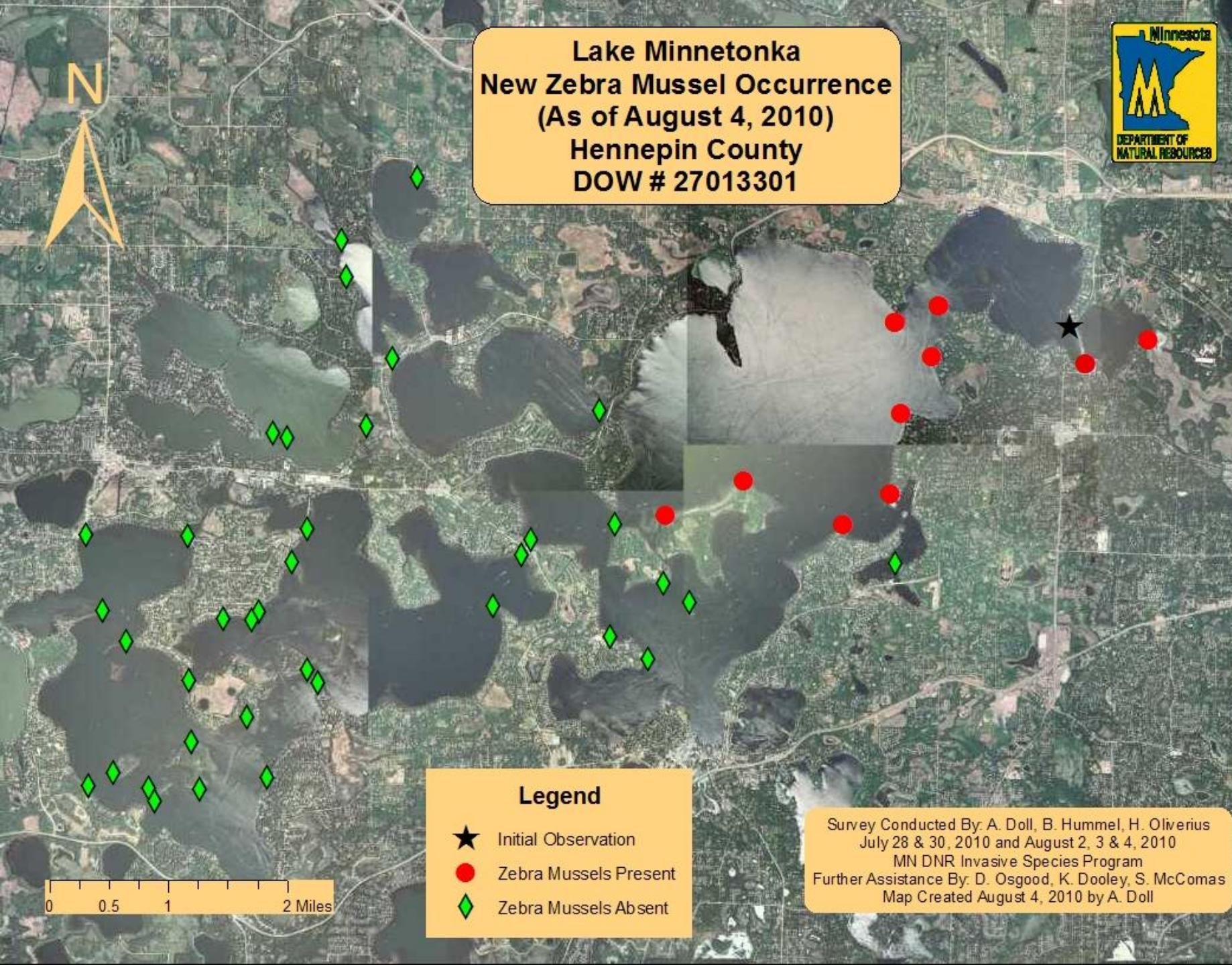
Connor McComas, Blue Water Science



Minnehaha Creek Watershed District

181 square miles
8 major creeks
129 lakes
thousands of wetlands





Zebra Mussels
First Observed
in 2010

Objectives

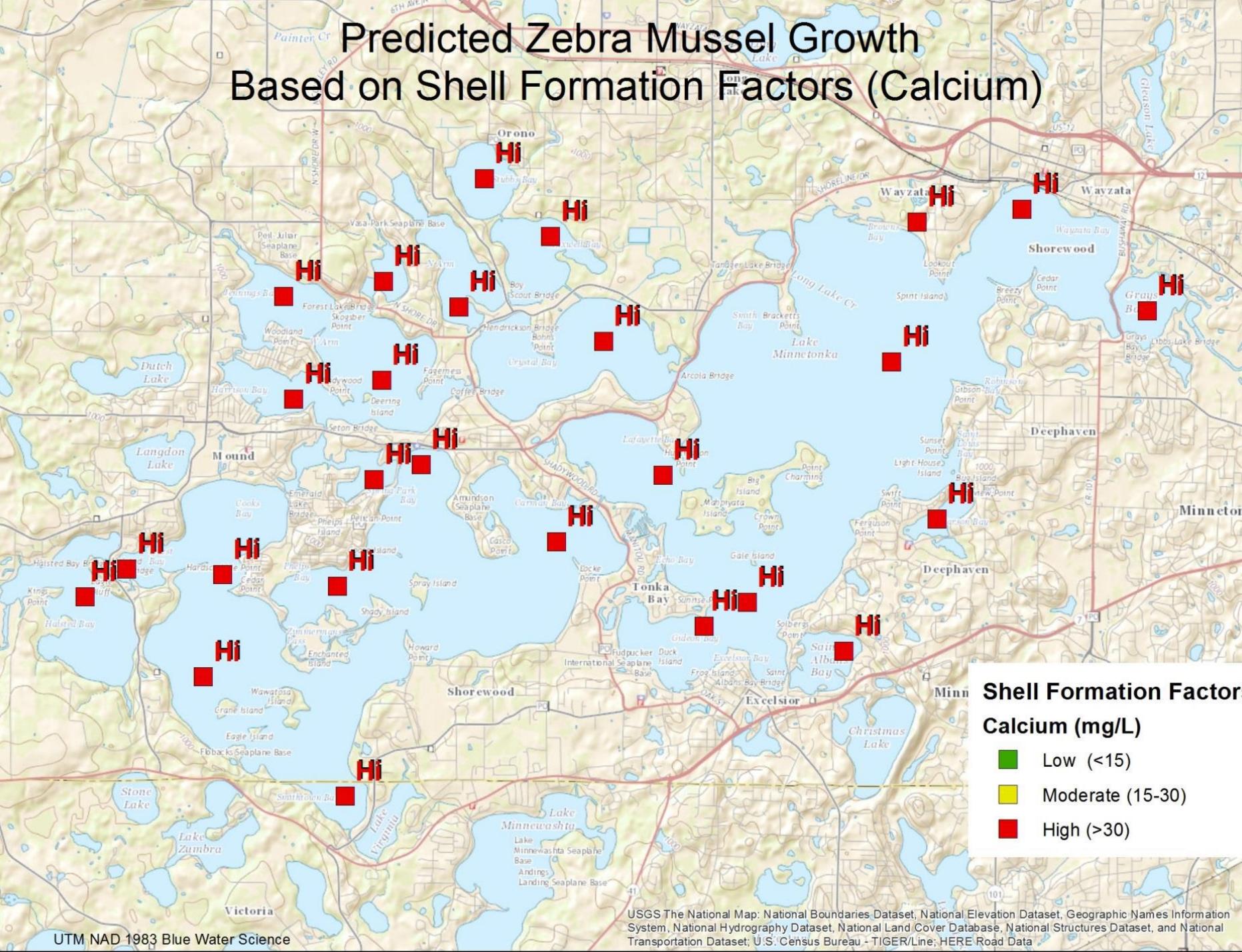
What type of zebra mussel growth would occur in Lake Minnetonka?

How would the lake change?

Natural experiment

(Zebra mussels, variety of water quality conditions, multiple parameters being monitored)

Predicted Zebra Mussel Growth Based on Shell Formation Factors (Calcium)



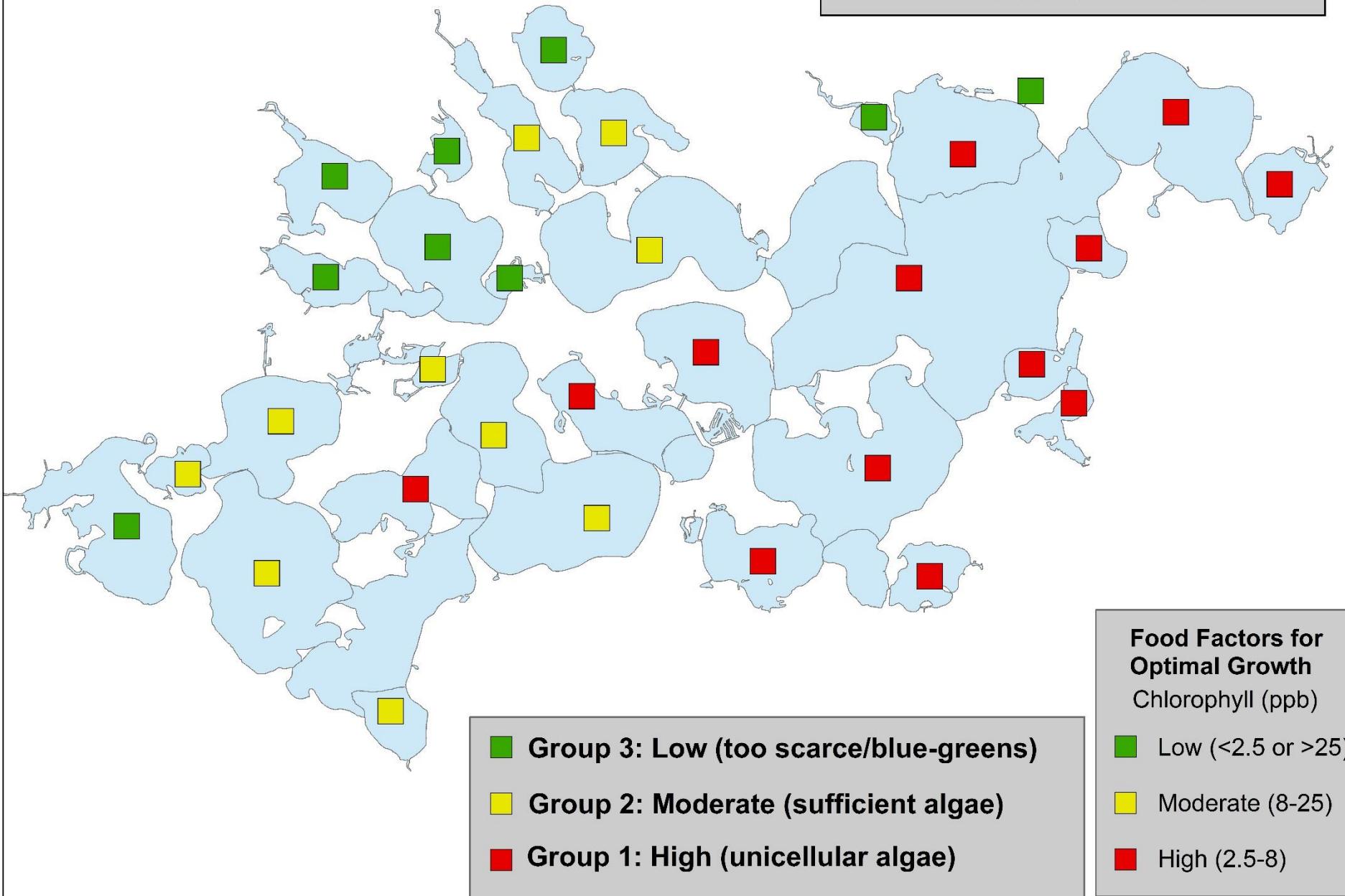
Calcium not limiting

Shell Formation Factors

Calcium (mg/L)

- Low (<15)
- Moderate (15-30)
- High (>30)

Predicted Zebra Mussel Growth
Based on Food Factors



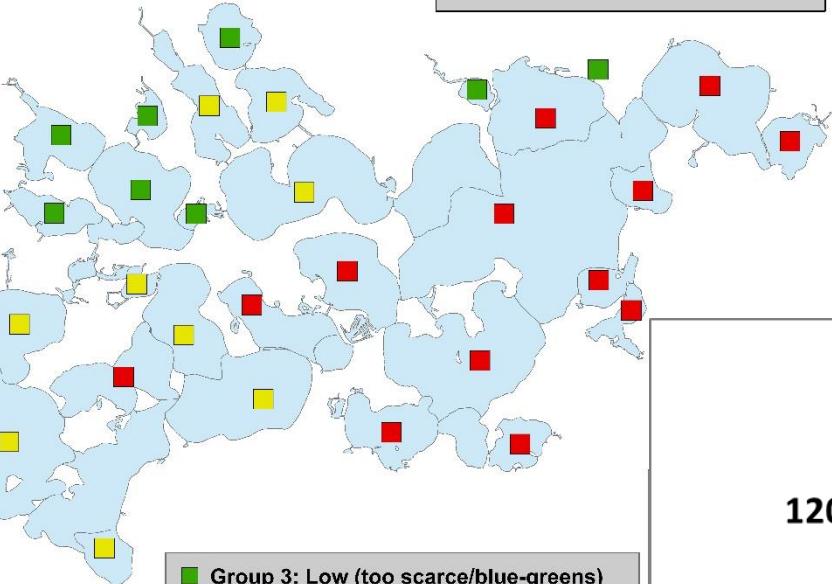
Chlorophyll-a
can be a
prediction tool
for population
growth and
ecological
impacts



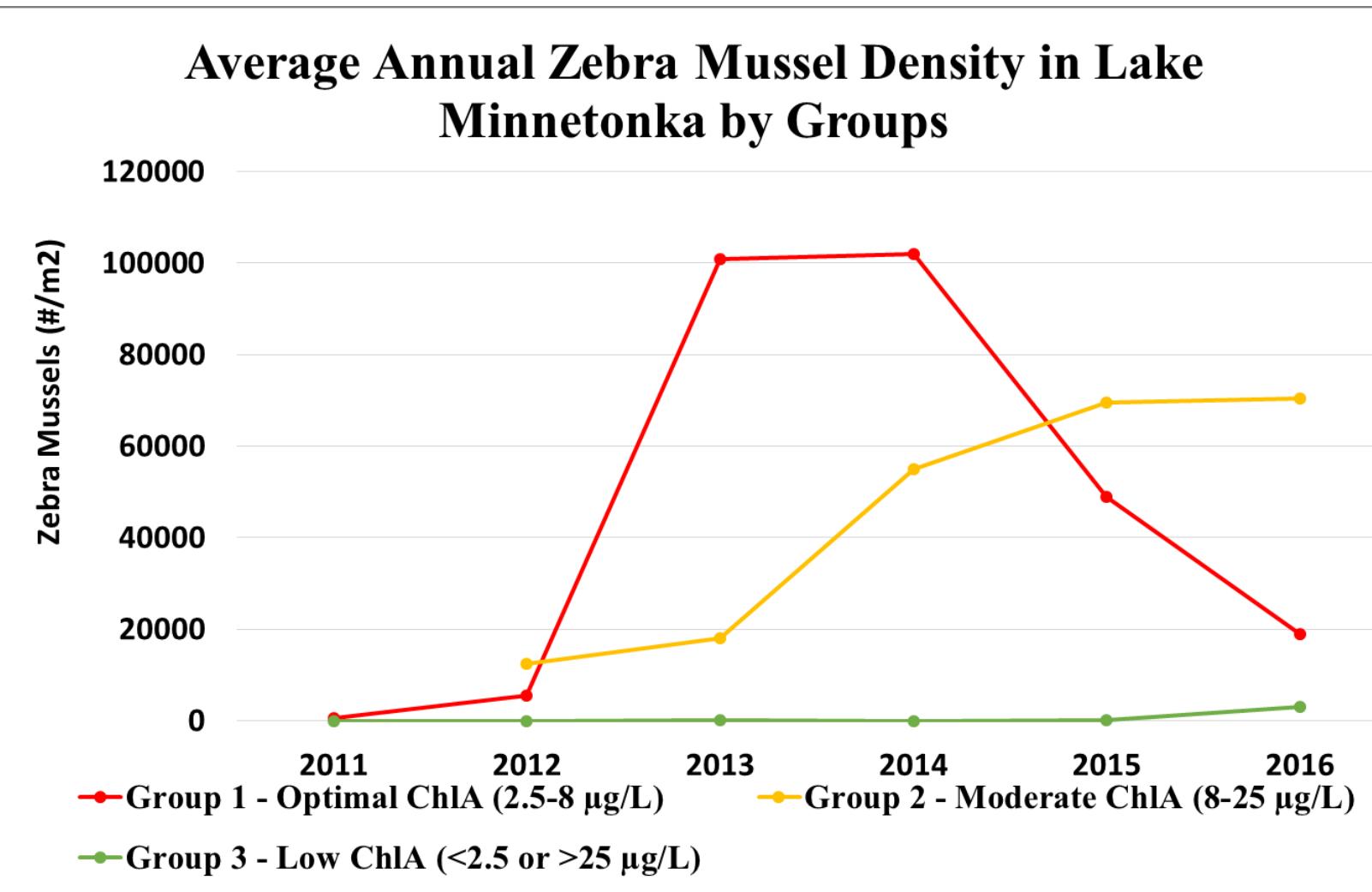
- Monthly & Seasonal Zebra Mussel Densities
- Zebra Mussel Veligers
- Water Quality Data
- Plankton Community
- Algae Community



Predicted Zebra Mussel Growth
Based on Food Factors



6 years after infestation

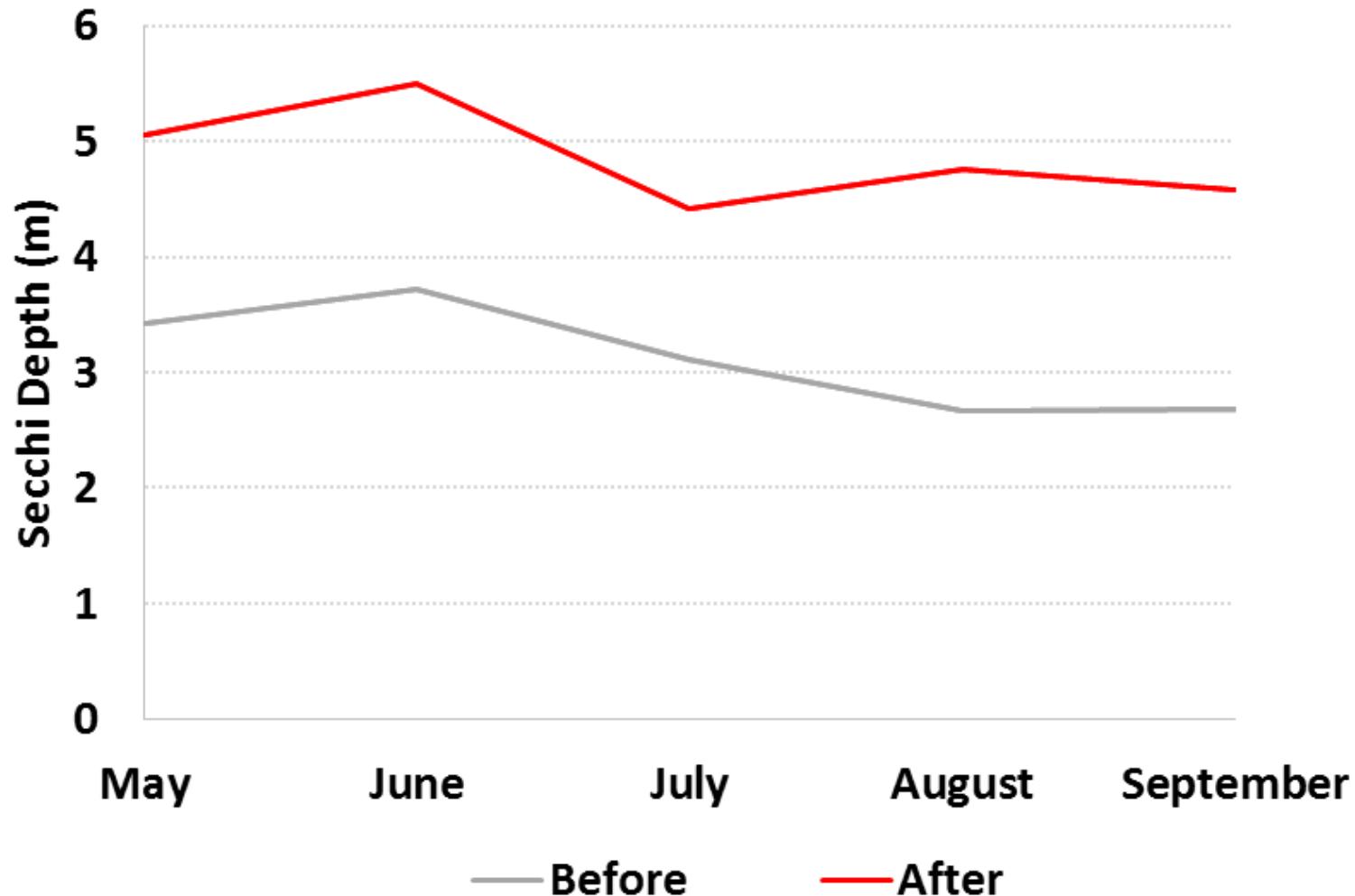


Assessing water quality changes

- Paired t-test with 2011 as a dummy variable for before/after zebra mussel infestation (2007 – 2015)
- 95% confidence interval (p-value < .05 is statistically significant)
- Always difficult to link water quality changes to one source

Water Clarity

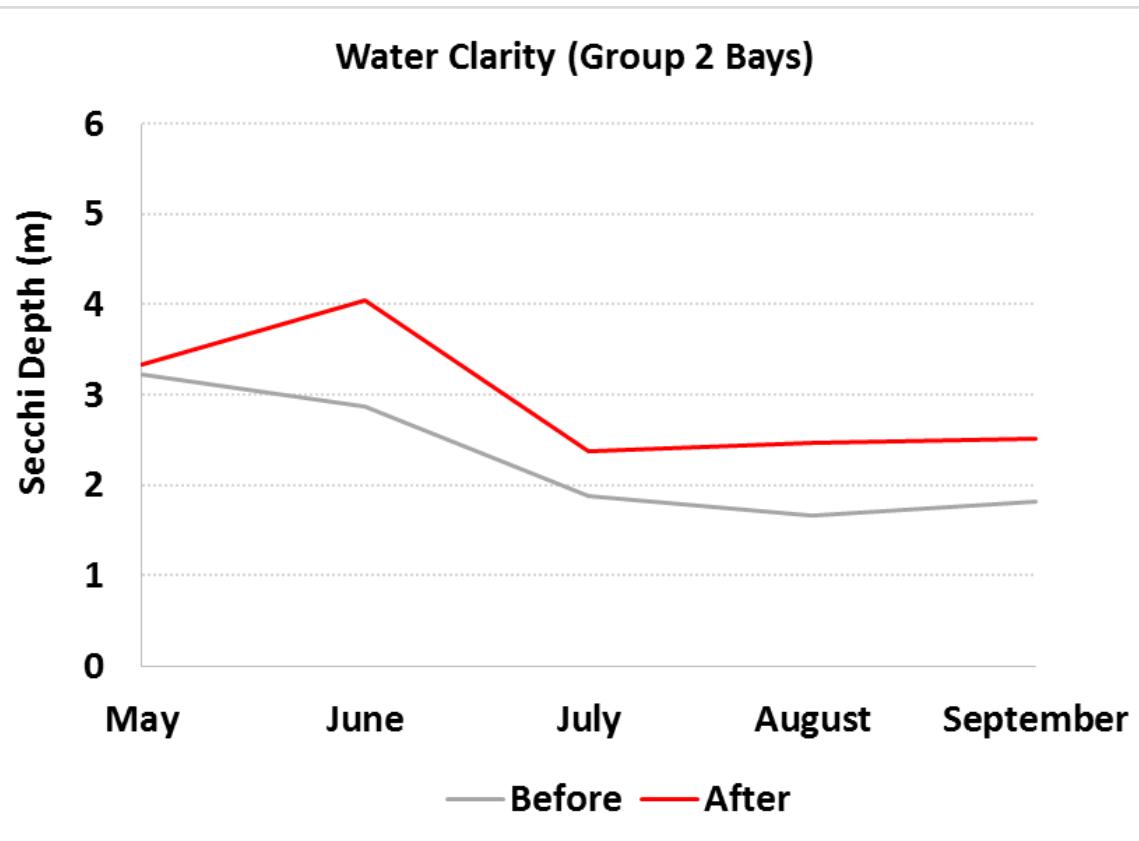
Water Clarity - Group 1 Bays



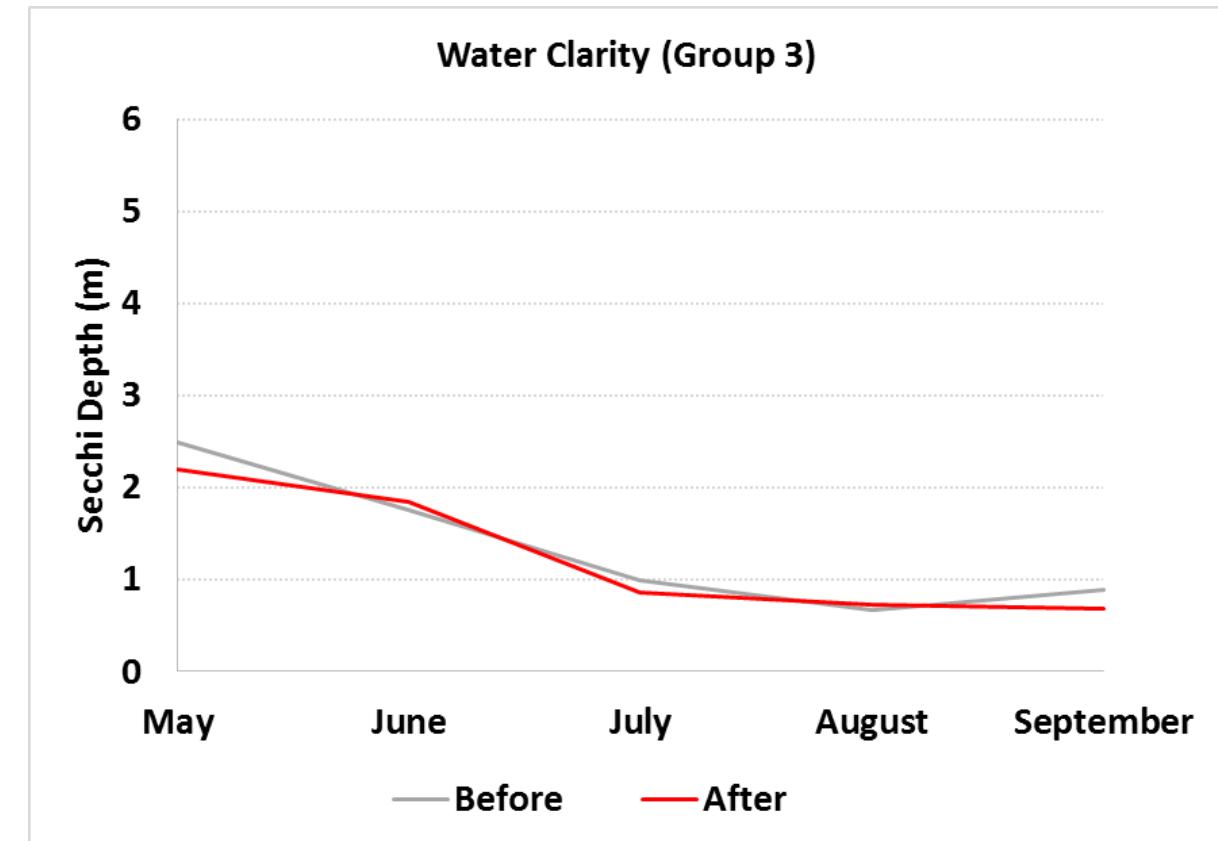
P-value: 5.59E-05

**Significant
increase in water
clarity**

Water Clarity

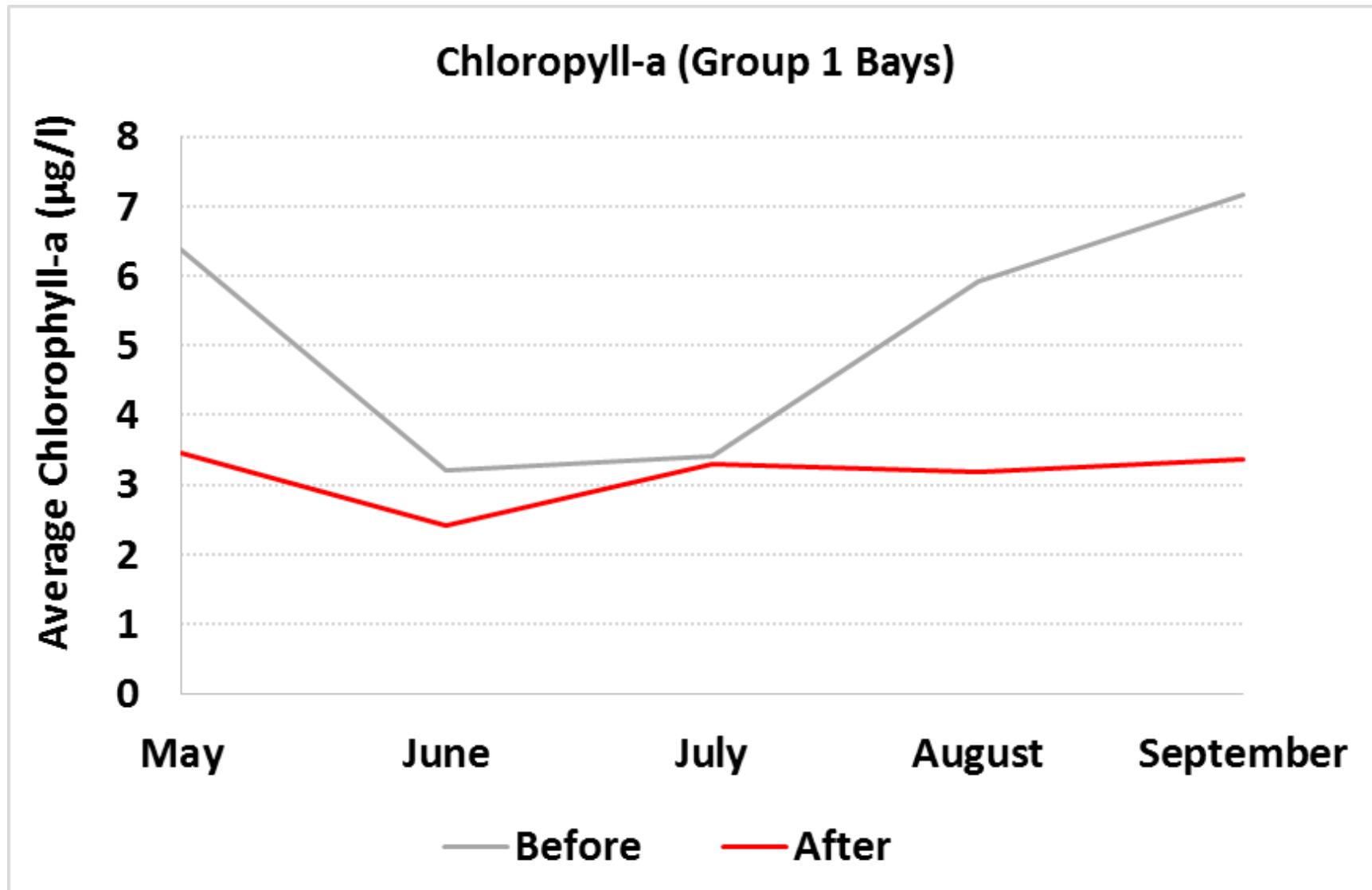


p-value: 0.062841
Nearly significant increase



p-value: 0.582725
No change

Chlorophyll-a

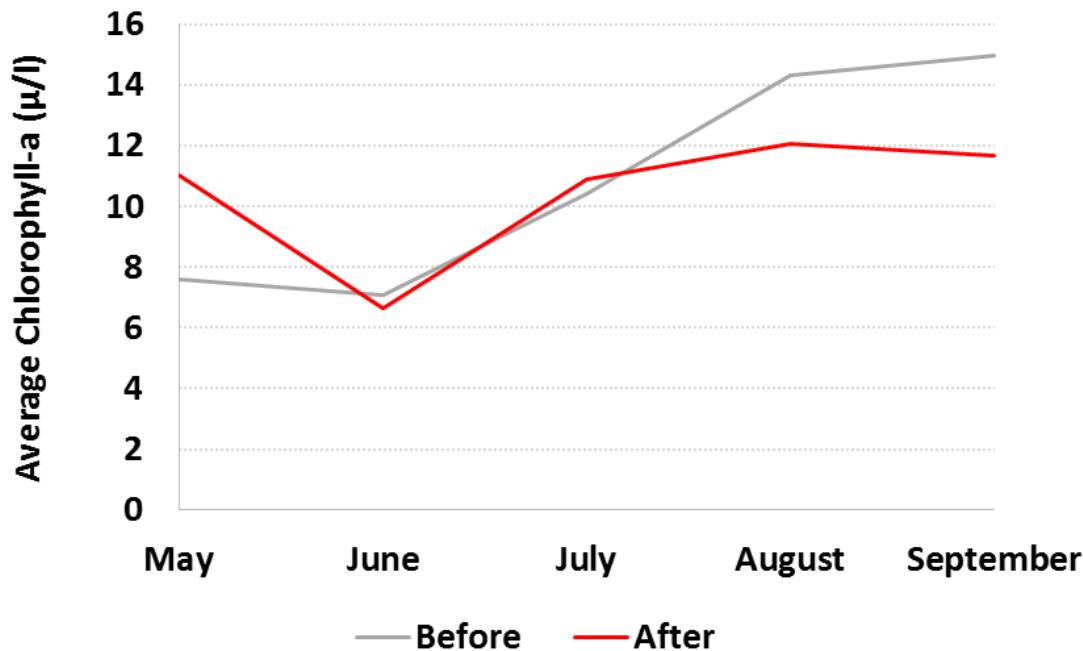


p-value: 0.000378

**Significant
decrease in
Chlorophyll-a**

Chlorophyll-a

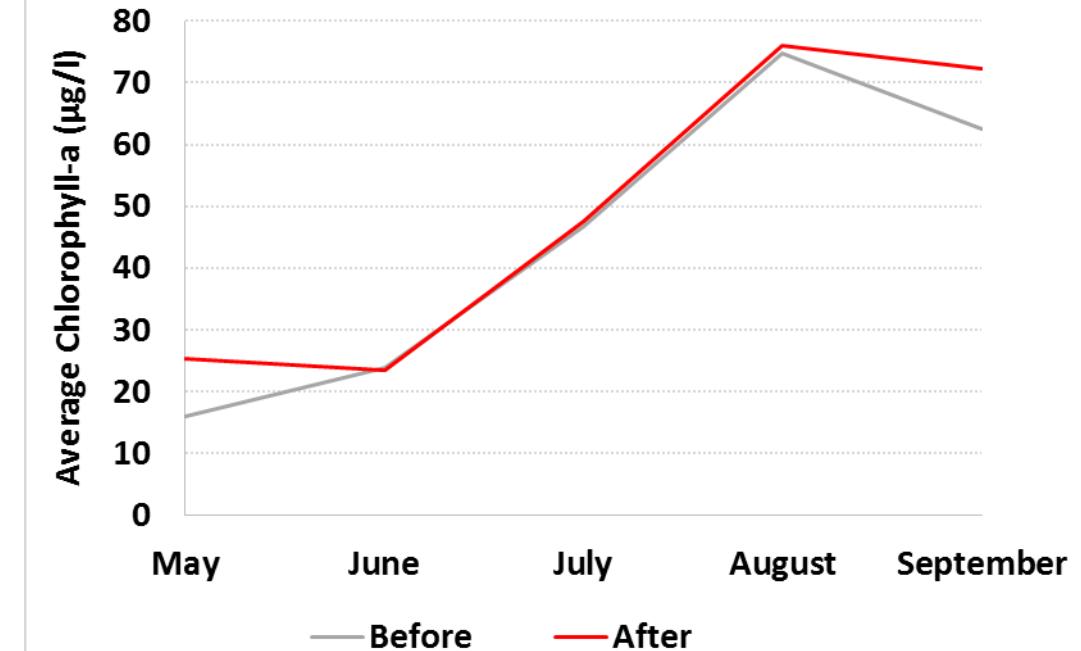
Chlorophyll-a (Group 2 Bays)



p-value: 0.956328

No change

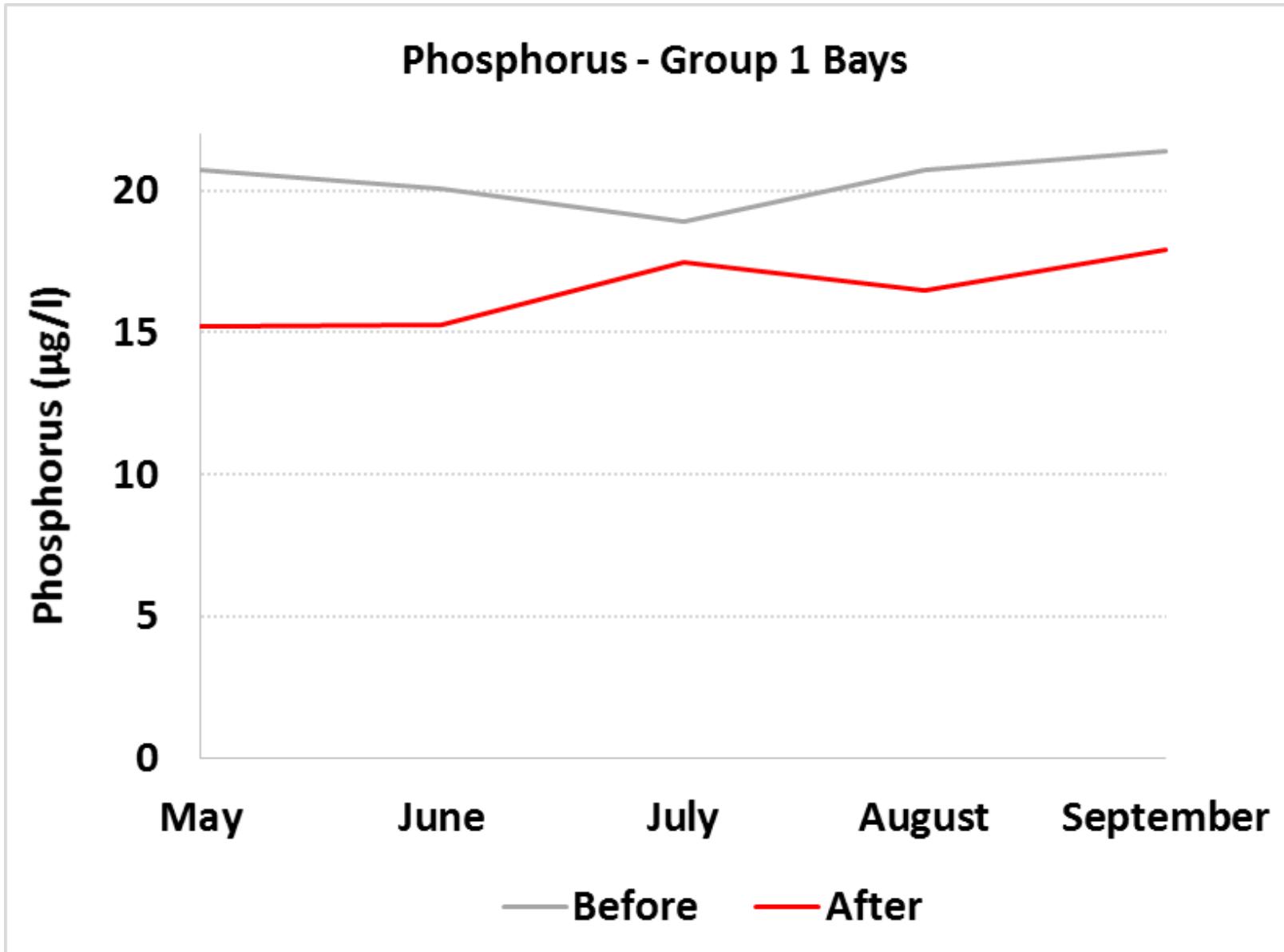
Chlorophyll-a (Group 3 Bays)



p-value: 0.939694

No change

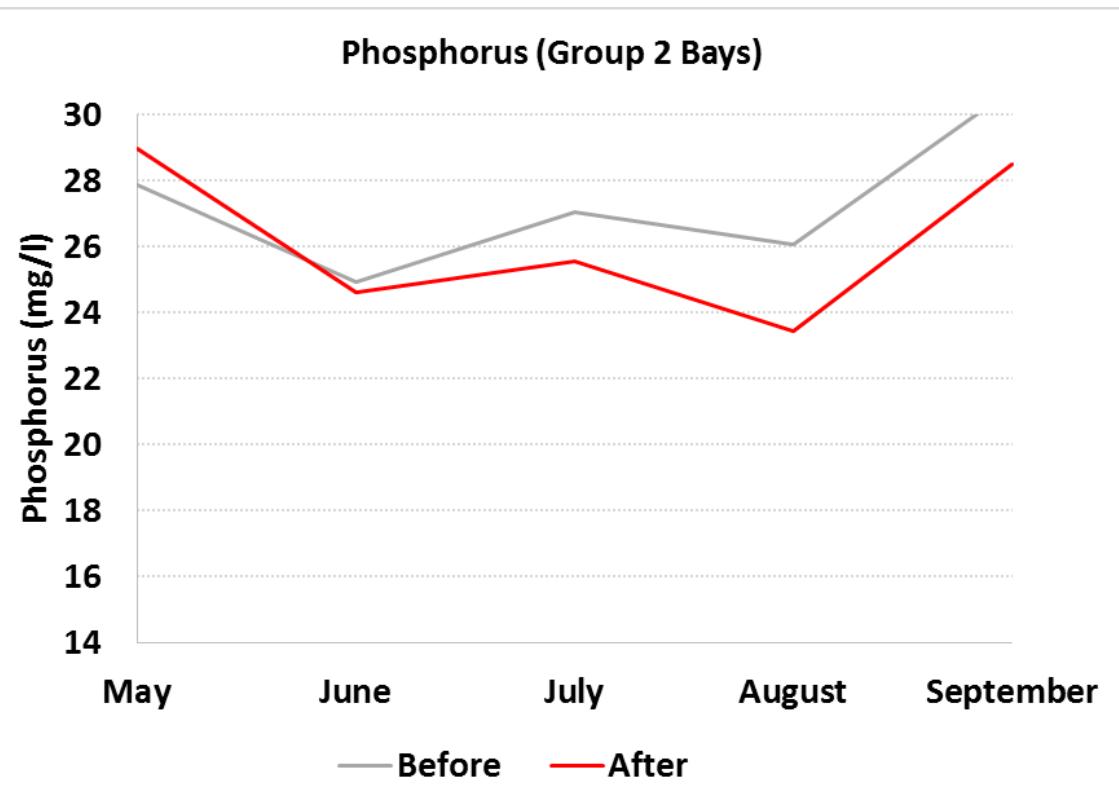
Phosphorus



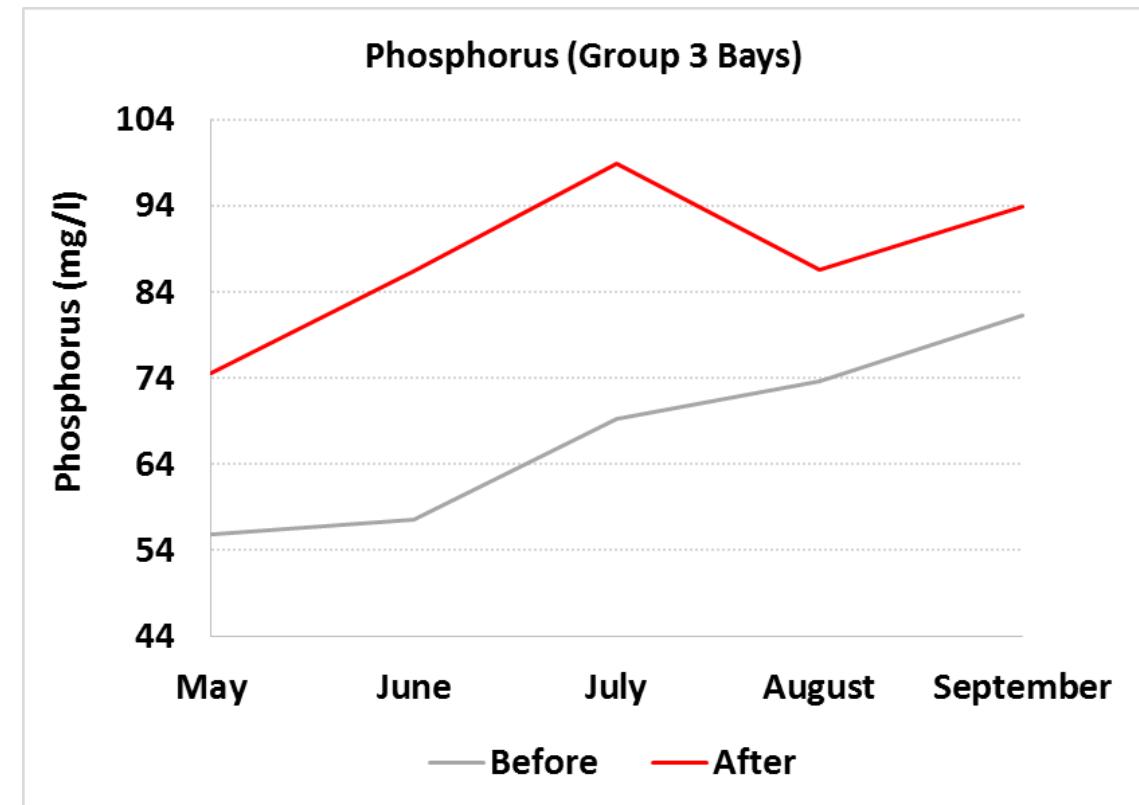
p-value: 0.001254

**Significant
decrease in
Phosphorus**

Phosphorus



p-value: 0.005206
Significant decrease
in Phosphorus



p-value: 0.013676
Significant increase
in Phosphorus

What Did We Learn?

In high zebra mussel density bays

Water Clarity 

Algae 

Some bays are becoming food limited after high zebra mussel growth

Zebra mussels in Group 1 Bays 

What Did We Learn?

- Algal composition influences zebra mussel growth
- Highly eutrophic bays have low zebra mussel populations
- Zebra mussels have greatest impact in moderately fertile bays and lakes (mesotrophic)
- This study can be used as a predictive tool for other lakes

Next Steps

- Short term monitoring (2011-2015) has been vital to understanding how the lake has changed
- Lake changes will continue
- Long term monitoring is necessary to understand full impacts of zebra mussels on lakes
- SCUBA surveys were done in 2016 – how does that compare to plate samples
- Complete analysis on algae and plankton community

A Few of Many Ongoing Questions

What density of zebra mussels can cause change?

- > 10,000/m² based on seasonal plate samplers

Will zebra mussel populations ever reach high densities in the highly eutrophic bays?

Zebra mussels have changed water quality in the short term, what does that look like in the long term?

Can seasonal plate sampling be an effective way to assess zebra mussel populations?

- Less intensive than SCUBA

Priests Bay 2016
~ 187,000 zebra
mussels/m²



Any
Questions?