Lake Simcoe: Current status

LSRCA Annual General Meeting

January 24, 2020

Brian Ginn PhD

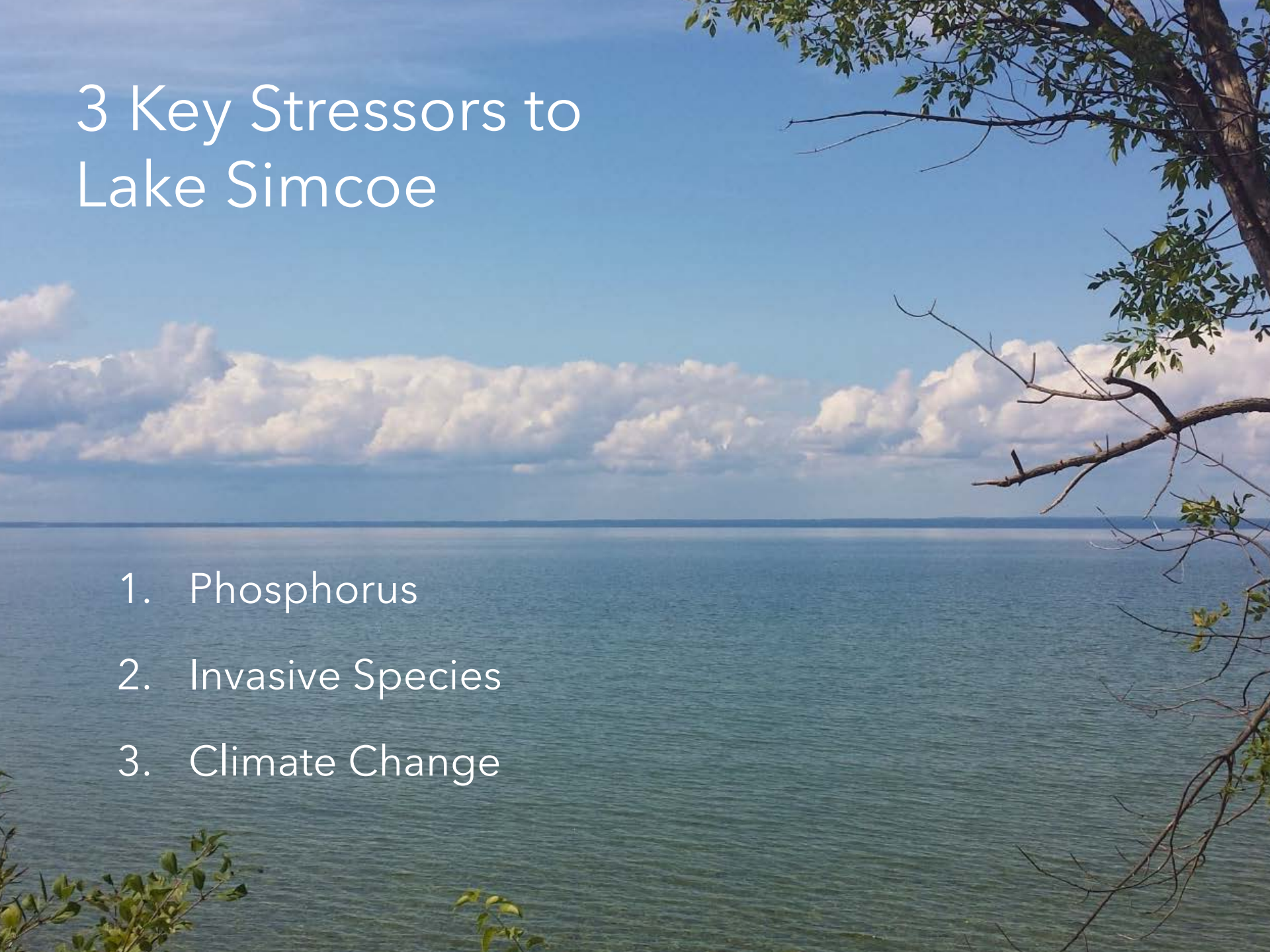
Limnologist

Certified Lake Manager (NALMS)

Lake Simcoe Region conservation authority

Our Role in Lake Research

- Address residents' concerns
- Fill data gaps (nearshore zone)
- Investigate new / emerging issues
- Work with MECP and MNRF

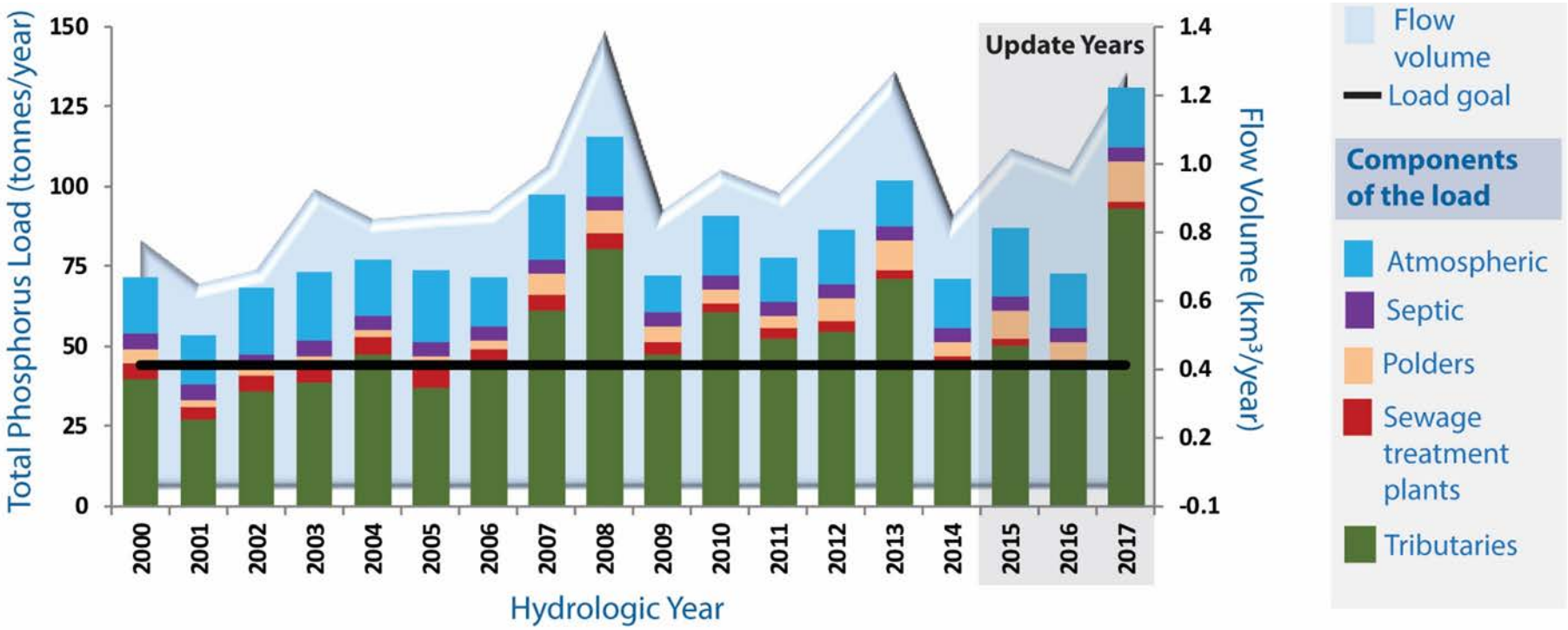


3 Key Stressors to Lake Simcoe

1. Phosphorus
2. Invasive Species
3. Climate Change

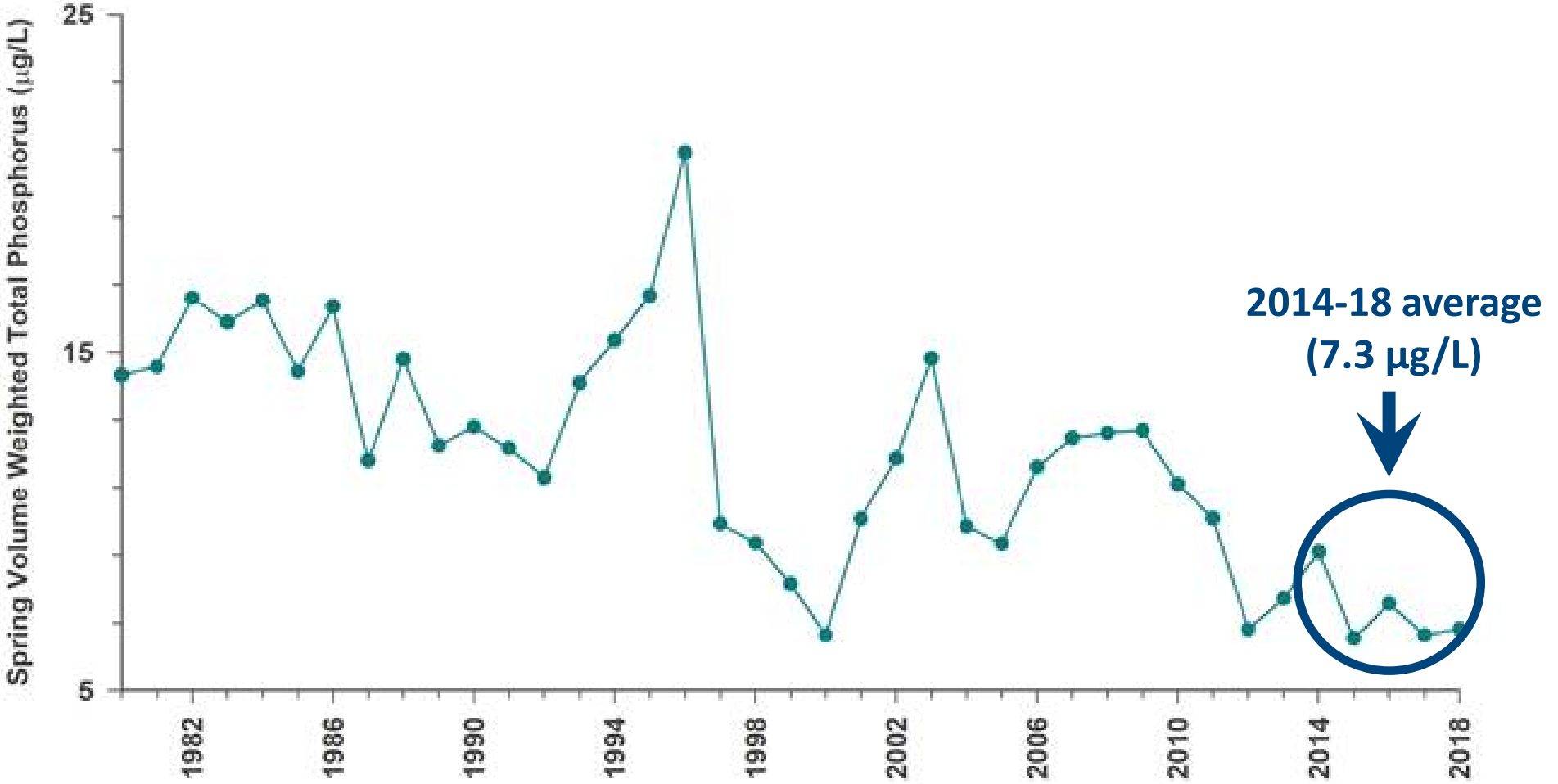
Phosphorus Loads (supply to lake)

- Very dependent on tributary flow, precipitation, and winter melt events
- **Timing and intensity of precipitation are critical!**



Phosphorus Concentration (amount in lake)

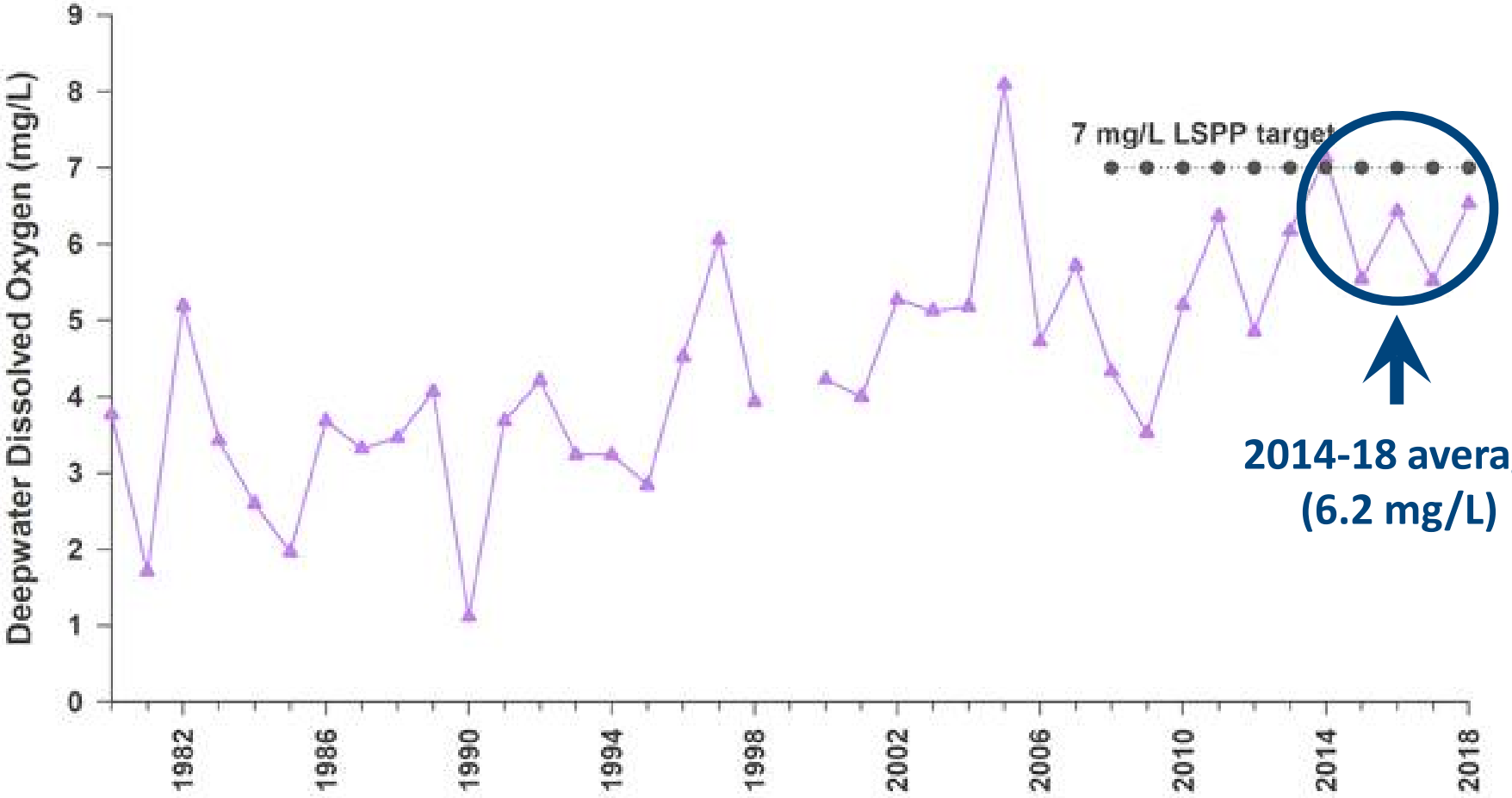
- **Improved since 1980, but we need continued lake management**
- Phosphorus reduction strategies (and probably invasive mussels & aquatic plants)



MECP 2020;

Deepwater Oxygen (and coldwater fish)

- Basis of LSPP target (DO = 7 mg/L → 44 tonnes P loading)
- High phosphorus → more algae → decomposition → less oxygen → fewer fish



Loads Change, Lake Stays the Same?

Limnological Theory

Increased P Loading → Increased P Concentration → Lower Oxygen

- **Lake Simcoe:**
  - Theory: P load 131 tonnes → P concentration ~13-18 µg/L → oxygen 1-3 mg/L
  - Actual : P load 131 tonnes → P concentration = 6.8 µg/L → oxygen = 6.5 mg/L

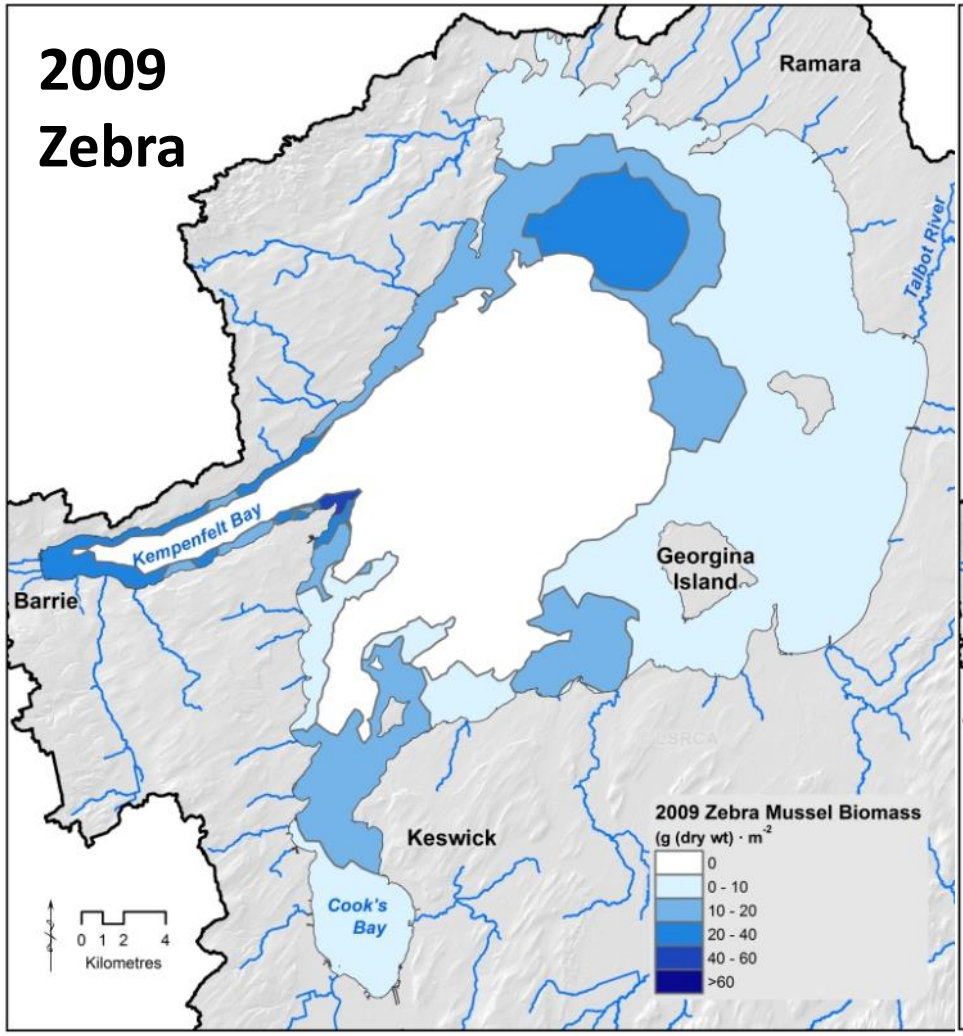
What's Going On?

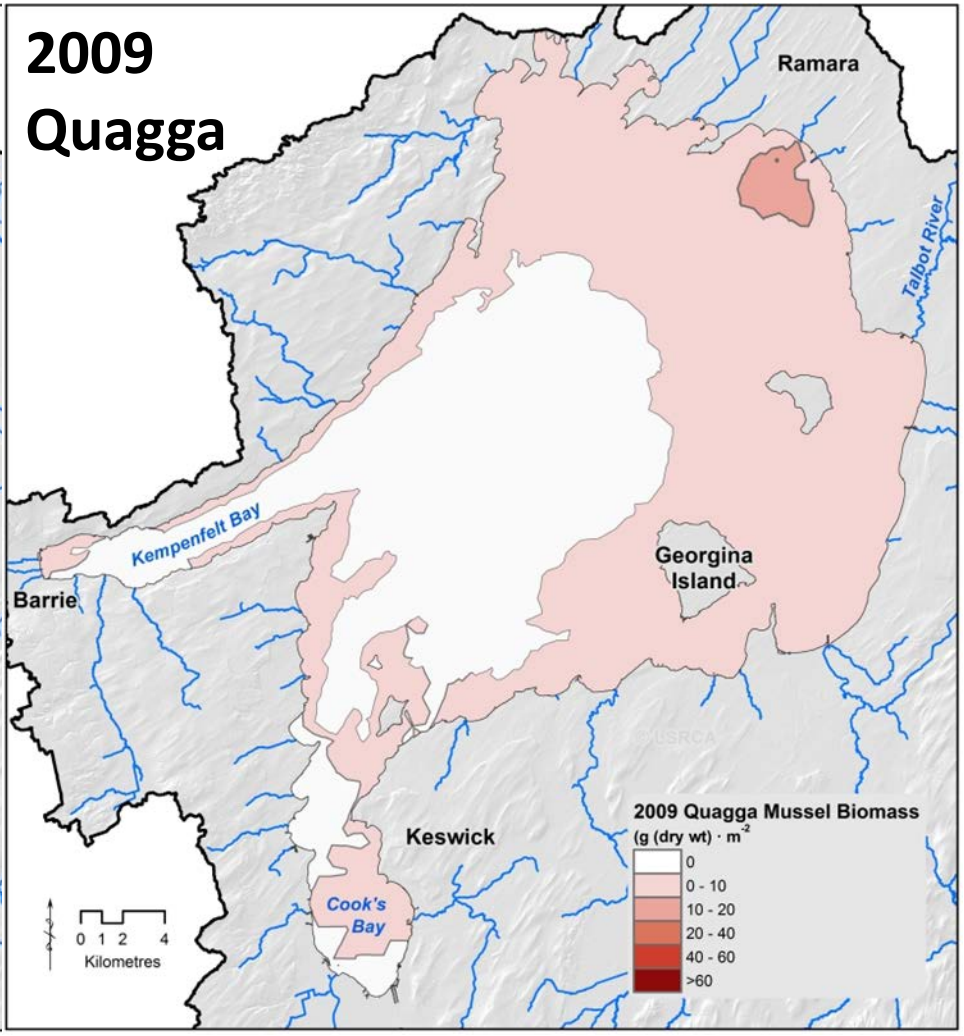
1. Climate and hydrology?
2. Zooplankton increase?
3. **Quagga mussels?**
4. **Invasive plants?**

LSRCA

Role of invasive mussels

- 2009: 84% zebra mussels
- Shallow water “ring” around lake



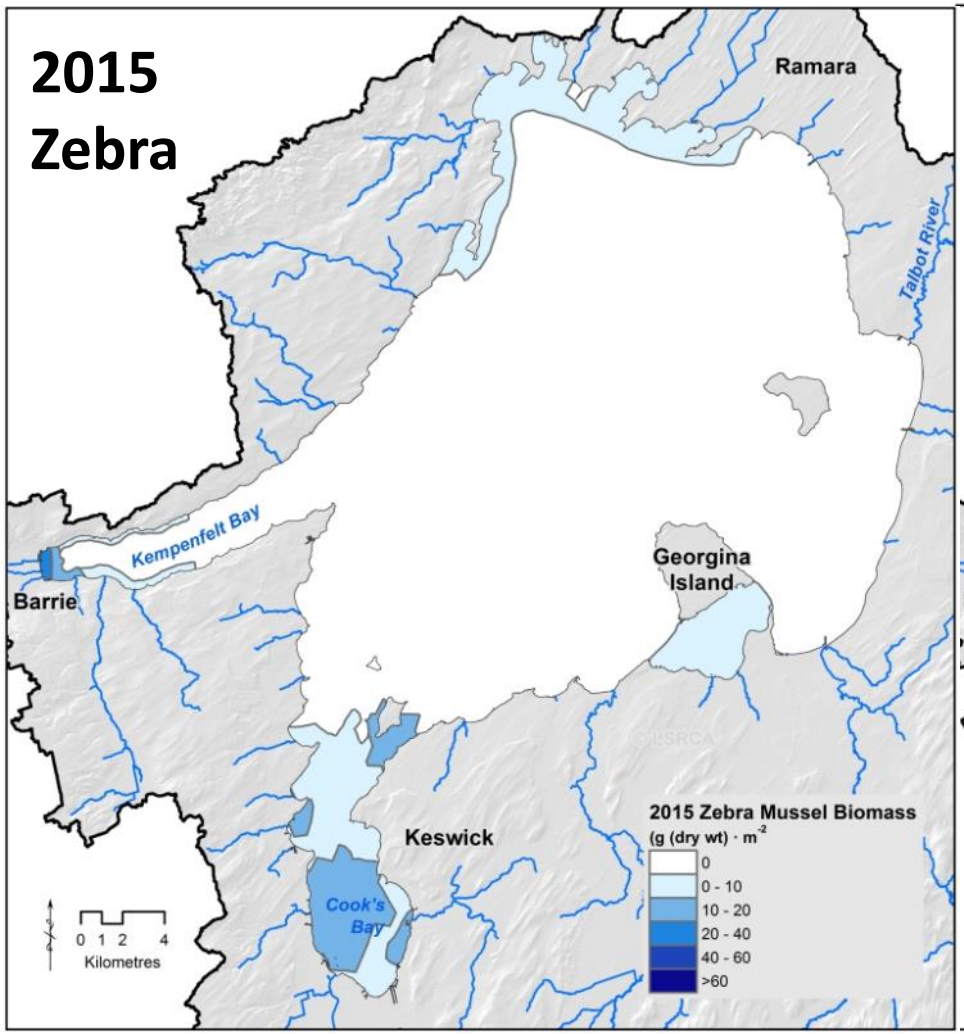


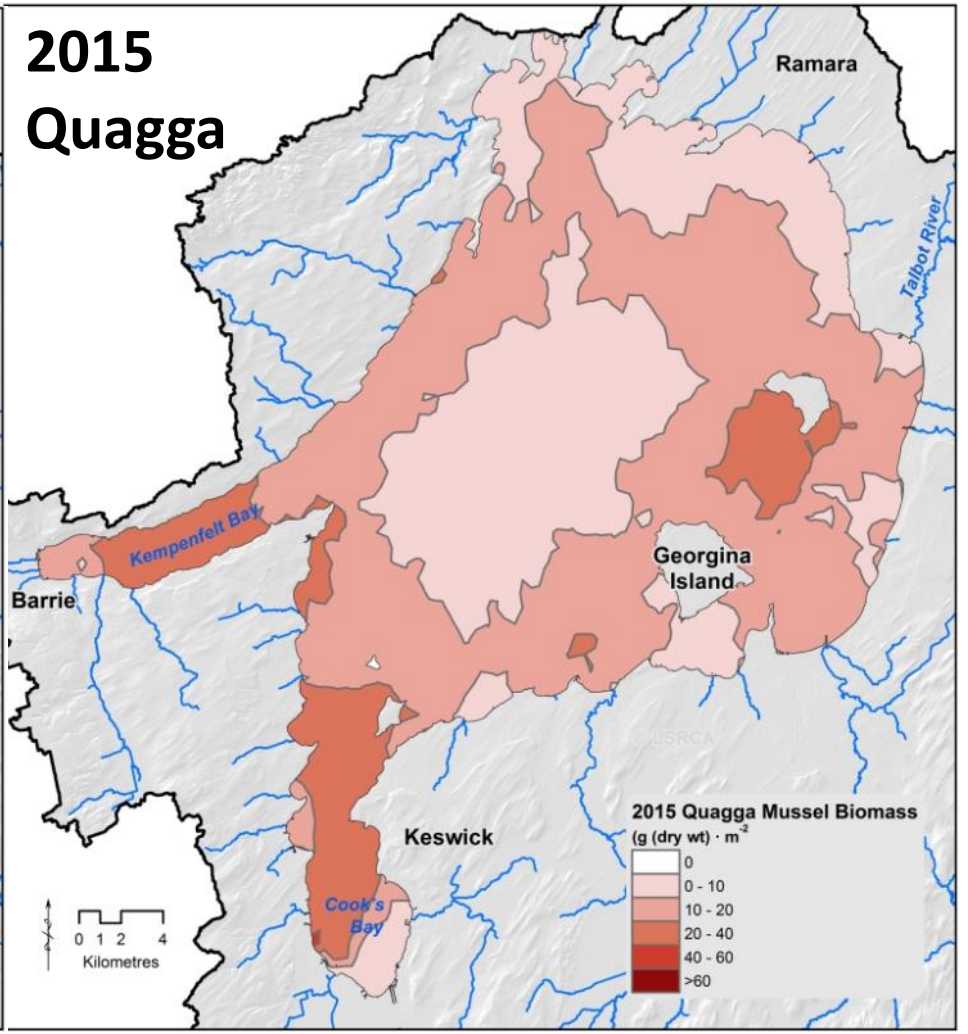
Ginn et al. 2018. J. Great Lakes Res.

Role of invasive mussels

- 2015: 88% quagga mussels
- Deep water invasion

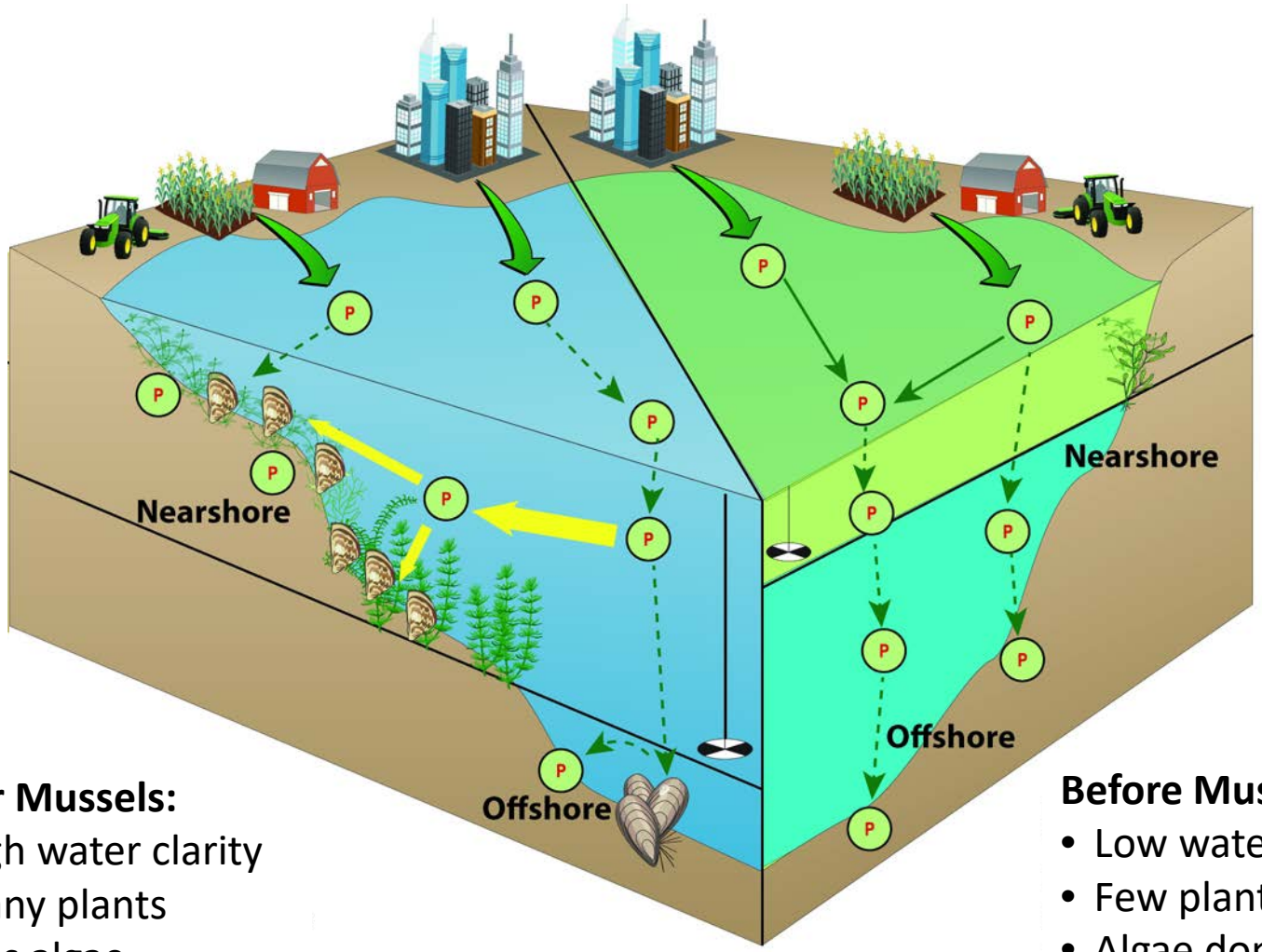
- The “ring” remains present





Ginn et al. 2018. J. Great Lakes Res.

Invasive mussel influence



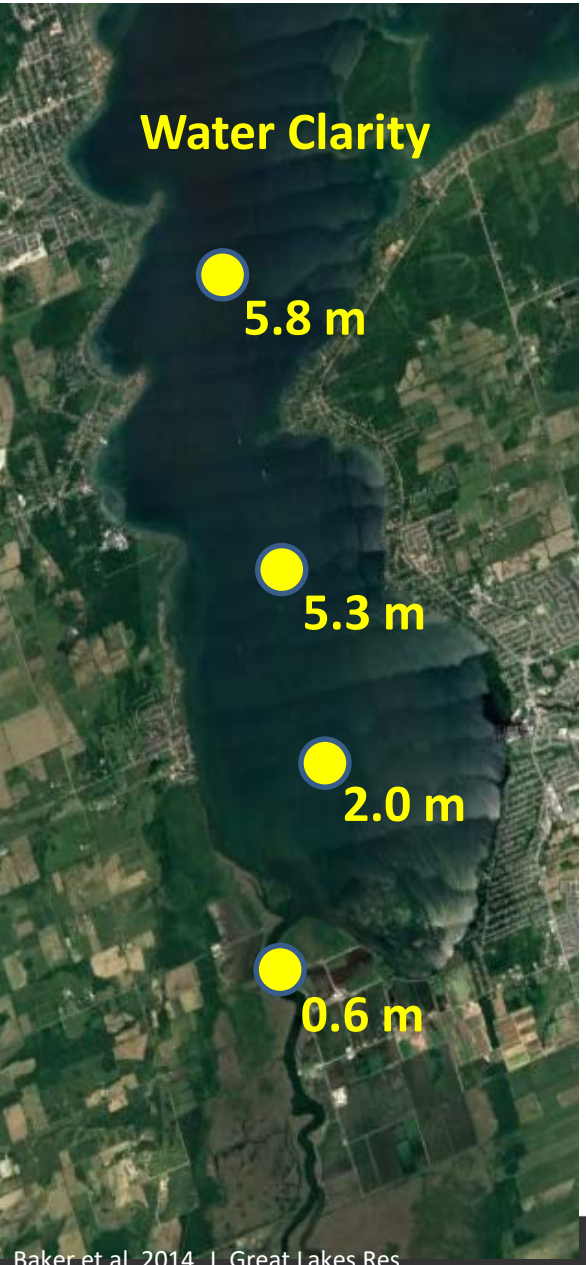
After Mussels:
- High water clarity
- Many plants
- Less algae

Before Mussels:
- Low water clarity
- Few plants
- Algae dominated

Phosphorus (mostly) retained in shallow water

Hecky et al. 2004. Can. J. Fish. Aquat. Sci.

Are mussels changing phosphorus?



- Filter lake volume every 2.75 days
- Very efficient at removing particles (e.g. Cook's Bay)

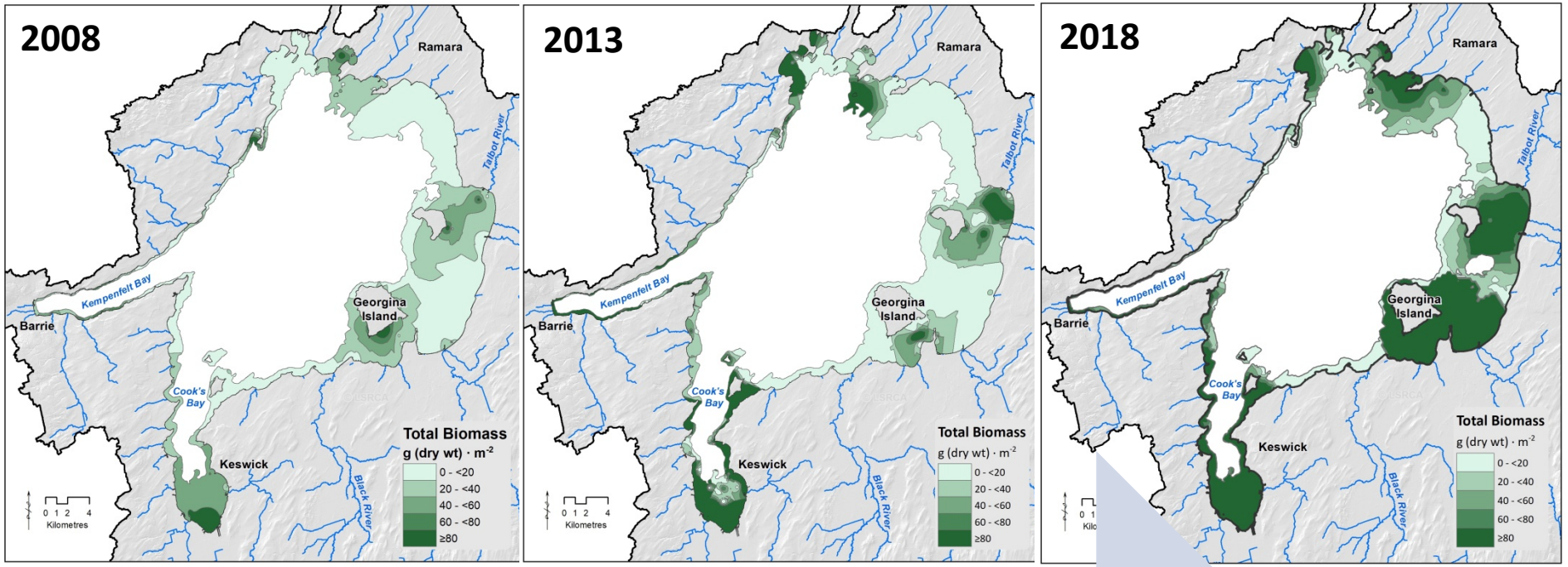
- **There are 2 types of P:**
  - particulate P (75-80%): mussels / sedimentation
  - dissolved P (20-25%): mostly bioavailable

- Lake Michigan: mussels reduce particulate P, increase dissolved P

- **If true, what happens to dissolved P in Lake Simcoe?**

Baker et al. 2014. J. Great Lakes Res.
Shen et al. 2020. Ecol. Model.

Aquatic plants have increased… a lot



29.9 g/m^2

80.3 g/m^2

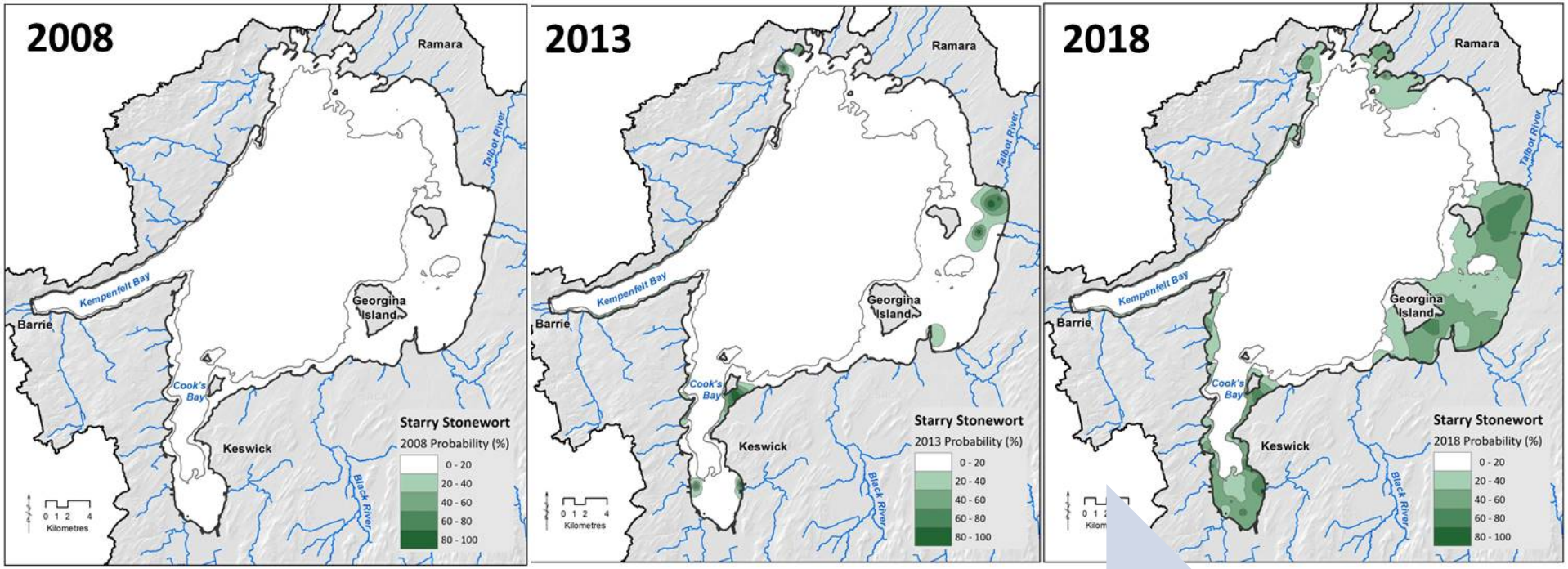
153.9 g/m^2

- Like mussels, a “ring” of plants in shallow water
- Increase is mostly one (invasive) species

Starry Stonewort

- From Eurasia - St. Lawrence R. (1974); L. Simcoe (2009)
- “Macro- algae” (plant-like algae)
- **No roots, all nutrients come from water**
  - dissolved P → plant biomass

Starry Stonewort Expansion



0%

31.4%

67.6%

Summary

- The lake has improved, but loads did not?

- Why is there a disconnection?

- **Phosphorus loads:** timing / intensity of precipitation
- **Invasive species:** How are they impacting nutrients?

- We need targeted monitoring to find our answers

- **Lakes are complex ecosystems!**
  - "*It's not rocket science, it's much, much, more difficult*" ~J.P. Smol

Our Lake Research Moving Forward

- Study dissolved and particulate phosphorus
- Are plants and mussels our phosphorus sink?
- What does this disconnection mean to lake management?

Our existing strategy / targets were based on different environmental conditions!