

Why we need adaptive lake management

LSRCA Board of Directors

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Limnologist

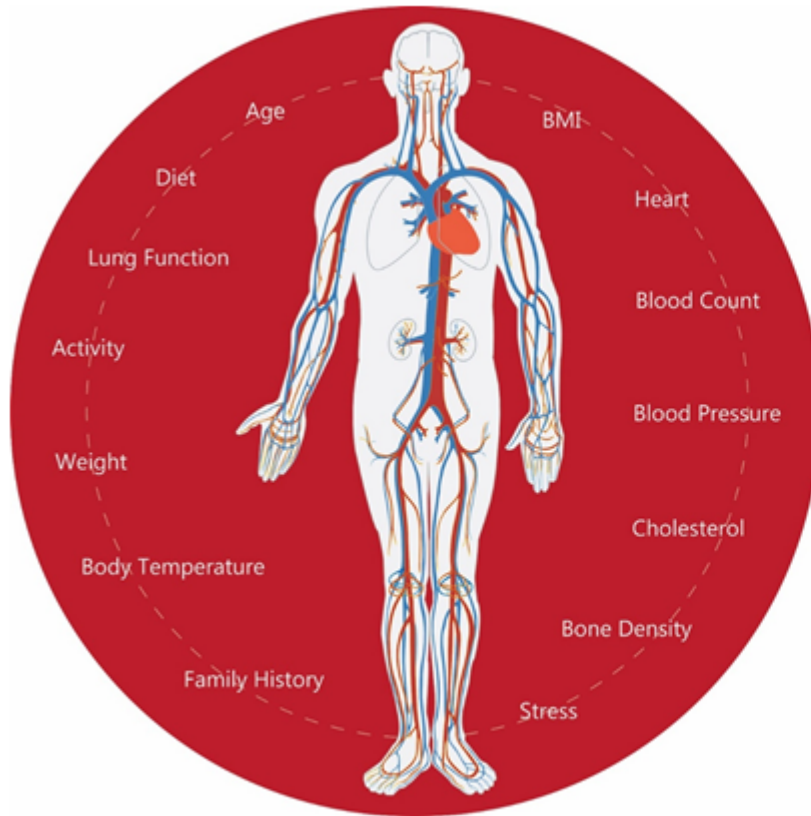
Certified Lake Manager (NALMS)



Lake Simcoe Region
conservation authority



How we determine overall health



Our Health

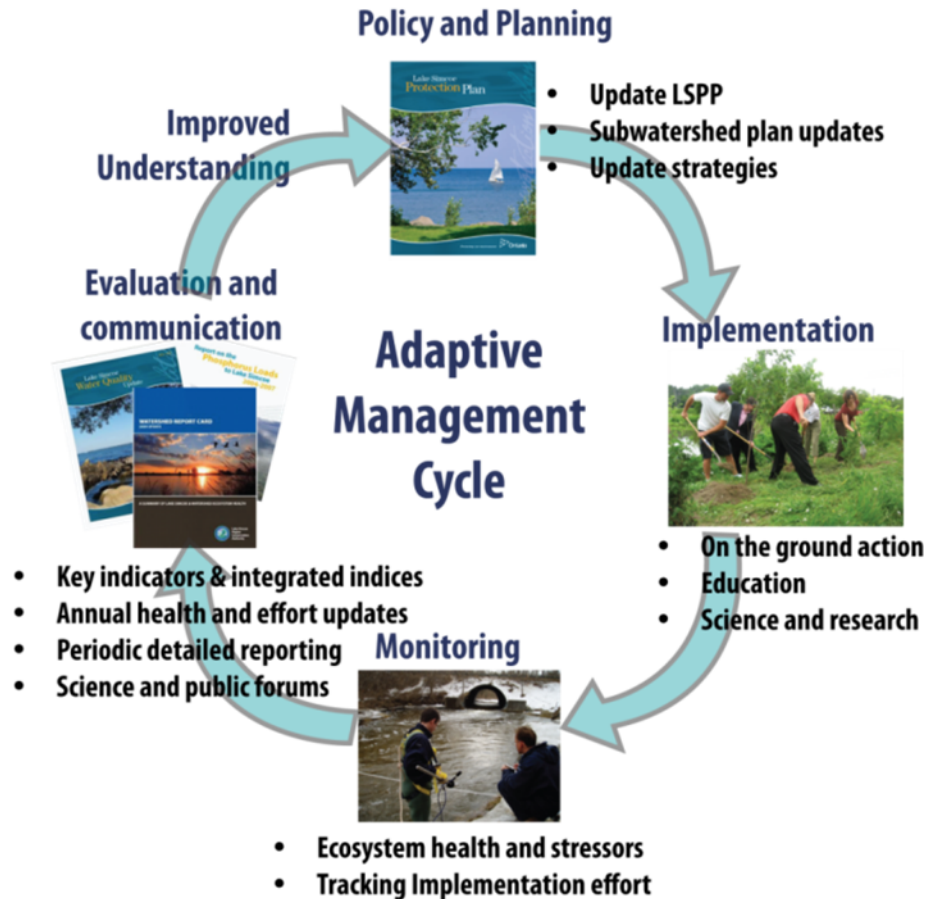


Lake Health

Assessing health requires a holistic approach

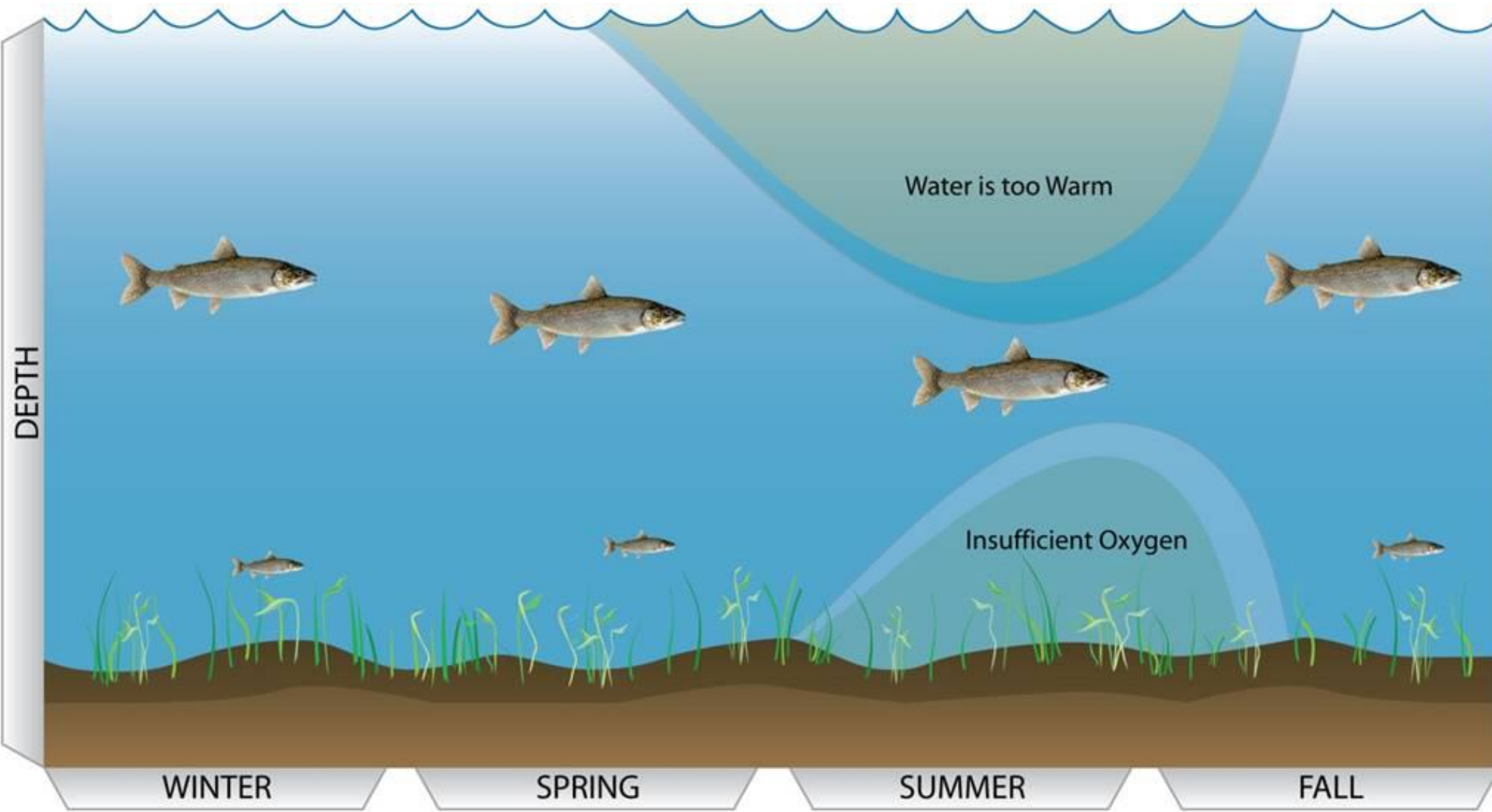
Adaptive lake management

- Science-based approach
- Monitor and evaluate
- Things change!
- Problems now will not be the same in 10 years
- And the lake is not the same as it was in 2009

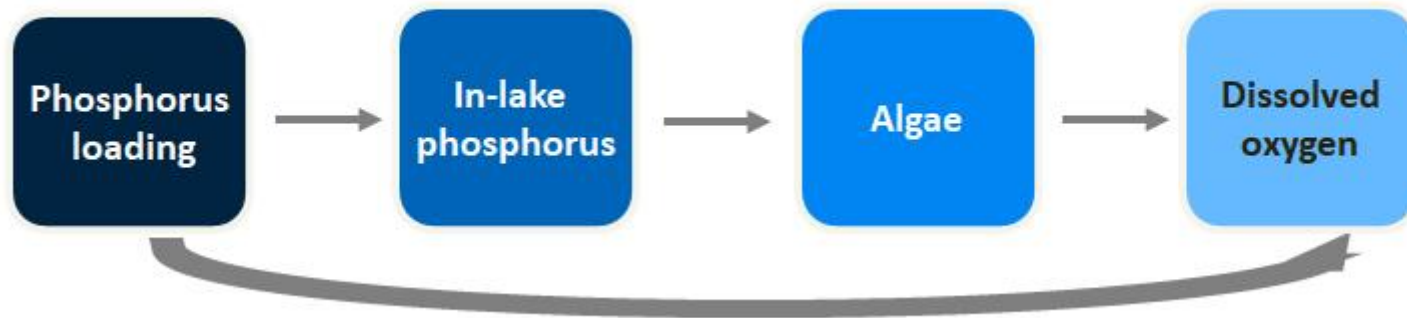


Lake Simcoe Protection Plan

- Target for dissolved oxygen = 7 mg/L
- Estimated load = 44 tonnes of phosphorus per year



Our management model:

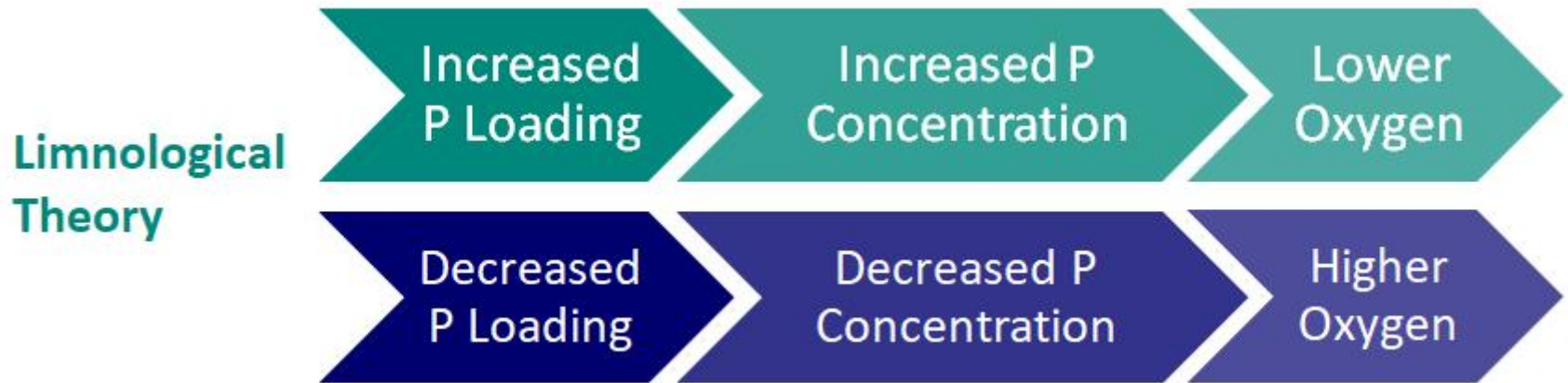


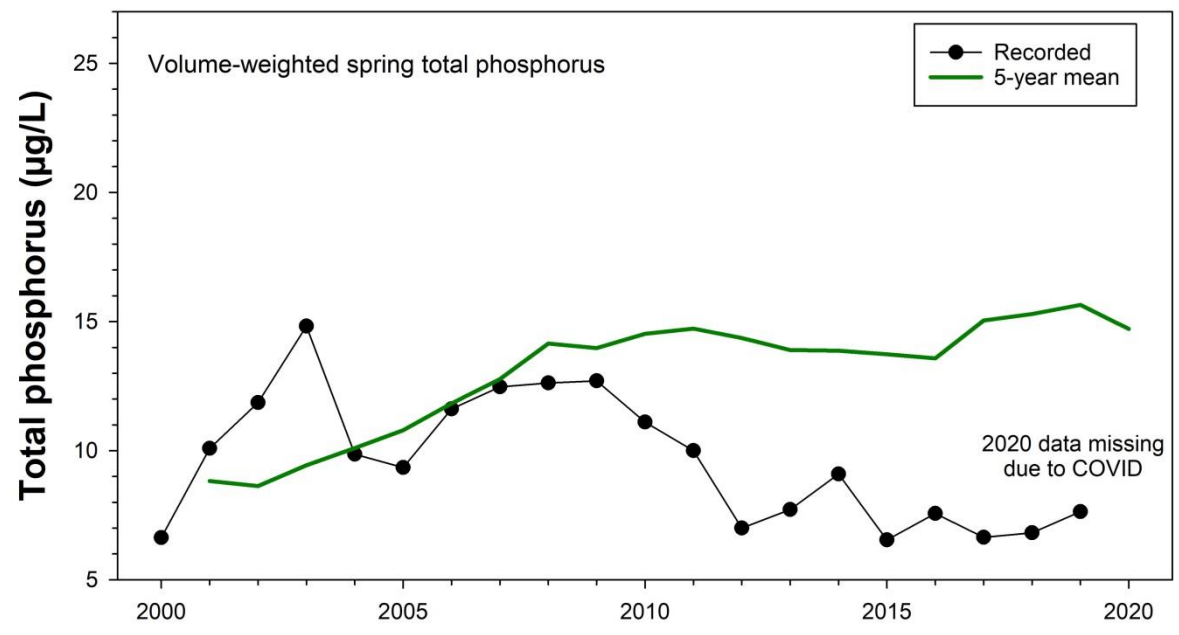
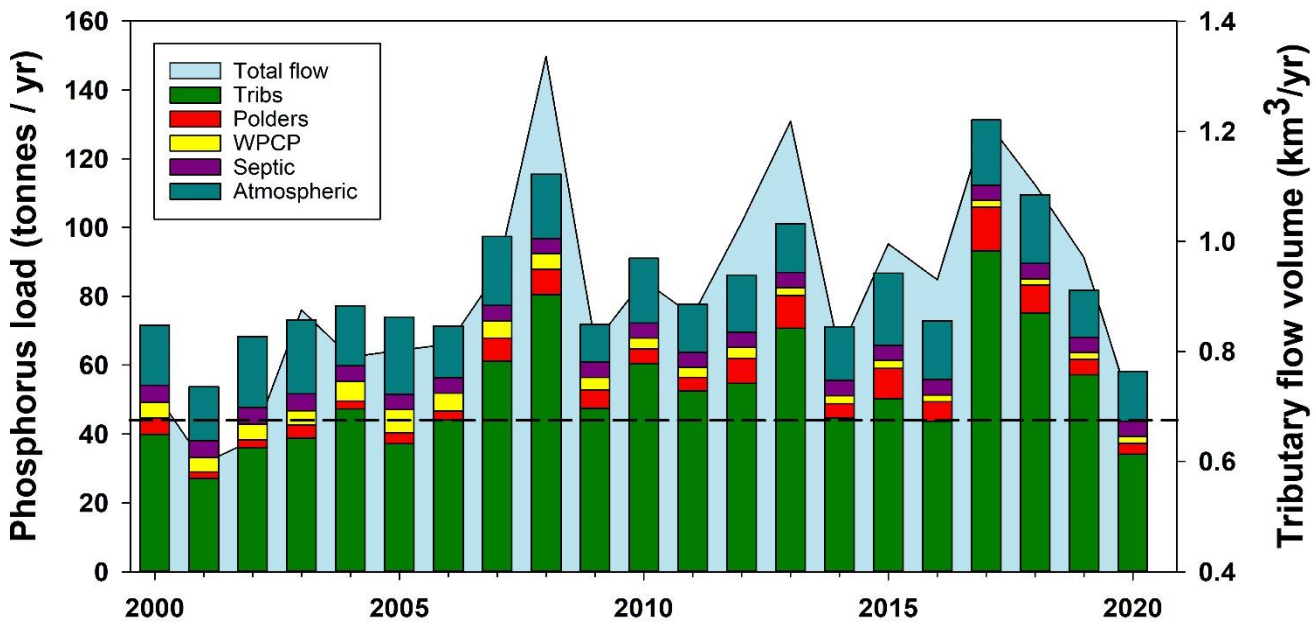
E. Effects of decreasing phosphorus on productivity

The reduction of the productivity of lakes by decreasing phosphorus loading can be very effective.

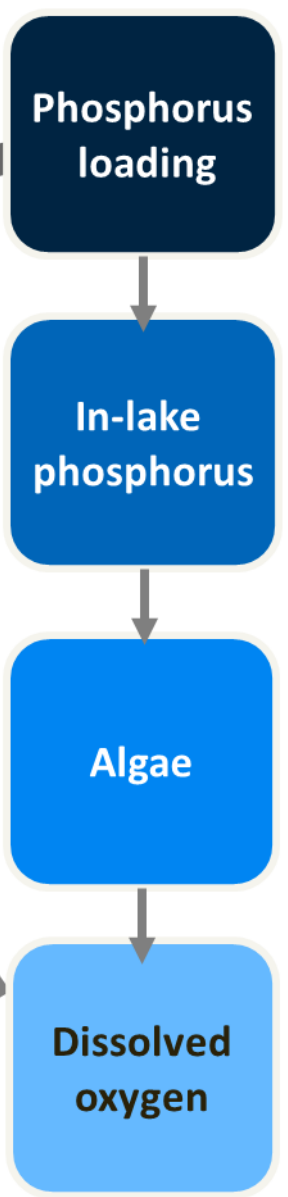
Wetzel's Limnology
2023, p. 401

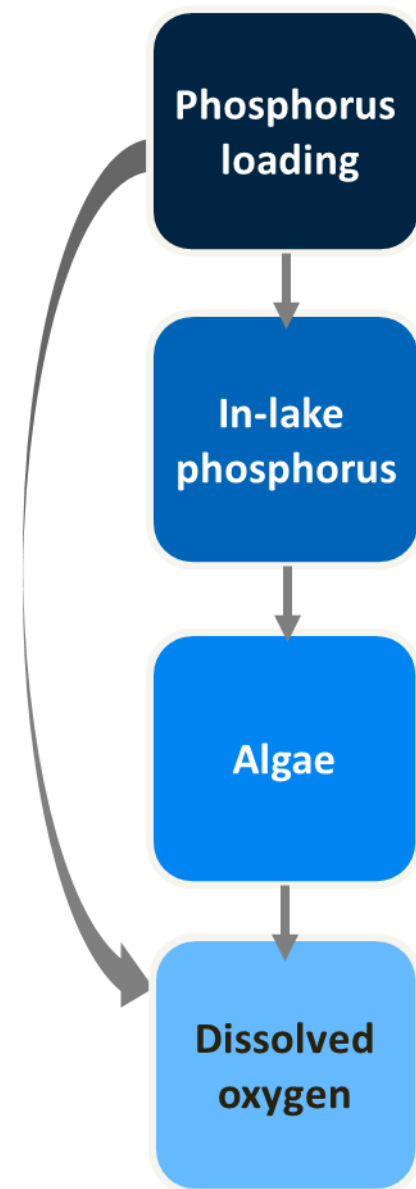
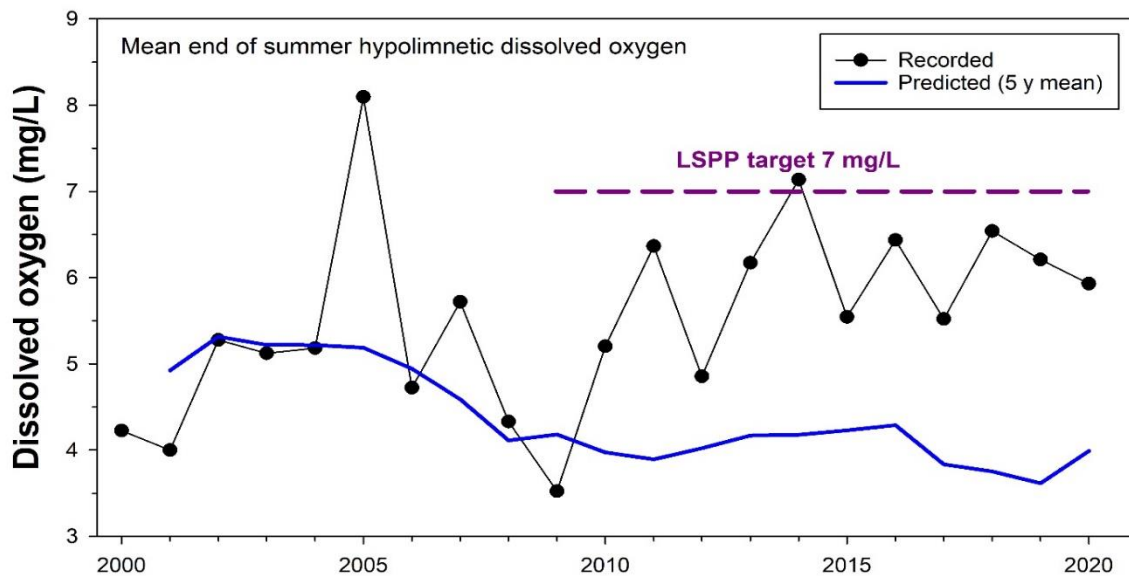
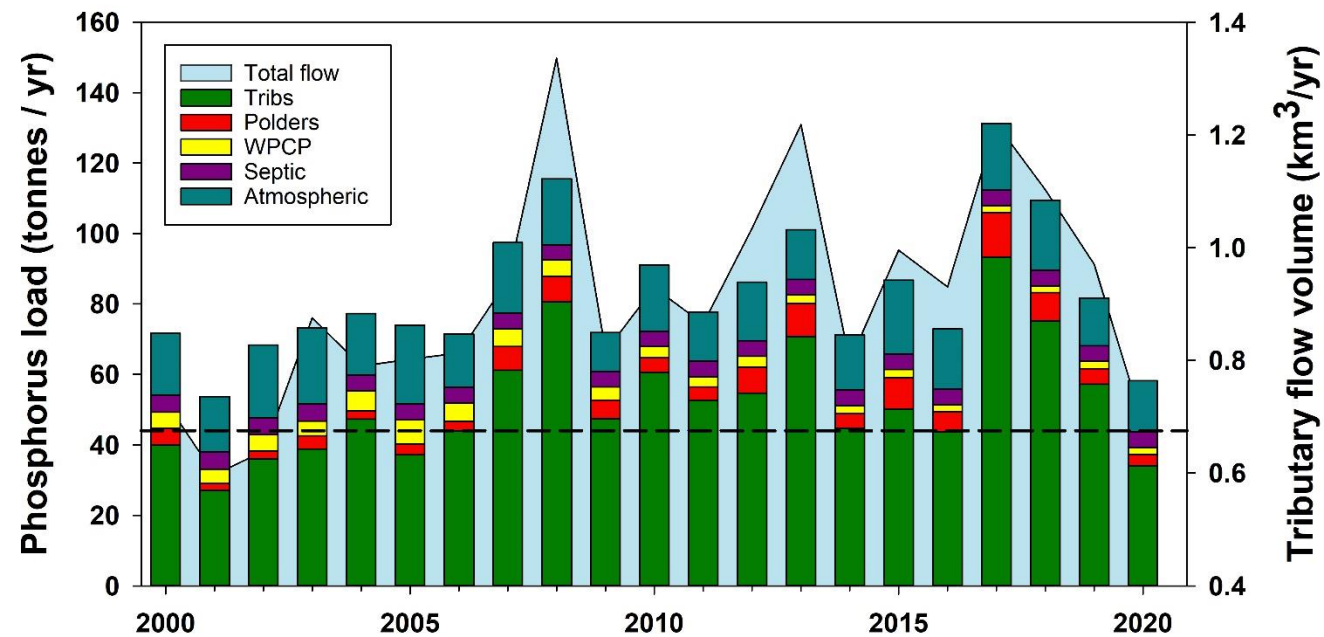
P Loads, P Concentration, and Oxygen





← Assuming a steady state





1: Phosphorus supply

- Climate change
- More intense summer storms:
 - June 2017: 12.6 tonnes P in 2 days
- More rain in winter on frozen ground
 - Feb 2018: 15% of annual P load
- Tributary flow drives phosphorus supply!
- Until we control climate, we can't control tributary flow (or P loads)



Before June Storm

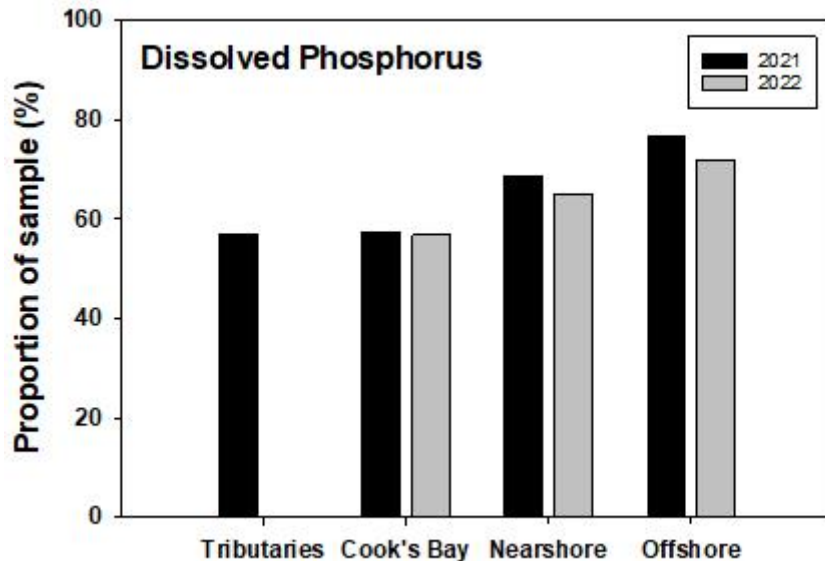


After June storm

2: In-lake phosphorus use

Quagga mussels control phosphorus concentrations and use in Lake Simcoe (and in lakes Michigan, Huron, and Ontario)

- strip particulate P from water column, deposit on bottom
- Release dissolved P (algae and plants love this!)



Mussels have changed a lot!

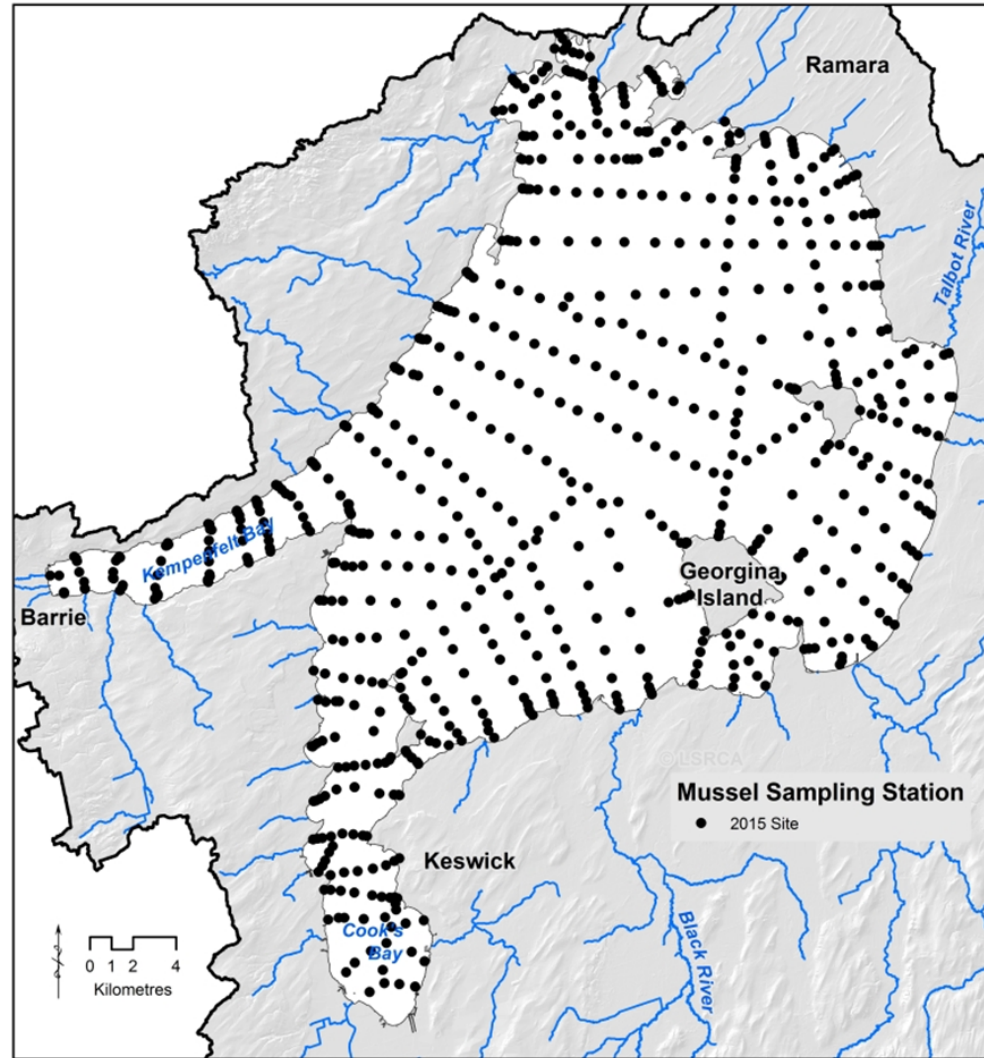
Population	% zebra	% quagga
2009	88.1	11.9
2015	7.4	92.6
2023	0.9	99.1

Total mussel biomass

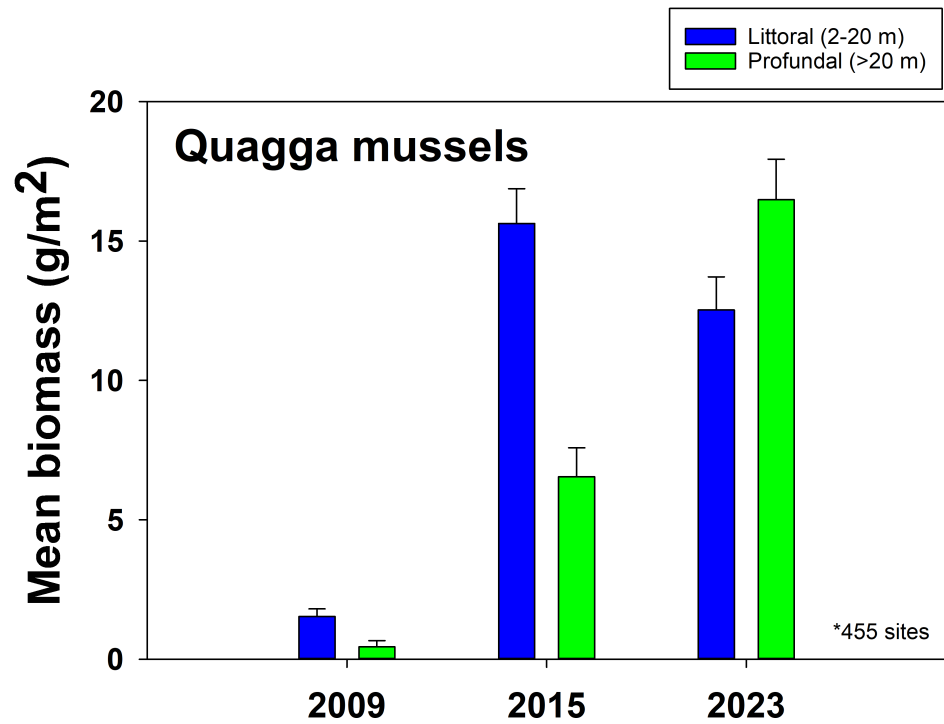
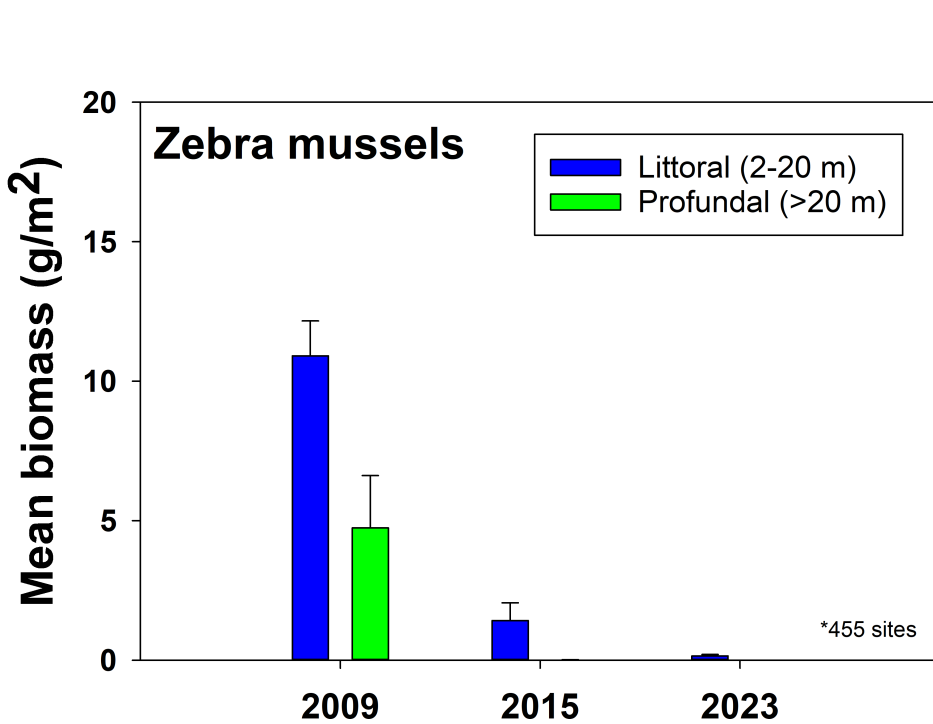
2009	2015	2023
10.6	14.3	13.7

Deepwater biomass

2009	2015	2023
5.2	6.6	16.5

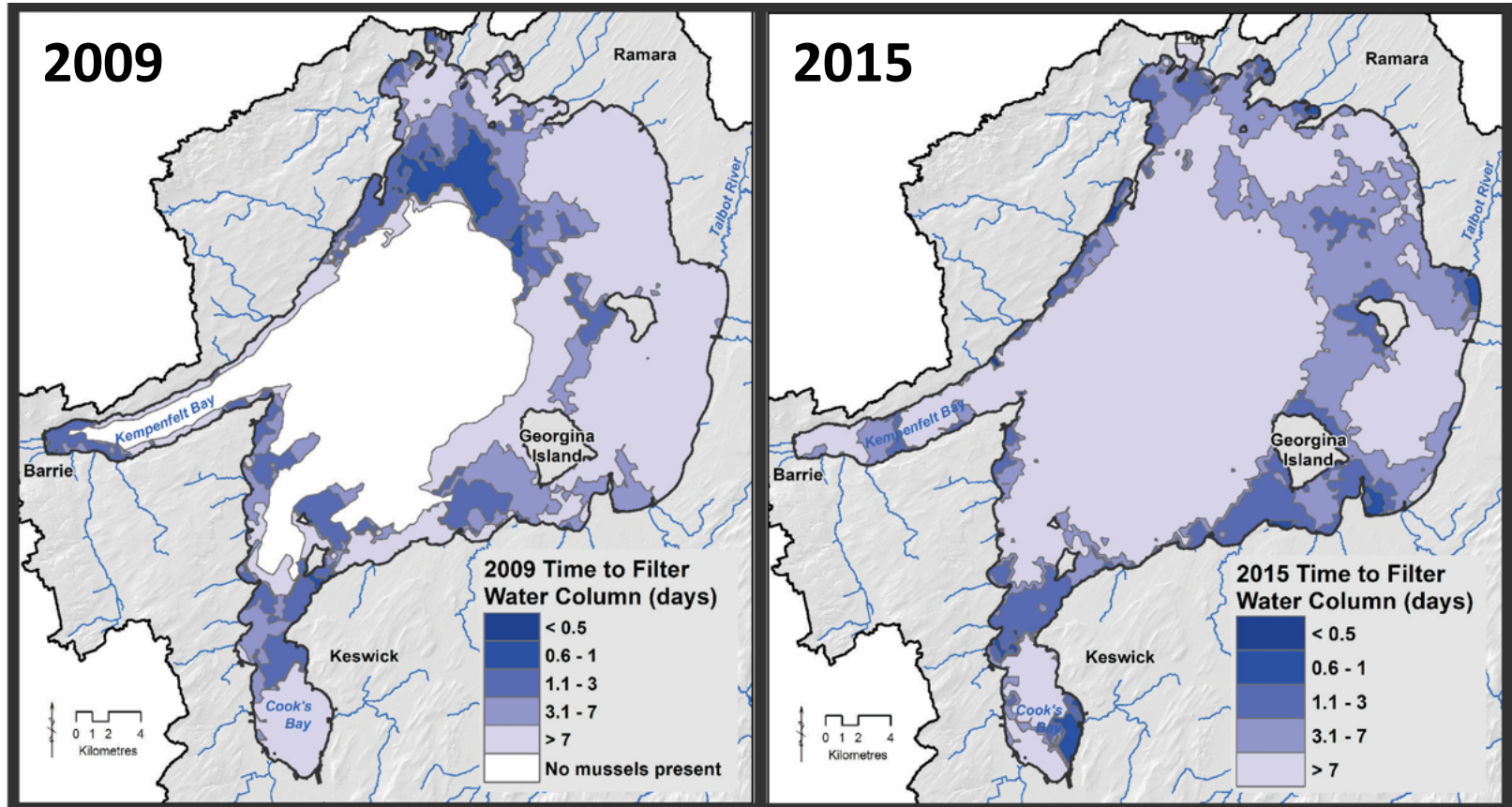


*Comparison of same 455 sites processed (preliminary results)



*Comparison of same 455 sites processed (preliminary results)

Mussel filtering



Clearance rate (10^9 L/h): Shallow water 126.5 \rightarrow 169.0 \rightarrow 120.5

Deep water 3.5 \rightarrow 9.2 \rightarrow 18.7

Consequences to P cycling and water clarity?

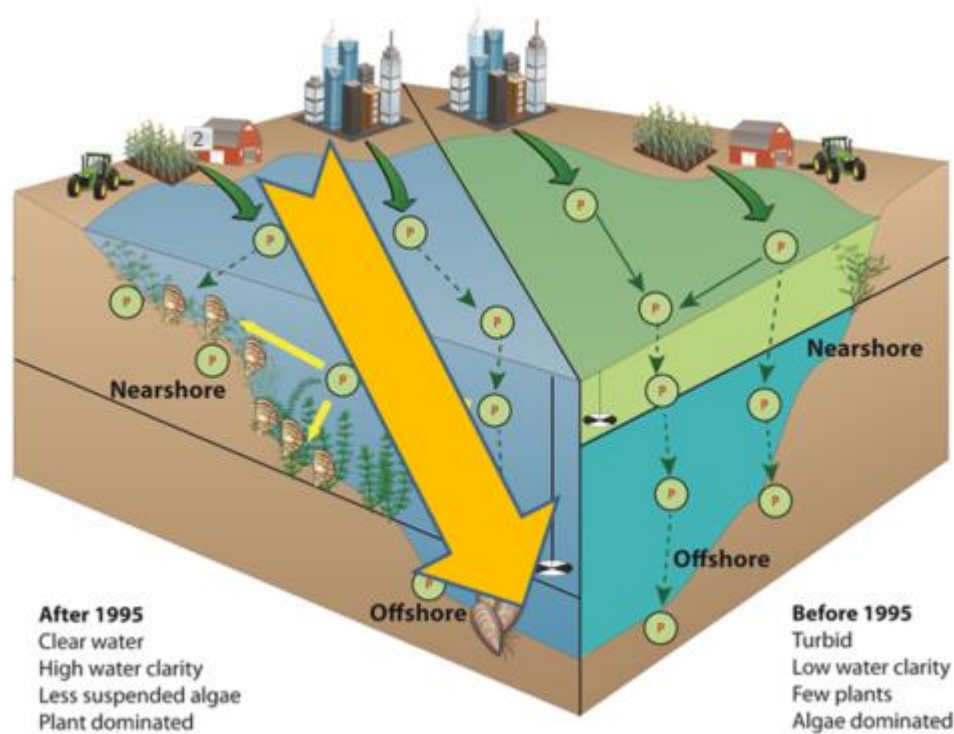
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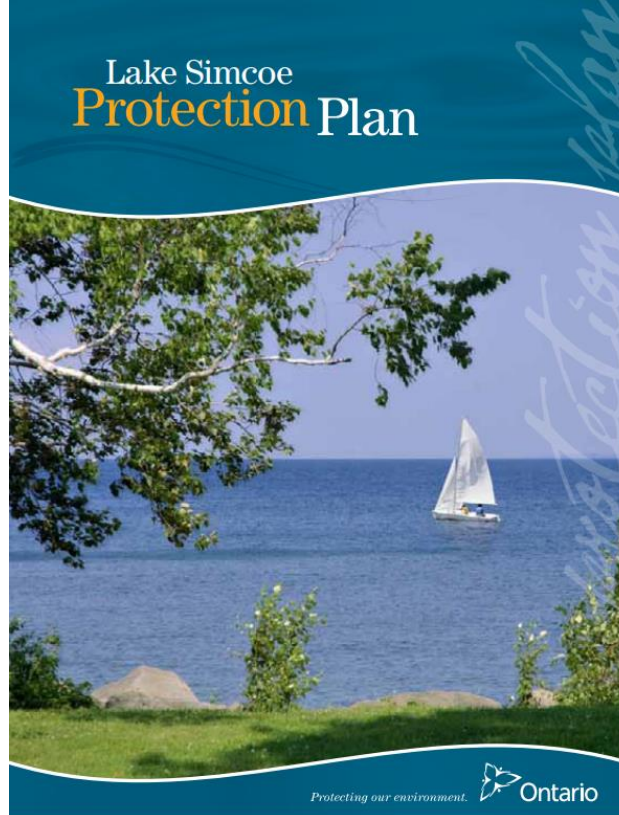
What about dissolved P?

- Great Lakes: *Cladophora* algae
- L. Simcoe: starry stonewort?



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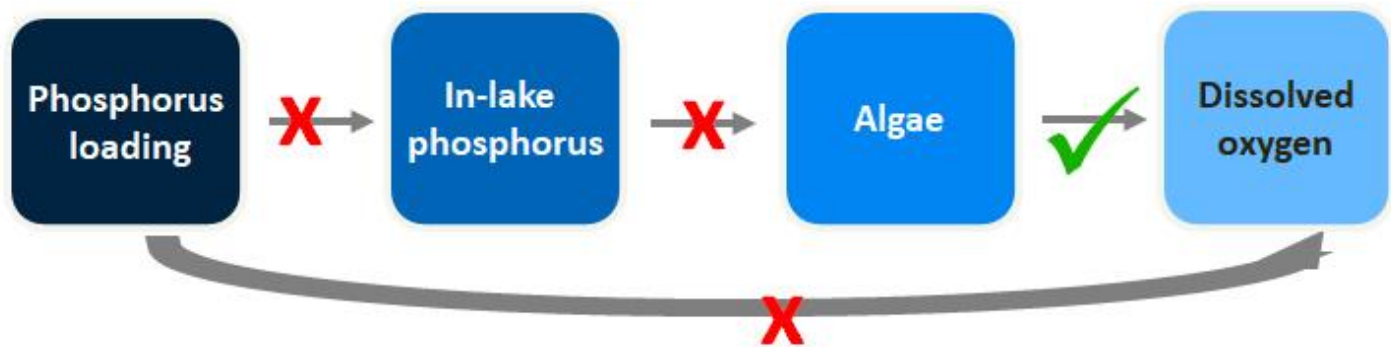
RESEARCH, MONITORING AND REPORTING

To remain effective over time, **the Plan must be adaptive to what is learned** from ongoing scientific research and monitoring in the watershed. The Plan provides for a number of key research and monitoring actions. Collectively, these actions will help to improve our understanding of how the Lake Simcoe watershed functions and increase our ability to detect changes in the natural environment. Scientific research and monitoring will also inform the adaptive management approach used in the Plan by providing the information necessary to **review and evaluate the effectiveness of Plan policies and targets.**

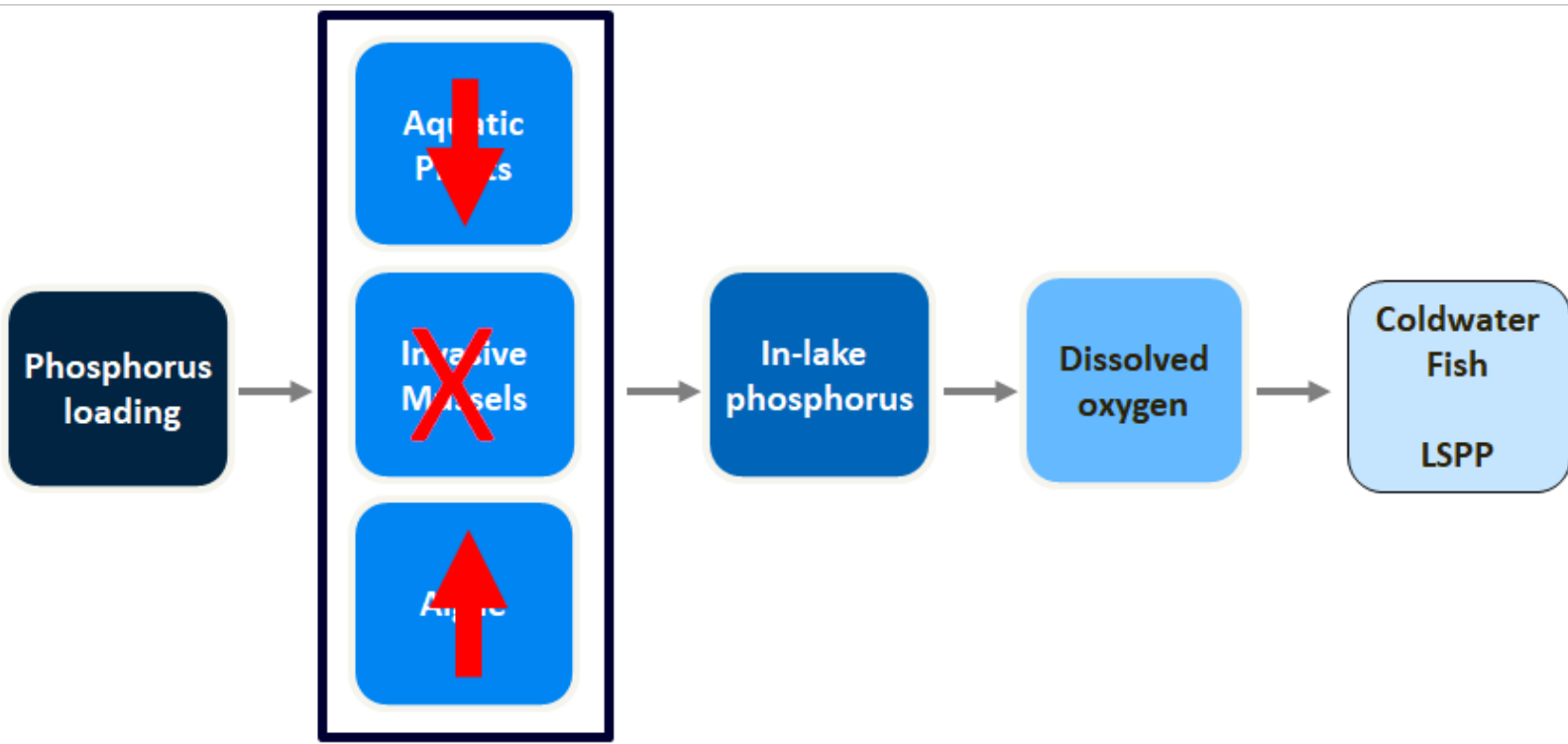
LSPP 2009

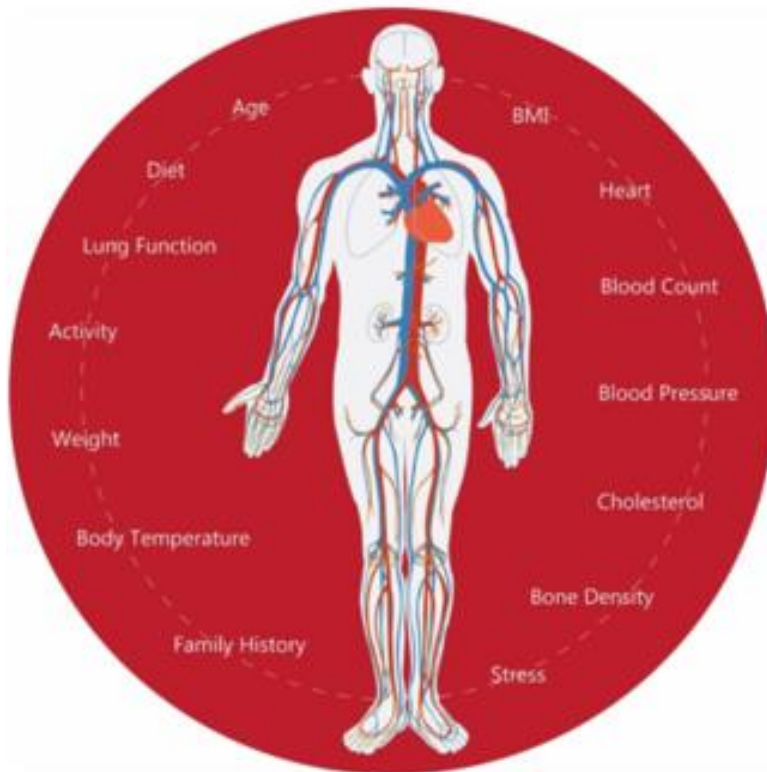


Current model:



Coming in fall 2024:





Our Health



Lake Health

Summary

- Lake Simcoe undergoing complex changes since ~2009-10 (climate, invasive spp.)
- Changes are also occurring, in part, across Great Lakes Region
- P loading is less important as long as quagga population is growing
- We need to re-evaluate how we manage lakes and what our targets need to be for a sustainable ecosystem

