

Investigating the land-lake phosphorus disconnect in Lake Simcoe

LSRCA Board of Directors

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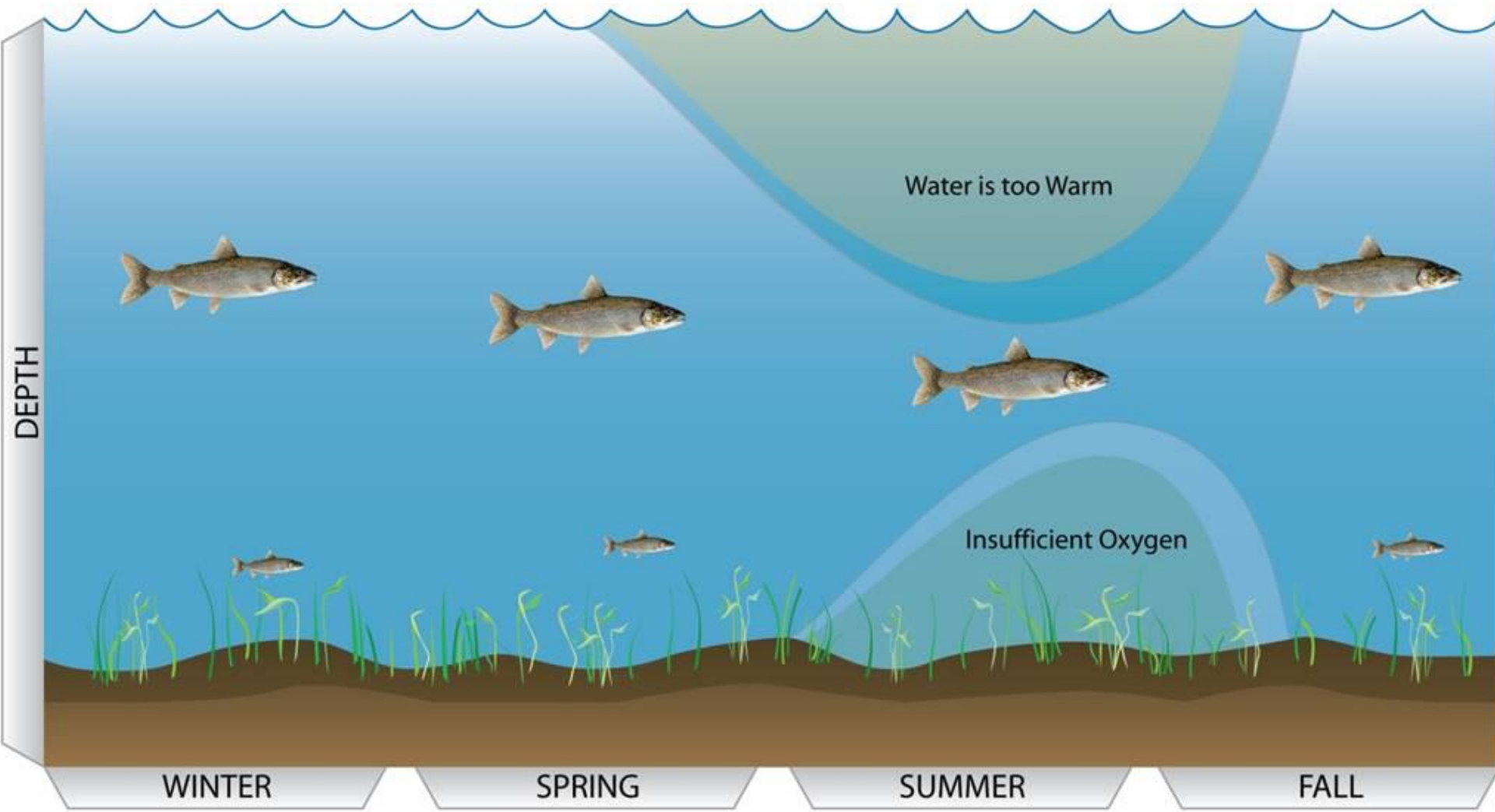
Lake Simcoe Region
conservation authority



Member of Conservation Ontario

Lake Simcoe Protection Plan

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



Phosphorus

Phosphorus loading



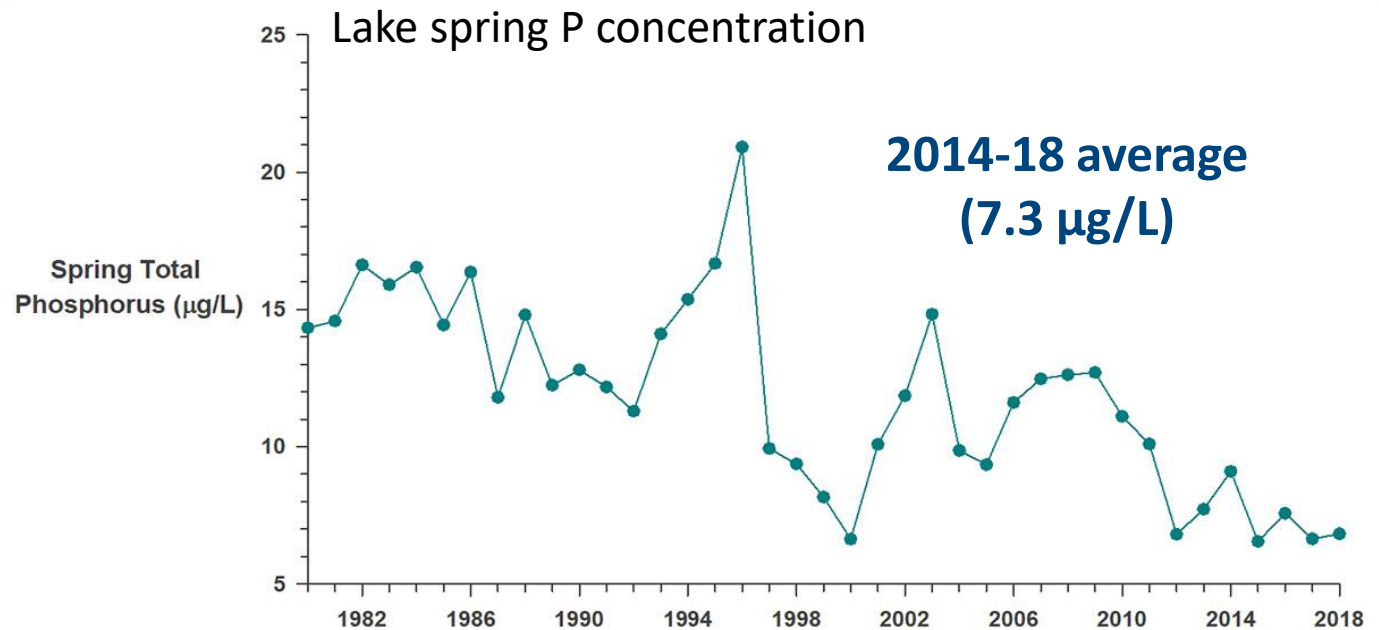
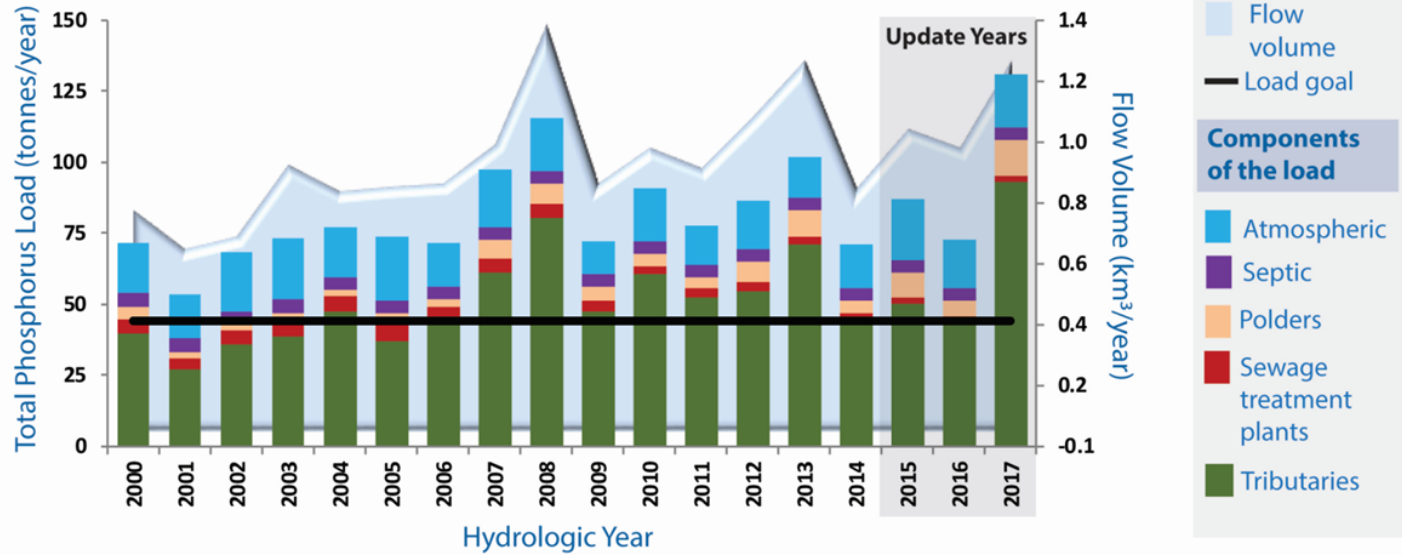
Phosphorus levels in lake



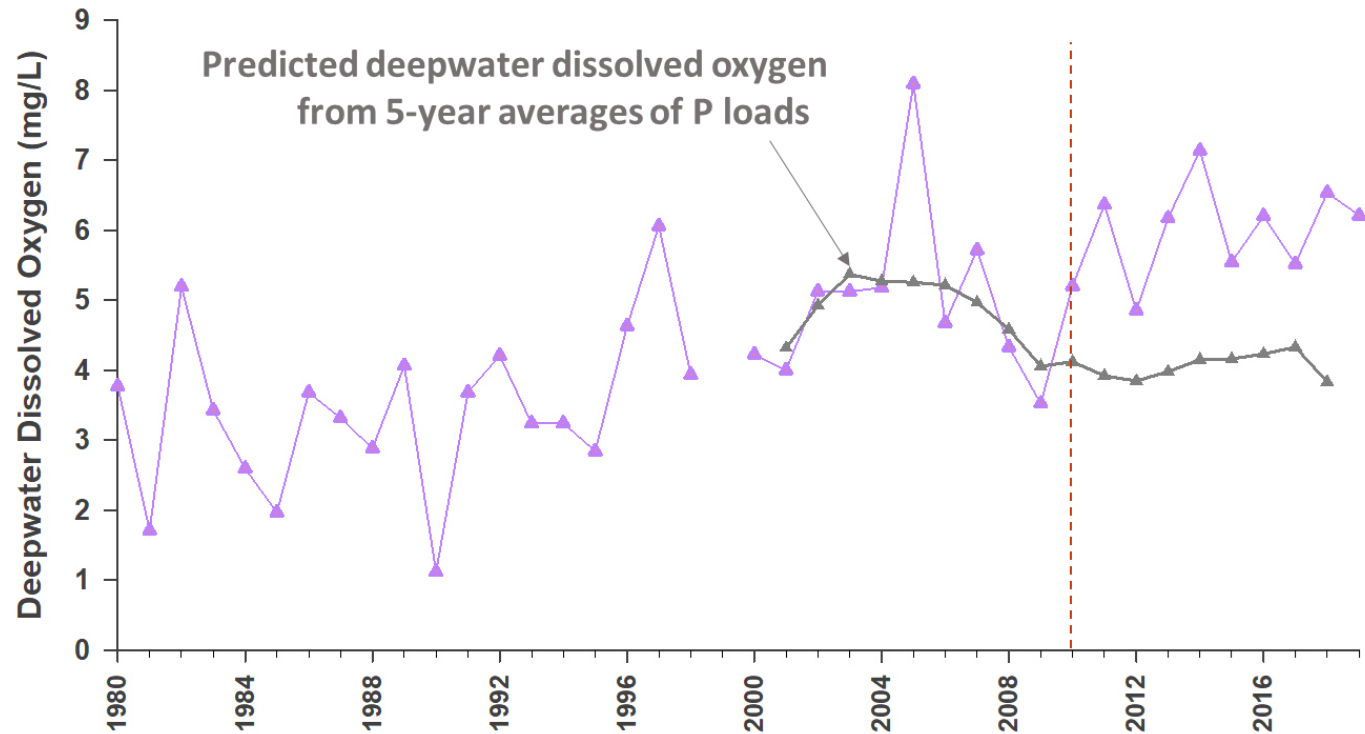
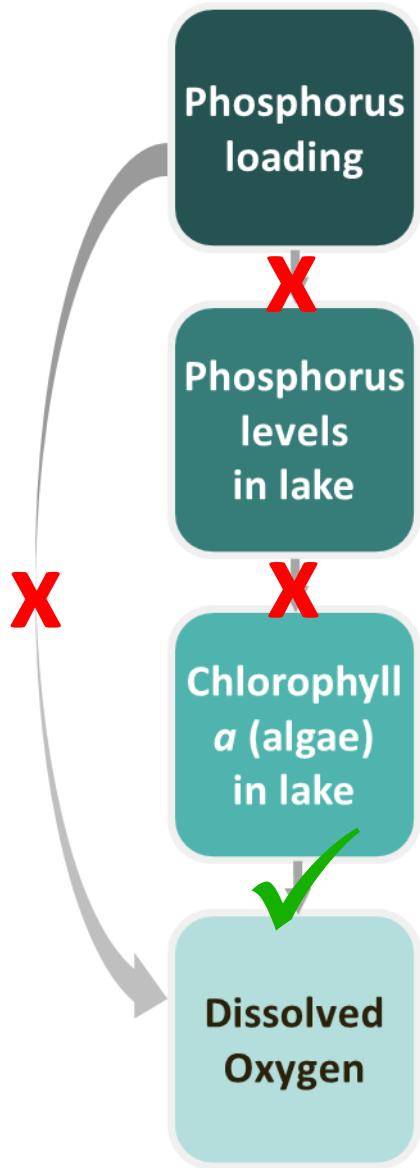
Chlorophyll *a* (algae) in lake



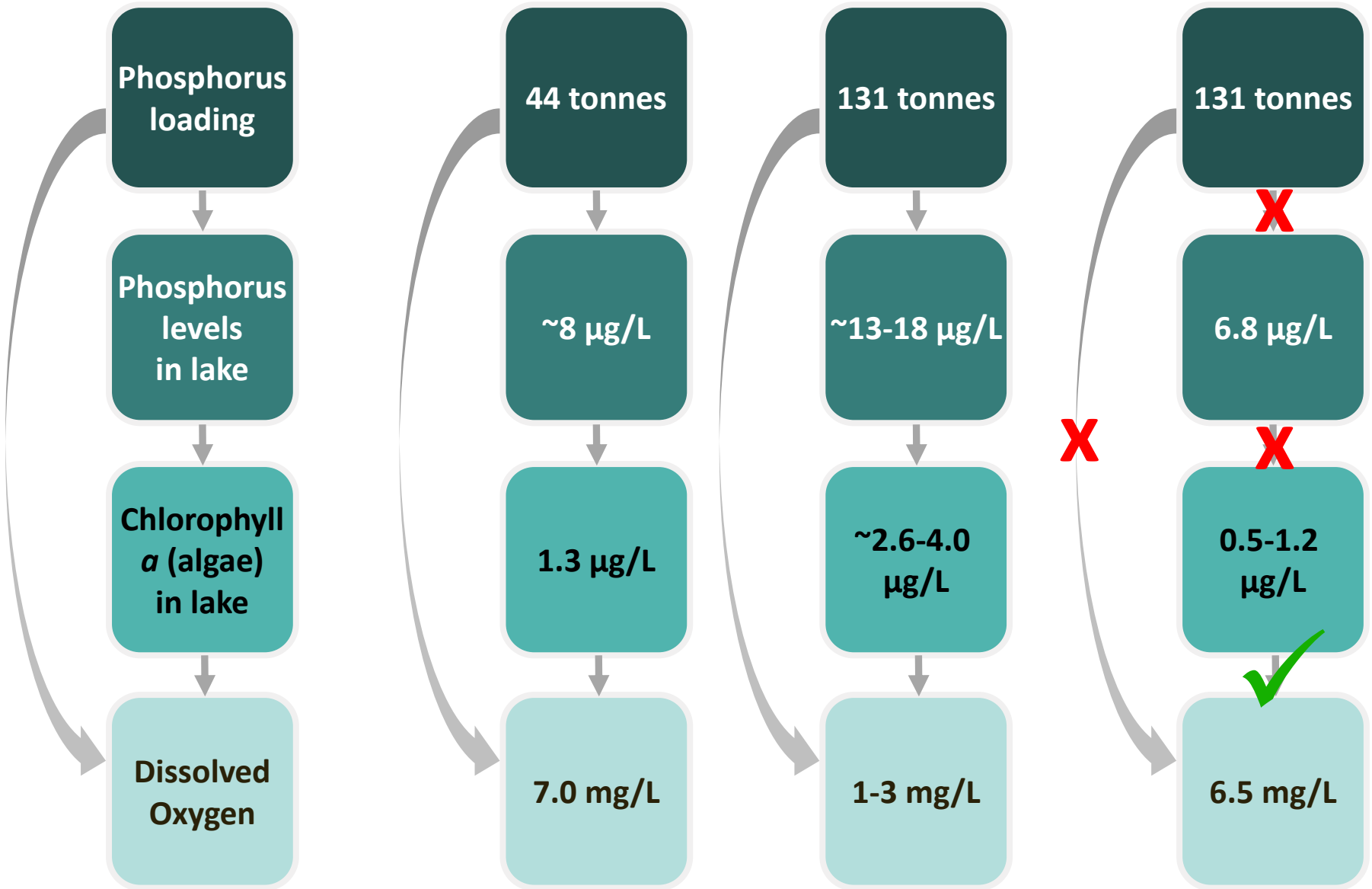
Dissolved Oxygen



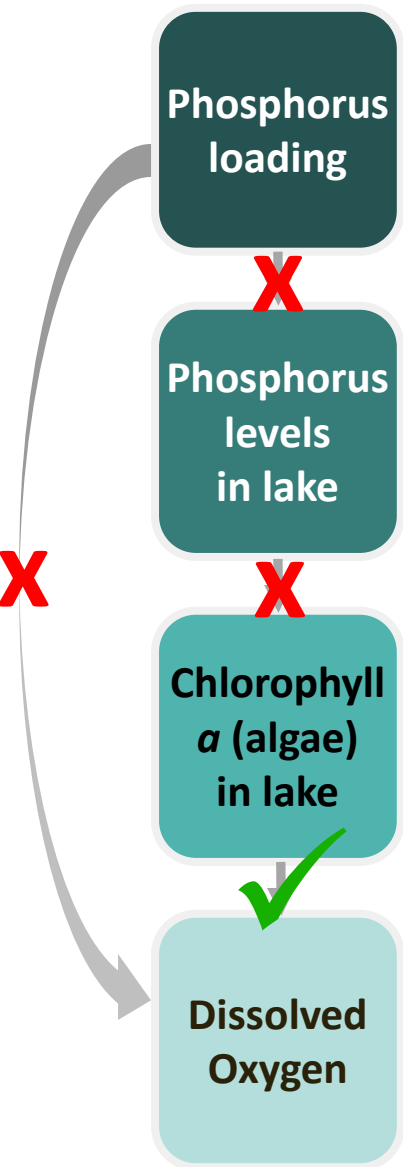
Dissolved Oxygen



Model



What's going on? Climate

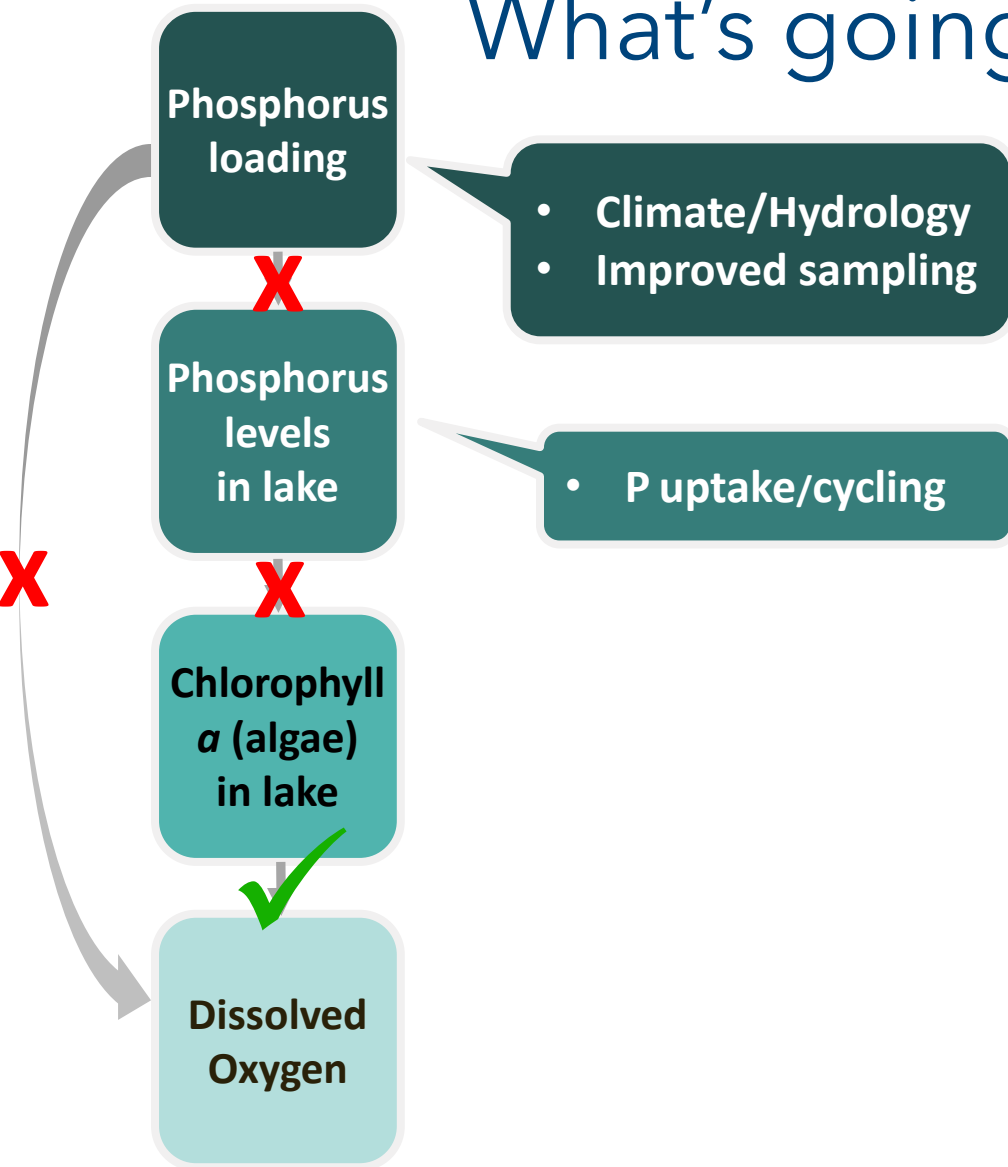


- Climate/Hydrology
- Improved sampling

- The timing / seasonality of flow of loads has changed
 - More winter rain / snowmelt
 - More intense summer storms
 - Tribs up to 75-80% of load
- Higher flows = faster flushing rate
 - 11.6 yrs → 9.1 – 15.4 yrs
- Higher water temp + low chlorophyll = deepwater DO
- Better monitoring of Talbot R. (up to 25% total tribs)
- Improved sampling = measuring higher loads



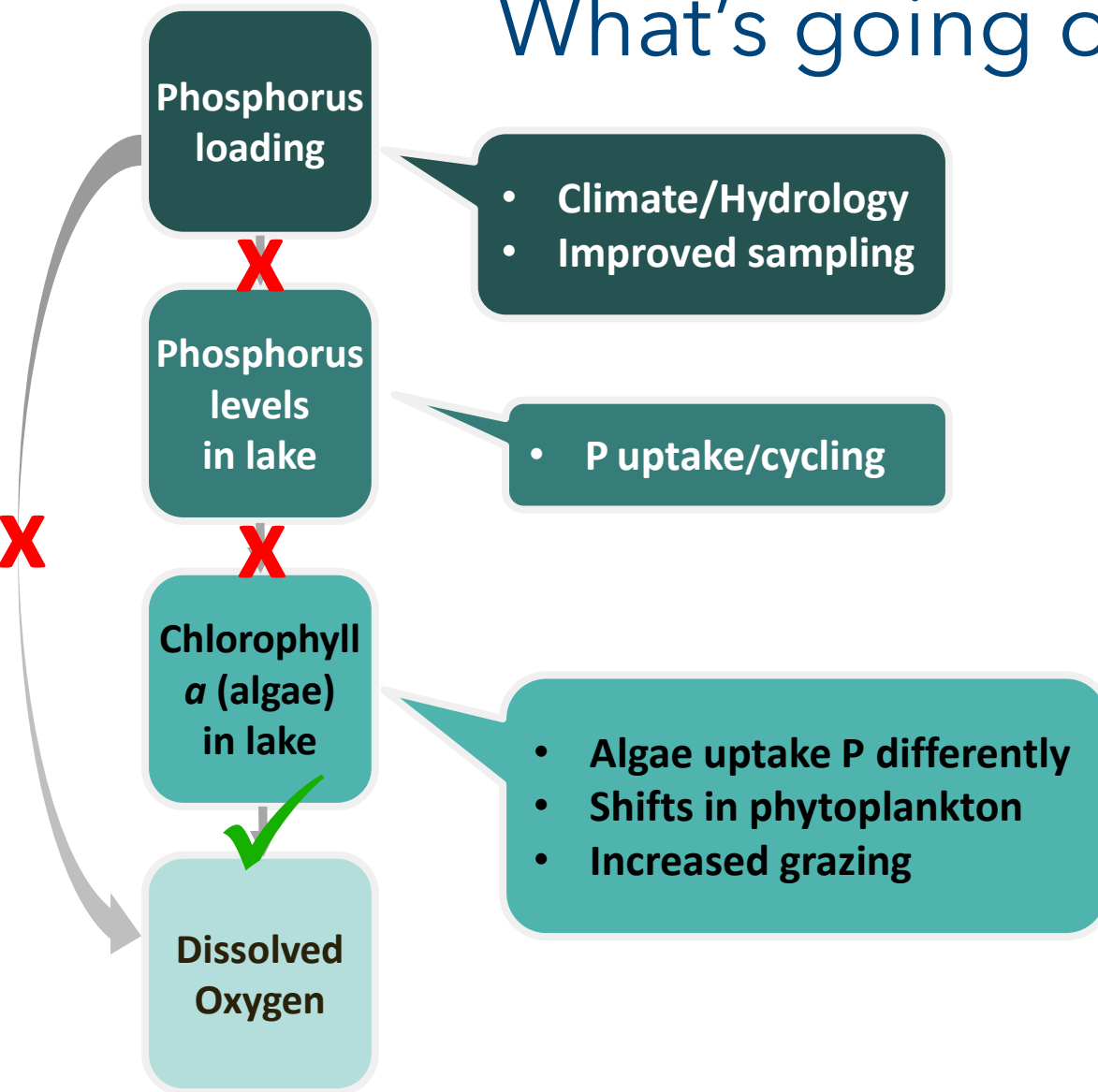
What's going on? P cycling



- Is lake using P differently?
- Starry stonewort (~2009)
 - Macroalgae: no roots, uptake dissolved P
- Macroalgae rapidly strip P
- Higher P = faster uptake
- Dissolved P in plant tissues?
 - Aquatic plants: ~0.11 mg/g
 - **Starry stonewort: ~1.32 mg/g**
- Macroalgae can overwinter
 - less decomposition = less P turnover



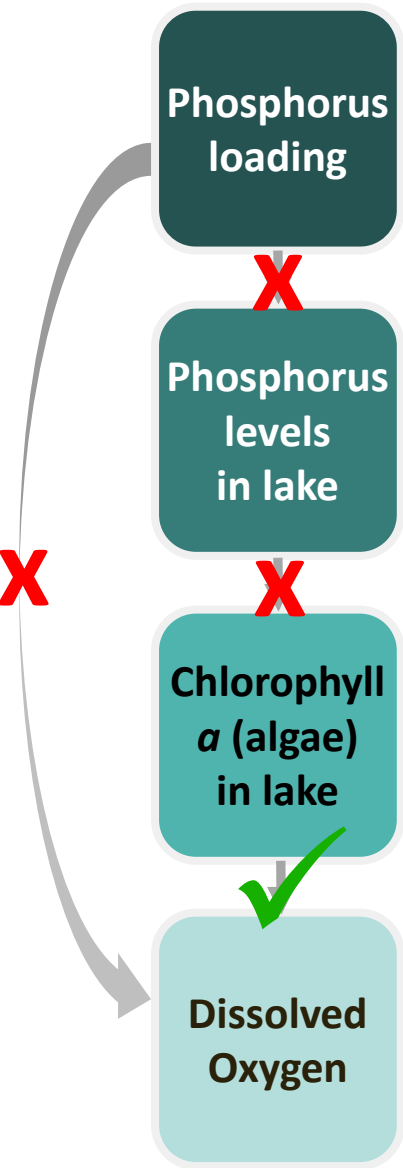
What's going on? Algae



- Lower chl-a:biomass ratio since 2008
- Decline in chl-a rich diatoms?
- Invasive mussels:
 - Consequences of species change?
 - Invasion of deepwater?
- Phosphorus impacts?
 - particulate P filtered by mussels
 - Mussels leak dissolved P
 - P in mussel biomass
 - Impact of round gobies?

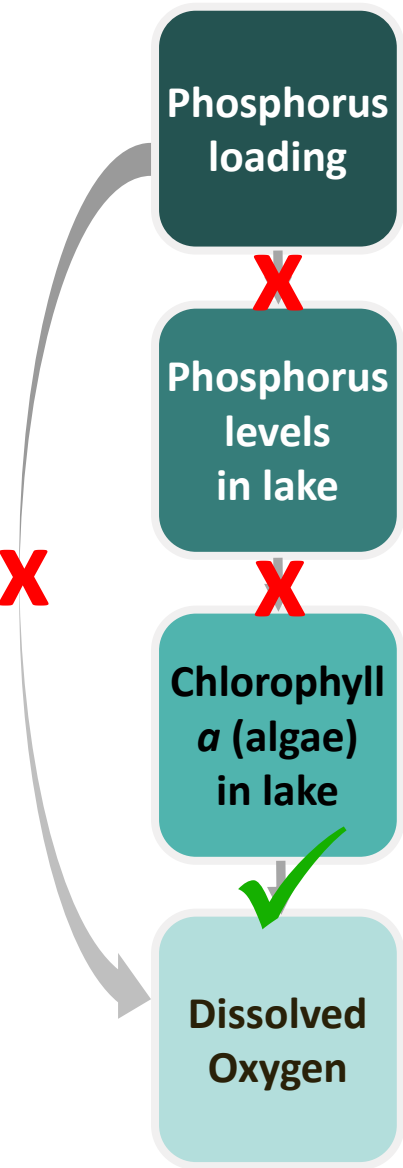


Conclusions



- Many changes ~2009, coinciding with a “disconnect” between P and DO
- Lake Simcoe is a complex system and we need to consider all physical, chemical and biological changes and their combinations
- Efforts to reduce P and improve ecological health need to be continued

Next Steps



- Is winter P processed the same as during ice-free season?
- Faster flushing rate: Is P pushed out of lake faster?
- Has P uptake to mussels changed since quaggas dominated?
- How does starry stonewort uptake P? Has this changed?
- How does this impact phytoplankton?

