2017 and 2018 cyanobacteria bloom update

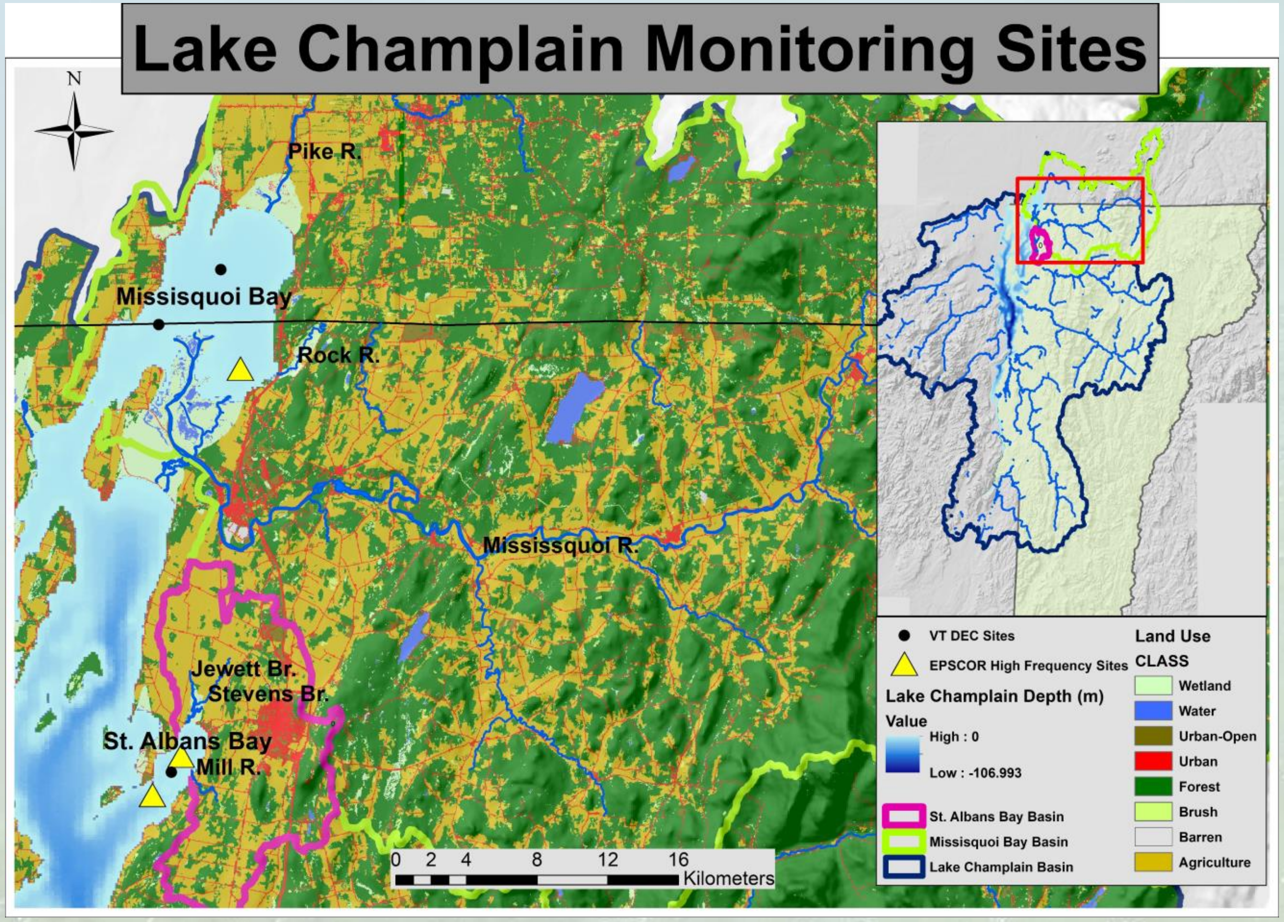
November 30, 2018 || PTAC Meeting

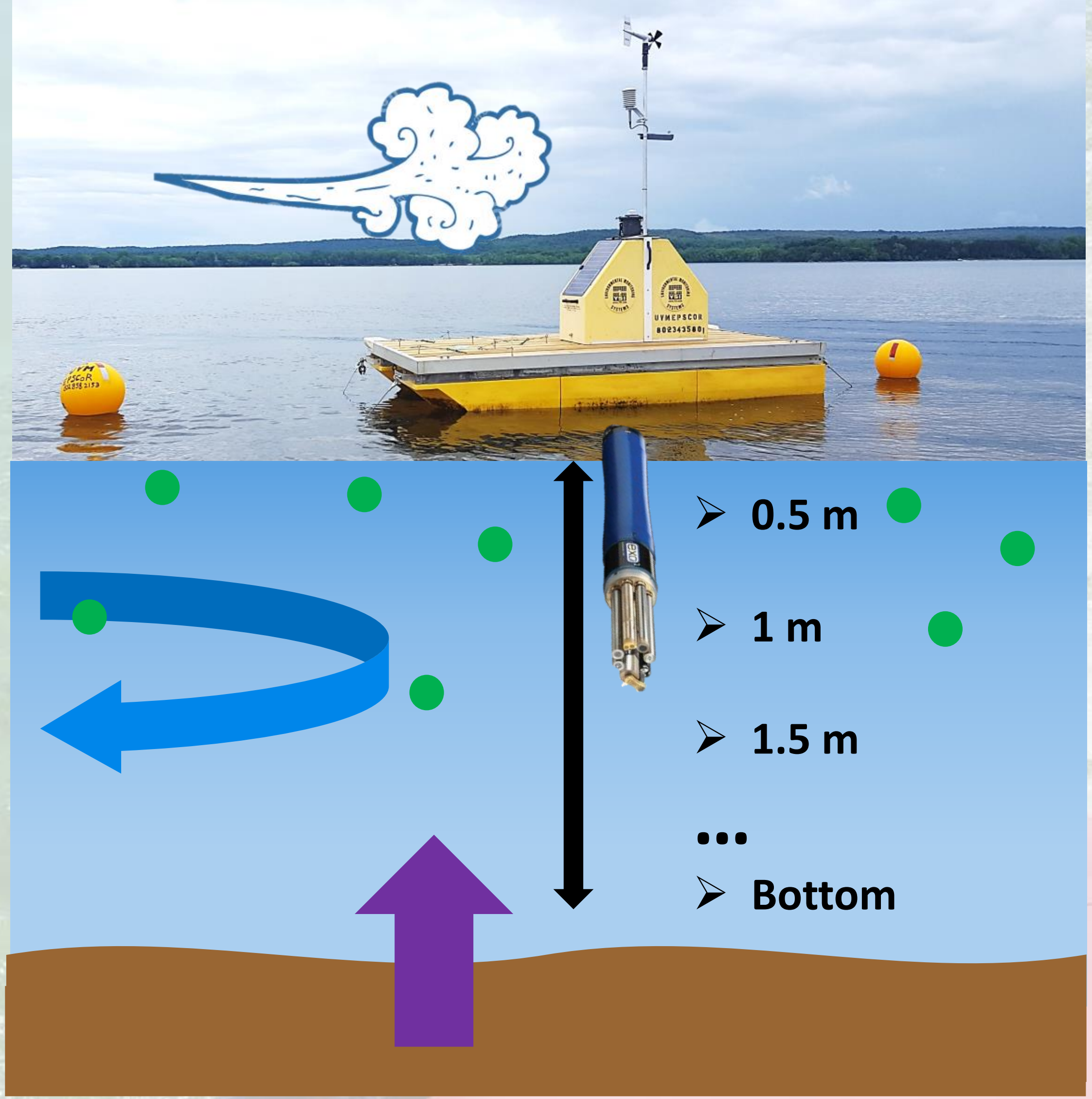
Wilton G. Burns

Advisors: Andrew W. Schroth and Jason D. Stockwell

Collaborators: Clelia Marti, Patrick Bitterman, Rick Stumpf, Donna Rizzo, Liv Herdman, Dr.'s Tom and Patricia Manley, and Mindy Morales-Williams

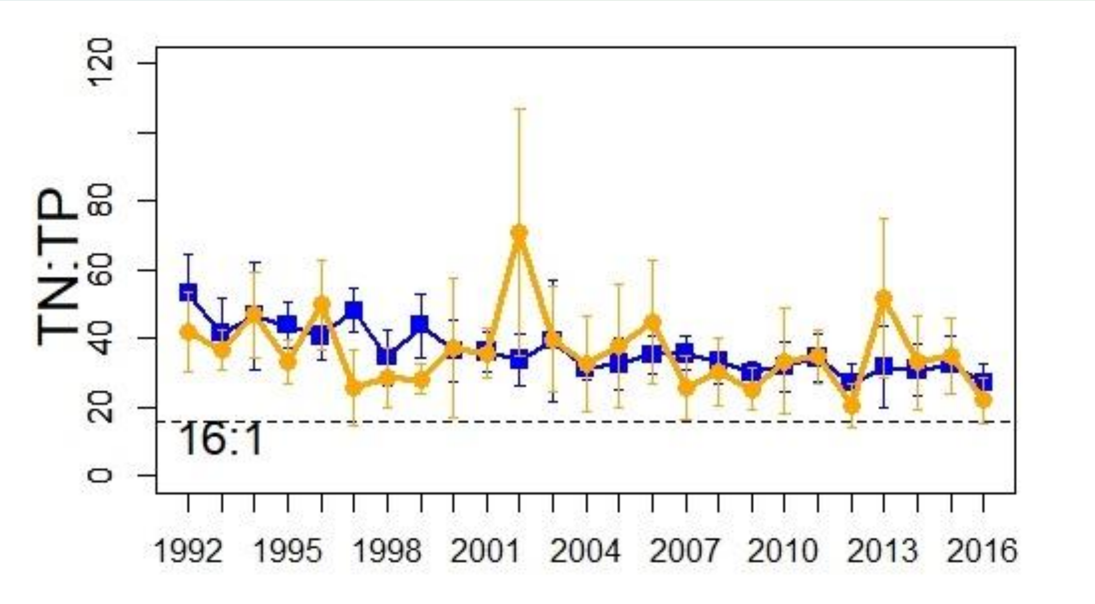
High-frequency monitoring of Missisquoi and Saint Albans bays

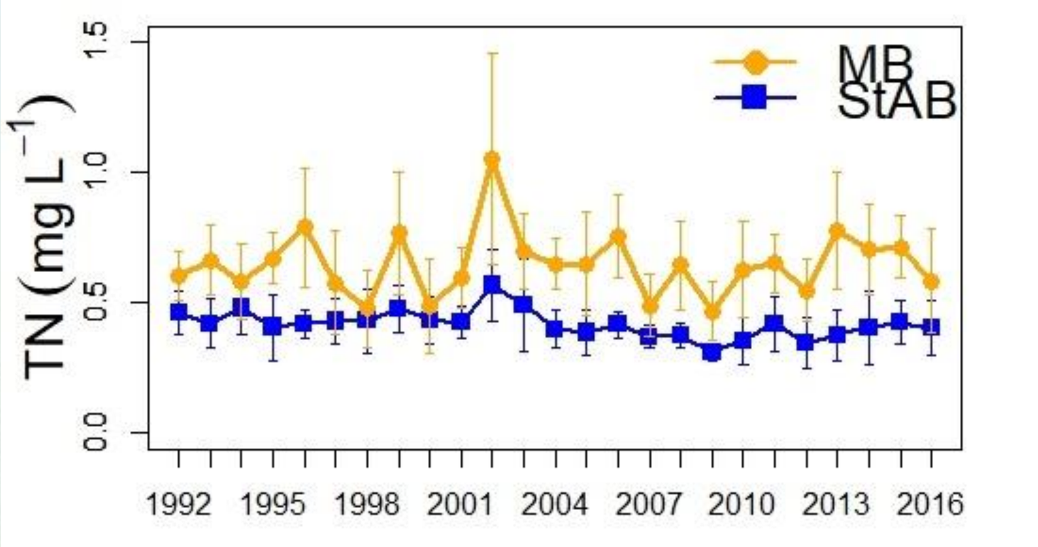


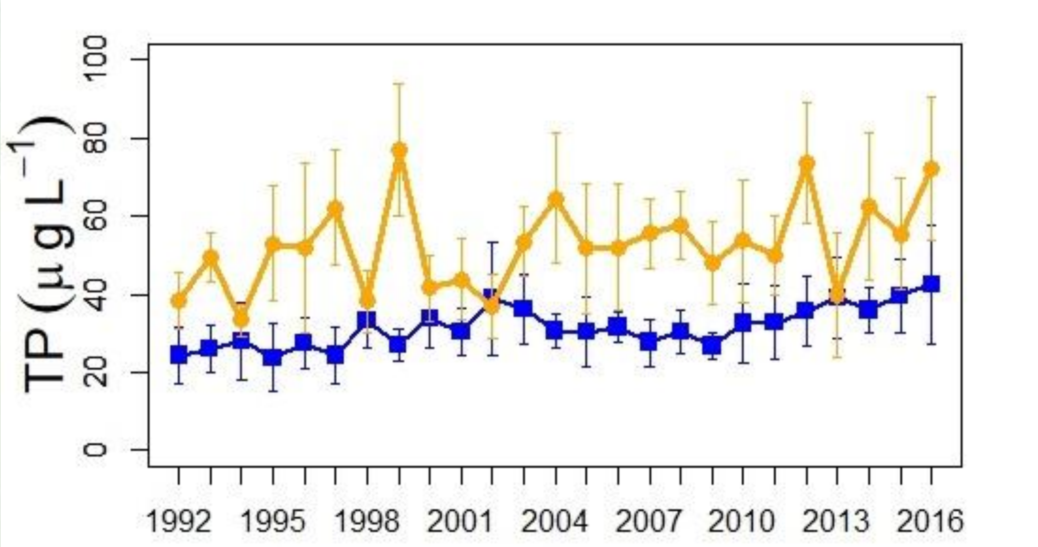


Long-term VT DEC dataset shows similar ratio in both bays and higher total nutrients in MB

- Data: VT DEC 1992 – 2016, bi-weekly
- Average values for July - September







Today’s objectives

- What did we learn from 2017 field campaign?

- How do our buoy sensors pair with remote sensing technologies?

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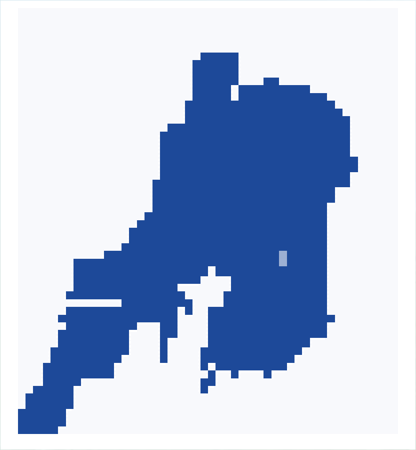
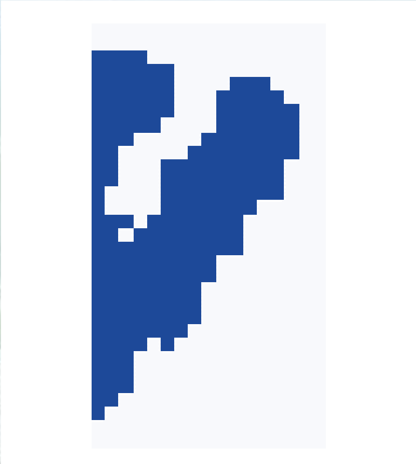
1) Bay comparison



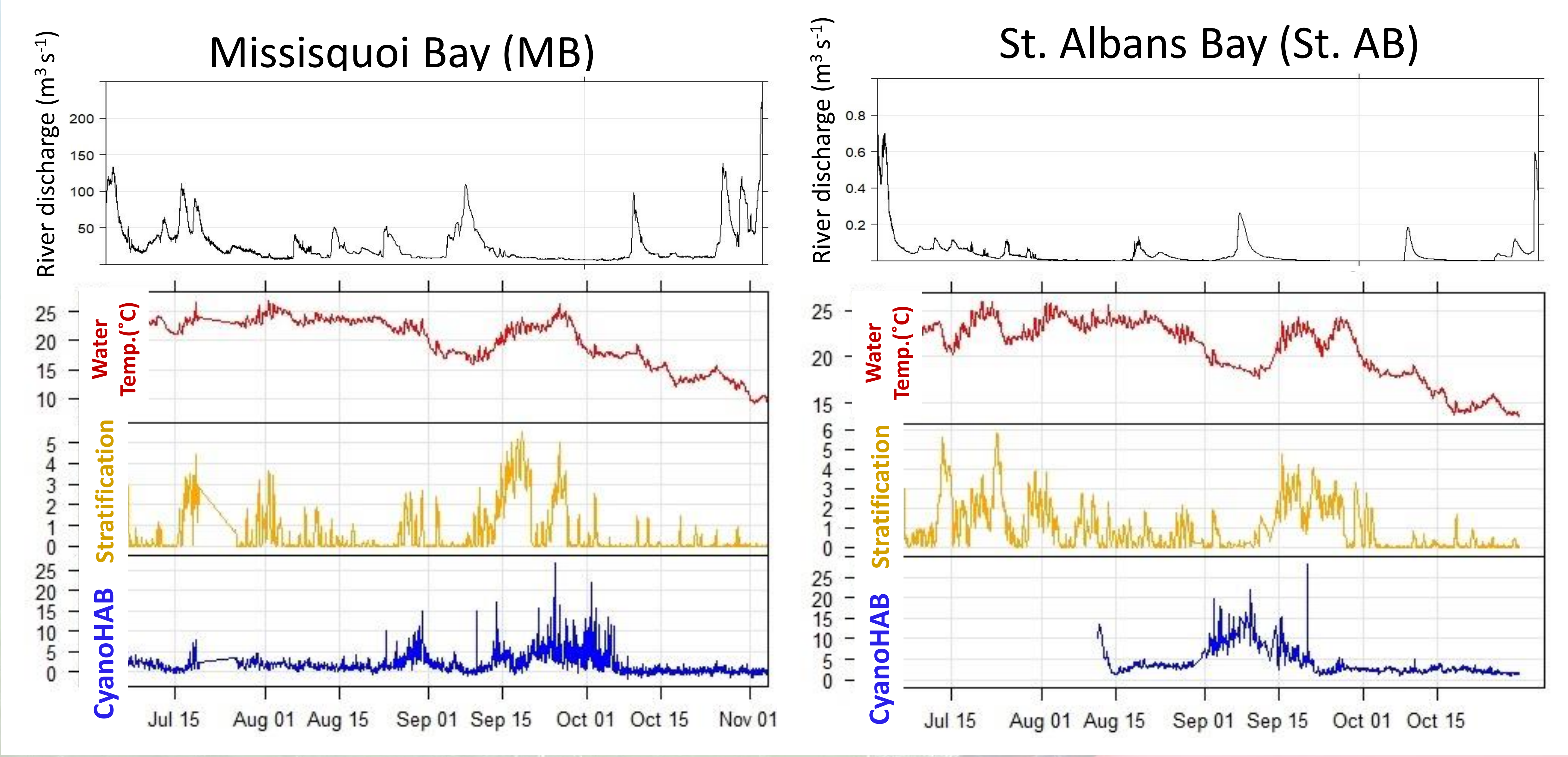
vs



2) Year to year comparison

vs

2017 blooms were late and had different timing



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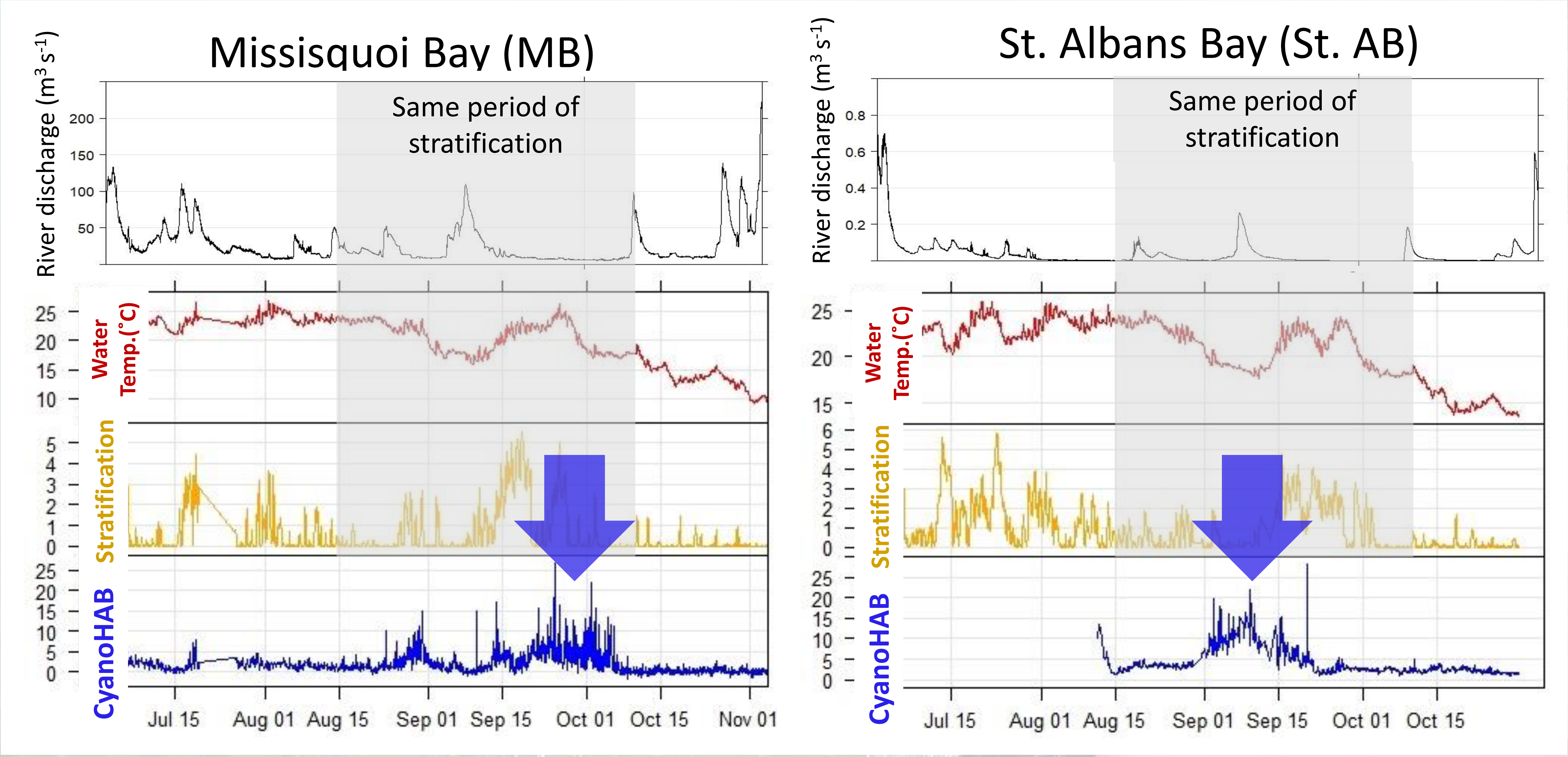

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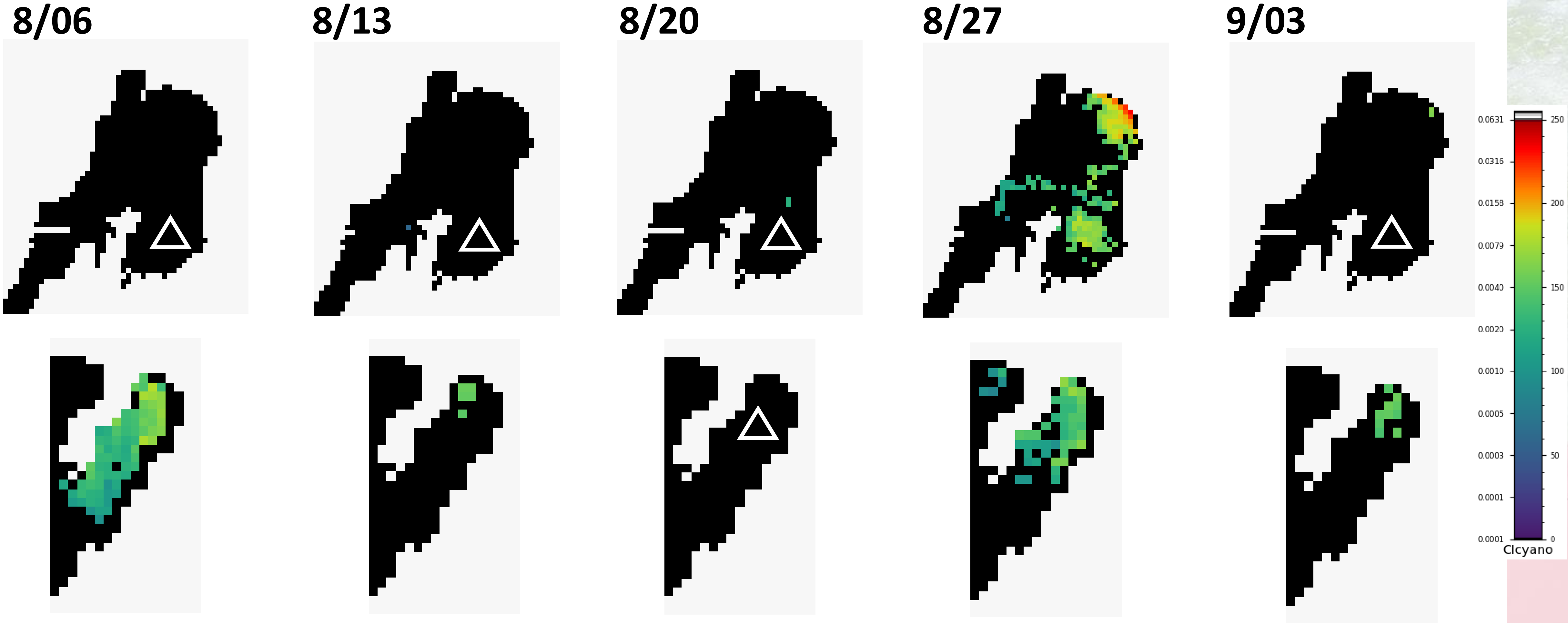
How does our buoy sensor data compare to the rest of the bay?

- Remote sensing data through collaboration with Rick Stumpf at NOAA
  - ➢Cyanobacteria Index
- Help from Patrick Bitterman (BREE post-doc)
- In future: use to validate the IAM and capture missing dynamics

2017 bloom was late and persisted into October in MB but shut down late September in St. AB



*Composite images of weekly maximum values for each pixel

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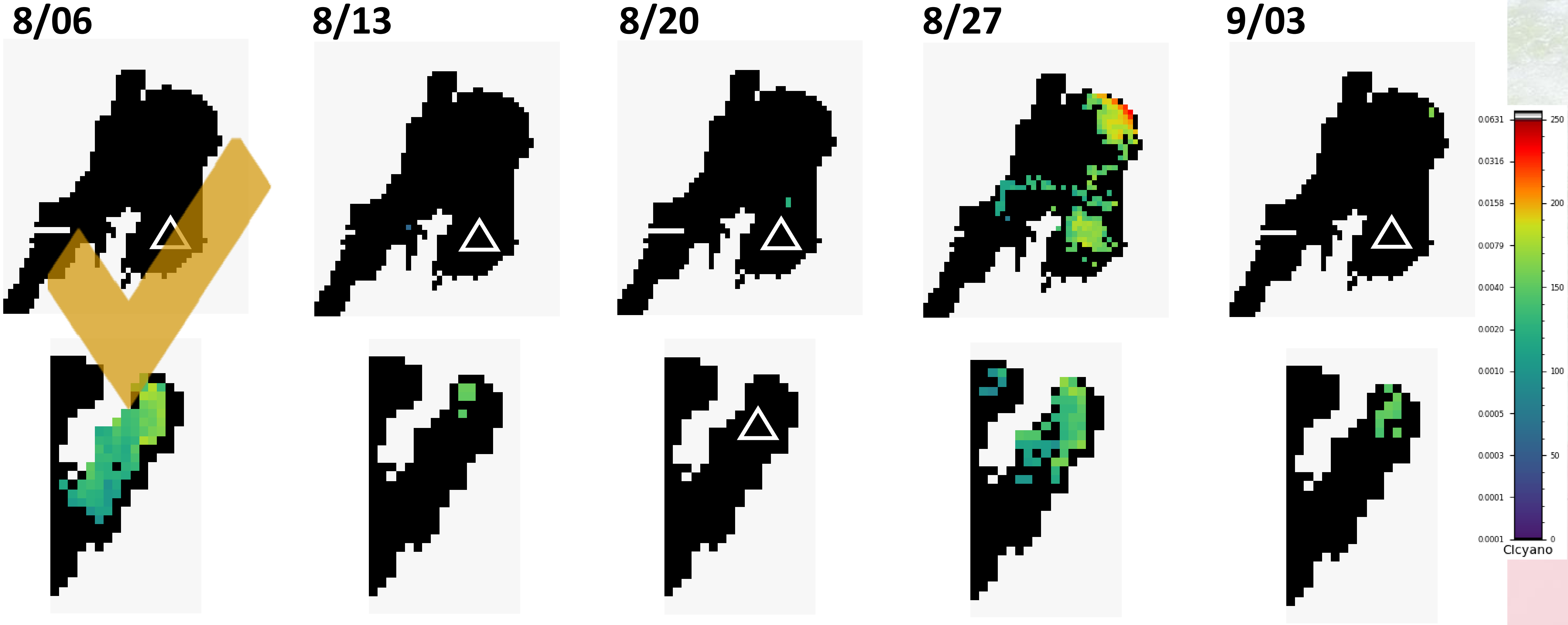

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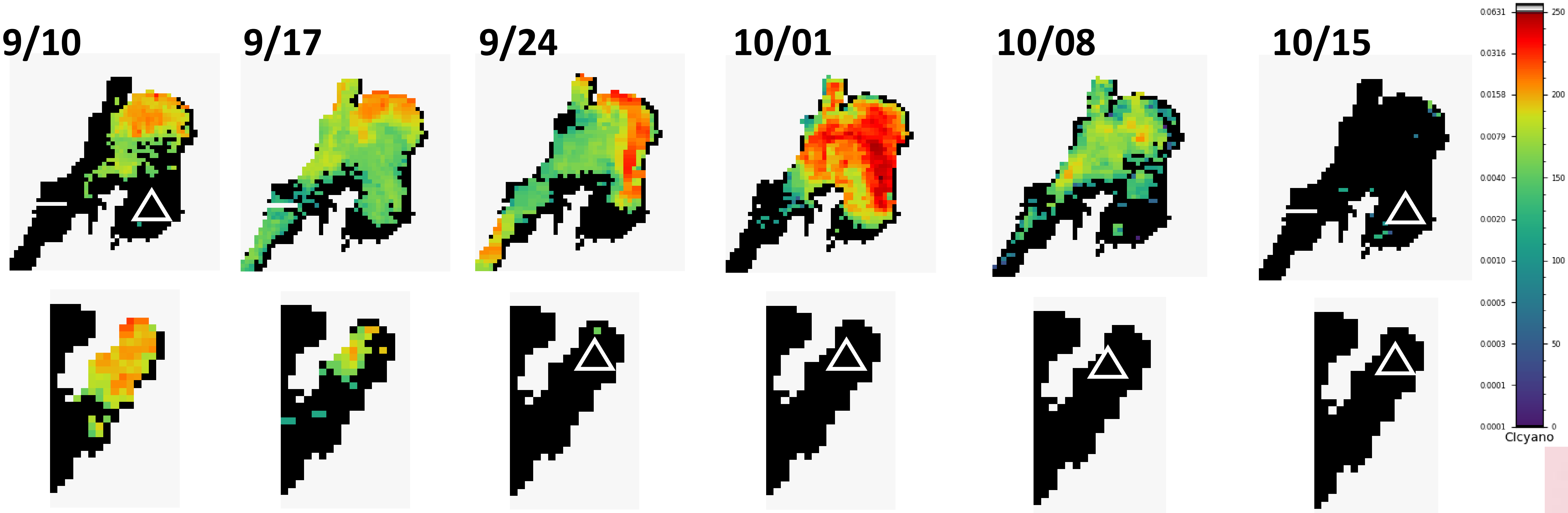

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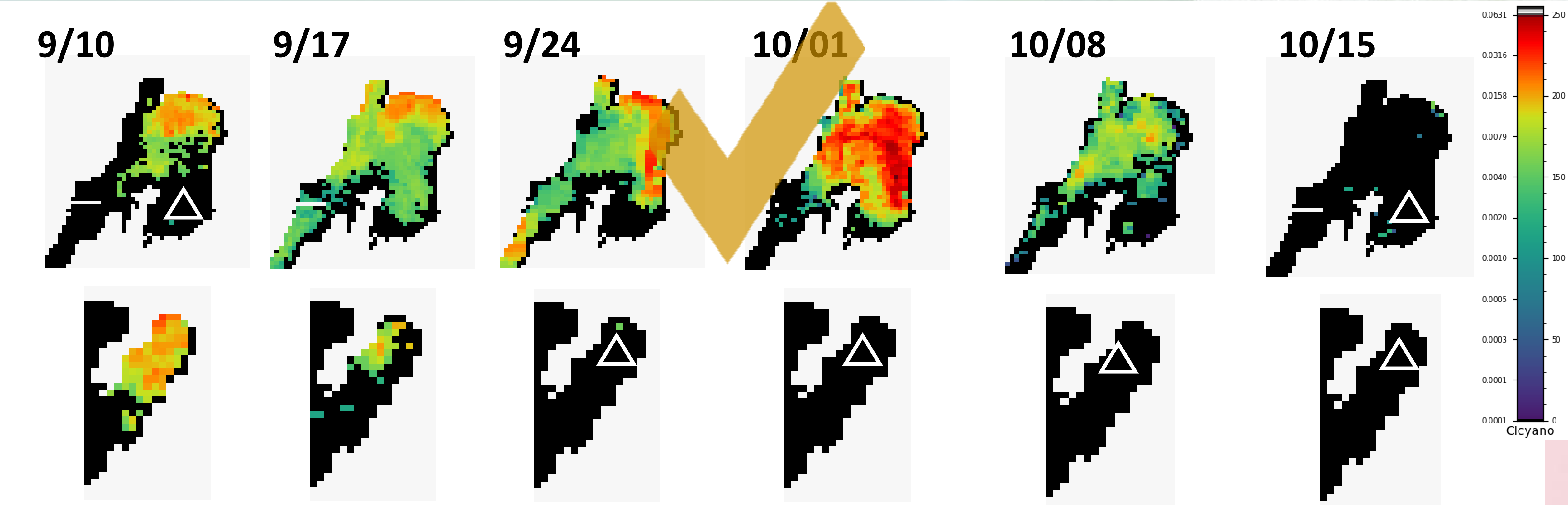

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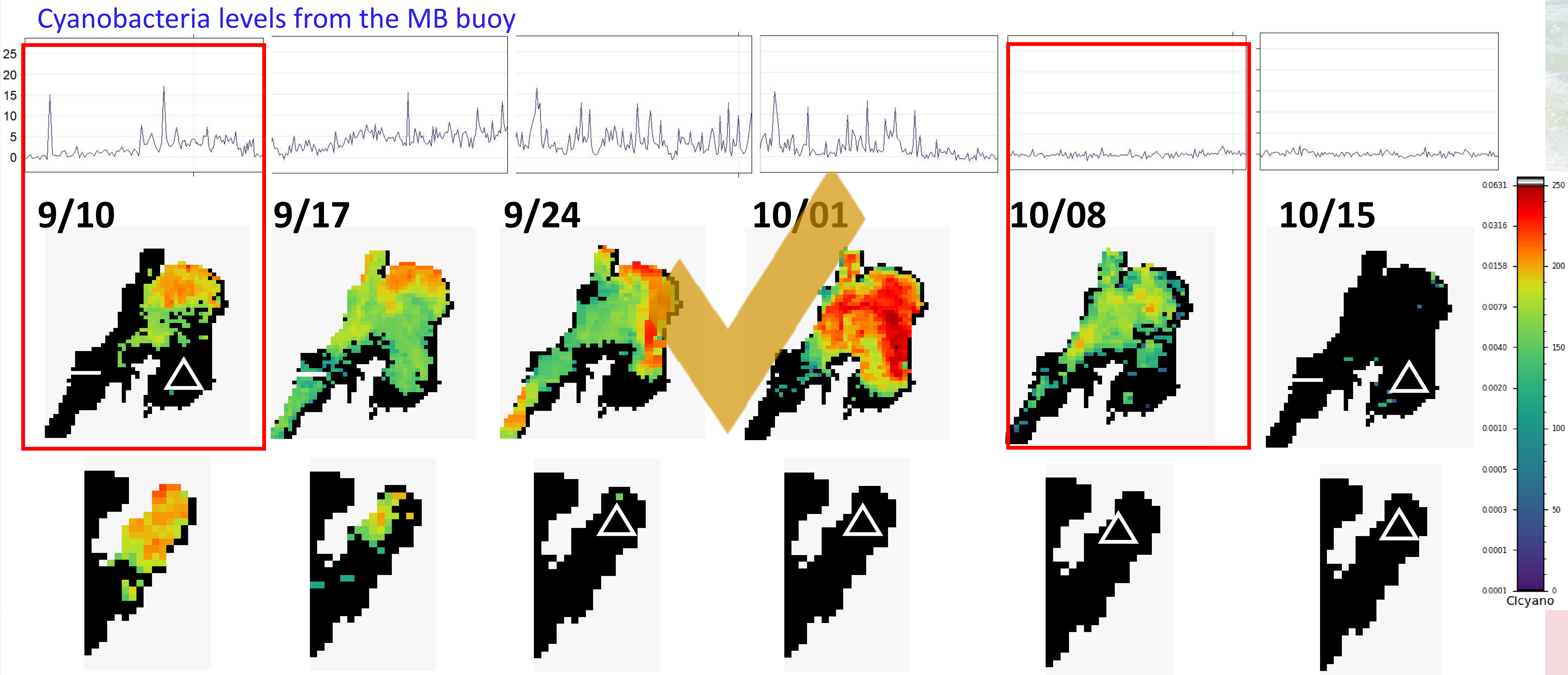

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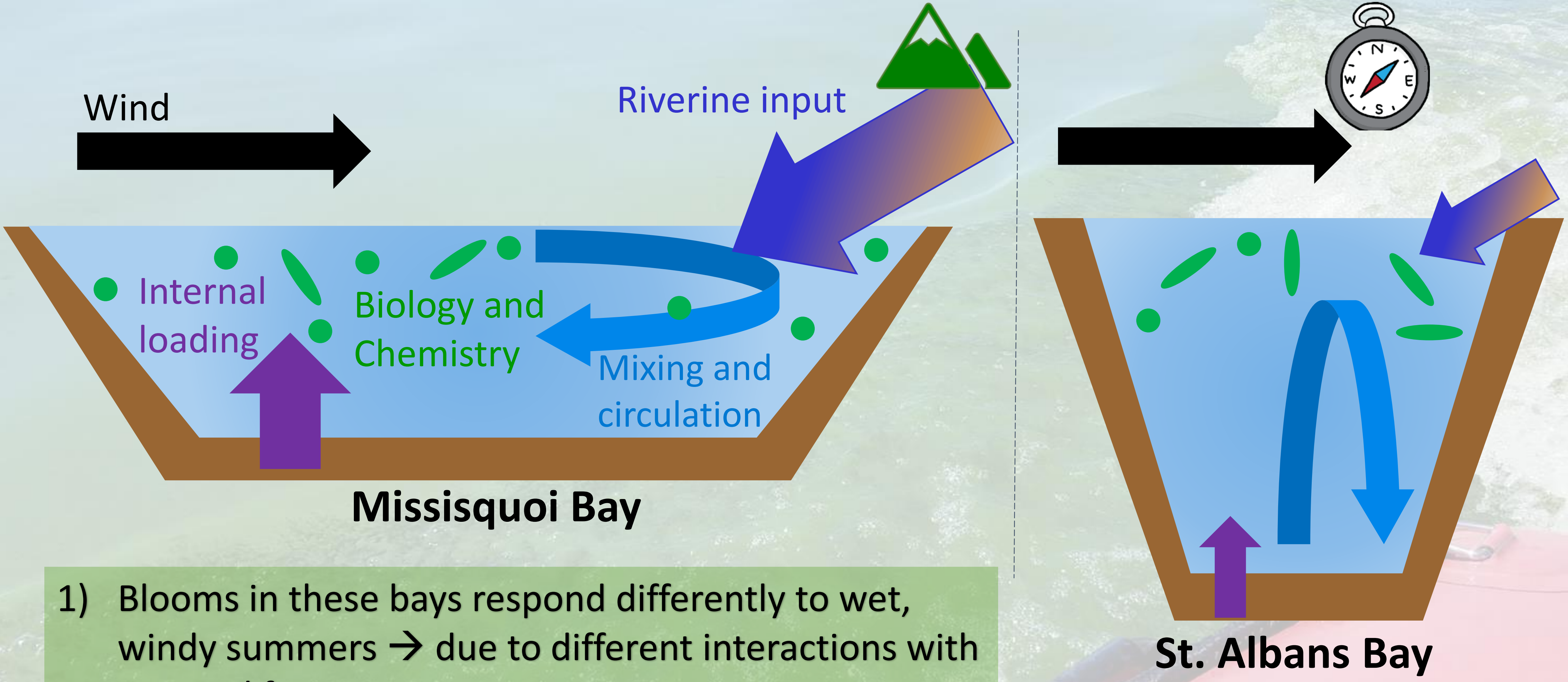
What did we learn from the 2017 high frequency data?



1) Blooms in these bays respond differently to wet, windy summers → due to different interactions with external forces

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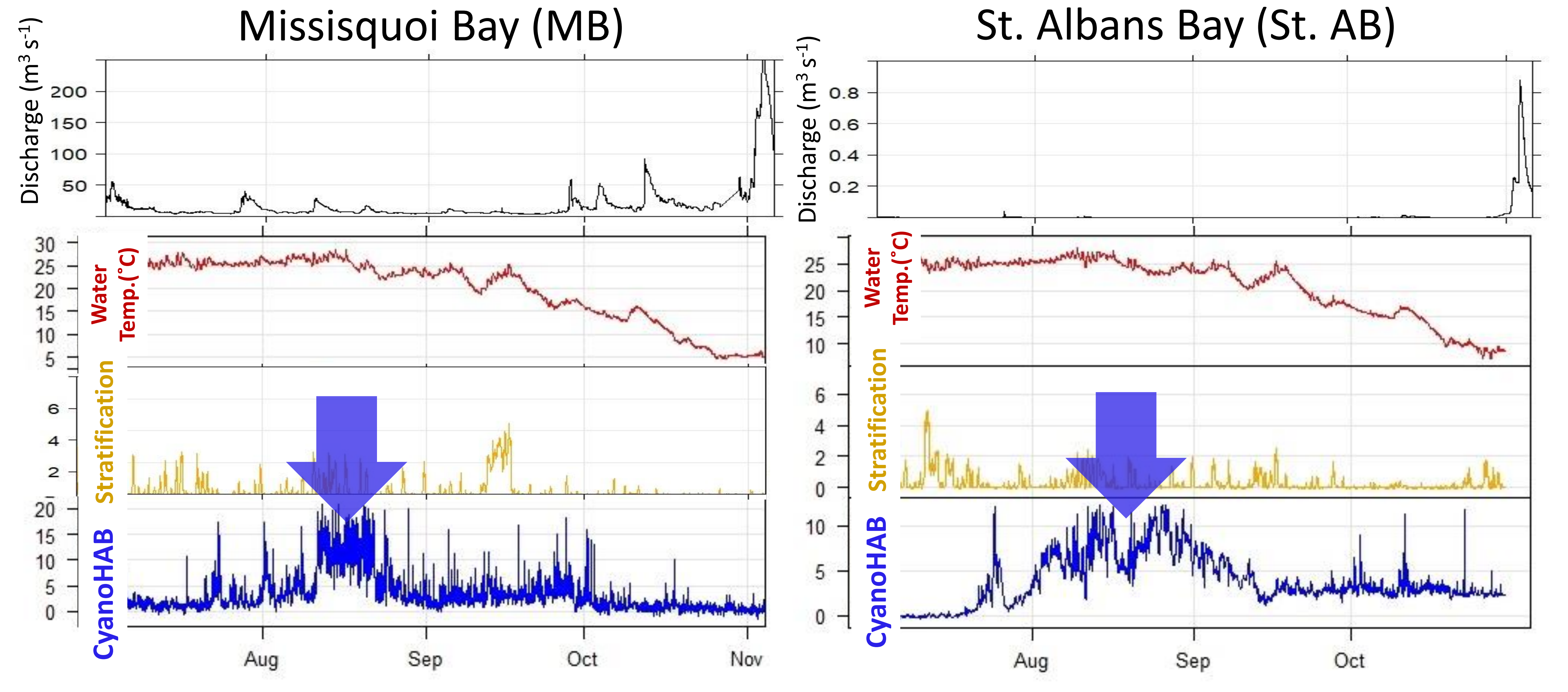
2018 bloom earlier than 2017 and similar timing between bays



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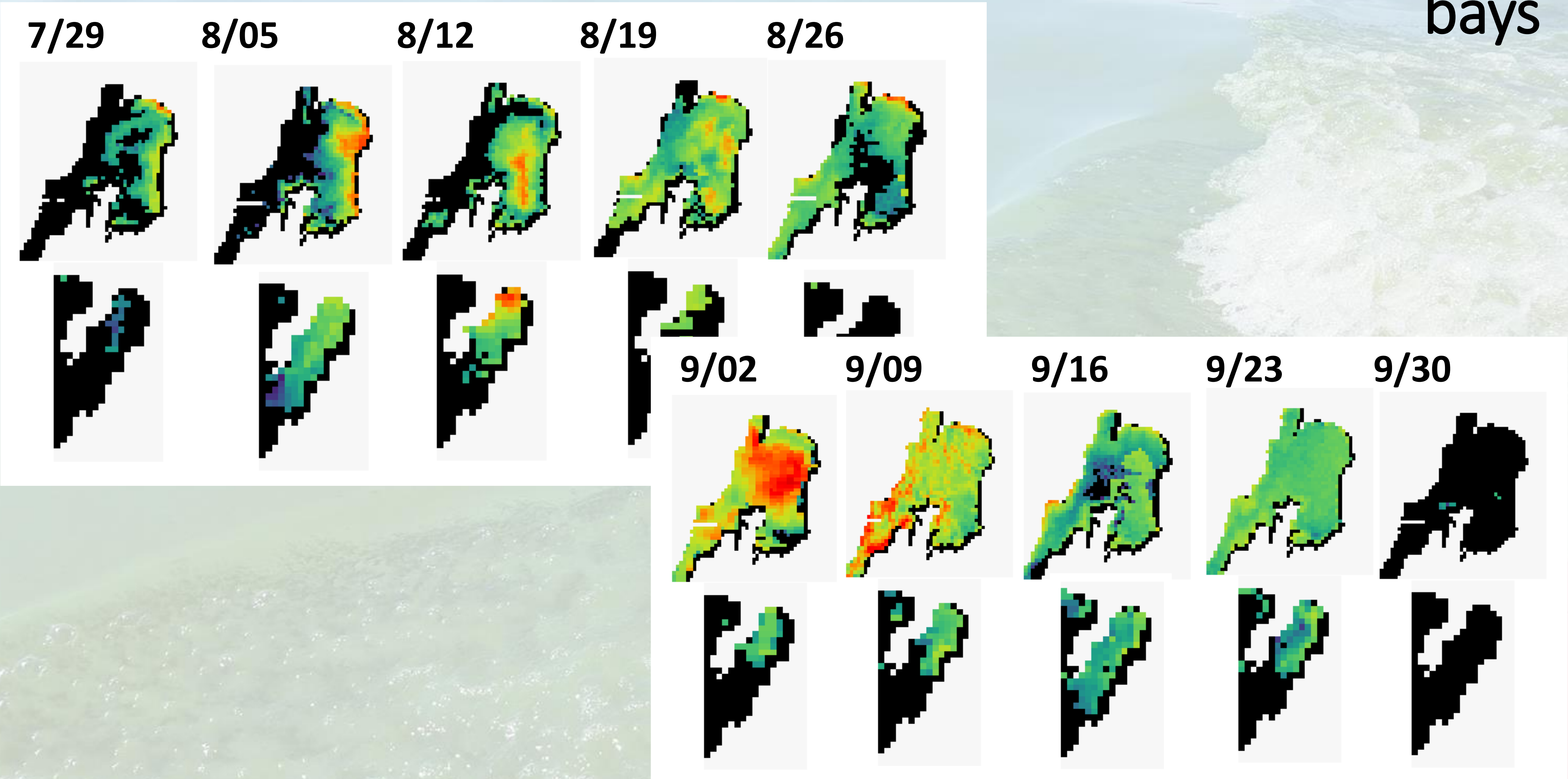

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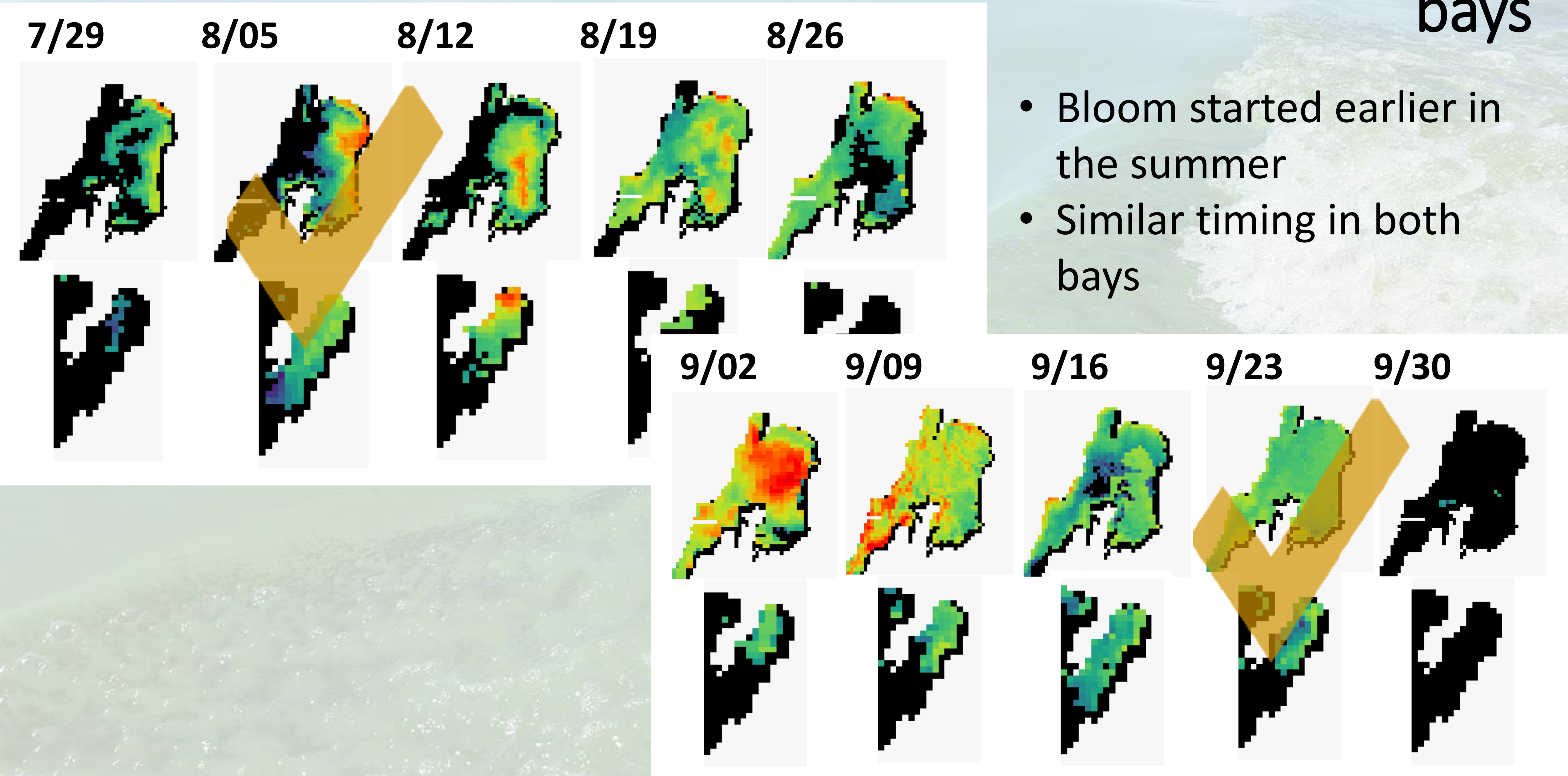


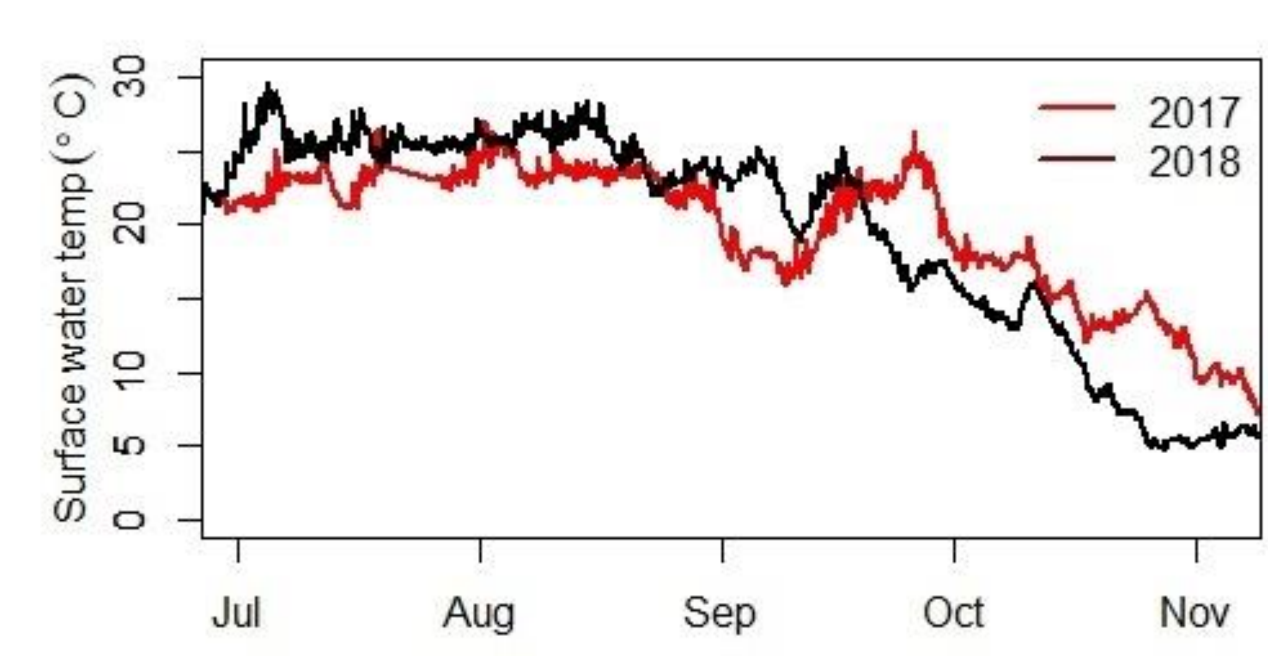
- Bloom started earlier in the summer
- Similar timing in both bays

2018 surface water temperature was higher earlier in the season

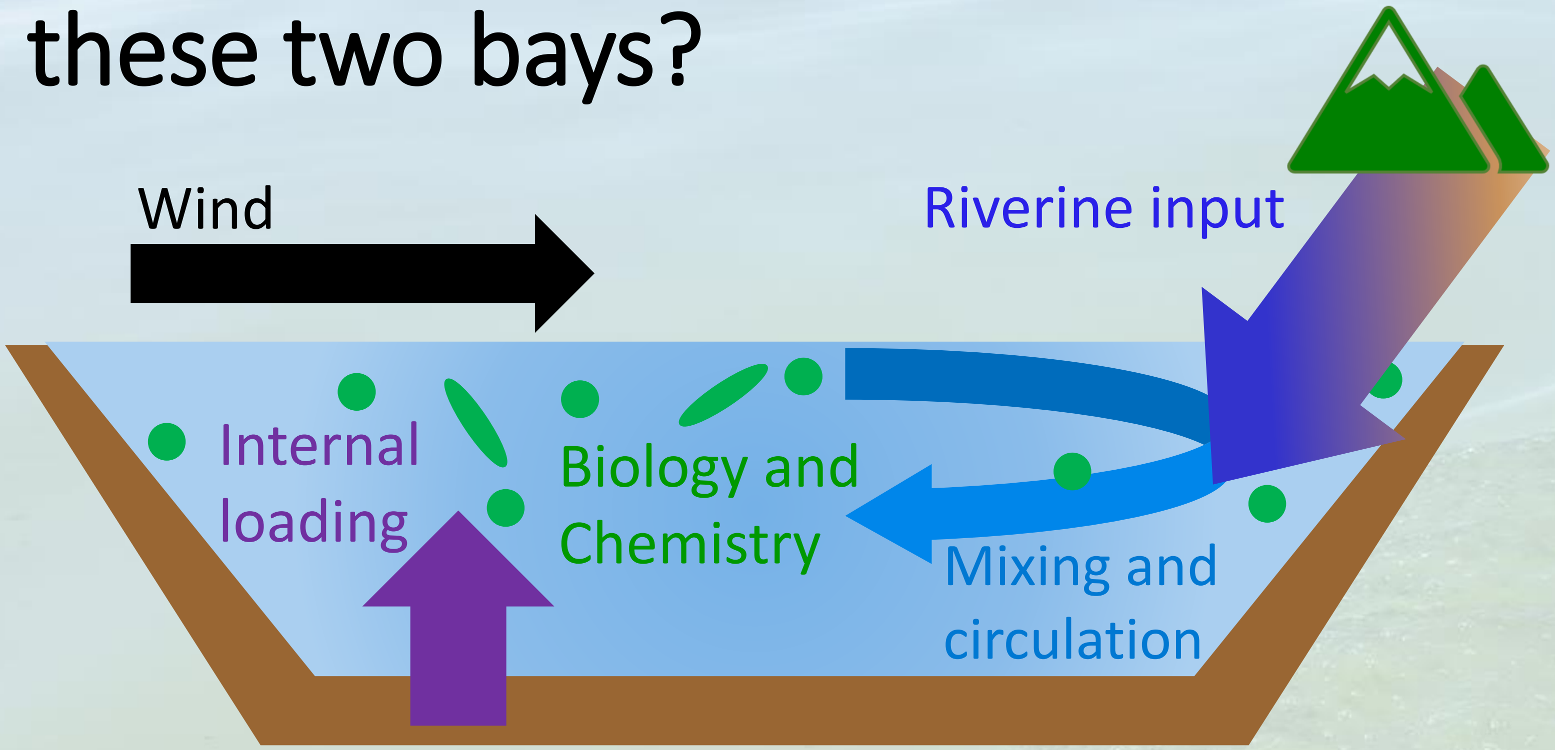
Mean monthly water temperature in Missisquoi Bay

	Jul	Aug	Sept	Oct	Days > 24˚C
2017	22.8	23.6	20.9	**15.2**	8
2018	**25.8**	**25.3**	20.7	10.6	55

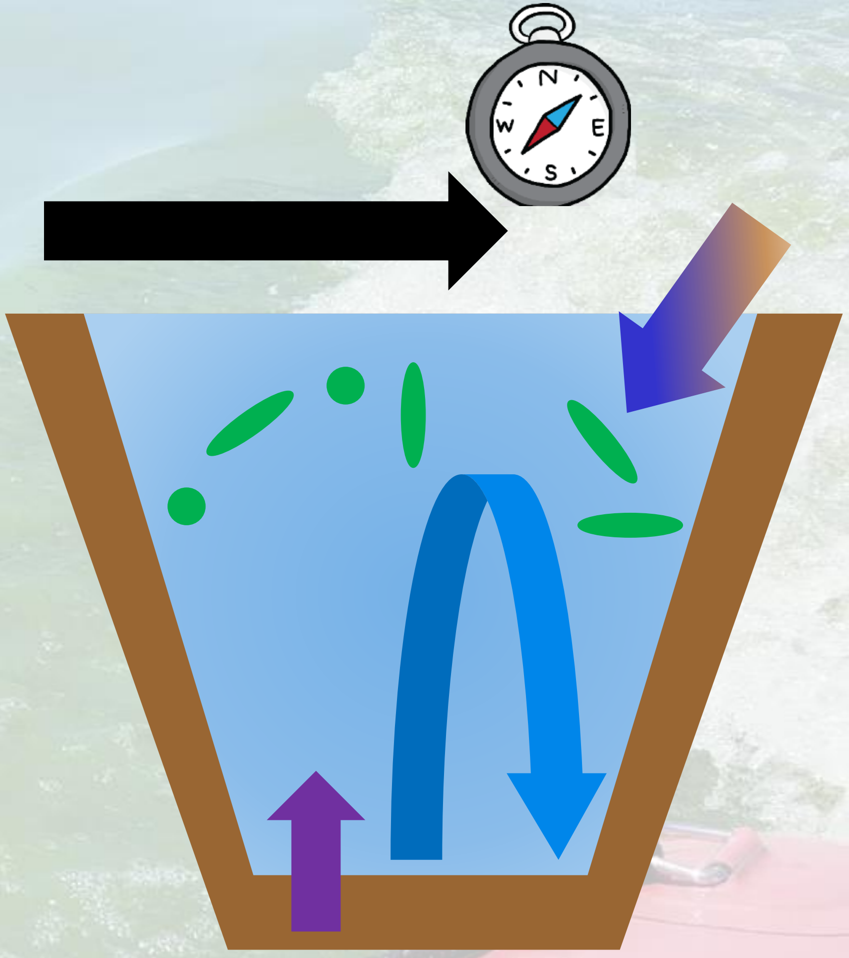
Missisquoi Bay temperature comparison



How does 2018 add to our conceptual understanding of these two bays?



Missisquoi Bay



St. Albans Bay

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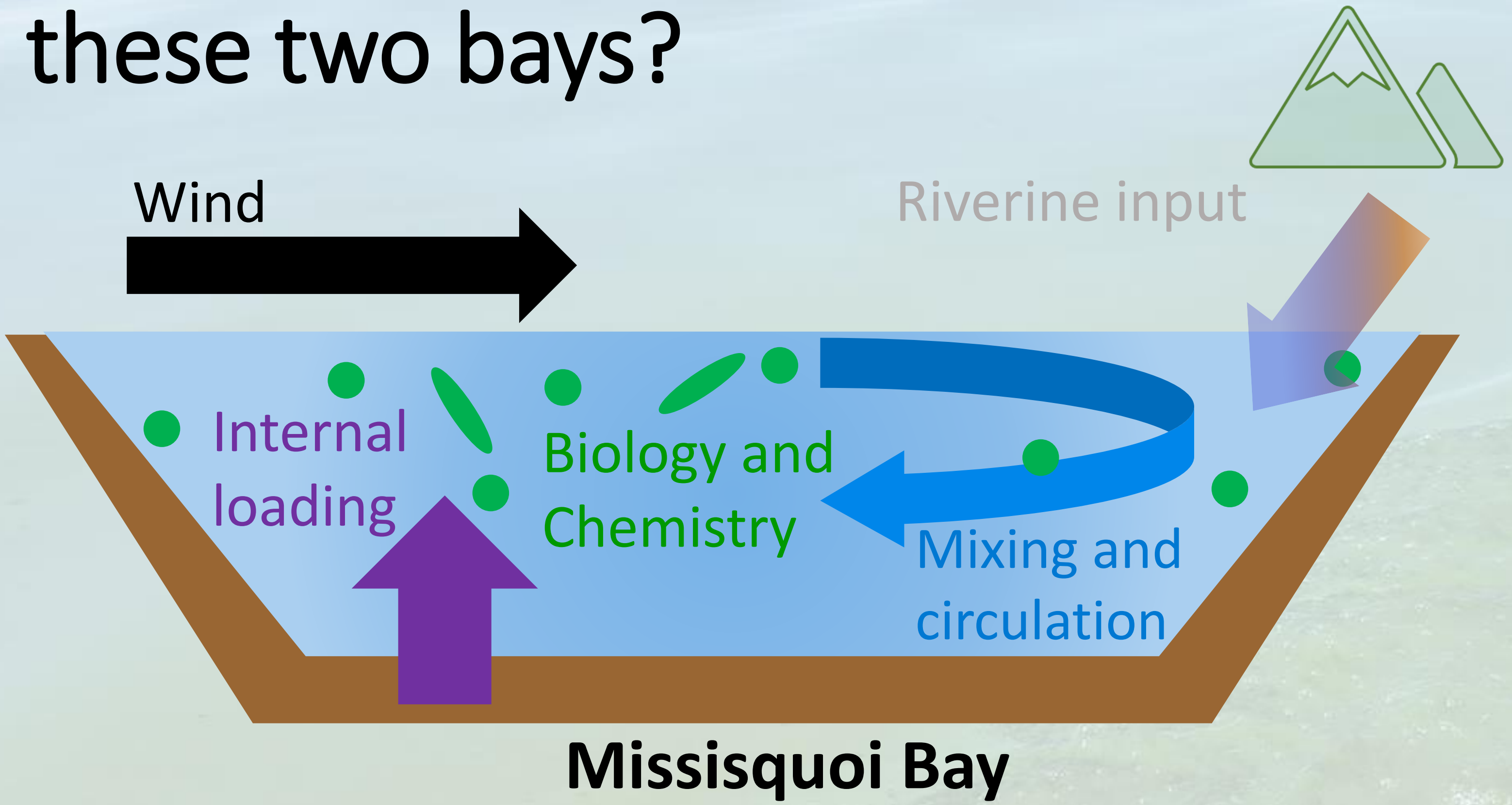

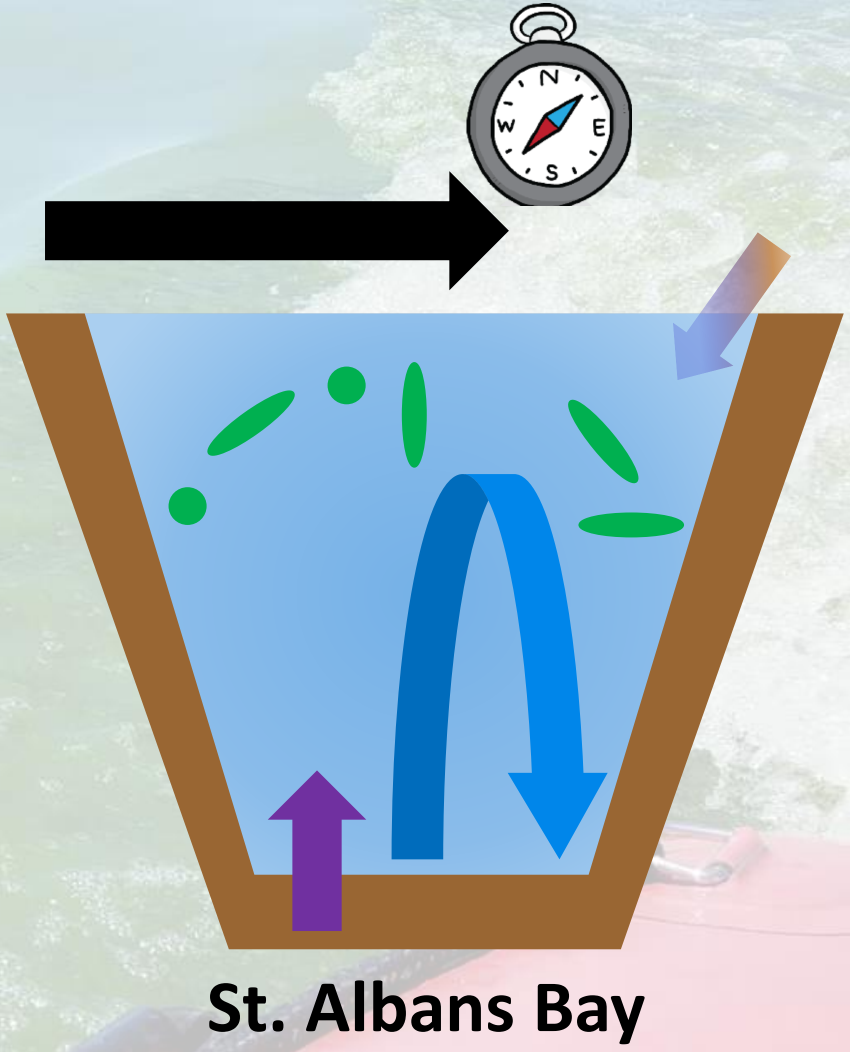

When riverine inputs are muted → internal processes are more similar

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- What did we learn from 2017 field campaign?

✓ **Wet, stormy summer = MB and St. AB cyanoHABs different timing**

✓ **External forces affect bays differently**

- How do our buoy sensors pair with remote sensing technologies?

✓ **Buoy consistently captures bloom dynamics**

✓ **Buoy intermittently doesn't capture bloom dynamics when blooms are more severe in Canadian waters**

- How did our perspective on bloom dynamics evolve with another year of high-frequency buoy data?

✓ **Dry, hot summer = MB and St. AB cyanoHABs similar**

✓ **Riverine inputs low → internal dynamics more similar**

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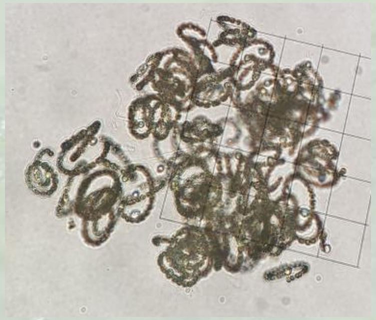
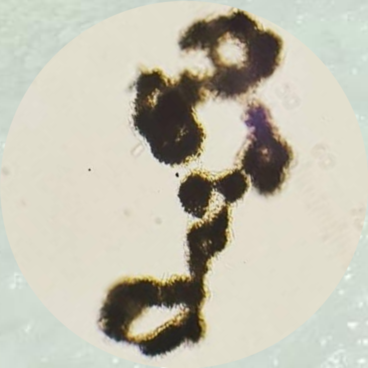
Future work

- ➢Hydrodynamic and biogeochemical lake models
- ➢Quantitative assessment of remote sensing data
- ➢Advanced statistical analysis with high frequency data
- ➢Weekly grab samples - phytoplankton counts and nutrient analysis





Light microscopy pictures of cyanobacteria cells from St. AB

Thank you to the summer interns and research technician, Saul Blocher.