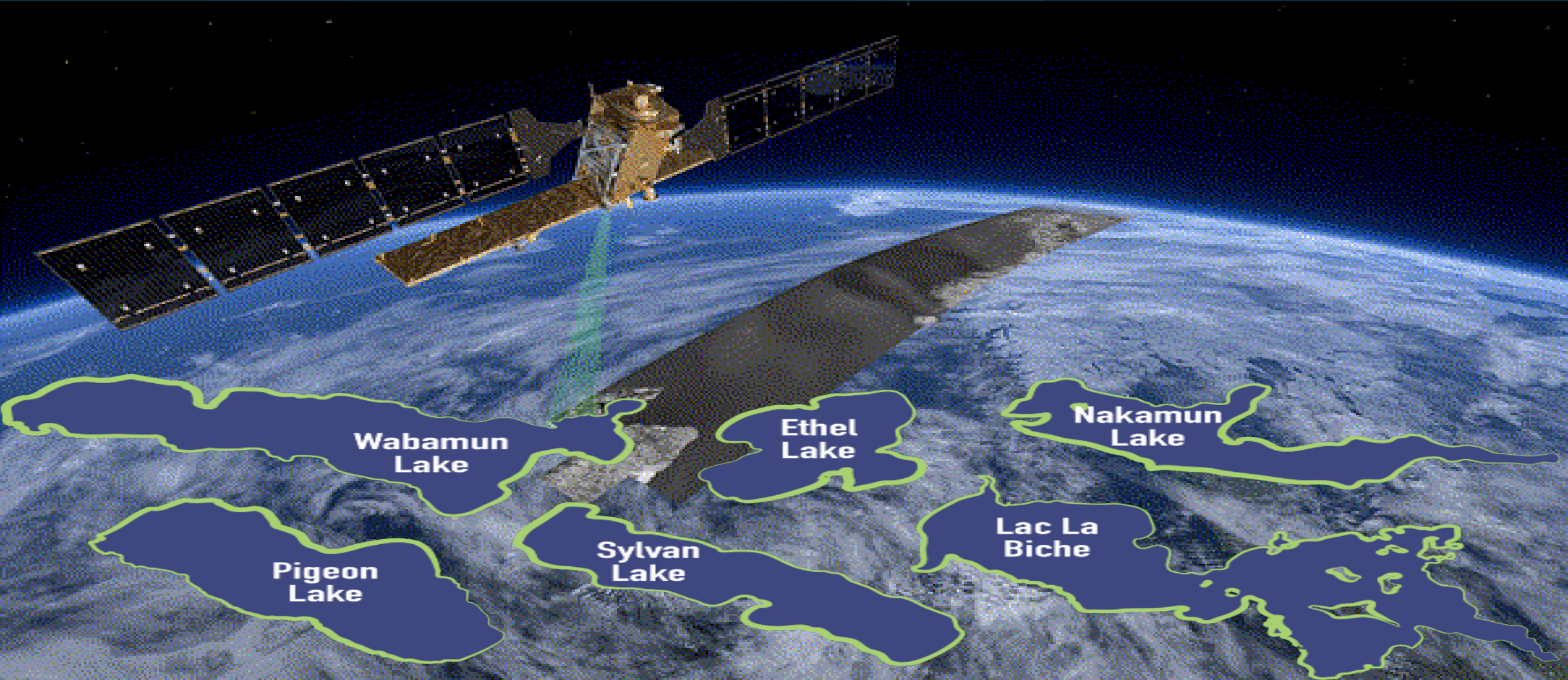


# Tracking and Forecasting Harmful Algal Blooms (HABs) in Alberta

*Rolf Vinebrooke et al.*

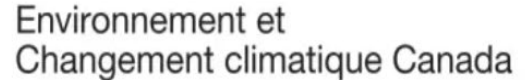
*Department of Biological Sciences, University of Alberta*



# Funding & Partners



Alberta Environmental Science Program



INGRID CHORUS (ED.)

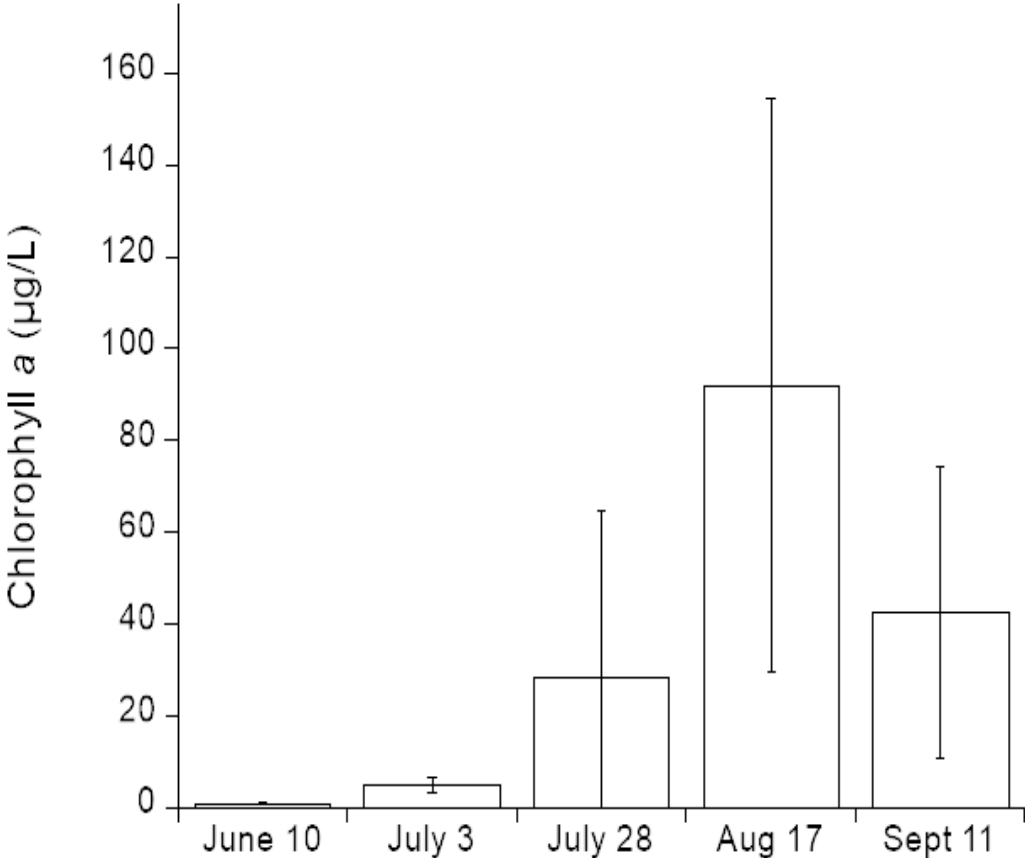
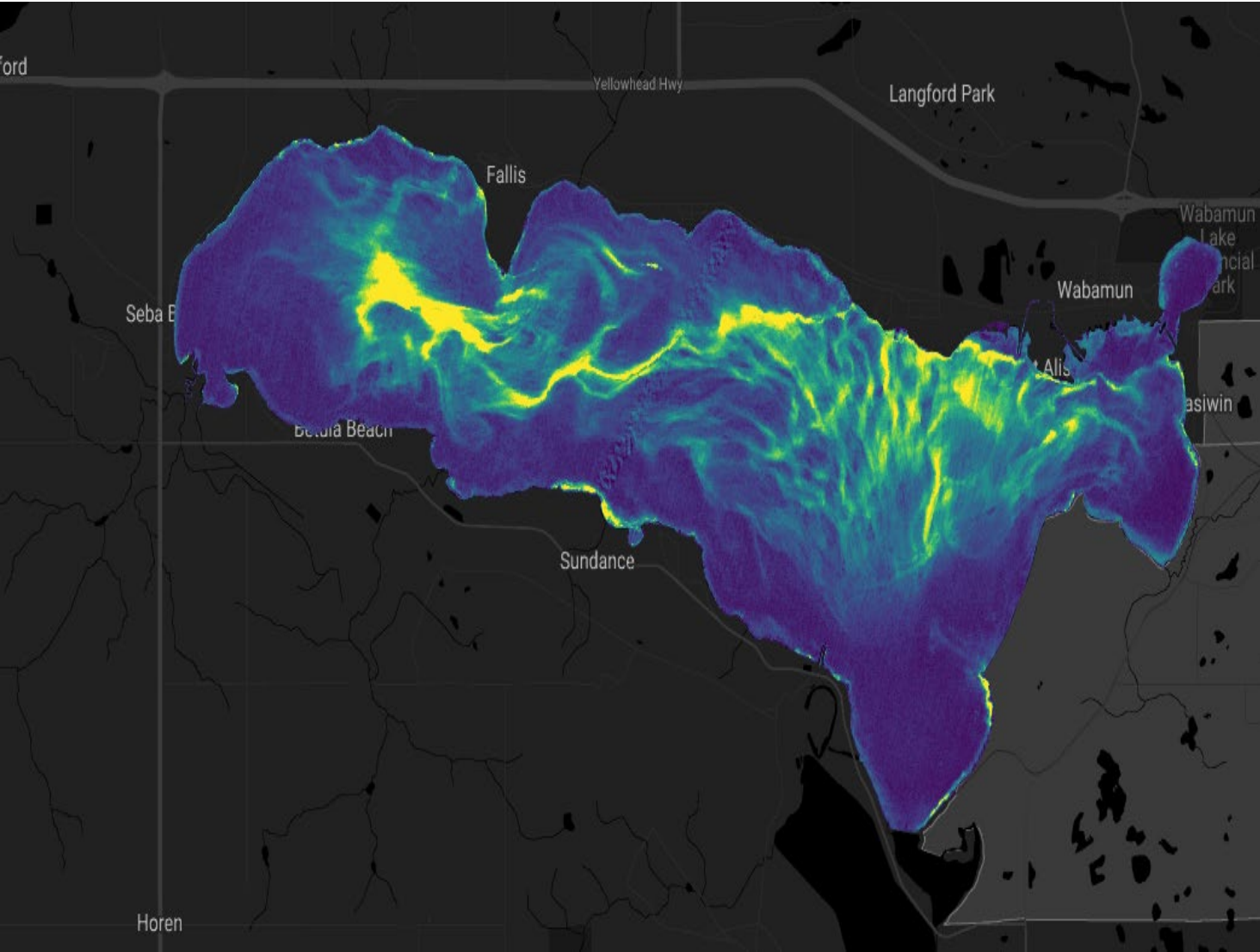
# CYANOTOXINS

OCCURRENCE  
CAUSES  
CONSEQUENCES

Springer



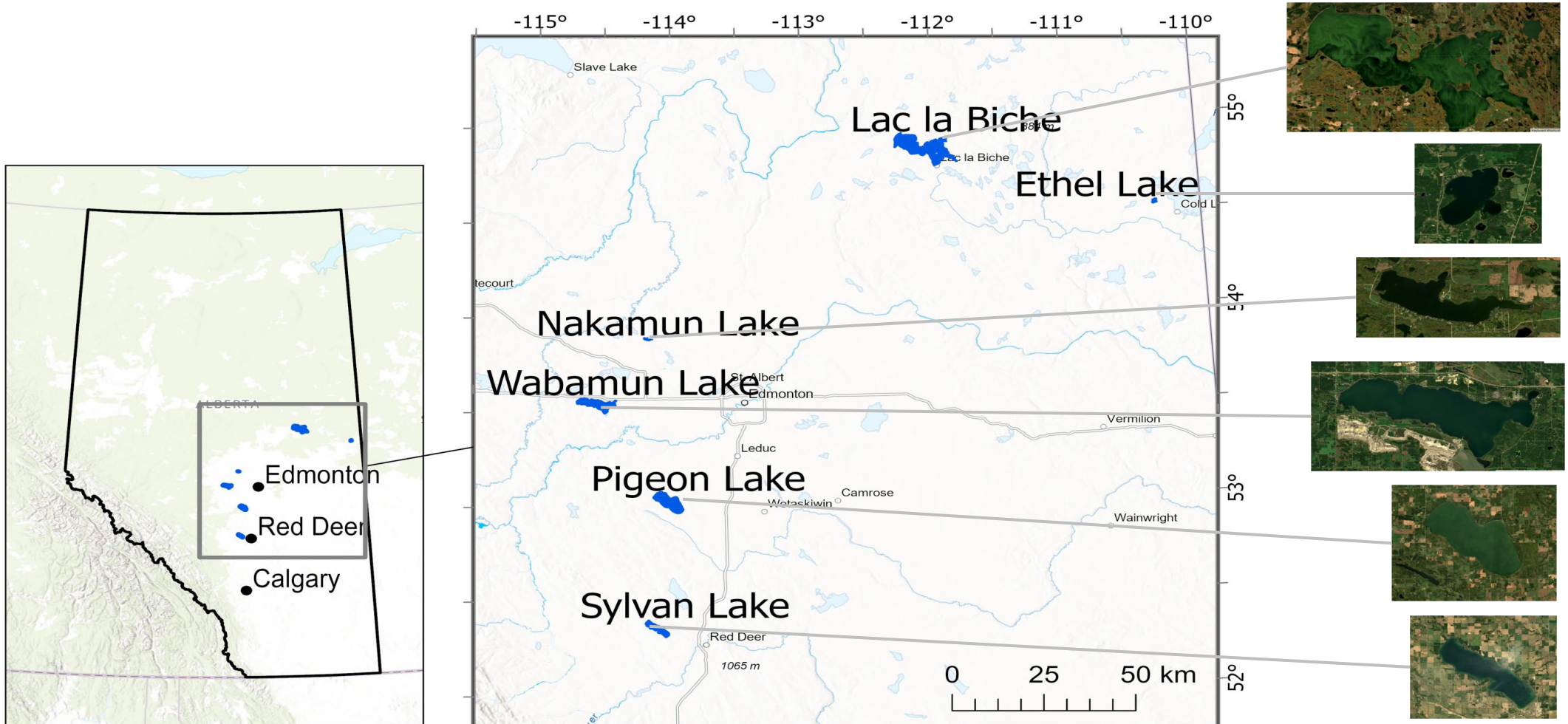
# HABs are Highly Dynamic and Difficult to Measure



# Guiding Research Questions

- How to achieve representative whole-lake sampling of HABs?
- Have HABs worsened over time in Alberta?
- How can we forecast future HABs in lakes of Alberta?

# The Study Lakes





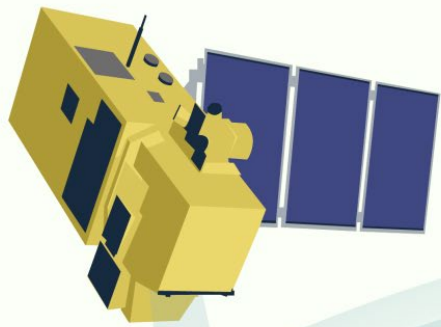
## Project Objective #1

Calibration and  
validation of satellite-  
based chlorophyll  
retrieval models of HABs

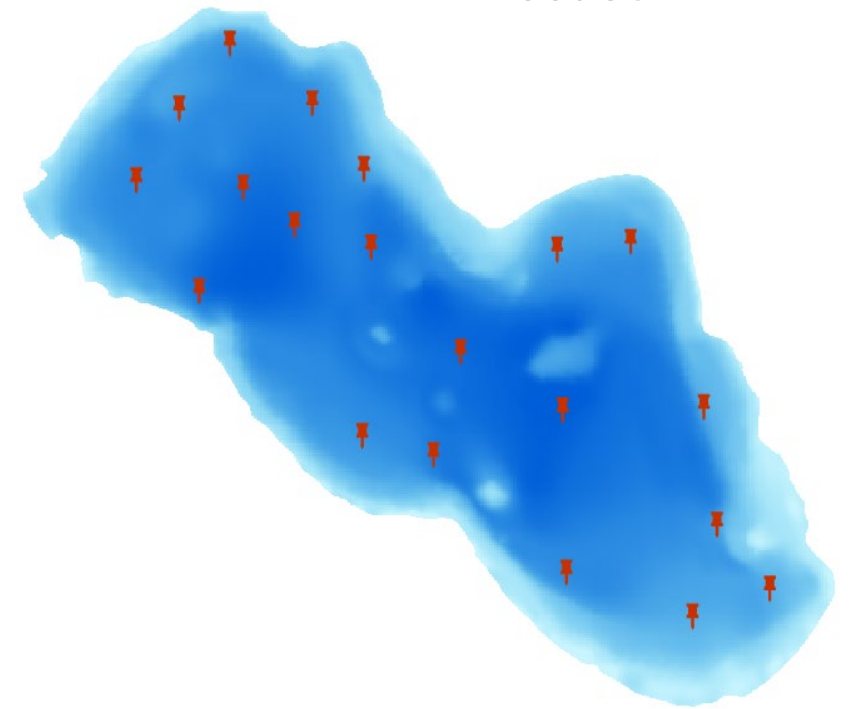
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# Ground-Truthing of Satellite Imagery



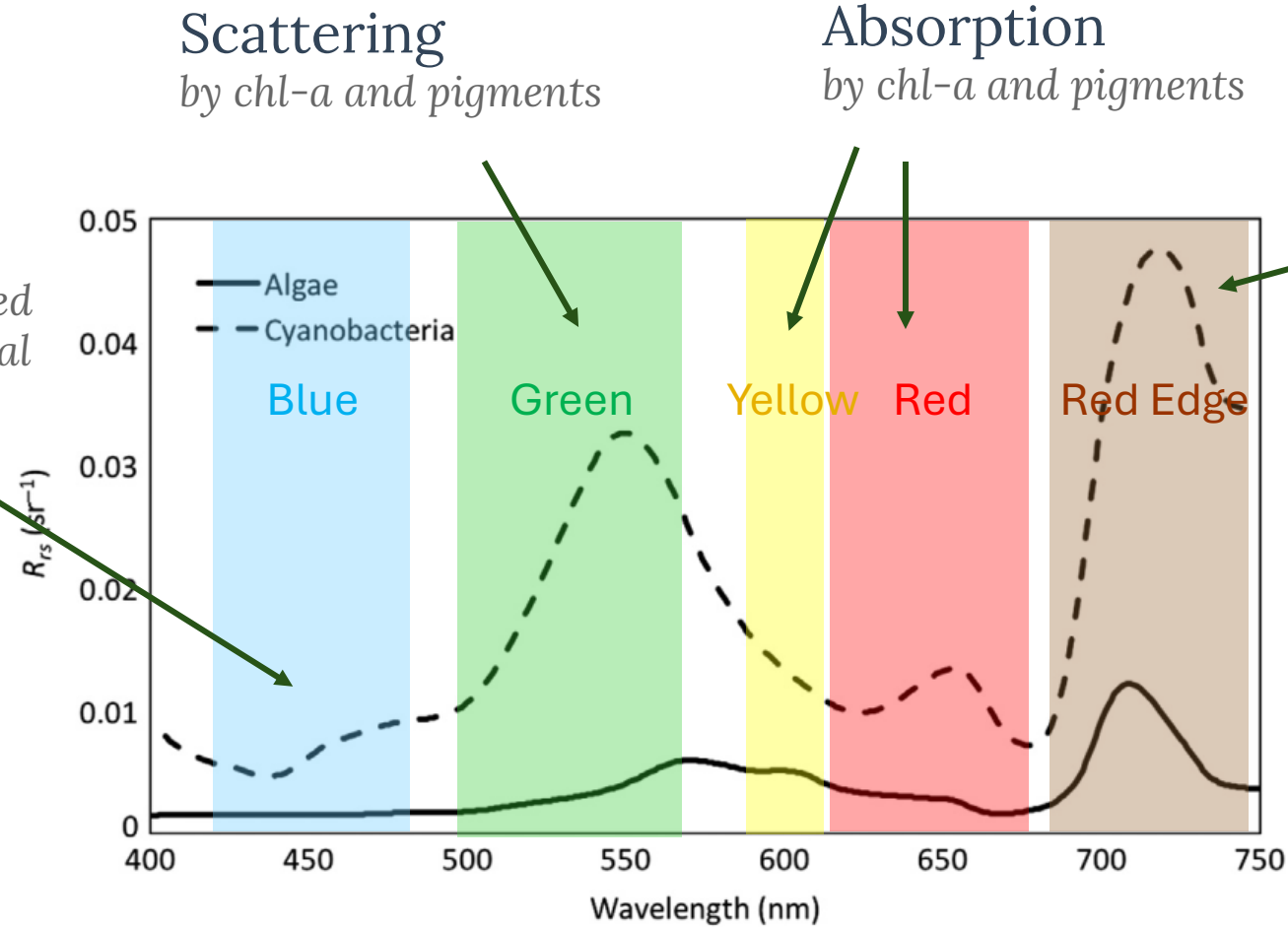
Sentinel-2  
overpass,  
every 5 days



20-40 sample sites  
per lake or basin,  
visited 3-4 times per  
season

# Satellite Detection of Reflectance of Sunlight by HABs

Absorption  
by chlorophyll, dissolved  
organic matter, mineral  
sediment



Scattering  
by phytoplankton cell  
structures

Source: Matthews, M. (2017) from "Bio-optical Modelling of Phytoplankton Chlorophyll" in Mishra, Ogashawara, and Gitelson (ed.) *Bio-optical Modelling and Remote Sensing of Inland Waters*, p. 177.

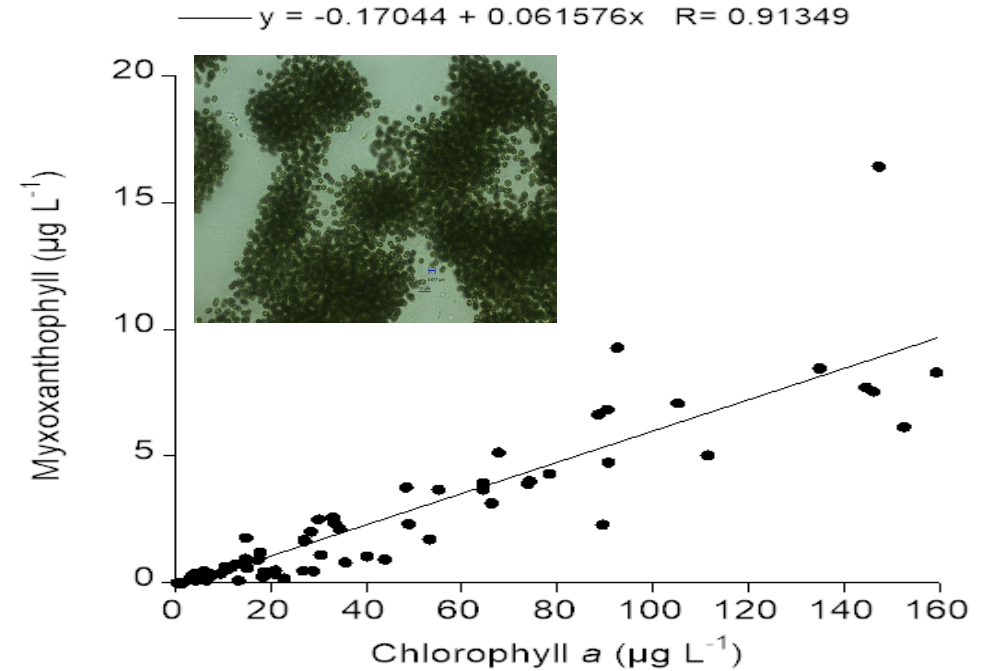
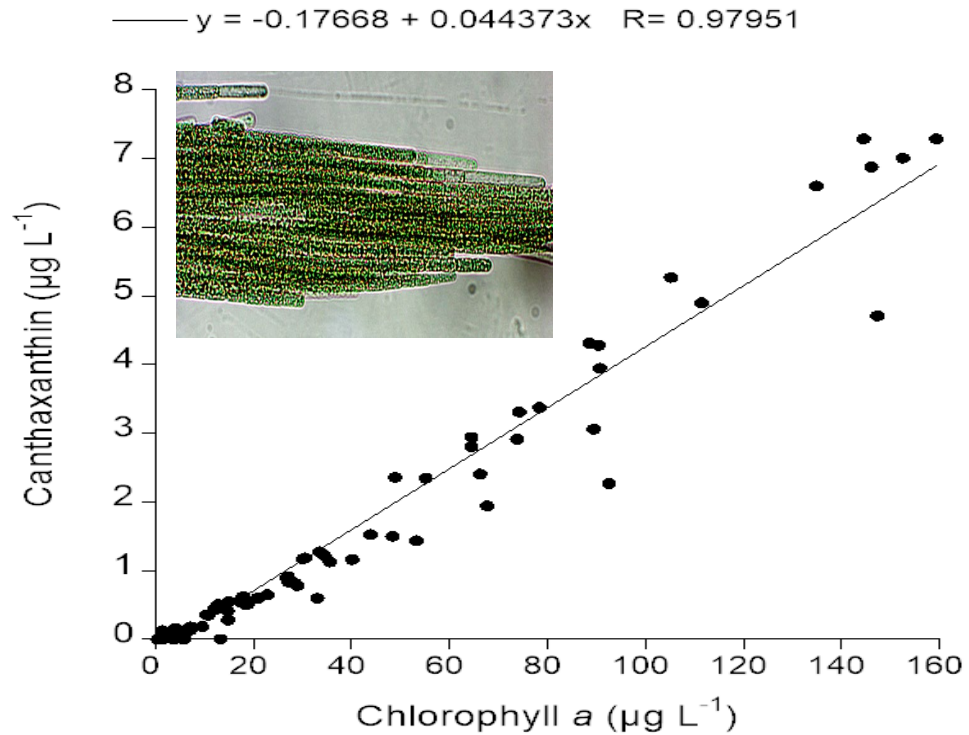
Annotations added by F. Gregory & J. Hird

# High Performance Liquid Chromatography - Analyses of HAB pigments



# Taxonomically Diagnostic Pigments Confirm Cyanobacteria are the Primary Producers of Chlorophyll *a*

*Vinebrooke et al. 2025 Can J Fish Aquat Sci*



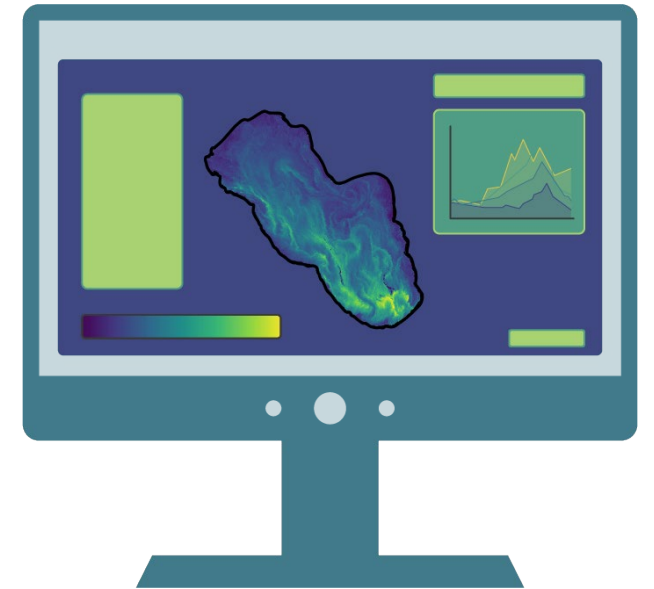
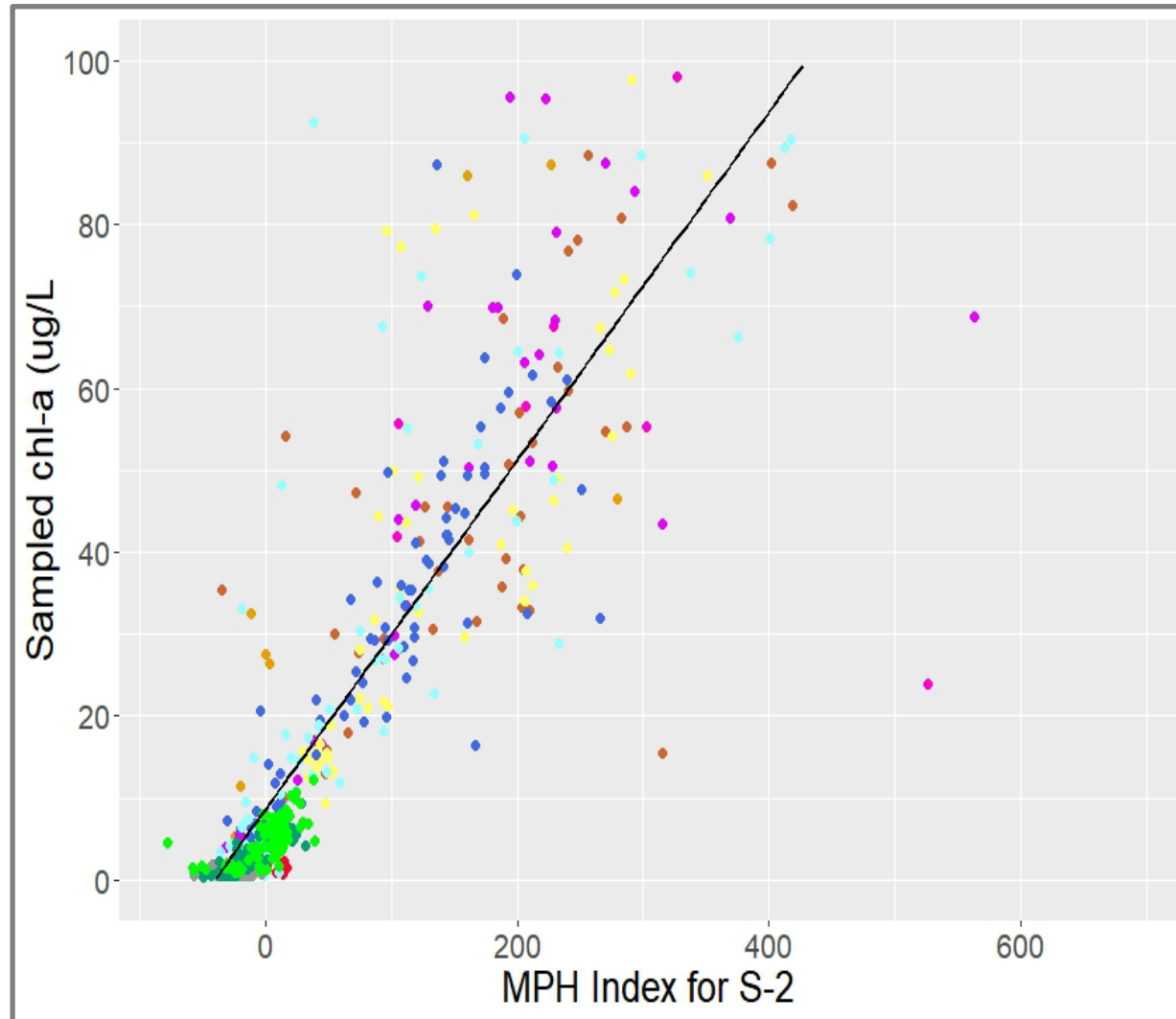
# Calibration of the Satellite Model – The Algorithm

$$\text{Chlorophyll } a = 0.217x + 7.828$$

$r^2 = 0.78$ ,  $n = 628$ ; *Fiona Gregory, ABMI*

## LakeName

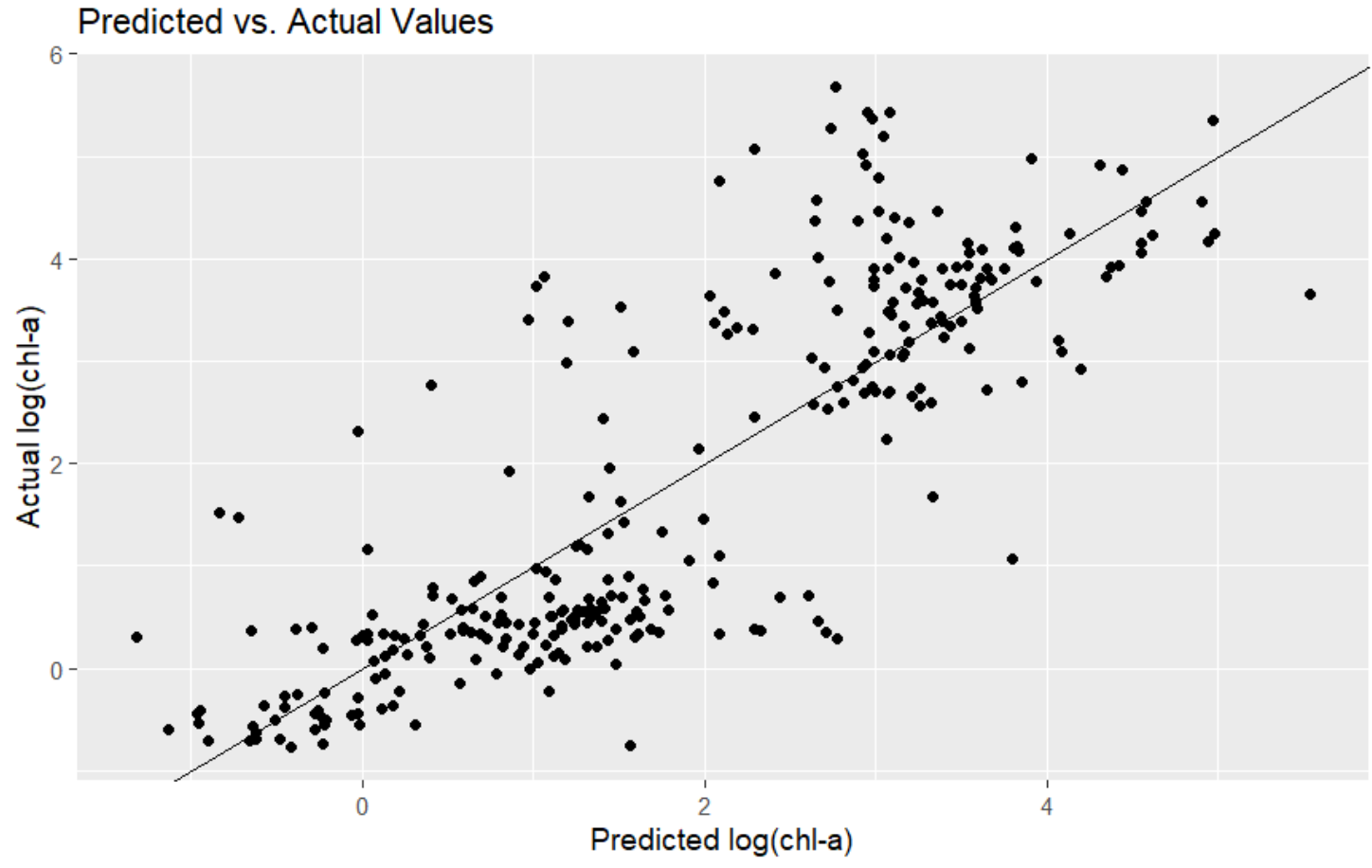
- Ethel\_2023
- LLB\_East\_2021
- LLB\_East\_2023
- LLB\_West\_2021
- LLB\_West\_2023
- Nakamun\_2023
- Pigeon\_2020
- Pigeon\_2023
- Sylvan\_2023
- Wabamun\_2021
- Wabamun\_2023



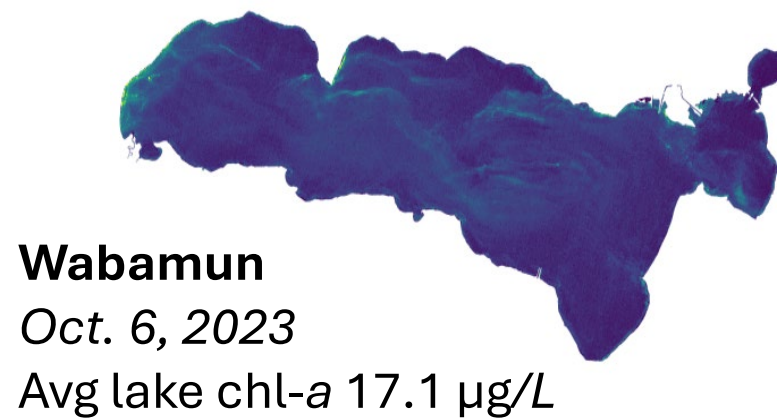
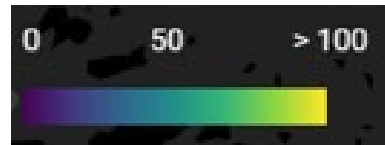
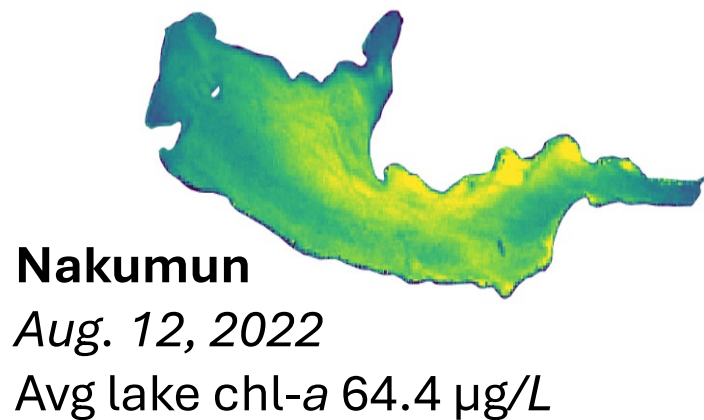
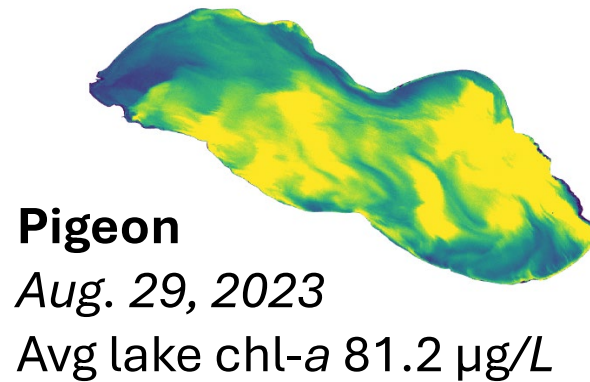
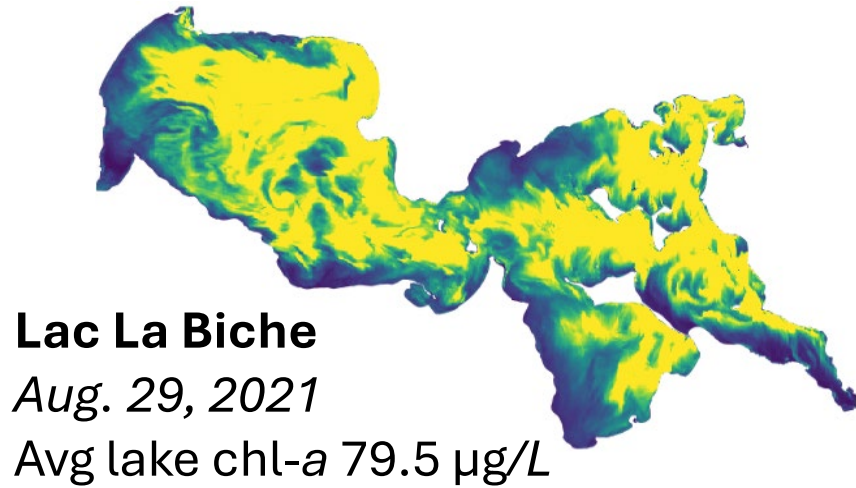
# Validation of The Algorithm

$r^2 = 0.69$ ,  $n = 296$

*Fiona Gregory, ABMI*



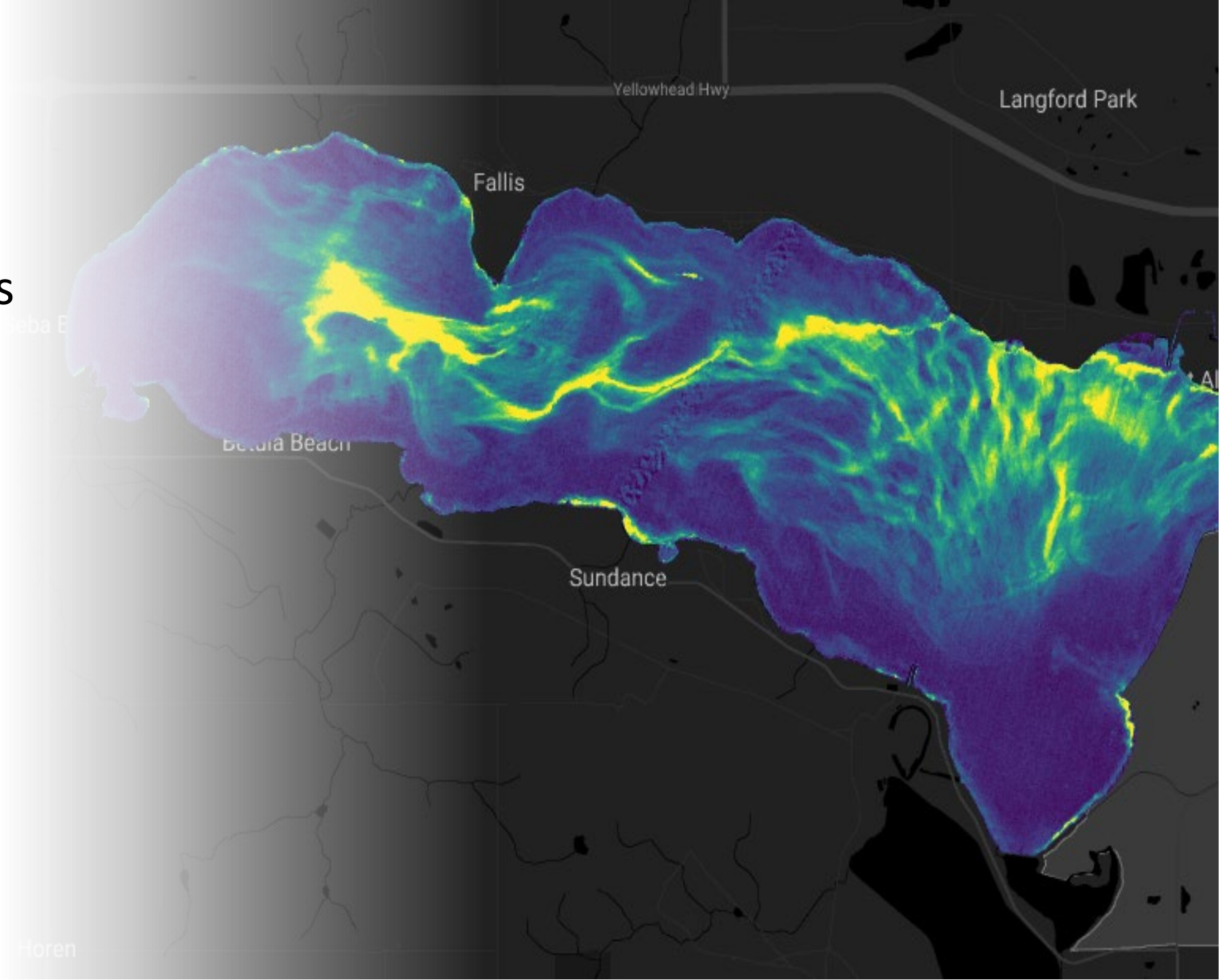
# Sentinel 2 Satellite Data Show Peak HABs Differ in Timing Across Alberta Lakes from 2017 - 2025



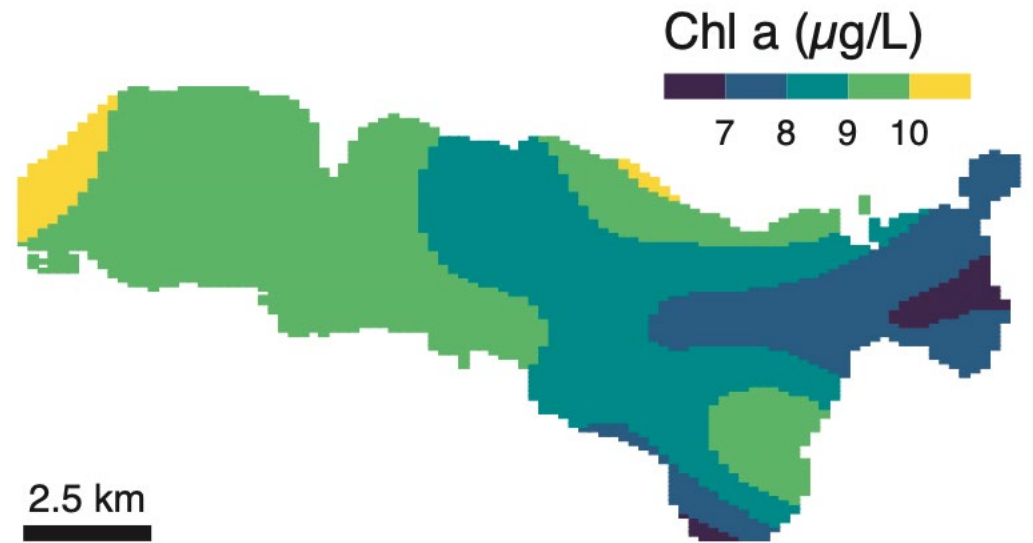
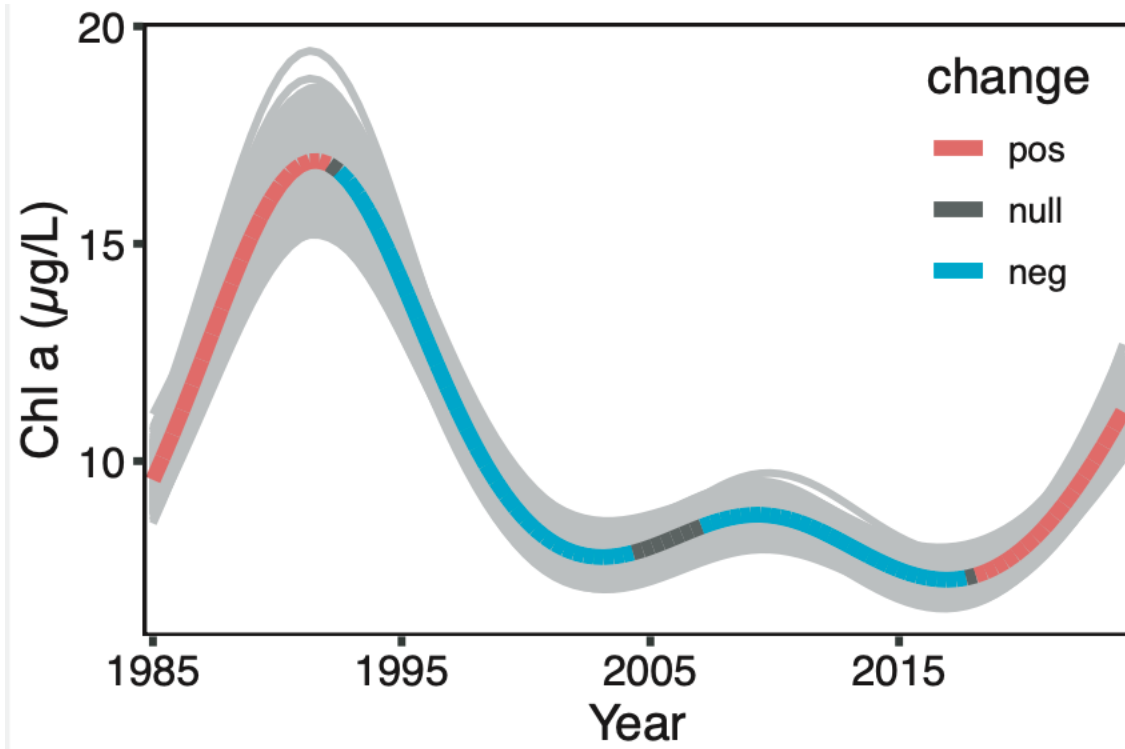
## Project Objective #2

Trend analyses of HABs  
over the past decades  
using archival satellite  
data

*Renz Layugan, MSc*



# Trend Analysis of Landsat Satellite Data of HABs in Wabamun Lake since the 1980s





## Project Objective #3

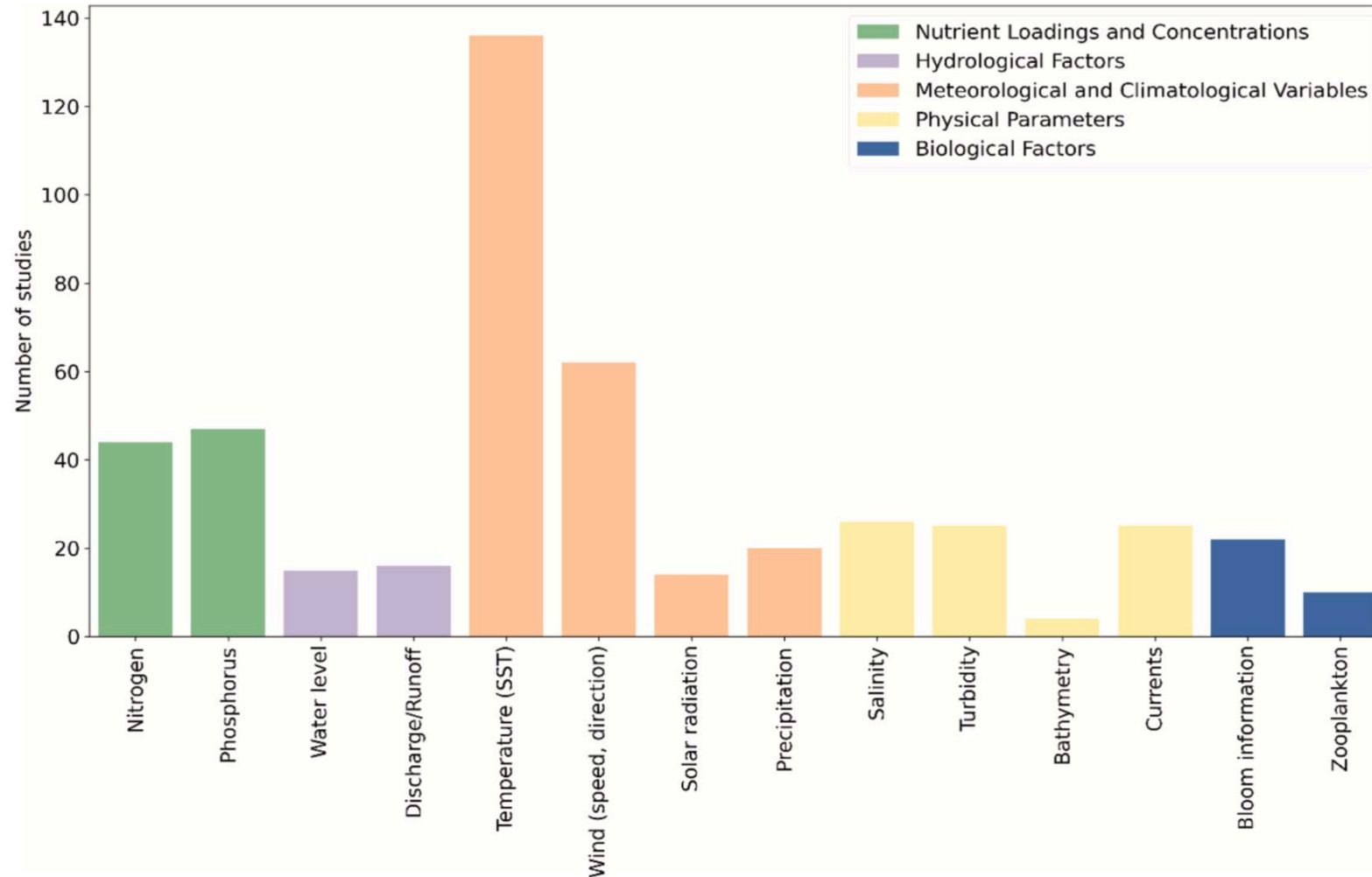
Develop forecasting models for HABs using lake observatories with satellite remote-sensing data

*Katie Campbell MSc*

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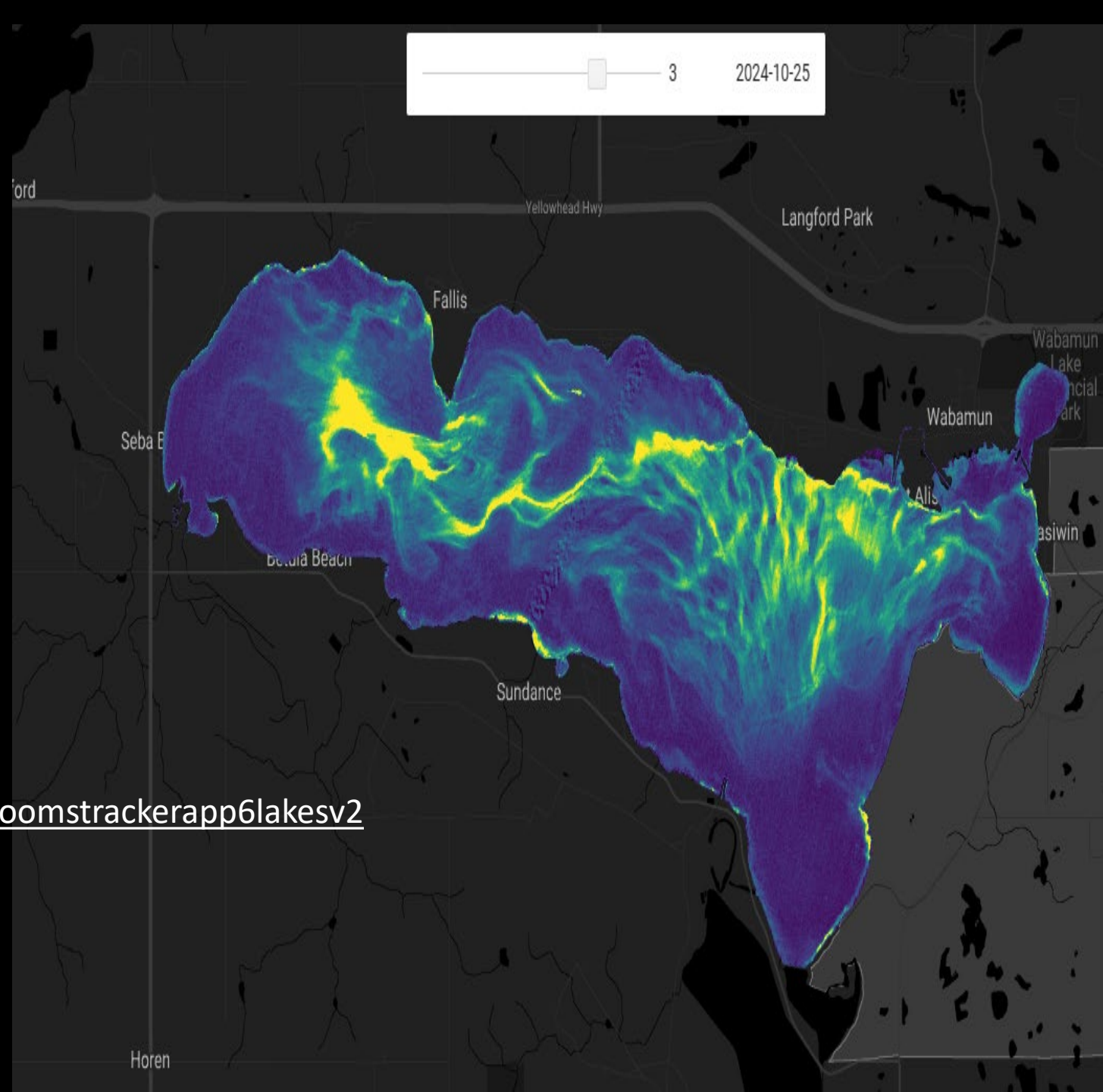
# Predictor Variables Used in Forecasting Models



## Project Objective #4

Develop a web-based application for HABs in Alberta lakes

<https://ee-habs.projects.earthengine.app/view/algalbloomstrackerapp6lakesv2>





QUESTIONS?

