Leveraging Citizen Science to Improve Water Monitoring in Alberta's Boreal

Bradley Peter – February 25, 2025

Vision: Healthy Lakes for Alberta’s Future

Mission: ALMS builds awareness and understanding of lakes by engaging individuals and communities in monitoring, management, and education.

Values:

- ALMS values sustainable, functioning, and resilient lake ecosystems.
- ALMS values relationships with diverse audiences built on trust, transparency, and respect.
- ALMS values local, traditional, and scientific knowledge systems for stewardship of Alberta's lakes.
- ALMS is valued as a credible leader in lake monitoring and management.

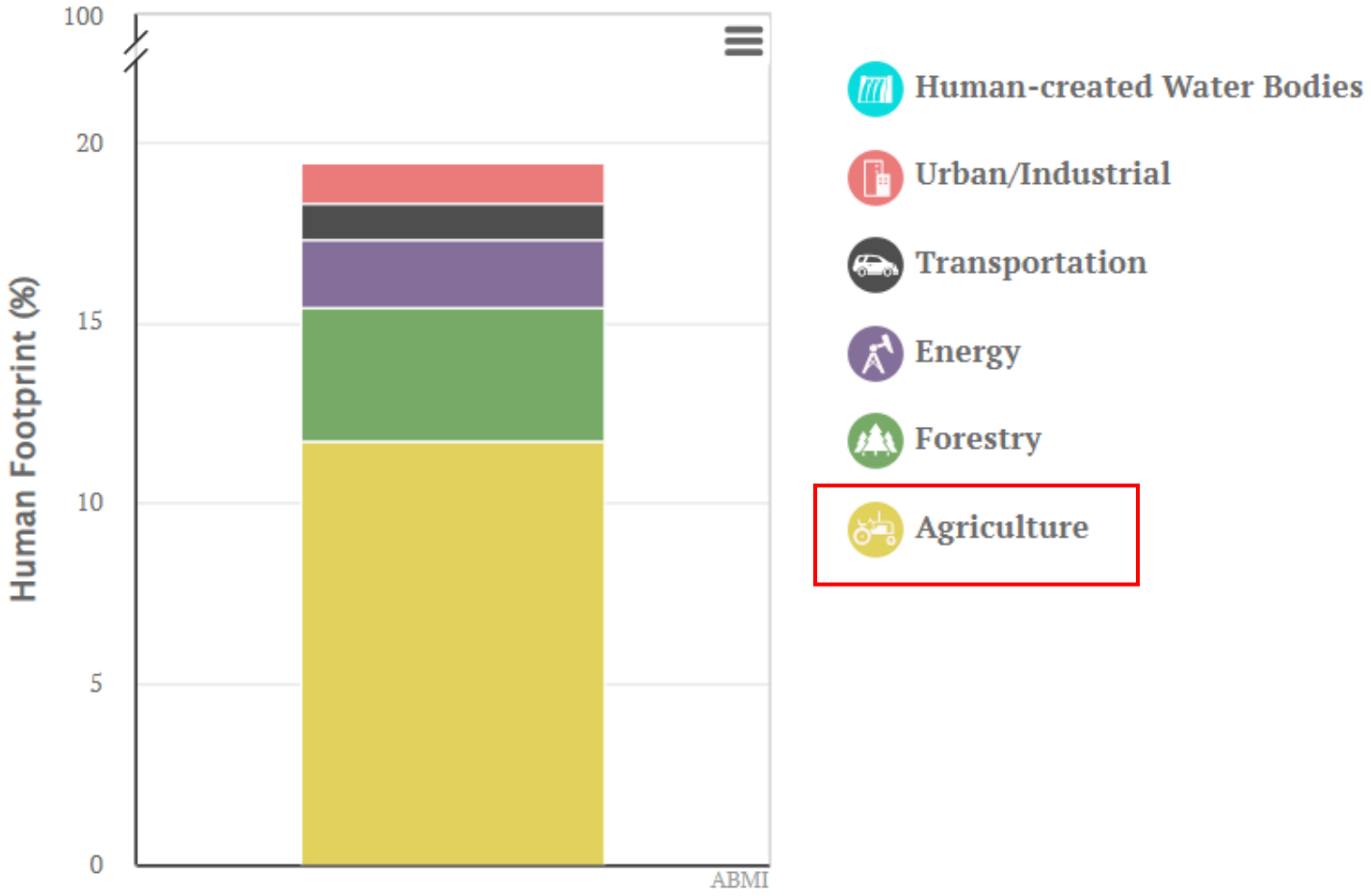
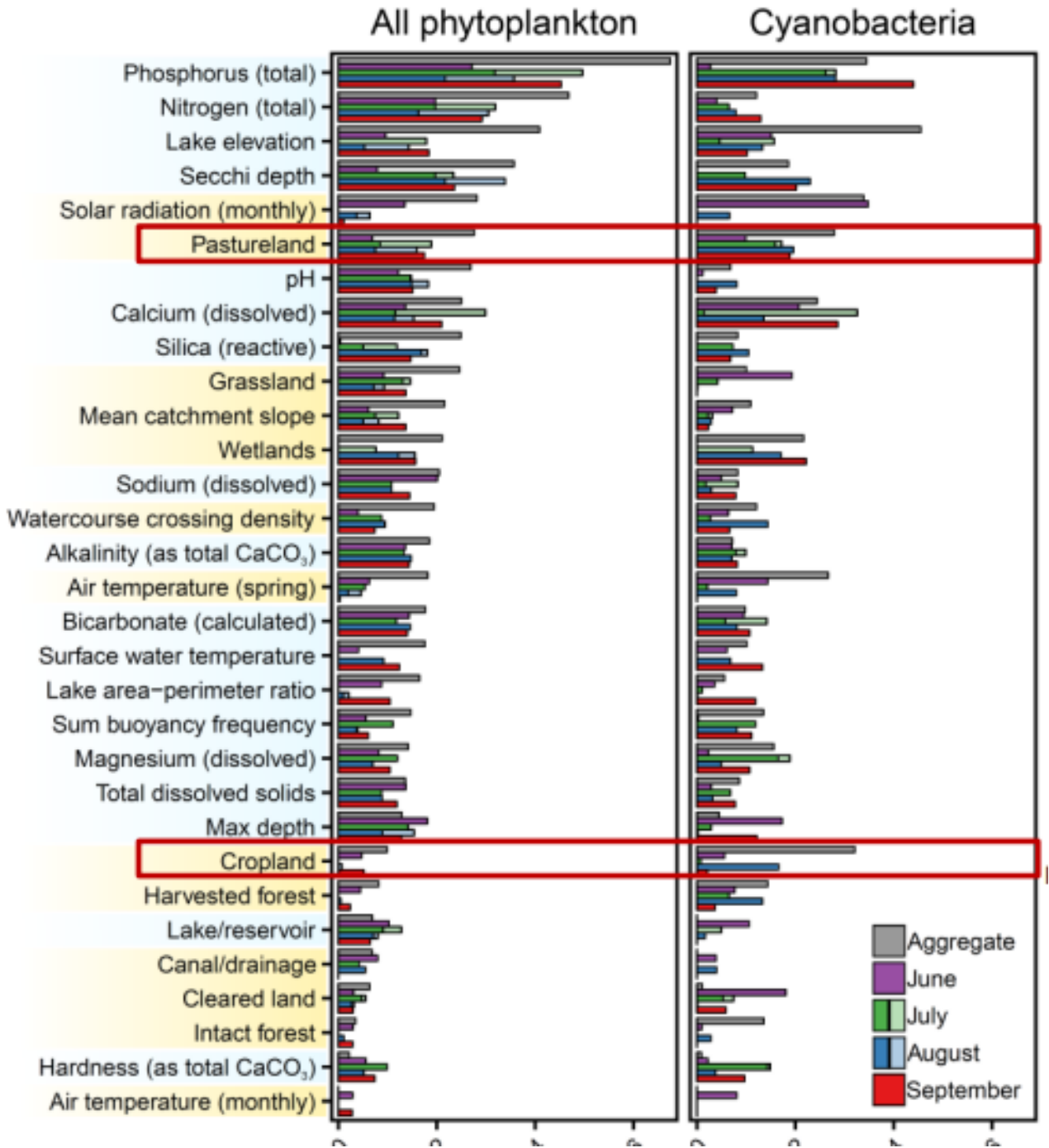


Figure: Status of Human Footprint. Summary of percentage cover of total human footprint broken down by human footprint category in the Boreal Forest Natural Region, circa 2021.

Human footprint in the Boreal Forest Natural Region

Agricultural Impacts?

- Pastureland is the primary land use driving phytoplankton composition.
- Cropland is the primary land use driving cyanobacteria composition.



Internal Loading Too!

- Trew et. al. found high rates of internal loading in shallow lakes.

- Ex.
  - Sturgeon 96%
  - Winagami 87%
  - Saskatoon 98%

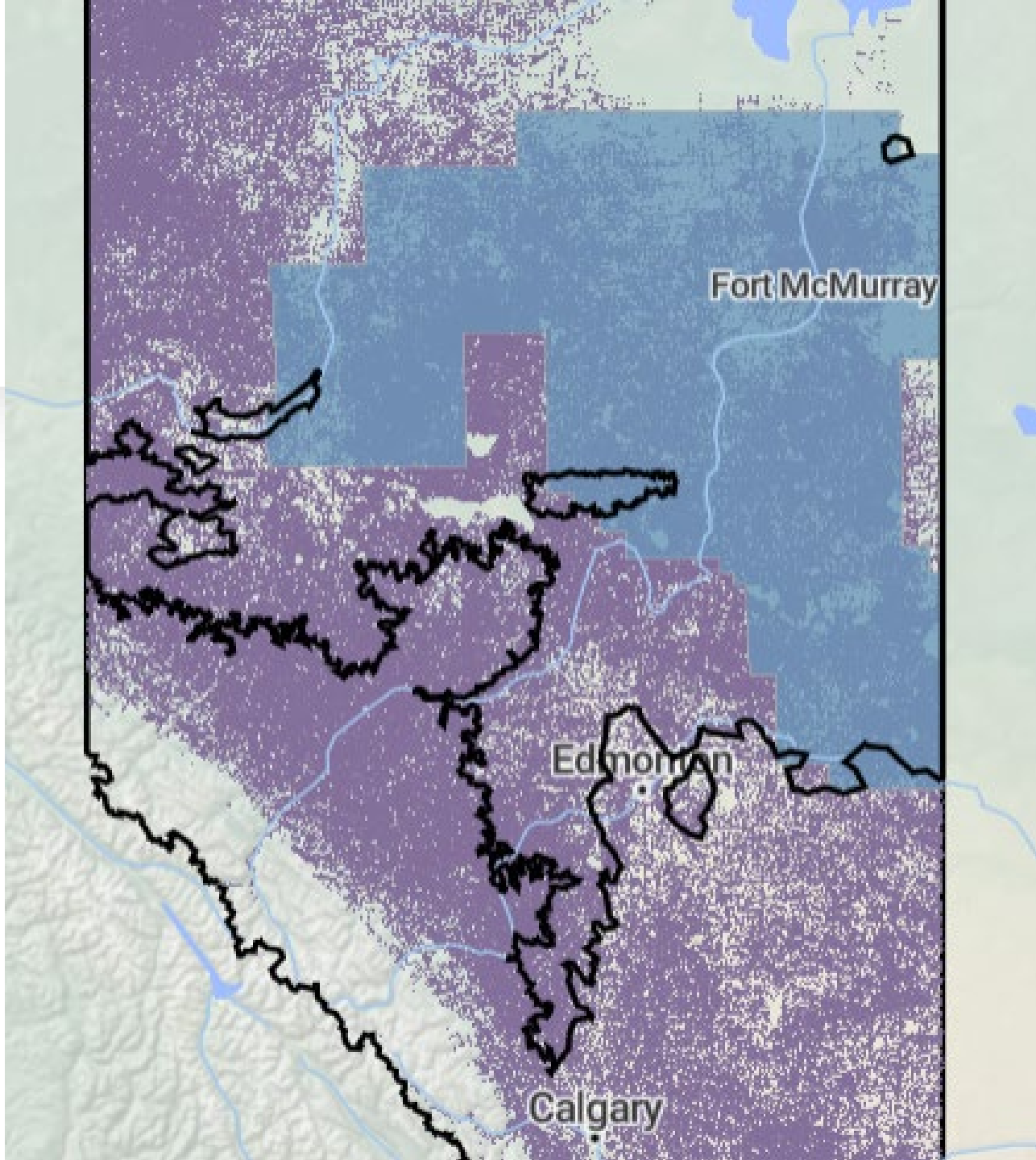
Table 3. Internal P loading (expressed as a % of total P input) in study lakes for 1988 and range in internal P loading from 1980 to 1990. n = number of years.

Lake	1988 Internal P Load	Range in Internal P Load	n
Baptiste N.	49	47-96	10
Battle	91	68-91	3
Bonnie	97	0-97	4
Buck	92	80-98	3
Buffalo		41-86	4
Crimson	19	0-35	5
Dillberry	62	0-62	3
Elkwater	84	62-94	6
Goose	86	63-86	2
Gull	77	0-86	5
Iosegun		56	1
Isle	41	41-96	3
Lac La Nonne	97	94-98	3
Lac St. Anne	50	50-80	2
Long	92	72-97	7
McLeod (East)	64	0-87	5
Moonshine	92	76-95	7
Moose	88	48-95	7
Muriel	91	91	1
Nakamun	88	88-99	11
Pigeon	88	2-95	6
Pine		69-95	2
Sandy N.	83	83-96	2
Sandy S.	83	83-97	2
Saskatoon	98	98-99	4
Smoke		85	1
Steele	65	16-96	7
Sturgeon	96	76-98	6
Sylvan	85	55-91	7
Thunder	80	29-88	7
Tucker	97	74-97	3
Wabamun	70	0-96	9
Winagami	87	42-96	7
Wizard	71	71	1

Energy and Oil Sands

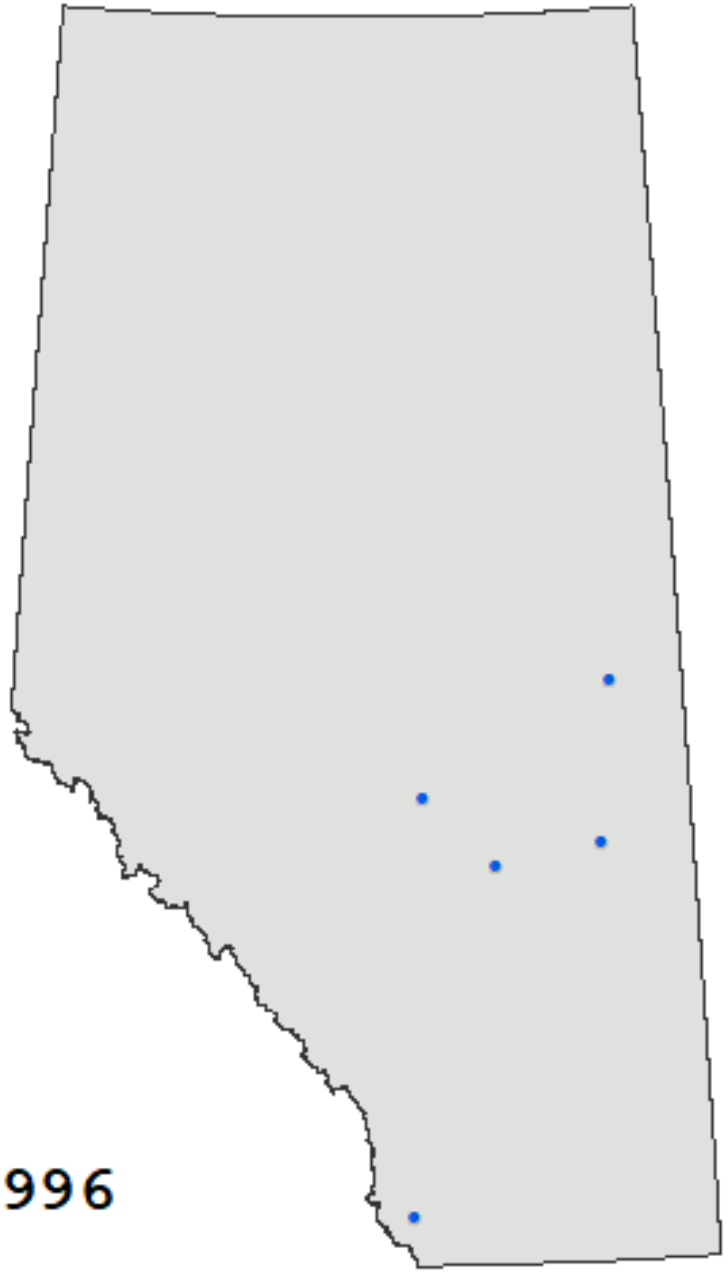
- What are the potential impacts from oil sands on lakes?

- How diverse are the impacts?
  - Linear features
  - Increased population
  - Additional fishing pressure




So How Do We Monitor?


Nutrients
Chemistry
Physical Parameters
Biological Parameters
Invasive Species
Lakewatch
Alberta
Environment and Protected Areas

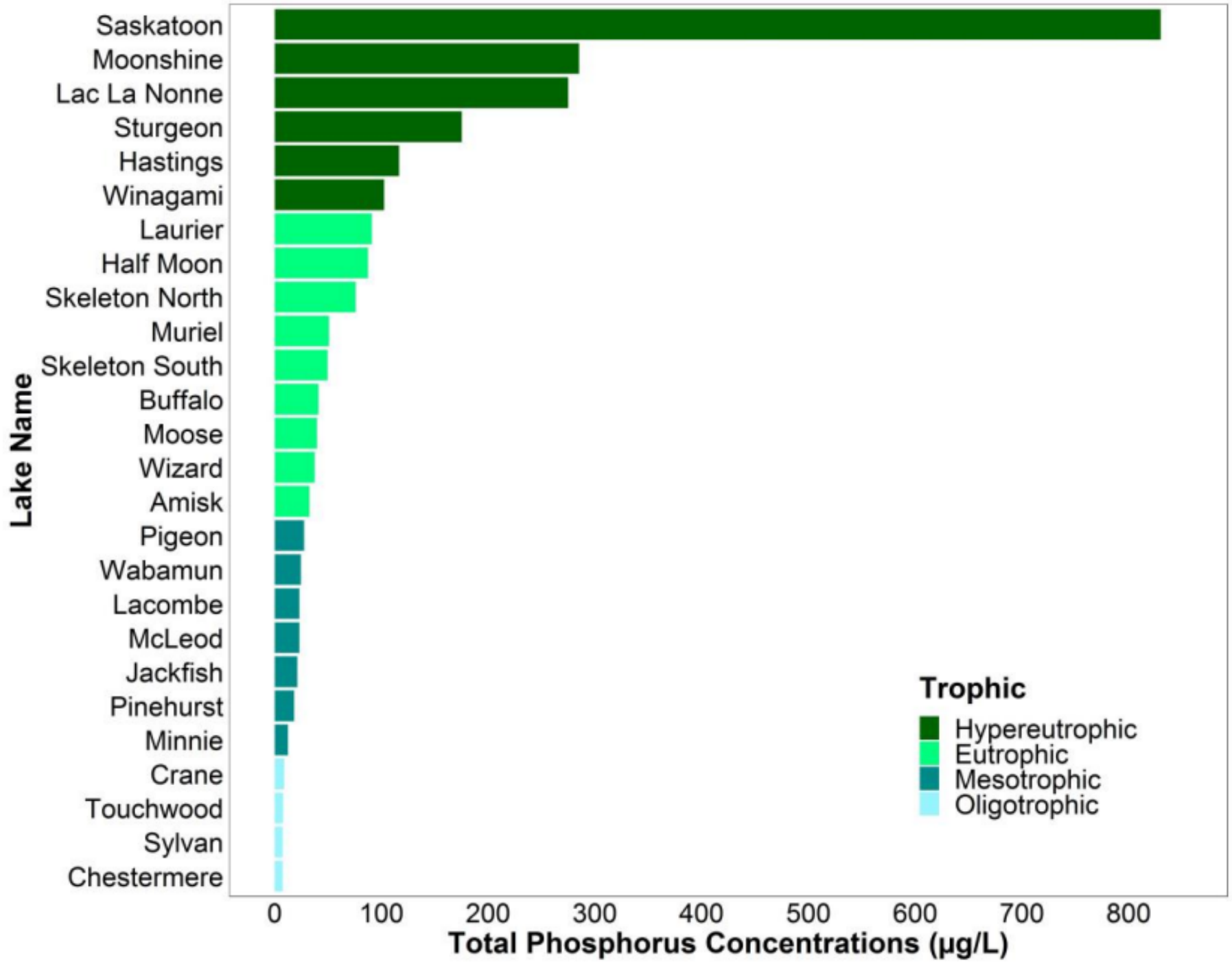


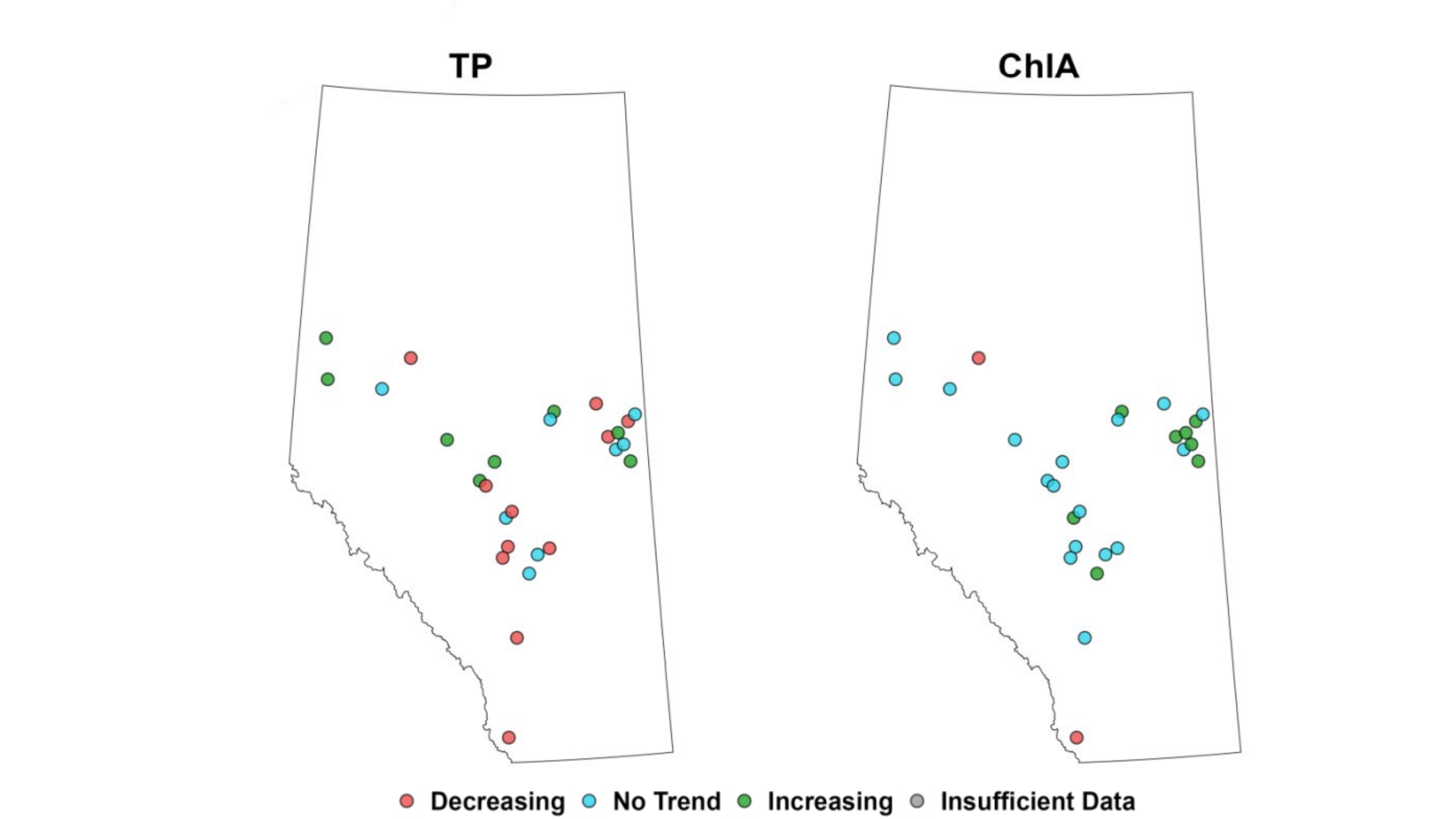
- Extensive sampling since 1996
- Where are the gaps?
- Where is LW concentrated?

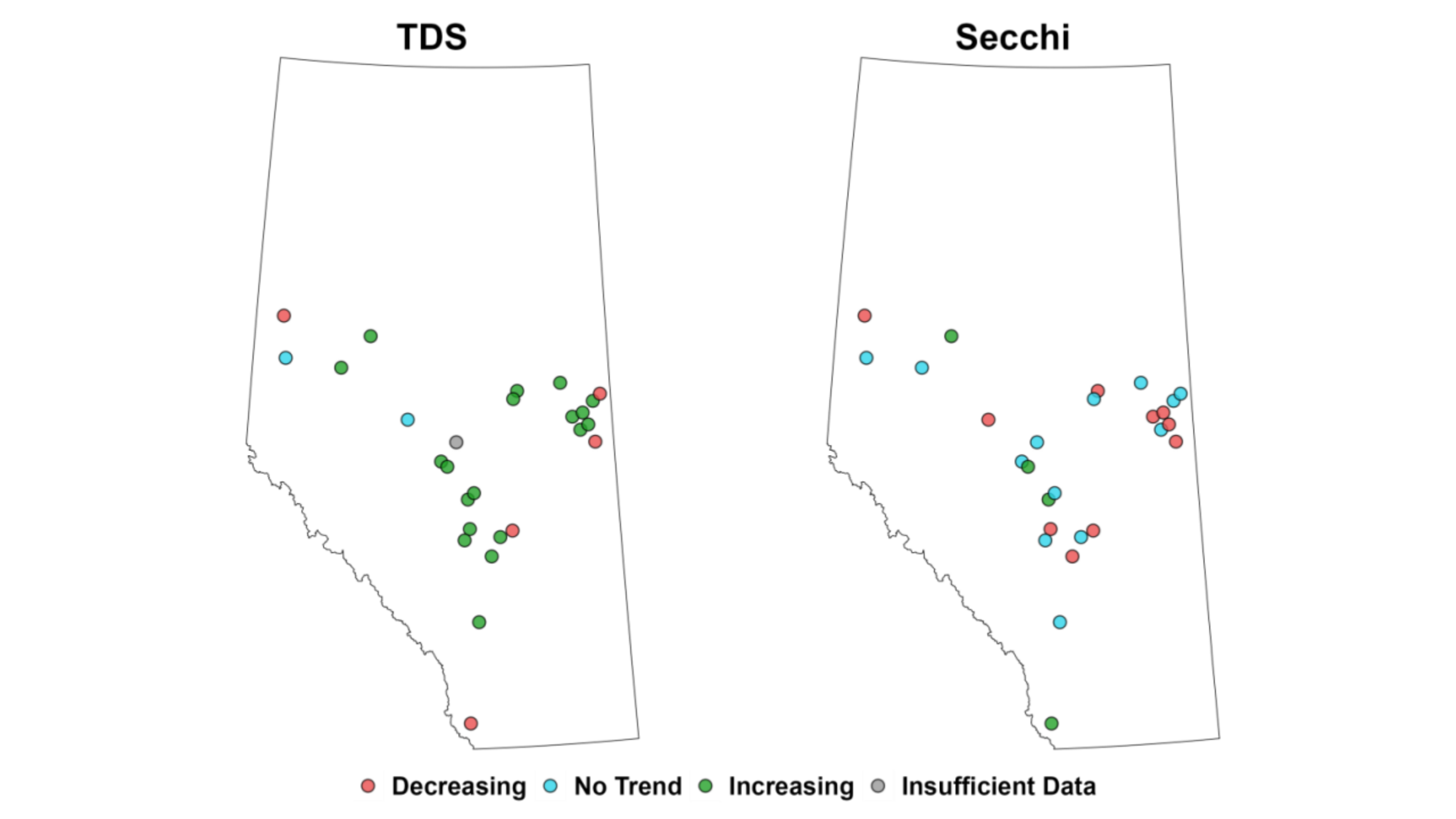
Lakewatch

LICA
ENVIRONMENTAL STEWARDS

Recognizing Long Term Partnerships


Saskatoon
Moonshine
Lac La Nonne
Sturgeon
Hastings
Winagami
Laurier
Half Moon
Skeleton North
Muriel
Skeleton South
Buffalo
Moose
Wizard
Amisk
Pigeon
Wabamun
Lacombe
McLeod
Jackfish
Pinehurst
Minnie
Crane
Touchwood
Sylvan
Chestermere
Lake Name
0
100
200
300
400
500
600
700
800
Total Phosphorus Concentrations (µg/L)
Trophic
Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic


TP
ChlA
Decreasing
No Trend
Increasing
Insufficient Data


TDS
Secchi
Decreasing
No Trend
Increasing
Insufficient Data

ALMS technician Maddie Koning sampling Laurier Lake.

Lakewatch

- Provincial Park Lake Monitoring Program incorporated into LW.
- Originally delivered by Parks – now by ALMS + Parks partnership.
- Saskatoon, Moonshine, Sturgeon, Winagami, McLeod, Gregoire, all part of the program.

Parks Lake Program

- Data from Parks Lake program under reported.
- 2006 last analysis.
- Snipe, Winagami, Gregoire, Moonshine, Sturgeon, Saskatoon, McLeod

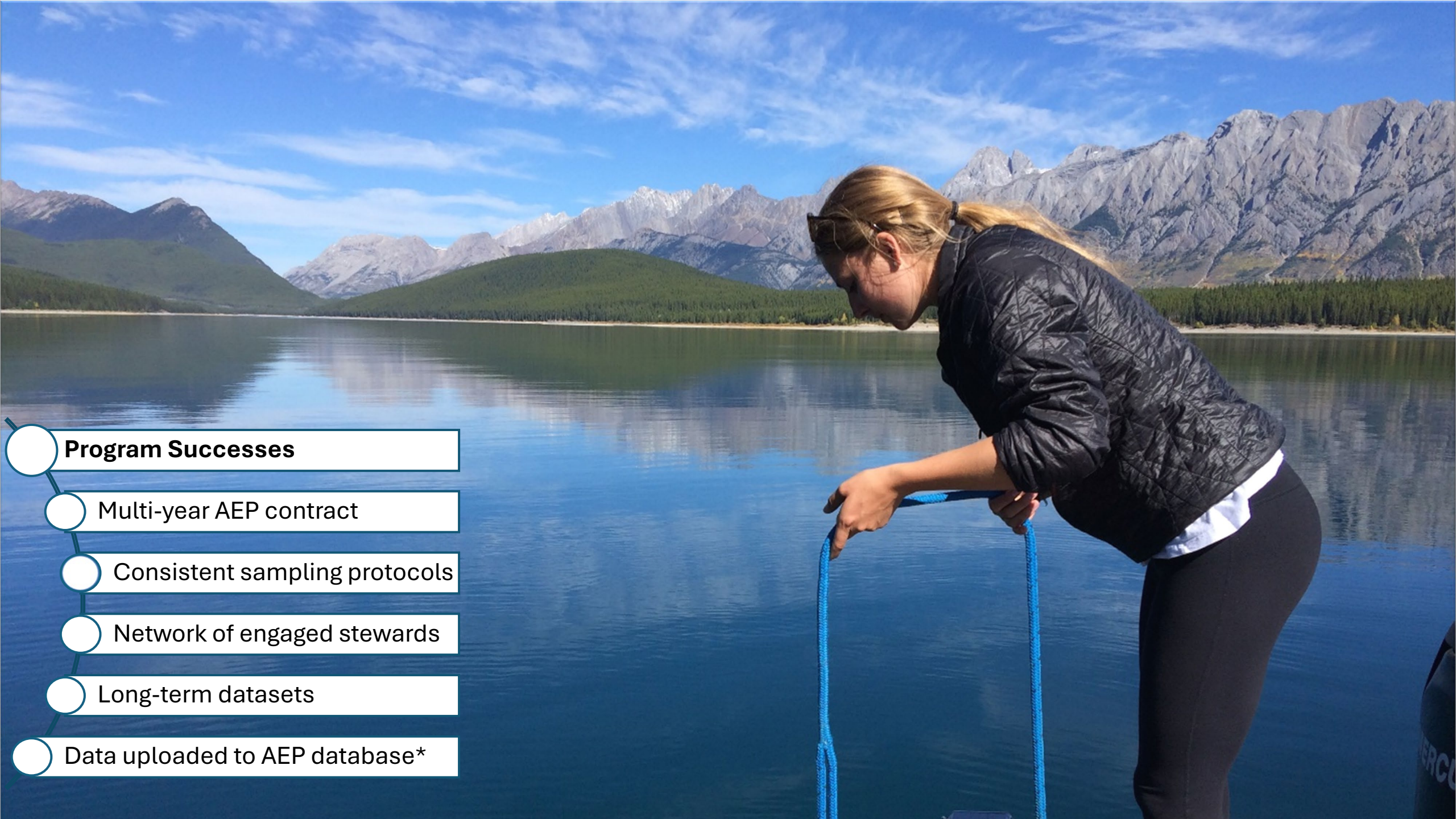
Winagami Lake

Water Quality Monitoring Report

Provincial Parks Lake
Monitoring Program

Lakewatch

- Revamping reporting
- More automated coding processes
- Rmarkdown
- Online versions of reports vs. pdfs.

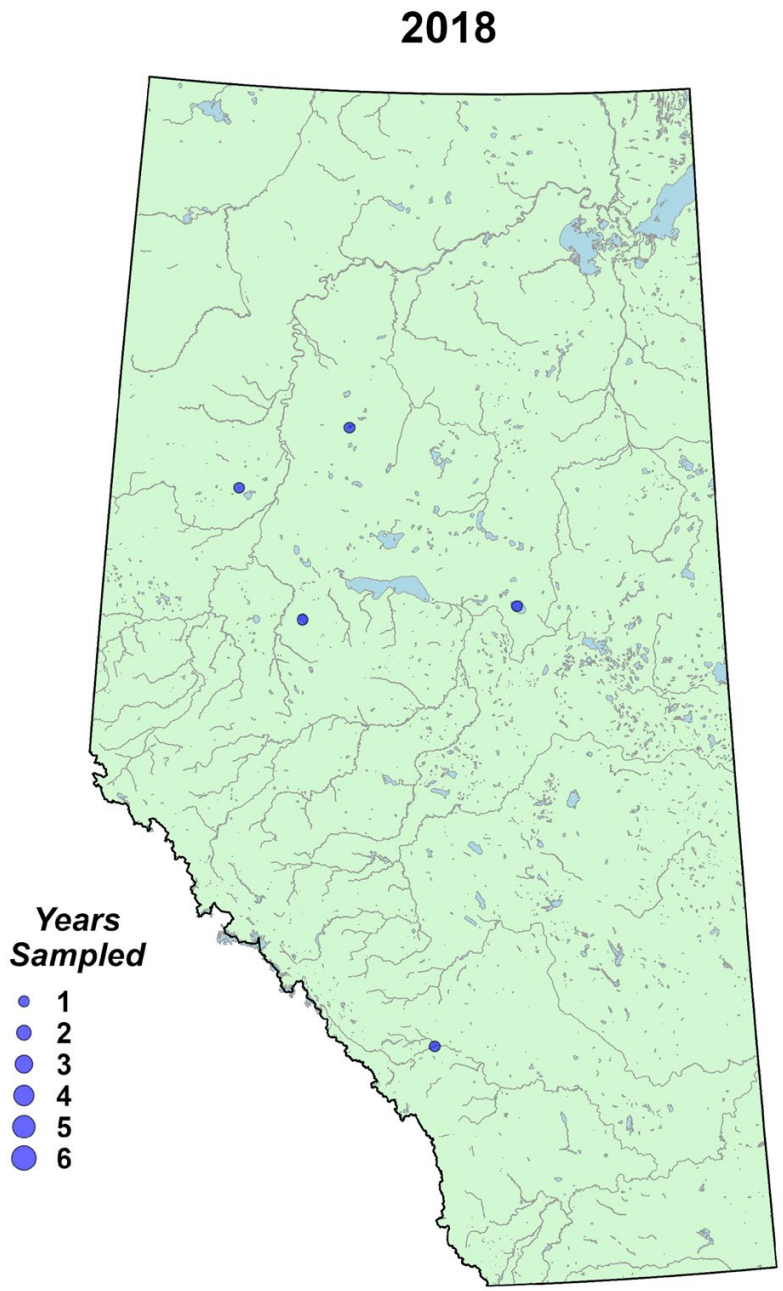


Program Successes

- Multi-year AEP contract
- Consistent sampling protocols
- Network of engaged stewards
- Long-term datasets
- Data uploaded to AEP database*


Program Limitations
Limited geographic reach
Restricted to open-water season
Rigid design


How to Address Limitations?



LakeKeepers

- Traditional citizen science program.
- Volunteers trained and equipped to collect data.
- Designed to support remote and under-sampled waterbodies.

Alberta Conservation Association

A TRADITIONAL CITIZEN SCIENCE APPROACH TO TRACKING WATER QUALITY

Animated GIF of sampling sites and frequency since 2018.


Nutrients and Ions
Dissolved Oxygen
Temp
Enviro. Observations
Chlorophyll-a
LakeKeepers
A'boatime

LakeKeepers

Summer LakeKeepers

- Key partnerships with Mighty Peace Watershed Alliance, Mackenzie County, Kehewin Cree Nation, Mountain Métis, Alberta Conservation Association, and others.

Alberta Conservation Association

Lesser Slave Watershed Council

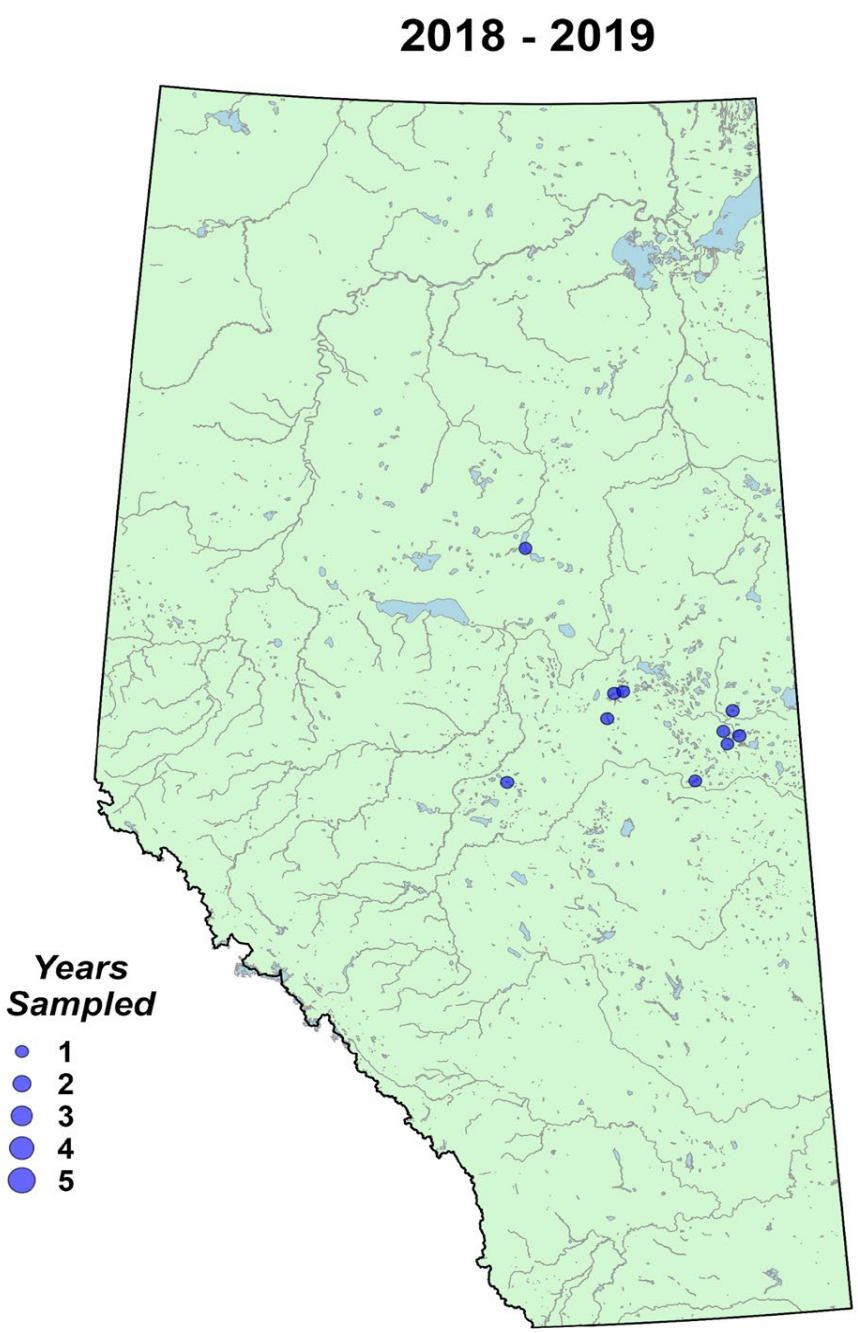
Mighty Peace Watershed Alliance

Wendell Koning and ALMS staff collecting samples at Bow Lake in Banff National Park.

LakeKeepers

Winter

- Expanded the program into the winter season.
- Focused on winter anglers
- Fill data gaps and new audience.



LakeKeepers

Winter LakeKeepers

- The most significant effort to understand winter lakes in Alberta.
- Training and equipping citizen scientists and winter anglers to monitor Alberta's lakes.

Alberta Conservation Association

Combining Approaches to Support Oil Sands Monitoring

Environmental Monitors from Peavine Métis Settlement monitoring Pelican Lake.

Indigenous Community-Based Monitoring

- Supporting 11 Indigenous Communities in Alberta's Oil Sands Region with year-round lake monitoring.
- Enhanced monitoring for industrial pollutants.
- Field visits to every community.

MONITORING ALBERTA'S LAKES IN THE OIL SANDS REGION

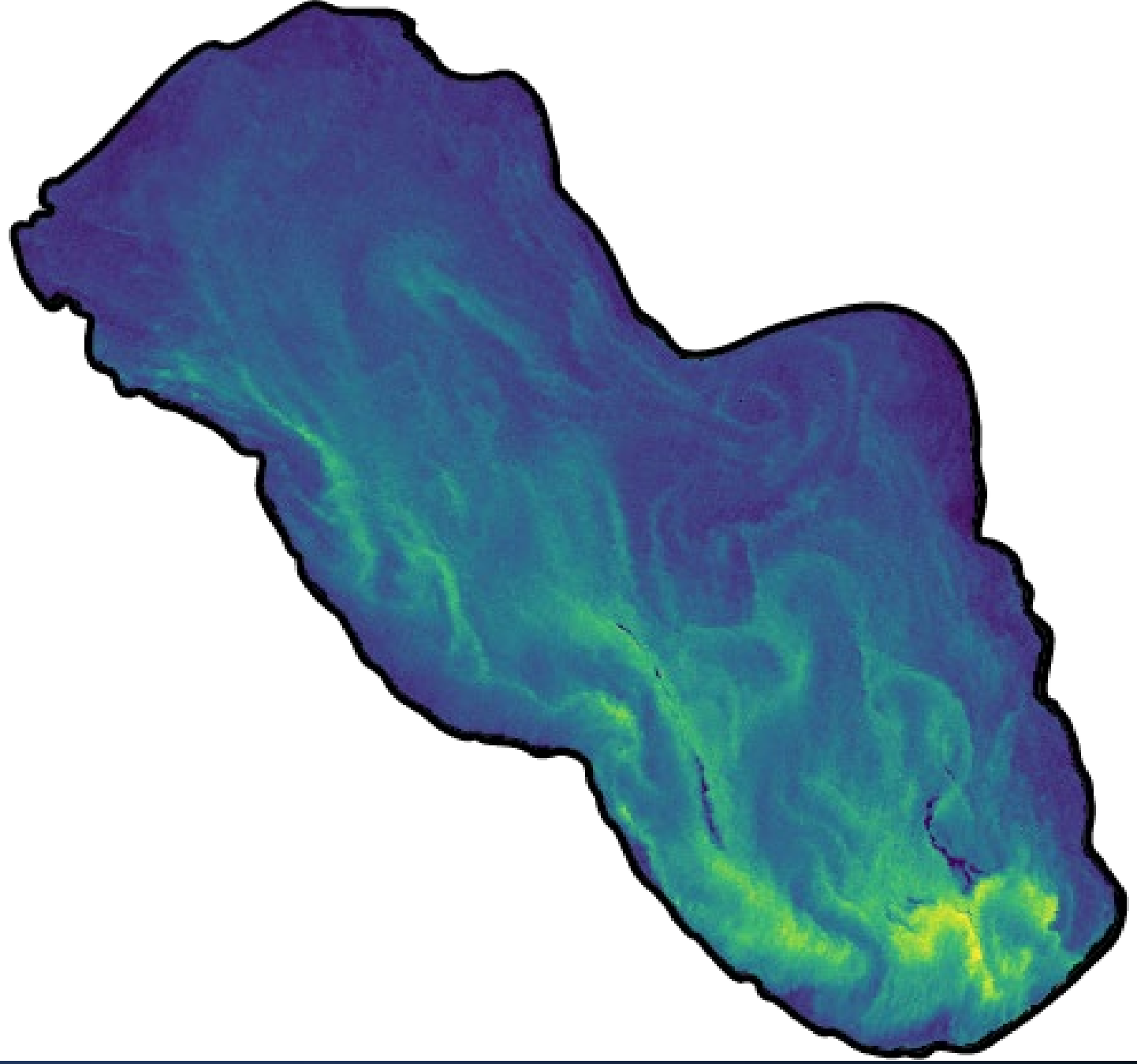
Sampling of Surmont Lake in the winter of 2024 through the ICBM program.

Indigenous Community-Based Monitoring

- Communities equipped and trained with monitoring gear.
- Monitoring throughout winter season.
- Data packages prepared for each participating community.

SUPPORTING INDIGENOUS COMMUNITIES IN ACHIEVING THEIR MONITORING OBJECTIVES

New Research to Address Knowledge and MonitoringGaps



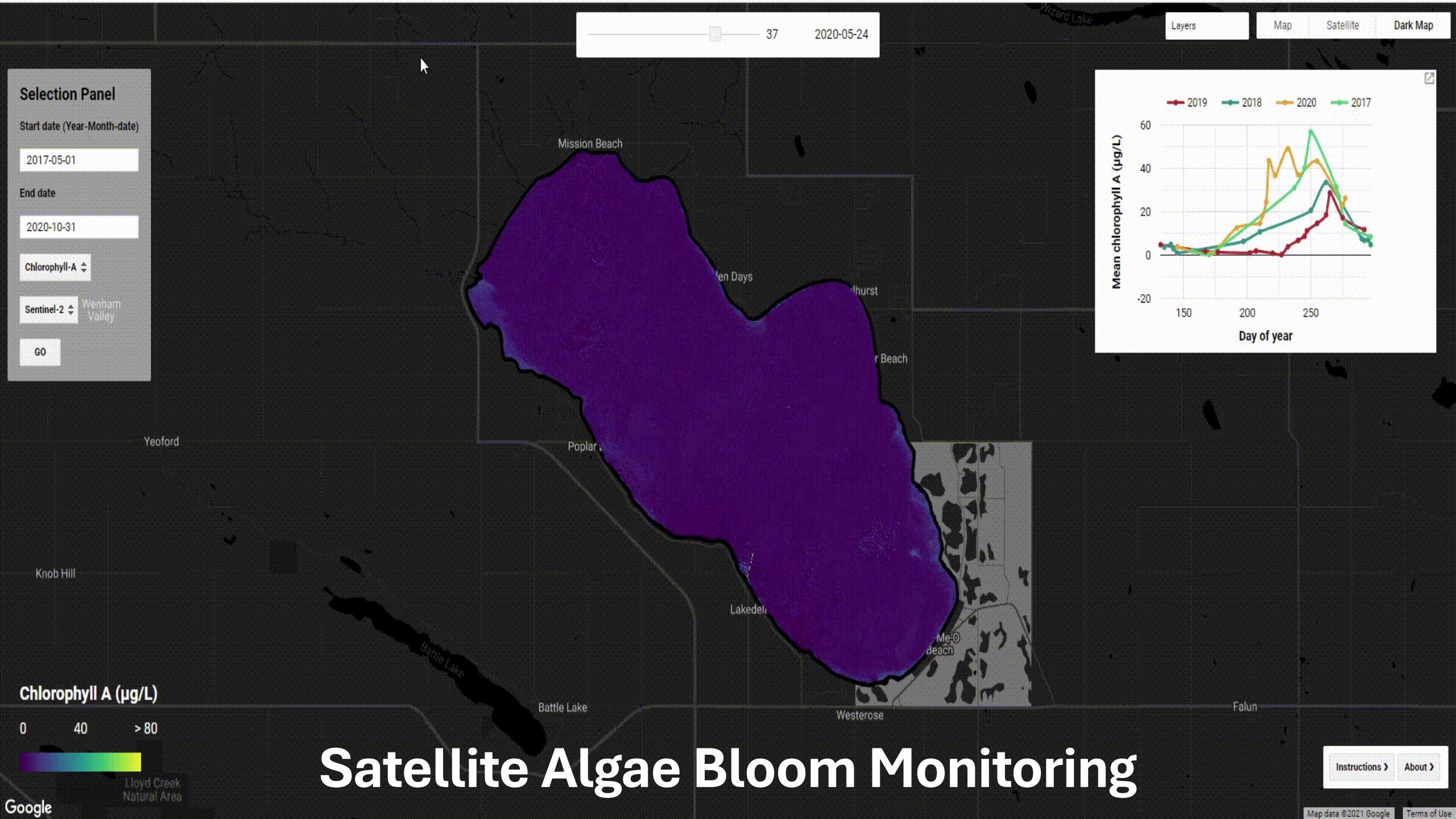
Algal Bloom Tracker

- Six lakes monitored over 40 monitoring trips in 2023 and 2024.
- Large collaboration between community partners, researchers, governments, and NGOs.
- ABMI is developing the web app component with planned completion in 2025-2026.

Pigeon Lake - Algal Bloom Tracker.

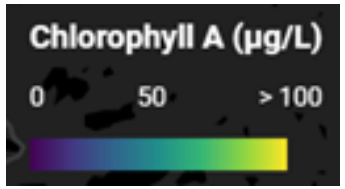
Methods

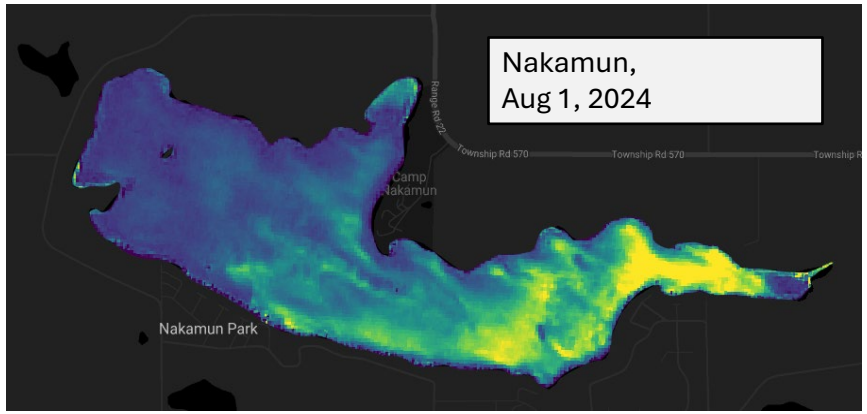
- Samples collected during flyover date of Sentinel 2 satellites on cloud-free days.
- Bonus if the Sentinel 2 satellite flyover date is also a LandSat flyover date.
- Samples collected from 20-30 locations.
- Kemmerer used to collect samples for:
  - Chlorophyll-a
  - Phytoplankton
  - Water chemistry

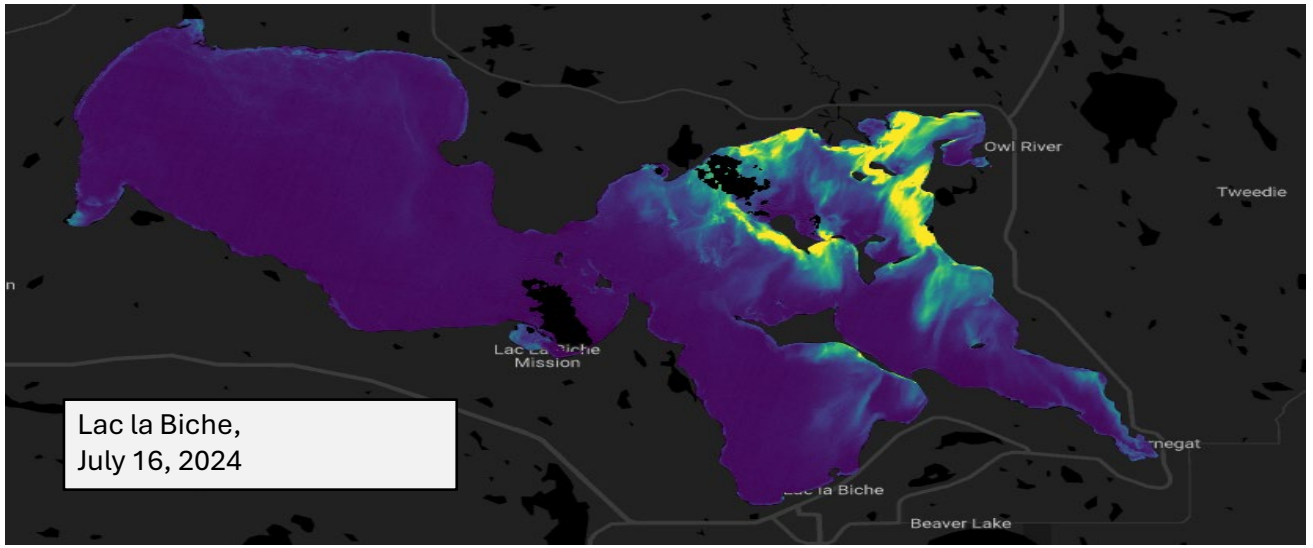


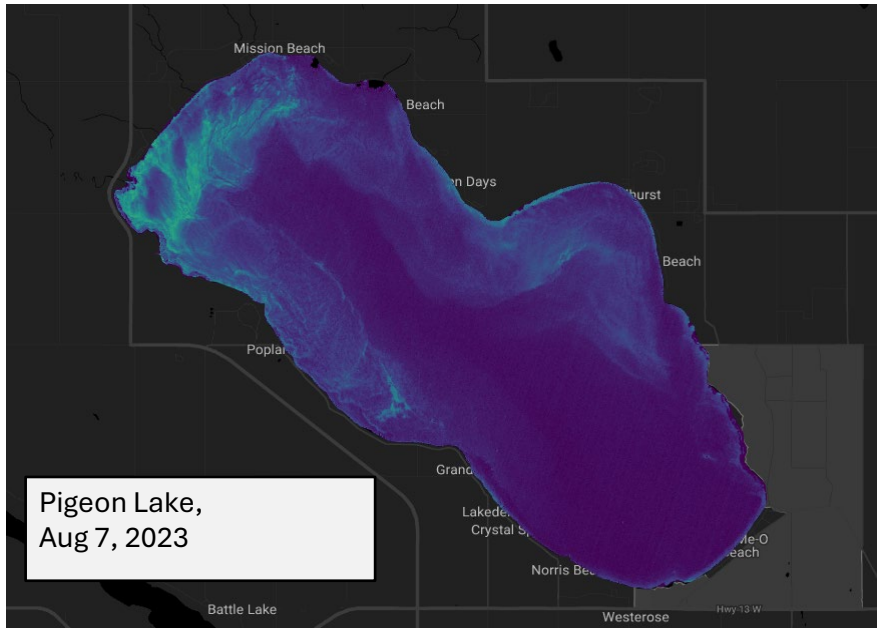
Satellite Algae Bloom Monitoring

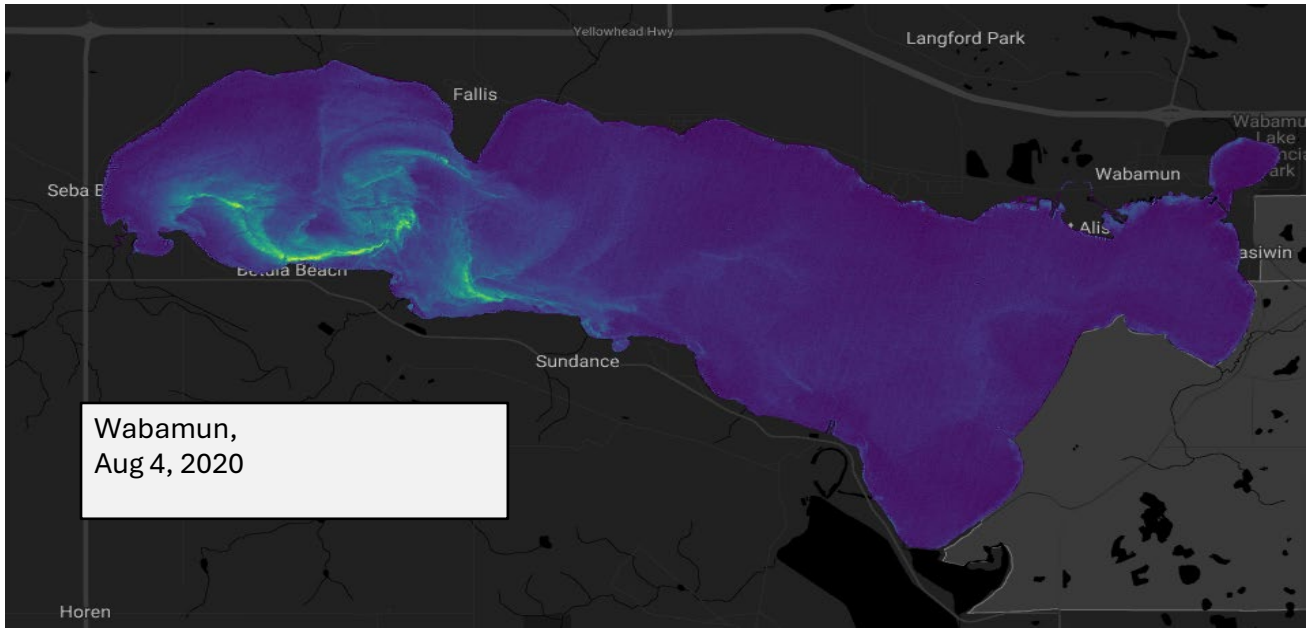
When and where do blooms start?












Bloom Duration
Bloom Extent
Bloom Intensity

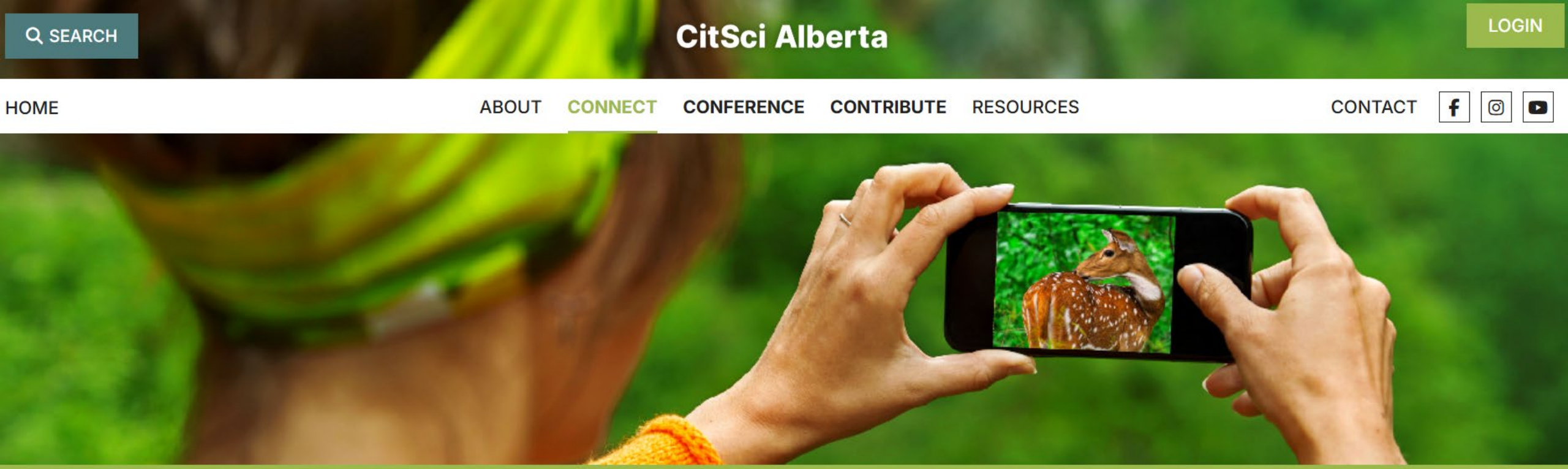
Forecasting Blooms

- Buoys installed on Nakamun, Pigeon, and Ethel Lakes

- Collect data every 15 minutes
  - Wind
  - Water Temp
  - Dissolved Oxygen
  - Chl-*a*

Continuing Work

- Web app development
- Historical trends using older satellite data
- Expanding model to other lakes
- University of Alberta M.Sc. theses
    - Bloom forecasting
- Public engagement and knowledge transfer
- Website development



New Tool: Citizen Science Collaboration Hub

Thank You!

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