

**Municipality of North Cowichan
Council - Regular and Public Hearings
ADDENDUM AGENDA**

Wednesday, February 17, 2021, 1:30 p.m.
Electronically

Pages

5. DELEGATIONS AND PRESENTATIONS

5.2. Update on Quamichan Lake Water Quality Monitoring and Management

5.2.1. *Report and Presentation on Quamichan Lake Water Quality Monitoring and Management*

2 - 15

Purpose: To provide Council with a presentation about the activities conducted by environment staff in the monitoring and management of water quality in Quamichan Lake.

Recommendation:

This report is provided for information only.

Report

Date February 10, 2021

File:

To Council

From Dave Preikshot, Senior Environmental Specialist

Endorsed:



Subject Update on Quamichan Lake Water Quality Monitoring and Management

Purpose

To provide Council with a presentation about the activities conducted by environment staff in the monitoring and management of water quality in Quamichan Lake.

Background

In 2018 a study of water quality in Quamichan Lake recommended a multi-year monitoring and management plan to set the resources necessary to evaluate management options for controlling Blue-Green Algae blooms in Quamichan Lake. The results of this research were presented to Council on July 17, 2019 in a report by the Director of Engineering. After hearing the report, Council passed a motion that directed staff to sample and test the Quamichan Lake water based on the following recommendations:

- Analyze Quamichan Lake sediment cores in order to fix the absolute level of internal versus external loading;
- Install temperature and dissolved oxygen meters in the lake to track changes on an hourly basis;
- Monitor weekly with a multi-parameter sonde(transmitter) for pH, turbidity, conductivity, chlorophyll and blue-green algae;
- Monitor monthly to track phosphorus and other nutrients; and,
- Begin installation of zeolite and limestone stream treatments to remediate nutrients in small urban tributary streams and ditches.

Discussion

Quamichan Lake has been subject to undesirable blooms of Blue-Green Algae (Cyanobacteria) since at least the 1930s and possibly even before European settlement in the Cowichan Valley in the 1860s. These Blue-Green Algae blooms have become longer and more intense over the past two decades. The root cause of these Blue-Green Algae blooms is the high phosphorus concentration in the lake, especially during summer.

The 2018 report on Quamichan Lake concludes that the control of phosphorus in Quamichan Lake is most likely to be achieved using one or a combination of the following five groups of options:

- Aeration, e.g., hypolimnetic aeration, bubblers, nano-bubblers, upflow bubble aeration, and downflow bubble aeration;
- Chemical Treatment, e.g., aluminum salts, calcium, iron salts, and lanthanum modified bentonite clay (Phoslock™);

- Dredging;
- Flushing, *e.g.*, stored water, well water, diverted water; and,
- Treatment of inflow water, *e.g.*, zeolite/limestone in creek beds, wetland enhancement.

The monitoring equipment has been put in place, and all monitoring programs are now collecting chemical and physical information on changes in the lake. An array of temperature and oxygen data loggers takes these measurements hourly at the surface, midwater and near the bottom. Monthly monitoring is being done to track nutrient concentrations through the lake water column and the streams and ditches leading to the lake. This data will be crucial in working with the province to develop a nutrient and Blue-Green Algae control program. Environment staff has had several interactions with provincial environment staff to share data and create a framework for future collaboration on water quality management in the lake. The province has also loaned equipment to North Cowichan environment staff to support field data collection.

Preliminary analysis of temperature and oxygen data from the lake has shown the benefits of this monitoring work. In the instance of a fish kill that occurred in September 2020, staff were able to use lake oxygen data to explain the mechanisms that created very low oxygen throughout the water column. Oxygen data showed that in addition to low oxygen near the bottom, associated with the summer Blue-Green Algae bloom, there had also been a collapse in surface water oxygen due to shading from smoke in the atmosphere. The ability to understand these physical and chemical changes in the lake will help us develop more effective management approaches to establishing and attaining water quality targets

In summer 2021, environment staff plans to collect sediment core samples to establish the lake bed's chemistry. This information will help determine whether treatment options like oxygenation and Phoslock™ are viable for Quamichan Lake. Secondly, if the lake bed chemistry is favourable to a treatment option, what is the scale at which that treatment should be implemented, *i.e.*, seasonal/interannual duration and area of application.

The monitoring program now in place will allow North Cowichan to make an informed decision on which of these options is most likely to succeed in mitigating Blue-Green Algae blooms in Quamichan Lake. Significant progress has been made in controlling phosphorus entering the lake through:

- working with stewardship groups to enhance riparian vegetation;
- managing stormwater through wetlands and detention ponds; and,
- establishment of zeolite/limestone nutrient traps around Quamichan Lake on a pilot basis.

Recommendation

This report is provided for information only.

Attachments: Presentation (Quamichan Lake Water Monitoring: 2020 and Beyond)

Quamichan Lake Water Monitoring: 2020 and Beyond



Dave Preikshot, PhD, RPBio
Senior Environmental Specialist

Quamichan Lake Blue Green Algae

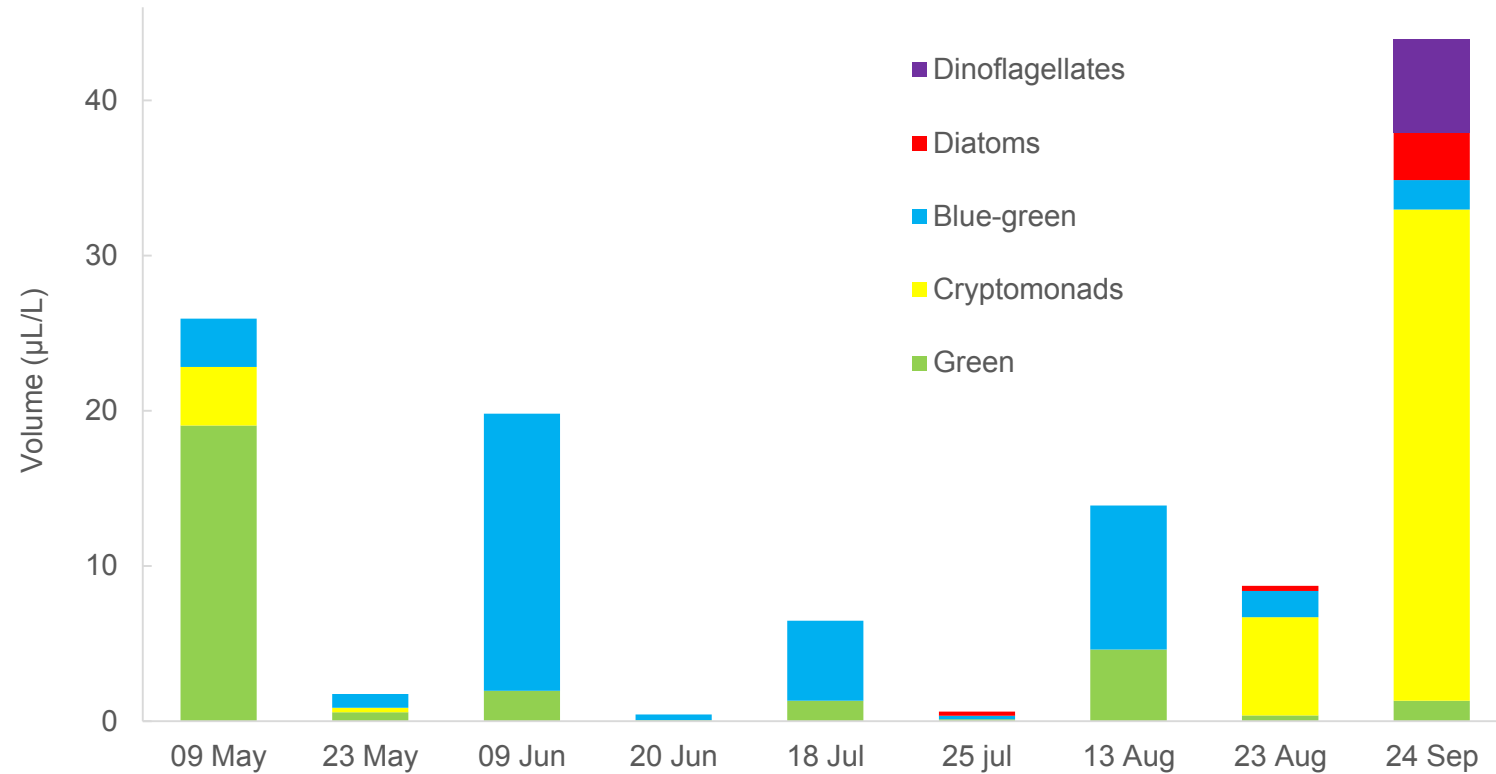
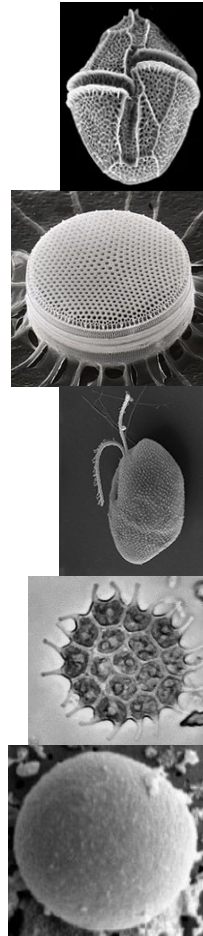
- Quamichan Lake is significant to Cowichan's society, ecology, history and economy
- historic occurrences of Blue-Green Algae blooms as early as 1930
- frequency and duration of these blooms appears to be increasing
- Study in 2018 and recommendations
- Current monitoring and sampling:
 - nutrients (monthly in winter, bimonthly in summer)
 - temperature (hourly)
 - oxygen (hourly)
 - piston coring (spring/summer 2021)
- Data and information from monitoring and sampling to inform management on actions to improve water quality

Not all Quamichan algae blooms are blue-green (summer 2018)



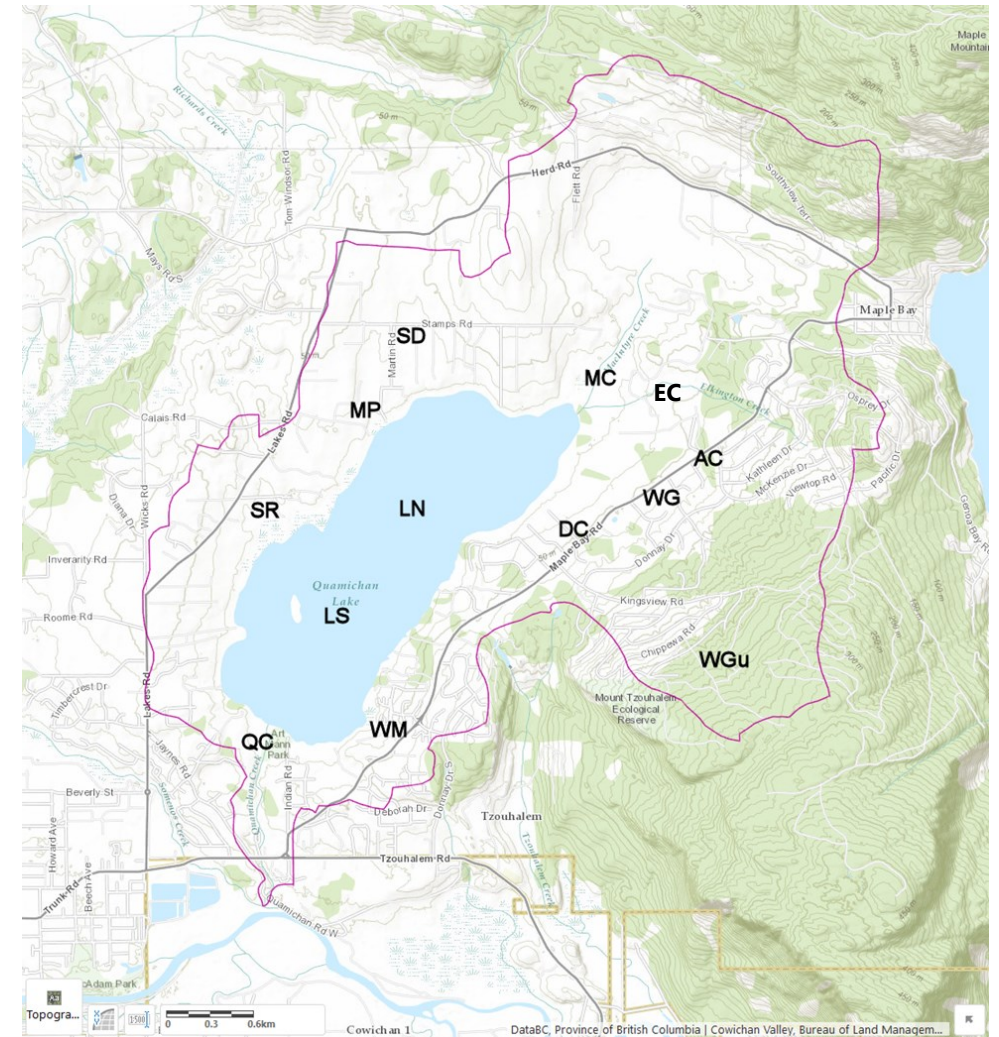
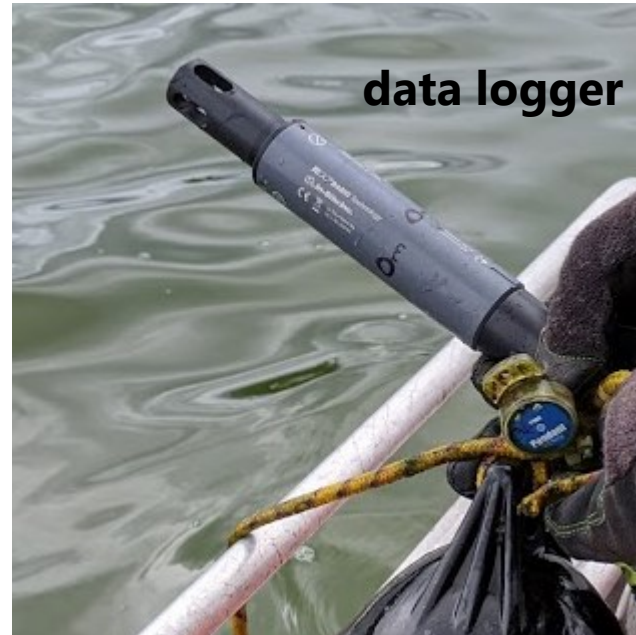
Meet the Neighbours: Quamichan Lake phytoplankton, summer 2018)

- Dinoflagellate
- Diatom
- Cryptomonad
- Green
- Blue-Green



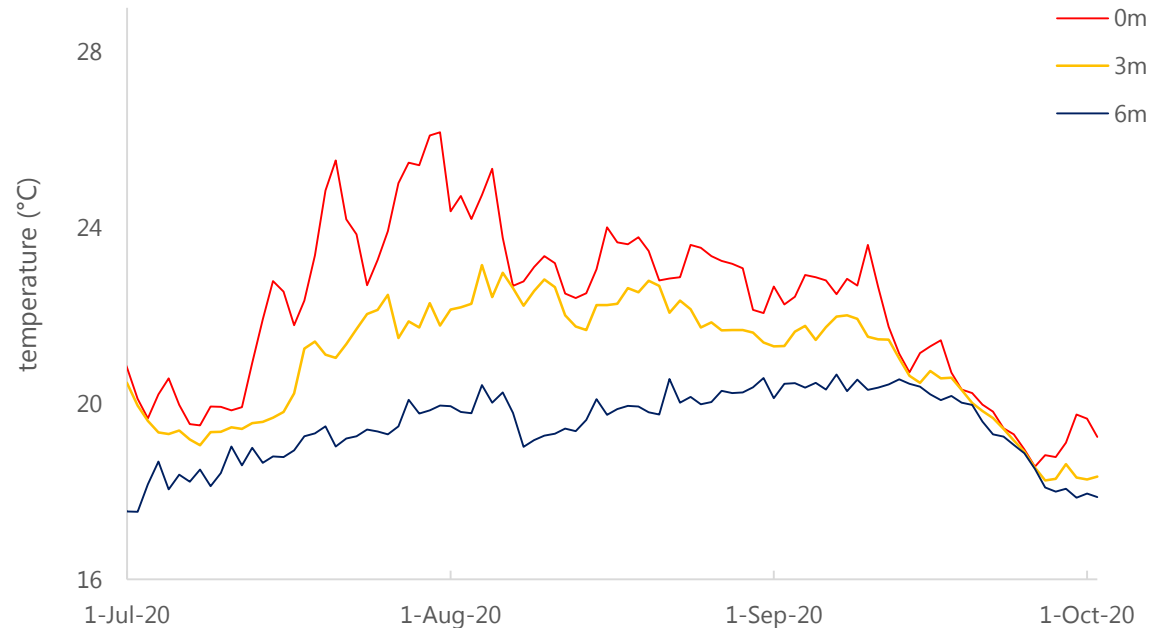
Monitoring Stations

- South Lake, T/DO logger array (LS)
- Martin Place (MP)
- Elkington Creek (EC)
- Stanhope Road (SR)
- Deykin Creek (DC)
- Aitken Creek (AC)



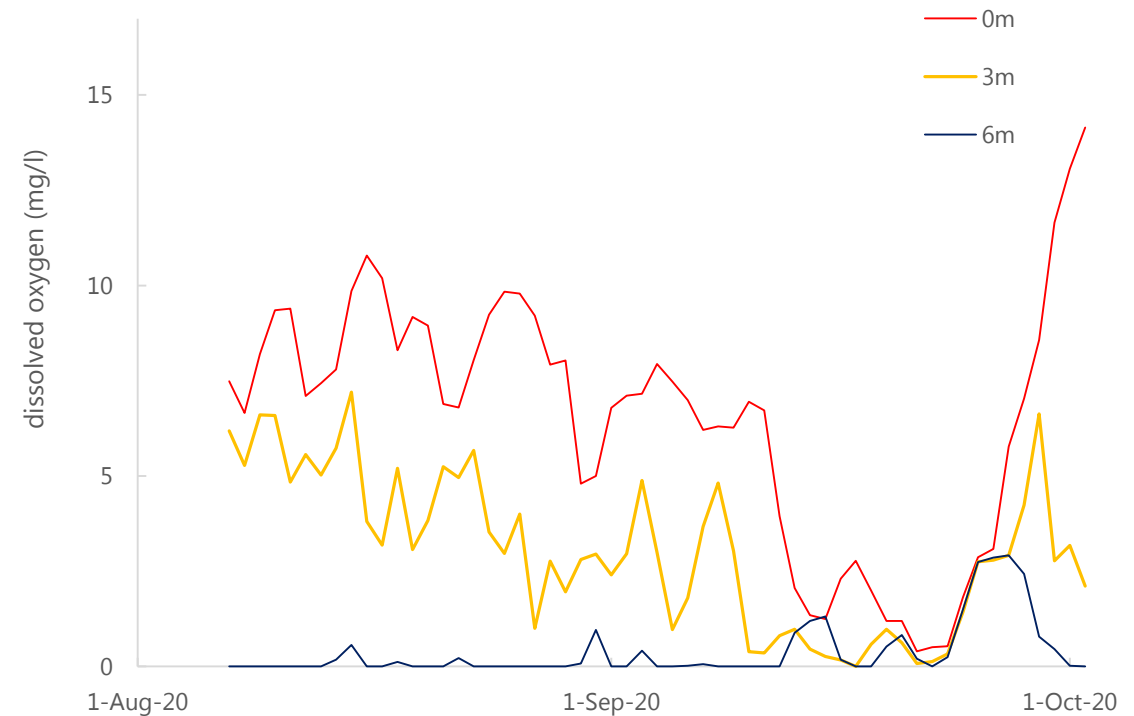
Changes in Summer Lake Temperature (2020, daily mean values, from hourly data)

- Peak: 31 Jul, 26°C
- Turnover: 15 Sep (historically ranges from early to late September)
- Note mixing between surface and 3m
- Note re-stratification starting 26 Sep: fall algae bloom



Changes in Summer Lake Oxygen (2020, daily mean values, from hourly data)

- Peak: end of time series
- Note sharp decline at surface starting 11 Sep



Smoke in Atmosphere: September 2020

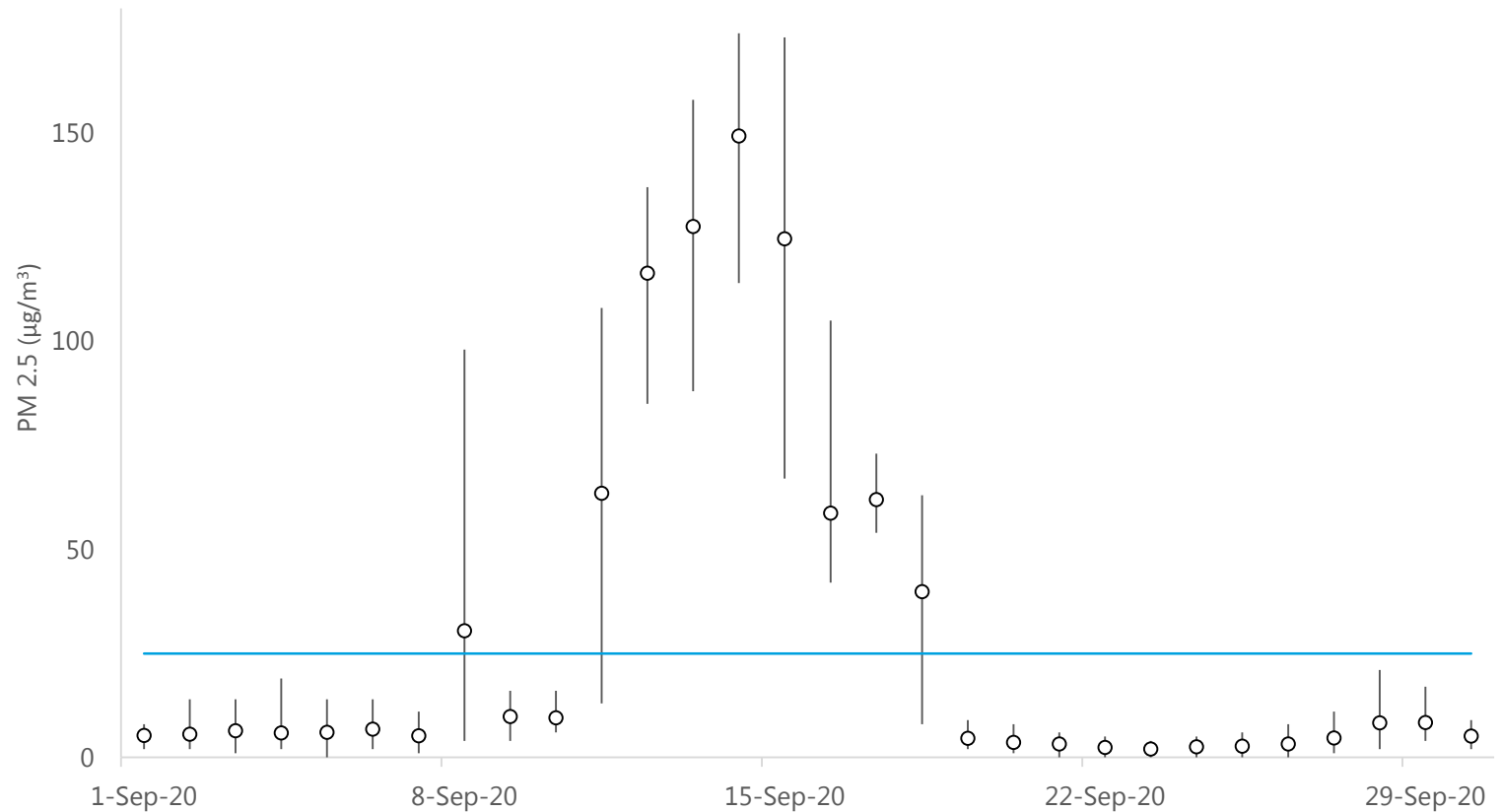
Bars show daily maxima and minima

Circle shows daily mean

Blue line is 24 hr mean target

Heaviest smoke: Sep 12-15

Heavy smoke caused a decline in oxygen production at the surface (0m) which meant that on turnover (15 Sep) the lake was almost entirely anoxic which caused a fish kill

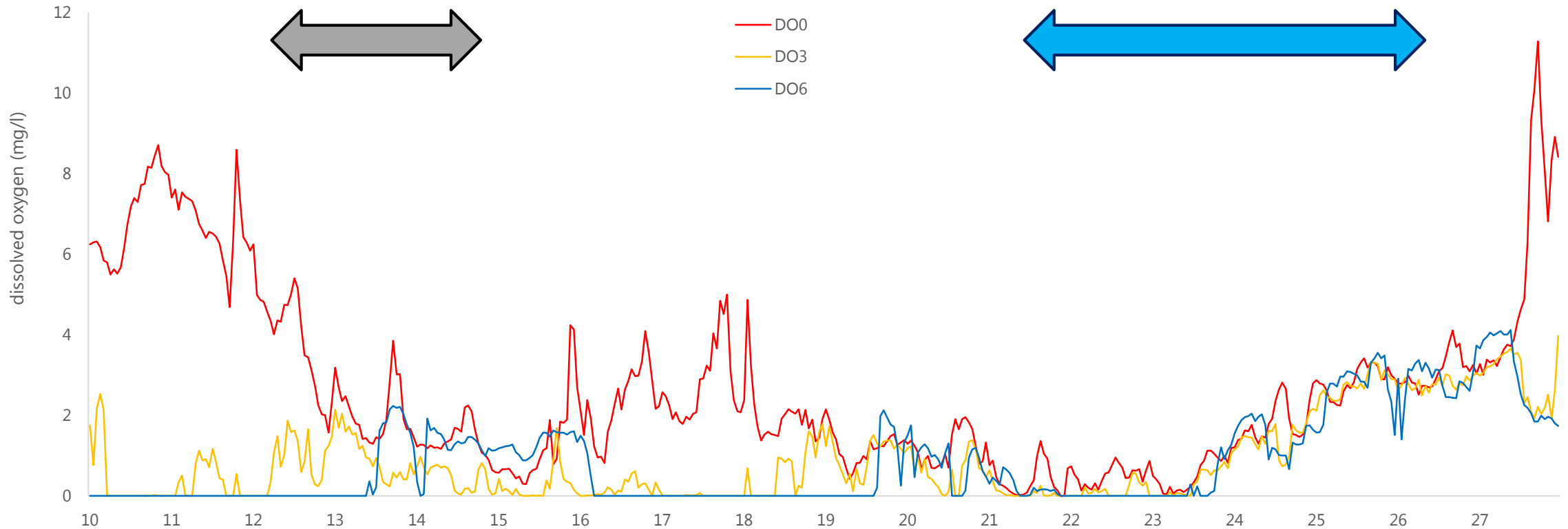


Fish collected by Rowing Canada Aviron coaches, September 2020



Hourly Changes in Lake Oxygen at 0m, 3m and 6m, 10-27 Sep.

Period of heaviest smoke (grey arrow) and clouds/rain (blue arrow)



What is the environment group up to?

- Managing phosphorus in the lake
 - *sediment coring*
 - *nutrient sampling*
 - *monitoring temperature and oxygen*
 - *consulting with province and applied scientists*
- Controlling phosphorus entering the lake
 - *zeolite traps in trial locations*
 - *managed wetlands and infiltration*
 - *work with agricultural community and ministry*
- Riparian protection and enhancement
 - *tree planting*
 - *work with stewardship groups*
 - *remove invasive plants*
 - *restore wetland habitat*

Questions?

Huy ch q'u / Thank you