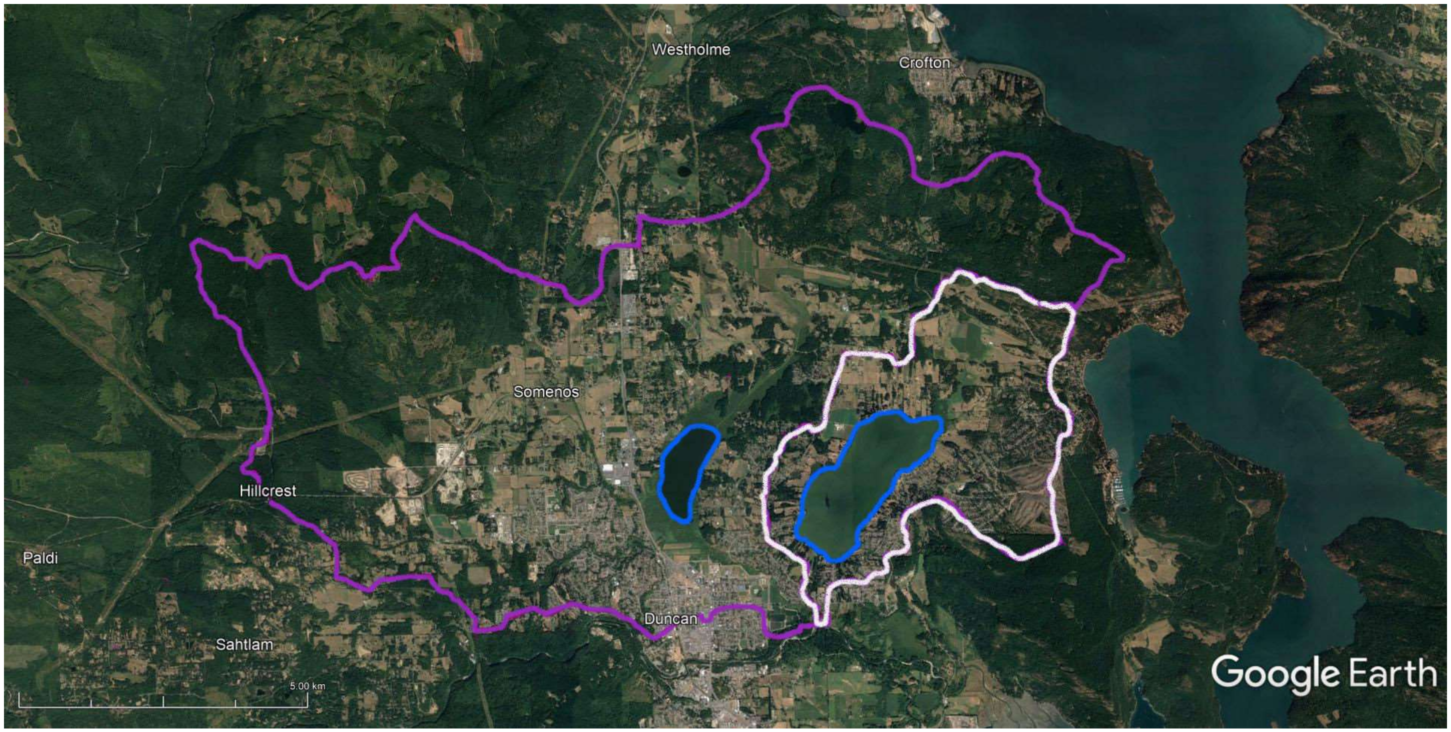
Attachment 1

Monitoring update, sediment sampling, and options for mitigating blue-green algae blooms in Quamichan Lake

MUNICIPALITY OF NORTH Cowichan

Dave Preikshot, PhD, RPBio
Senior Environmental Specialist

Geophysical Setting



Comparative area (ha)

Somenos watershed ~ 9,000
Quamichan watershed ~ 1,400
Somenos Lake ~ 100
Quamichan Lake ~ 310

Comparative volume (m^3)

Somenos Lake ~ 4 500 000
Quamichan Lake ~ 13 800 000

MUNICIPALITY OF NORTH Cowichan

Quamichan Lake and Blue Green Algae (Cyanobacteria)

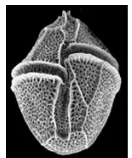
- Quamichan Lake is significant to Cowichan's society, ecology, history and economy
- historic occurrences of Blue-Green Algae blooms as early as 1930
- frequency and duration of these blooms appears to be increasing
- current monitoring and sampling:
  - nutrients (monthly in winter, bimonthly in summer)
  - Lake temperature (hourly)
  - Lake oxygen (hourly)
  - Sediment Sampling (4 stations)
- data and information from monitoring and sampling to inform management on actions to improve water quality

What have we learned? Not all Quamichan algae blooms are blue-green (summer 2018)

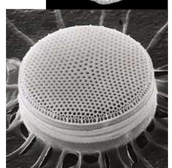
MUNICIPALITY OF NORTH Cowichan

Meet the Neighbours: Quamichan Lake phytoplankton, summer 2018)

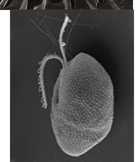
- Dinoflagellate



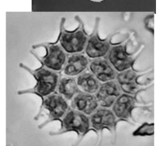
- Diatom



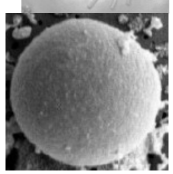
- Cryptomonad

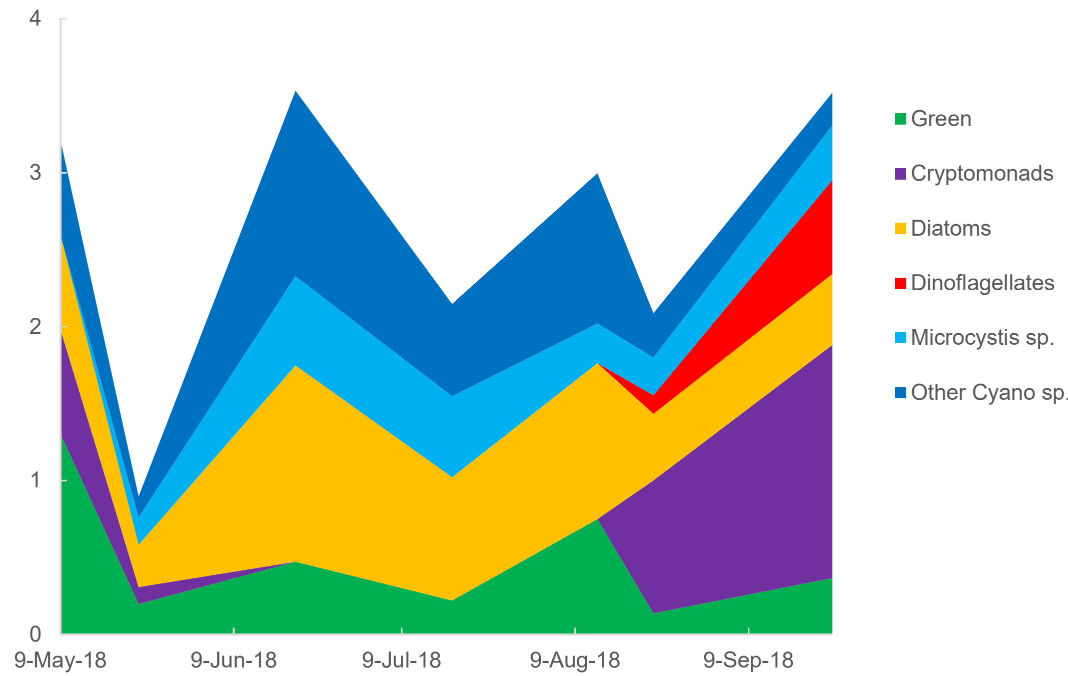


- Green



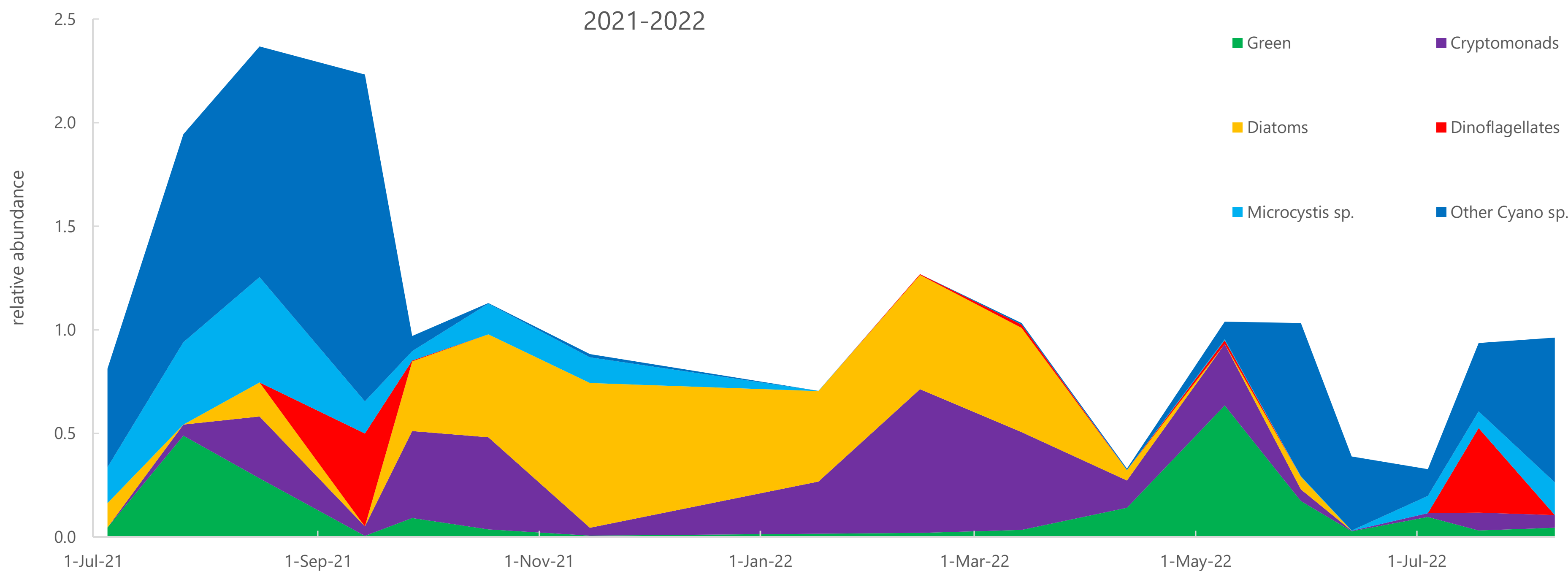
- Blue-Green





MUNICIPALITY OF NORTH Cowichan

2021-22 changes in phytoplankton community.



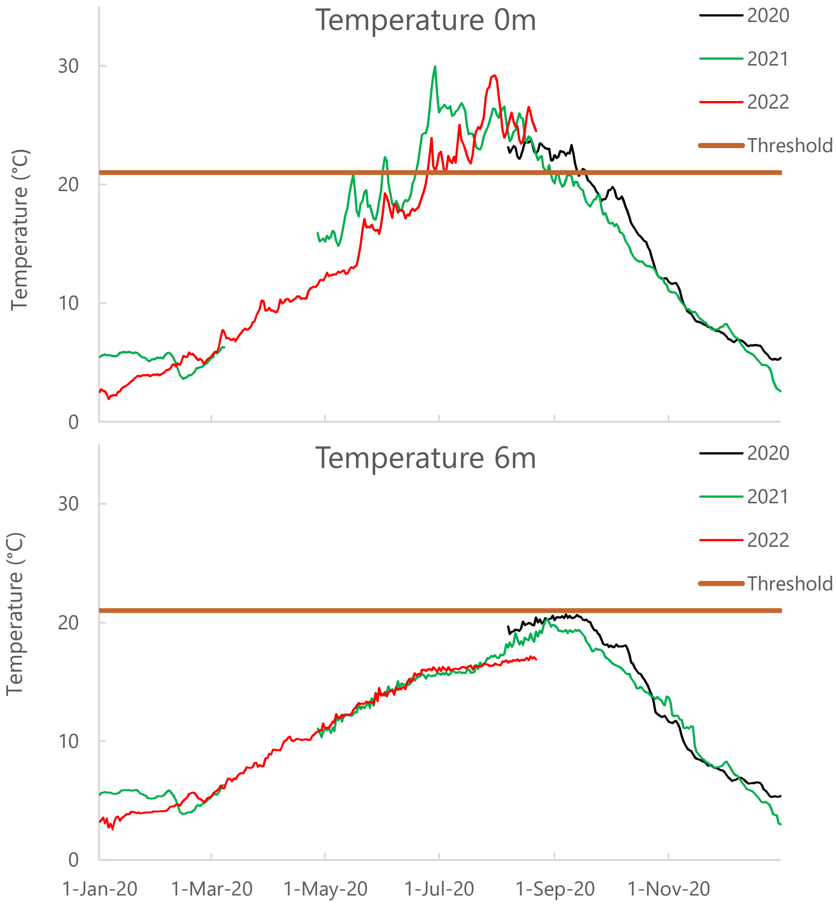
MUNICIPALITY OF NORTH Cowichan

What have we learned?

- Changes in Summer Lake Temperature and oxygen activate phosphorus in summer

- Peak July - Aug

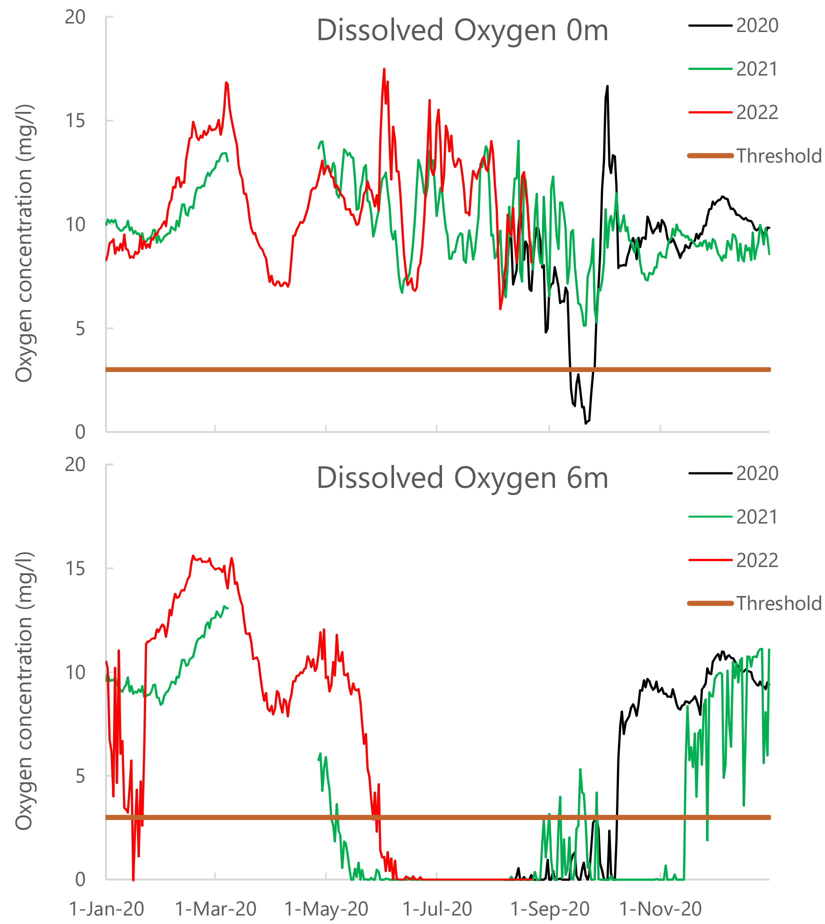
- Turnover historically ranges from early to late September



NORTH Cowichan

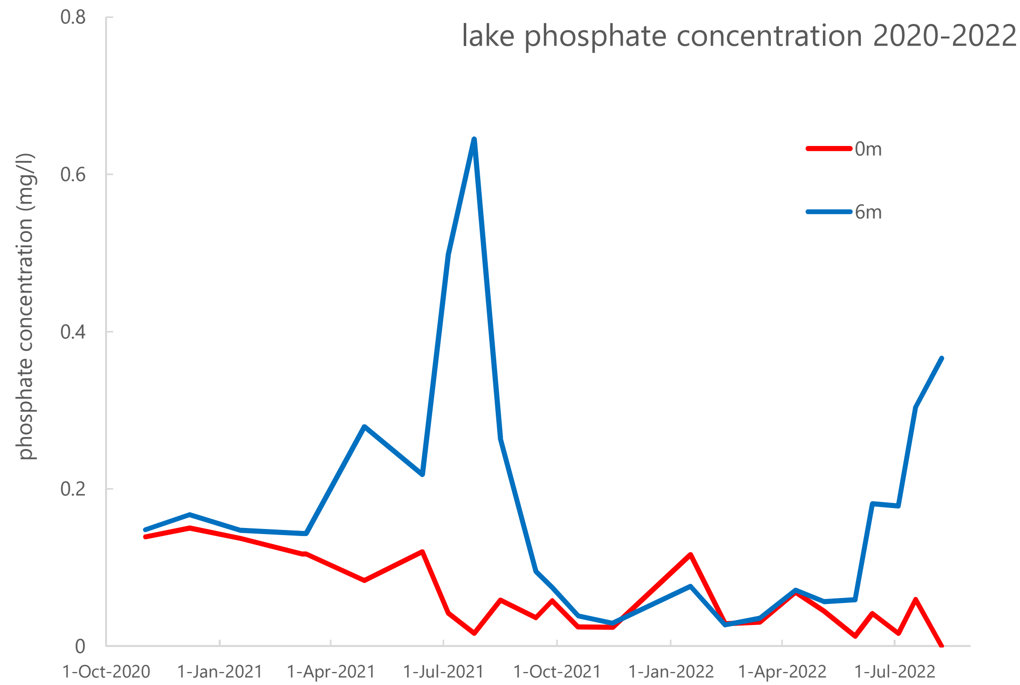
What have we learned?

- Changes in temperature affect changes in Oxygen and ecosystem dynamics
- Fish prefer > 5mg/l O_2, <3mg/l is lethal
- Decline over end of summer, peak at end: fall bloom



What have we learned?

- Anoxic periods release phosphate from lake sediment
- Peak July - Aug
- Peak associated with High surface T and Low oxygen at lake bed



MUNICIPALITY OF NORTH Cowichan

What is being done right now?

- Monitoring
  - *sediment coring*
  - *nutrient sampling*
  - *temperature and oxygen logging*
  - *phytoplankton community*
- Controlling input phosphorus
  - *zeolite traps in trial locations*
  - *managed wetlands and infiltration*
  - *tree planting*
  - *work with stewardship groups*
  - *remove invasive plants*
  - *restore wetland habitat*
  - *work with agricultural community*
  - *consult with province, federal governments*

MUNICIPALITY OF NORTH Cowichan

Limno Solutions Sediment Analysis

- sediment phosphorus is a key driver of the lake's poor water quality
- 32 tonnes of releasable phosphorus in lake sediment
- sediments of Quamichan Lake may not have enough iron to bind the releasable phosphorus
- high sulfur concentrations in the sediment might reduce the natural binding capacity of the sediment for phosphorus

Assessing management options

- Dredging
- Artificial mixing
- **Aeration**
- **Flushing**
- **Phosphorus capture**

Limno Solutions Assessment

- **dredging** not suitable for Quamichan Lake; large quantity of sediment to be removed, high costs, and uncertain efficiency
- **artificial mixing** may cause sediment resuspension and stimulate cyanobacteria
- **aeration** may attenuate fish kills but effect on phosphorus depends on iron available in sediment
- **deep water withdrawal /flushing** may not work in the short term
- **Phoslock®** high cost and may need reapplication

Next steps

- Continue monitoring

- Continue work to
  - *reduce external phosphorus*
  - *improve riparian habitat*
  - *Restore streams and wetlands*
  - *Augment stormwater features*
  - *Engage residents, and farmers*

- Continue consultation with provincial agencies and other local governments

- Assess potential of aeration and then report to Council with management plan

MUNICIPALITY OF NORTH Cowichan

Questions?