The Hidden Challenges of Callander Bay

Callander Bay is more than just a body of water — it's at the heart of our community. It shapes our daily routines, supports our local economy, and brings us together as families and friends.

For many years, blue-green algae (cyanobacteria) blooms have been a growing concern. These blooms can impact everything from drinking water to recreational activities like swimming, boating, and simply enjoying the lake.

On April 29, 2025, the municipality hosted an information session, bringing together experts from various fields to update residents and neighbouring communities on the issue. They also shared recent efforts to better understand this complex environmental challenge.

This presentation summarizes key information that was shared and outlines the main factors contributing to the blue-green algae problem in Callander Bay. For those interested in learning more, additional resources and links are included throughout the summary.

Callander ONTARIO

1 **Blue-Green Algae** + Info

2 **Physical Characteristics of Callander Bay** + Info

3 **Climate Change** + Info

4 **Legacy Phosphorus in Sediments** + Info

5 **Low Oxygen Levels along the Bay's Bottom** + Info

6 **External Phosphorus Loading** + Info

7 **Loss of Zooplankton** + Info

North Bay - Mattawa Conservation Authority
Source Protection Plan

Ontario Clean Water Agency
Operation of Water Treatment Plant

North Bay and District Health Unit
Health Concerns Associated with Blue-Green Algae

1 Blue-Green Algae

← Back

Blue-green algae, also known as cyanobacteria are photosynthetic organisms found in water. Although they are called algae, they are actually bacteria.

https://www.deq.ok.gov/state-environmental-laboratory-services/environmental-public-health-information/harmful-algal-blooms/what-are-cyanobacteria/

What conditions allow cyanobacteria to thrive ?

MORE INFO

- Cyanobacteria have existed for over **3 billion years** and are a natural part of aquatic ecosystems, but too much of them can be harmful.
- Some species of cyanobacteria **can produce toxins** that are harmful to animals and humans, especially during algal blooms.

What conditions allow cyanobacteria to thrive ?

1. Warm water: They grow best in warmer temperatures, so they tend to bloom in summer and early fall when lakes are warm. (Peak growth often occurring between 25°C and 30°C)

2. Still or slow-moving water: Calm conditions, like in sheltered bays, allow cyanobacteria to float and stay near the surface where there's lots of sunlight.

3. High nutrient levels: They especially need phosphorus, which often comes from fertilizer runoff, wastewater, or released from lake sediments.

4. Longer growing season: Climate change means shorter winters and longer ice-free periods, giving cyanobacteria more time to grow and bloom.

https://www.baytoday.ca/local-news/blue-green-algae-found-in-callander-bay-18368

5. Low grazing pressure: If animals like zooplankton (eg. Daphnia) that normally eat algae are missing or reduced, blue-green algae can grow unchecked.

6. Stratification and low oxygen at the lake's bottom: These conditions help release phosphorus from sediments, which cyanobacteria then use to grow.

2 Physical Characteristics of Callander Bay

← Back

Callander Bay is deep enough for the water to form layers, called **thermal stratification.** Also, its sheltered shape reduces wind, so the water doesn't mix as often.

https://craterexplorer.ca/callander-bay-complex/

- In summer, **the water forms layers based on temperature.** Warm water stays at the surface while colder, denser water remains at the bottom.

Thermal stratification

- The bay is **surrounded by land on three sides**, creating a sort of "U" shape. This natural shape blocks strong winds from sweeping across the surface of the water.

- **Wind is a main factor that stirs up the water and mixes the layers.** Since Callander Bay is protected from wind, there's less surface turbulence, and the layers stay separated longer.

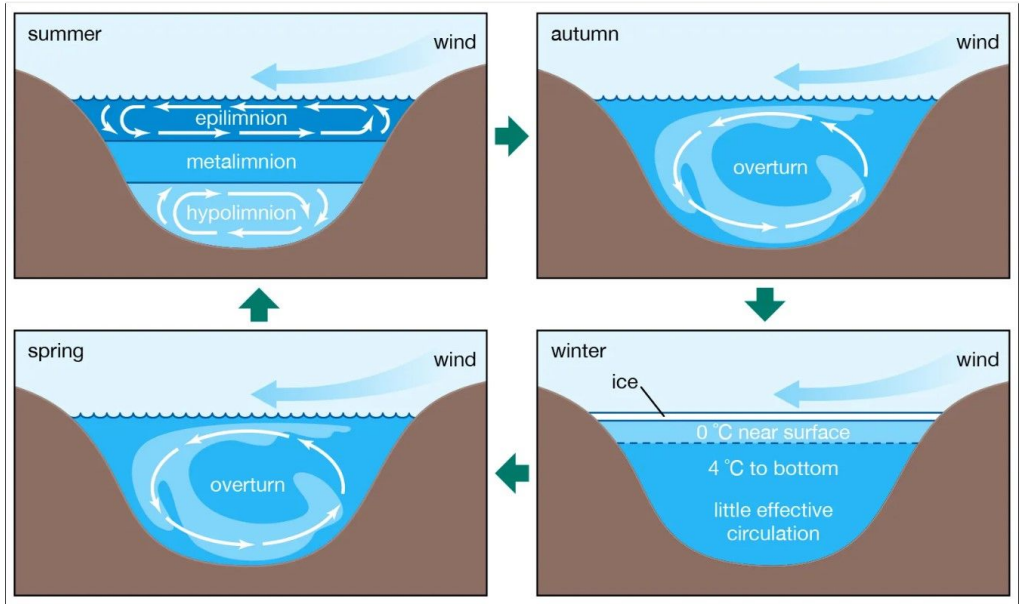
What is thermal stratification ?

Thermal stratification in lakes refers to the formation of distinct horizontal layers of water, each with different temperatures and densities.

This phenomenon is most common during the warmer months in temperate regions, such as Ontario.

As sunlight warms the surface of a lake, the upper layer becomes lighter and less dense than the cooler, deeper water.

Because water is densest at around 4°C, this temperature difference **prevents mixing** between layers.



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https://cdn.britannica.com/72/6572-050-A5BBE289/lake-circulation-patterns-layers-dimictic-stratification-mixing.jpg

When the lake is stratified in summer, the bottom layer of water is cut off from the air at the surface. **No fresh oxygen can get down there.**

3

Climate Change

← Back

Climate change refers to long-term changes in the Earth's average temperature and weather patterns. While Earth's climate has changed naturally over millions of years, **today's climate change is mostly caused by human activities.**

What evidence do we have to support that climate change is affecting Callander ?

- Northern Ontario is experiencing temperature increases at approximately **three times** the global average. This rapid warming affects ecosystems, wildlife, and human health .

- **Winter** temperatures in Canada increased by an average of **+3.3°C** from 1948 to 2016.

- **Summer** temperatures rose by about **+1.5°C** over the same period.

Canada's Changing Climate Report (2019)

Why does this matter ?

Longer growing season: Climate change means shorter winters and longer ice-free periods, giving cyanobacteria more time to grow and bloom.

Climate change affects **thermal stratification** by making it stronger and longer-lasting, especially in lakes.

Thermal stratification

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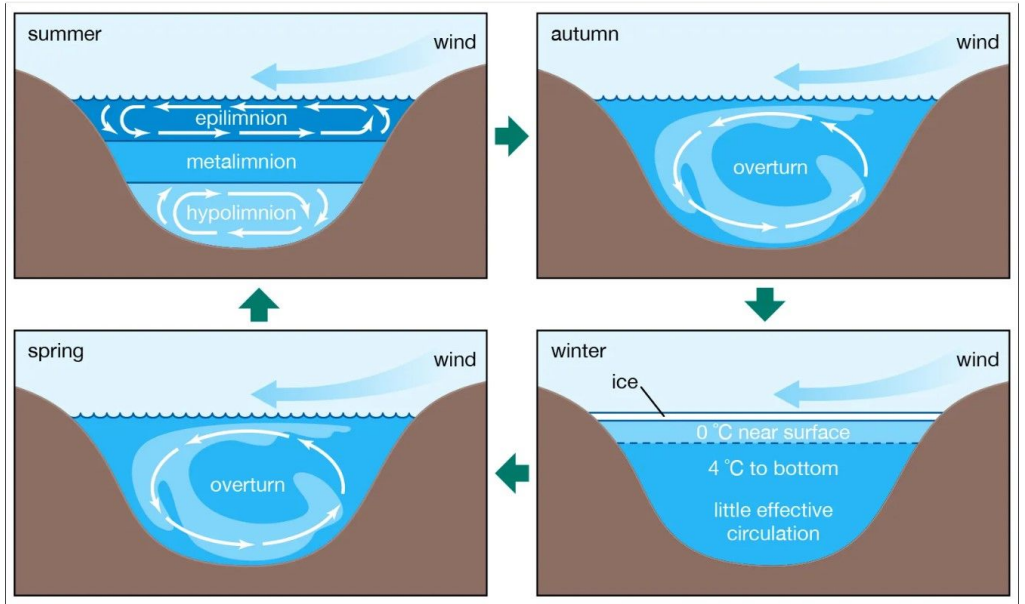

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4 Legacy Phosphorus in Sediments

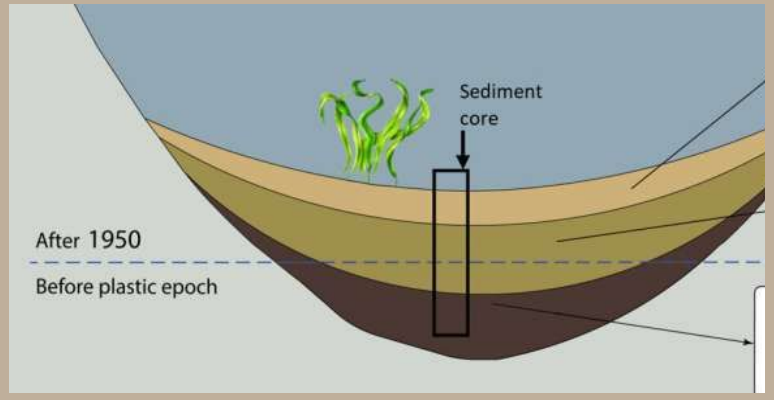
← Back

Legacy phosphorus refers to phosphorus that has accumulated in the environment, such as sediments at the bottom of water bodies, **due to past human activities**.

This residual phosphorus can continue to impact water quality long after the original applications have ceased.

A sediment core is a long, cylindrical sample of mud and material taken from the bottom of a lake.

Scientists use it to study what has happened in the environment over time .

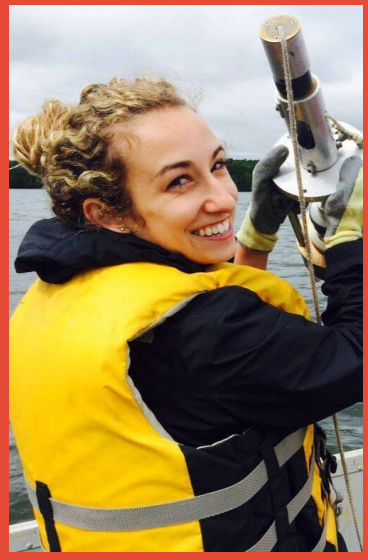


https://www.science.org/doi/10.1126/sciadv.adi8136

Dr. Liz Favot, professor and scientist from Laurentian University, has conducted a study analyzing sediment cores from Callander Bay to reconstruct historical phosphorus levels.

Her findings indicate that total phosphorus concentrations **have remained relatively stable over the past four decades.**

This suggests that external phosphorus inputs have not significantly increased during this period.



https://laurentian.ca/faculty/EFavot

MORE INFO

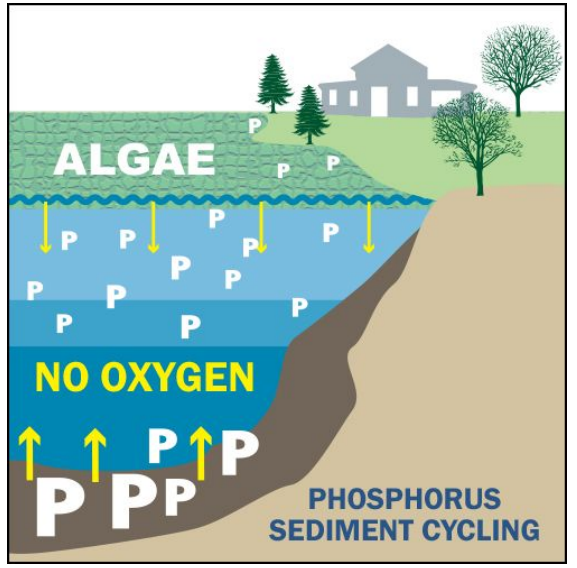
What is internal phosphorus loading ?

Phosphorus from sediments at the bottom of a lake are released back into the water column.

This internal phosphorus release feeds algae, helping it grow.

Even without new external phosphorus loadings, this process still adds nutrients to the water.

In Callander Bay, this internal nutrient release is now more frequent and intense, leading to more algae blooms.



https://vertexaquaticsolutions.com/pond-sediments-phosphorus/

While phosphorus inputs have improved in recent years thanks to better wastewater treatment and environmental regulations, the legacy phosphorus from past decades hasn't disappeared.

5 Low Oxygen along the Bay's Bottom

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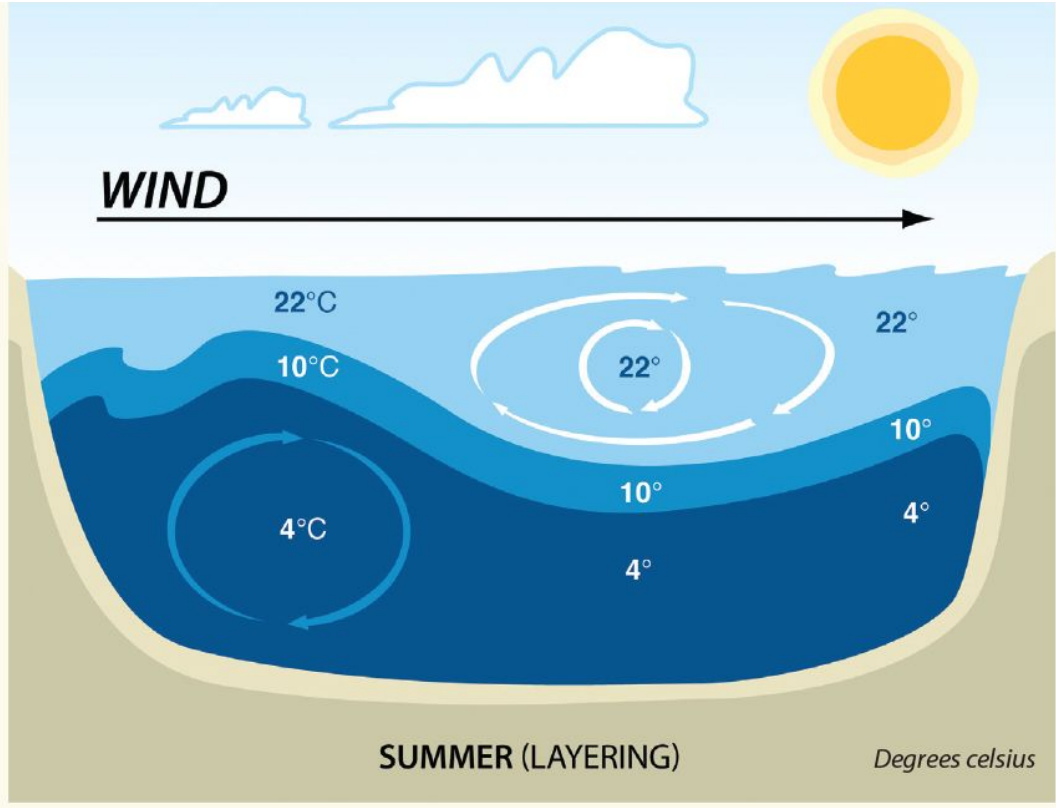

https://www.michiganseagrant.org/lessons/lessons/by-broad-concept/physical-science/dissolved-oxygen-and-lake-stratification/

- Oxygen gets into lake water mostly by dissolving from the air above the surface.
- However, when the lake is stratified in summer, the bottom layer of water is cut off from the air at the surface.

Thermal stratification

- Meanwhile, oxygen in the bottom water is still being used up by bacteria and other organisms.
- Over time, this leads to very low or no oxygen near the bottom, especially in calm, warm lakes like Callander Bay.

MORE INFO

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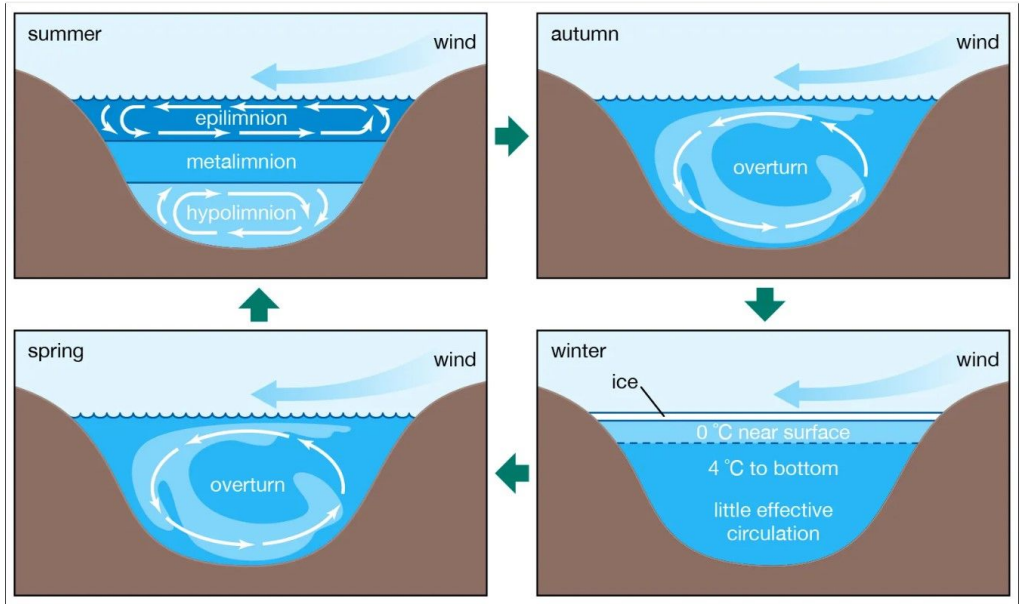

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When the lake is stratified in summer, the bottom layer of water is cut off from the air at the surface. **No fresh oxygen can get down there.**

How does low oxygen unlock nutrients from the sediment ?

When thermal stratification lasts for weeks or months, the oxygen at the bottom gets used up by bacteria and it isn't replaced.

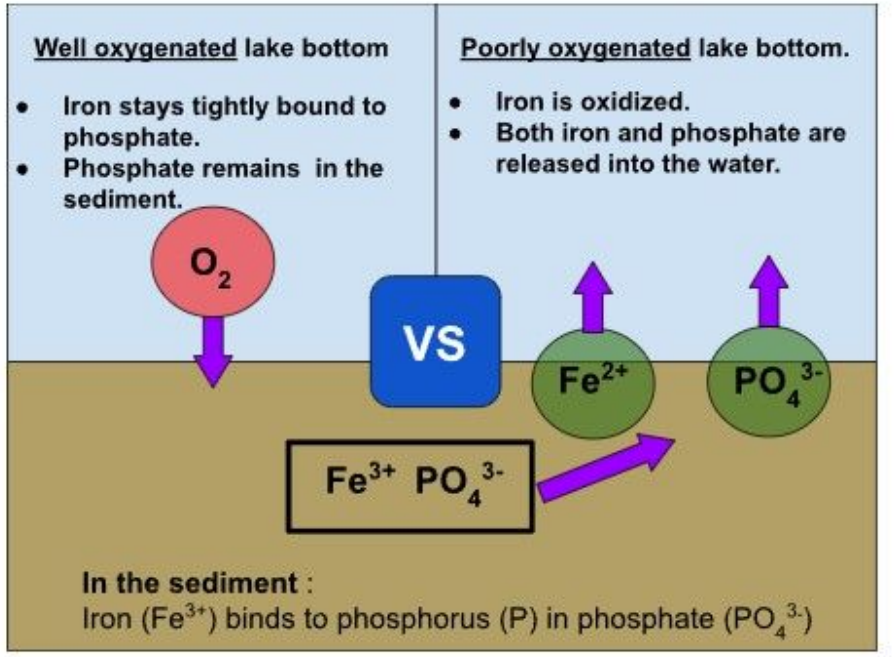
This low-oxygen environment (called hypoxia or anoxia) causes a chemical reaction: the iron that once held onto phosphorus changes form and releases it into the water.

Normally, phosphorus is locked in the sediment by binding to minerals like iron.

When oxygen levels get very low (called hypoxia or anoxia), chemical changes occur in the sediment.

In low-oxygen conditions, iron changes form and can't hold onto phosphorus anymore.

As a result, the "trapped" phosphorus is released back into the water.



Focusing solely on external inputs may not yield desired water quality improvements if internal loading remains unmitigated.

6 External Phosphorus Loading

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Phosphorus is the main nutrient that fuels algae growth in Callander Bay.

External phosphorus loading (top-loading) refers to phosphorus entering a lake from sources outside the water body.

Key contributors include:

1 - Effluent from sewage treatment plants or septic systems ;

2 - Fertilizers and manure from farmlands ;

3 - Stormwater which carries lawn fertilizers and pet waste.

Effective lake restoration requires addressing **both** external and internal phosphorus sources.

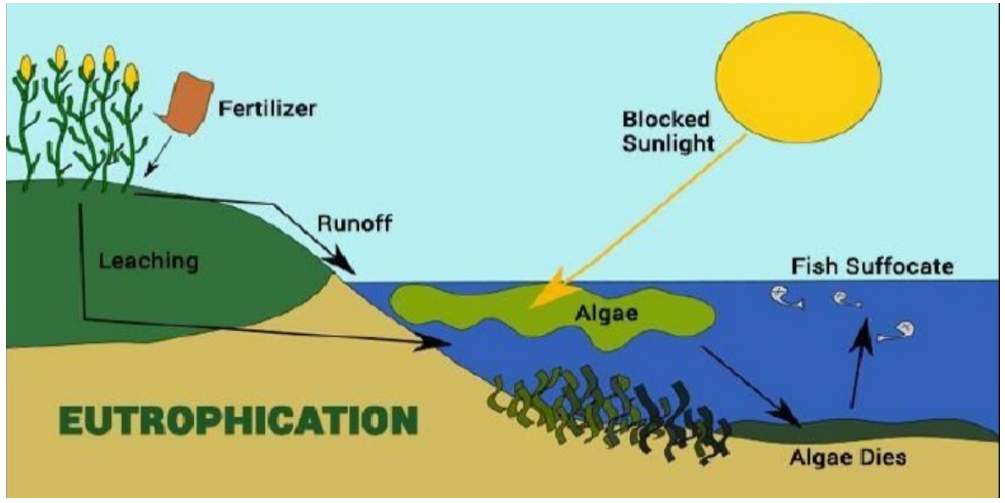
- Use phosphorus-free fertilizers: Choose lawn fertilizers labeled as phosphorus-free.
- Limit lawn watering: Excess watering can cause runoff that carries phosphorus into the bay.
- Maintain natural shorelines: Preserve or restore native vegetation along the shoreline to act as a buffer against runoff.
- Regular inspections: Ensure septic systems are inspected and pumped out as recommended to prevent leaks.
- Clean up pet waste: Dispose of pet waste properly to prevent nutrient runoff.

MORE INFO

What is Eutrophication ?

Eutrophication is a concern in Callander Bay. Monitoring and management efforts are ongoing between the Municipality, the Ministry of the Environment, Conservation and Park, Nipissing University, Laurentian University, North Bay Mattawa Conservation Authority, Ontario Clean Water Agency, and the Health Unit.

1. Extra nutrients, mainly phosphorus and nitrogen, enter the water (from fertilizers, septic systems, etc.)
2. The nutrients act like fuel for algae, causing algal blooms (green scum on the surface).
3. Algae block sunlight. This harms underwater plants and affects aquatic life.
4. Algae die and sink. As algae decompose, bacteria use up oxygen in the water.
5. Low oxygen caues problems.Fish and other animals may die from lack of oxygen, and the water can smell bad or look



Internal phosphorus loading can sustain or even exacerbate eutrophication, leading to persistent algal blooms and degraded water quality, even after external phosphorus sources have been reduced.

Loss of Zooplankton

← Back

- Zooplankton are natural algae grazers: They swim through the water and eat single-celled algae, including cyanobacteria (blue-green algae). This helps prevent large algae blooms.
- If zooplankton populations drop, there's less grazing pressure. Algae, especially fast-growing species like blue-green algae, can multiply quickly because nothing is eating them.

https://lemonadist.com/2024/03/19/zooplankton-what/

Why do zooplankton populations decline ?

- Invasive species, like the spiny water flea (*Bythotrephes cederströmii*), eat native zooplankton such as Daphnia, reducing their numbers.
- Warming water can also stress cold-loving zooplankton or disrupt their life cycles.
- Pollution or toxins may also harm zoo plankton directly.

What' the result ?

- With fewer grazers in the system, blue-green algae face less competition.
- They can form larger, longer-lasting blooms, especially in nutrient-rich and warm waters like Callander Bay.

MORE INFO

What is the spiny water flea ?

https://lemonadist.com/2024/03/19/zooplankton-what/

The spiny water flea *(Bythotrephes longimanus)* is an **invasive species** originally from Northern Europe and Asia.

Why is it a problem ?

- Callander Bay became vulnerable as the species spread within Lake Nipissing.
- It reproduces quickly and competes with native species.
- Its long spiny tail makes it difficult for small fish to eat.
- It preys on native zooplankton, like Daphnia, which are important algae grazers.
- With fewer grazers, algae can grow unchecked, contributing to blooms.