

WATER QUALITY REPORT



Photo Credit: North Shuswap Kicker



Photo Credit: Darren Robinson Photography / Shuswap Tourism

The Shuswap watershed is a very special place.

It is within Secwepemc'ulecw, the traditional unceded territory of the Secwepemc Peoples and the homeland of the Neskonlith, Skw'lax, Adams Lake and Splatshin te Secwepemc First Nations. The Shuswap watershed—including Shuswap Lake, Mara Lake, Mabel Lake, Adams Lake, and many more lakes and rivers—is about 1.5 million hectares. Shuswap Lake itself is about 310 square kilometres, with hundreds of kilometres of shorelines. It is known for its pristine

water and beautiful beaches. These attributes make the Shuswap one of the most popular recreational destinations in BC, and contribute to a desirable lifestyle for residents and a significant tourism economy. The Shuswap is a nursery watershed for four species of Pacific salmon and provides important habitat for a variety of plants and wildlife. The Shuswap is a vitally important source of water for drinking for many communities and rural residents, and for agriculture.

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Did you know?

97%

of the water on Earth is in the oceans

2%

is frozen in glaciers and polar ice caps

1%

is freshwater—in lakes, rivers and streams

Water quality is monitored at several locations in the Shuswap watershed, at different times of year, and by different organizations for different reasons.

The Shuswap Watershed Council (SWC) is a **partnership of many organizations** with a mandate or interest in monitoring, protecting, and improving water quality. The SWC is pleased to present a summary of water quality information, monitoring results, and water quality protection projects in the Shuswap watershed on behalf of its partners for 2022.

In this seventh annual report on water quality from the SWC, you'll find monitoring results and information about:

- Shuswap Lake, Mara Lake, Mabel Lake, Sugar Lake, White Lake, and Adams Lake
- Salmon River and Shuswap River
- Popular beaches
- Algal blooms and cyanobacteria
- Highlights on new work by the Province of BC: Water Quality Objectives for Shuswap Lake and a detailed water quality assessment for Shuswap Lake
- Aquatic invasive species, and how to prevent spreading them
- The SWC's advocacy to government regulators for better monitoring and action to protect water quality
- The SWC's Water Quality Grant Program to protect and improve water quality in the Shuswap
- A Phosphorus Action Plan for the Shuswap watershed.

The Shuswap watershed

A watershed—or drainage basin—is an area of land defined by where rain and snow collect and run off into a common river, lake, or aquifer. Watersheds receive precipitation and over time, water drains through creeks, rivers, and lakes to the single lowest point in the watershed.

The Shuswap watershed is much more than the lake: it is all the land and bodies of water that drain to the outlet of Little Shuswap Lake. It includes forests, fields, hillsides, wetlands, meadows, creeks, rivers and lakes from the Okanagan Highlands in the south, to the Monashee mountains in the north and east, to the Shuswap Highlands in the northwest.

The outlet of the Shuswap watershed is at the community of Chase, where Little Shuswap Lake flows out into the South Thompson River. Thus, the Shuswap watershed forms part of the larger Thompson and Fraser watersheds.

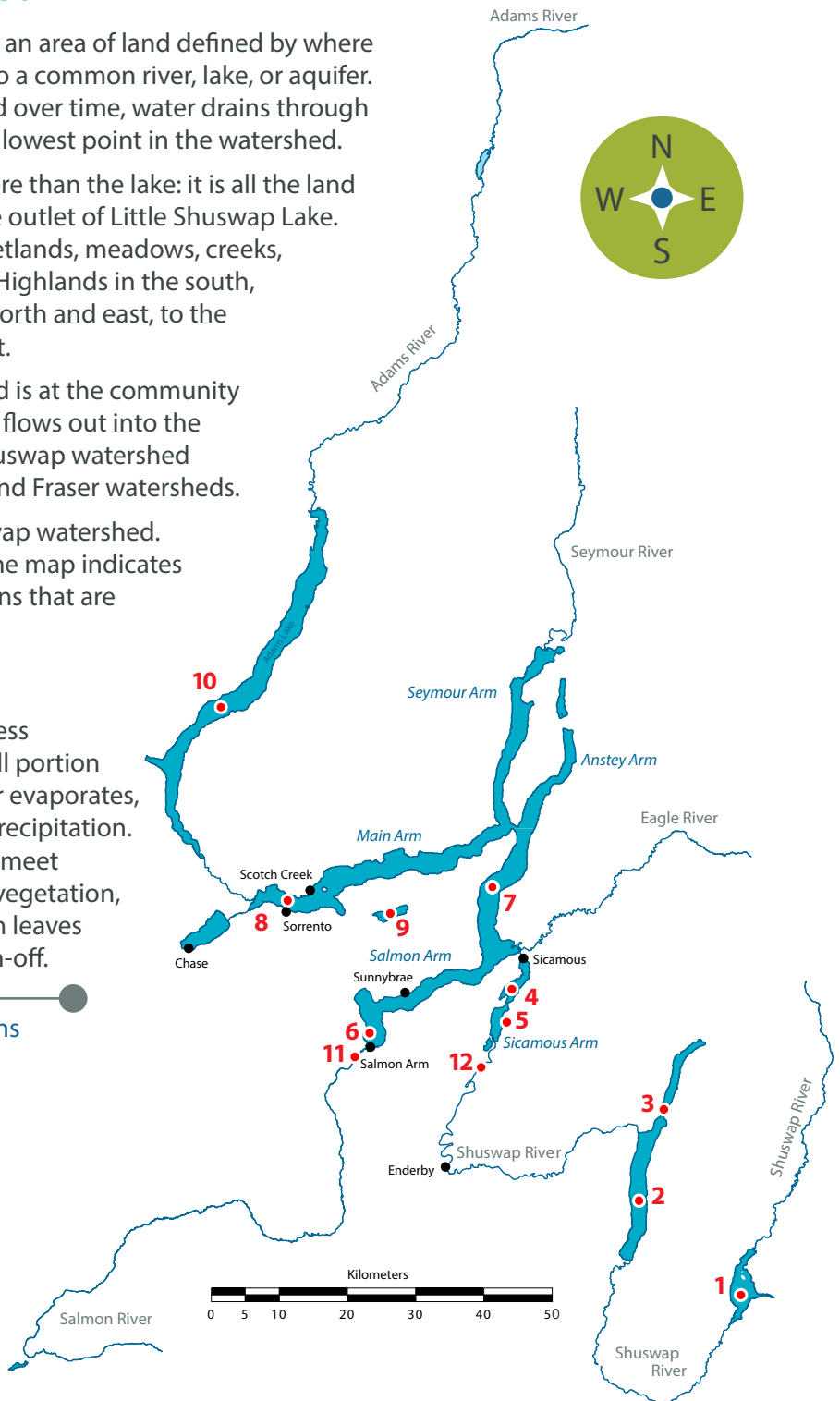
This is a simplified map of the Shuswap watershed. It shows the large lakes and rivers. The map indicates the water quality monitoring locations that are reported on the following pages.

The Water Cycle

While there may seem to be an endless supply of water on Earth, only a small portion is available to us as freshwater. Water evaporates, condenses into clouds, and falls as precipitation. Precipitation falling to the earth can meet many fates. It can soak into soil and vegetation, transpire (water vapor releasing from leaves into the air), evaporate, freeze, or run-off.

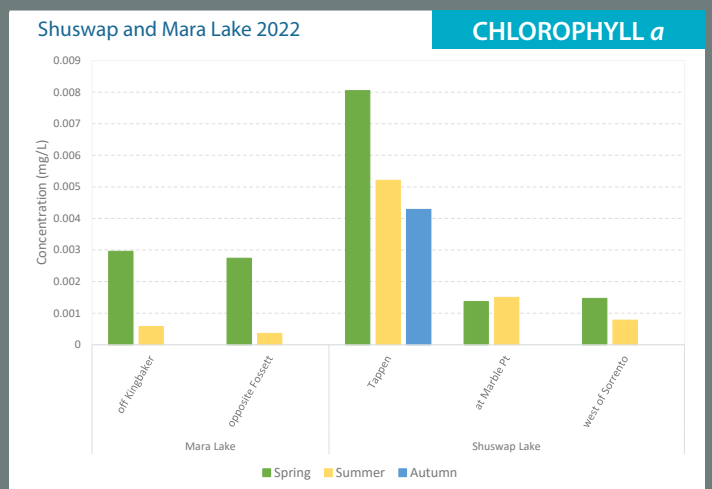
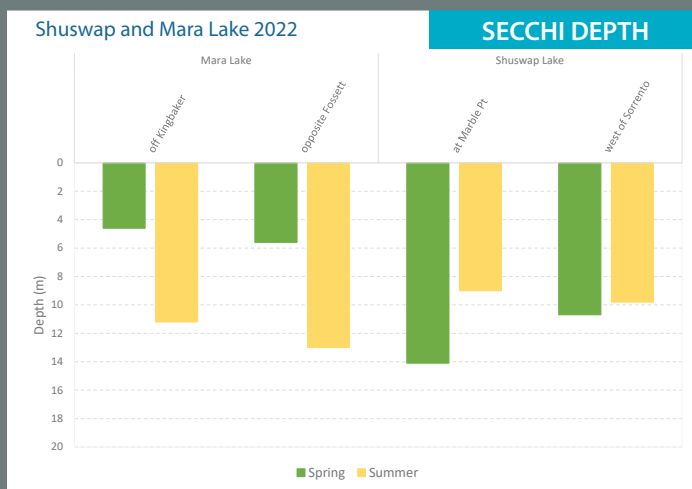
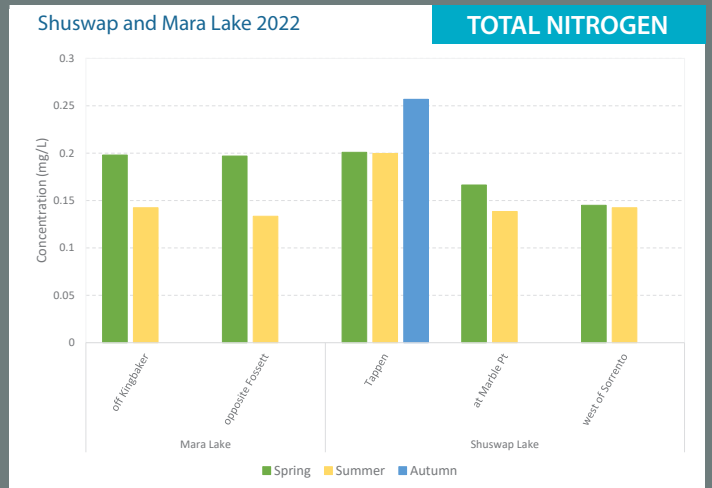
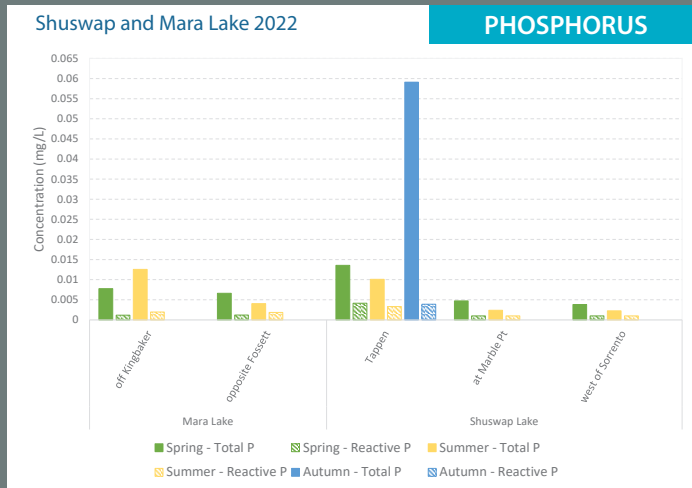
Select Water Quality Sample Locations

1. Sugar Lake
2. Mabel Lake—South End
3. Mabel Lake—Tsuius Creek
4. Mara Lake—Fossette
5. Mara Lake—S. Kingbaker
6. Shuswap Lake—Tappen
7. Shuswap Lake—Marble Point
8. Shuswap Lake—W. Sorrento
9. White Lake
10. Adams Lake
11. Salmon River
12. Shuswap River



Shuswap Lake and Mara Lake

The BC Ministry of Environment & Climate Change Strategy (MOE) routinely monitors several locations in the Shuswap watershed twice per year—spring and fall (and occasionally, also in summer)—to identify long-term water quality trends in the lakes. The water quality parameters reported here all relate to lake productivity; that is, the ability of a lake to support the growth of plankton, plants, and animals. MOE's monitoring program also includes a suite of water chemistry parameters to support data interpretation and provide a comprehensive record of water quality trends over time. Some of these parameters include pH, temperature, turbidity, total suspended solids, hardness, sulphate, and alkalinity. Here is a snapshot of water quality monitoring results from 2022.



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Did you know?

Notice that the Tappen water monitoring site has data reported three times per year, whereas the other sites report data for two times. This is because the Tappen site in Salmon Arm Bay has unique conditions and is more prone to algal blooms. Because of this, it is monitored more frequently.

Why is there an emphasis on Phosphorus and Nitrogen data?

Phosphorus (P) and Nitrogen (N) are important nutrients for many living things, and the concentrations of each really matter in an aquatic ecosystem. In some ways, a lake can be compared to a garden: if nutrients are added, plants will grow. In a lake, the first plant life to respond to nutrients is often phytoplankton, or algae. Algae—and other forms of aquatic life including invertebrates and fish—need these nutrients to grow and reproduce. In a healthy ecosystem, the give-and-take of nutrients is balanced. But, too many nutrients in an aquatic ecosystem can upset the balance and lead to excessive algae growth known as an **algal bloom**. This can create unpleasant odours, reduce water clarity, and compromise the quality of water for drinking and recreation.

There are two types of P reported: Reactive P and Total P. Reactive P is a form of phosphorus that's immediately available (also known as "bioavailable") to plant life, such as algae and aquatic plants. Therefore, Reactive P is the form of P that has the potential to trigger an algal bloom.

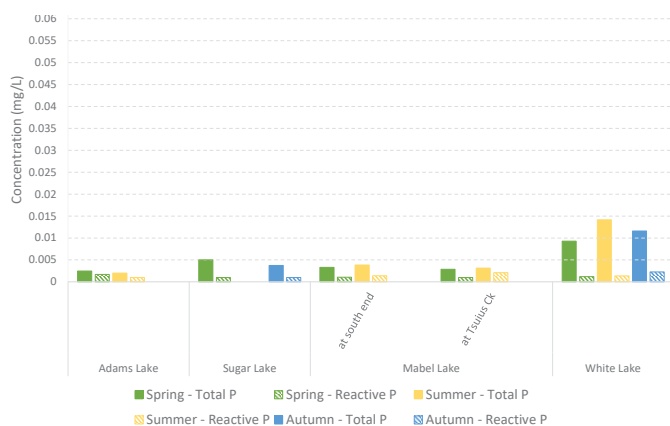
Adams Lake, Sugar Lake, Mabel Lake, and White Lake

Photo Credit: Samantha Cooper



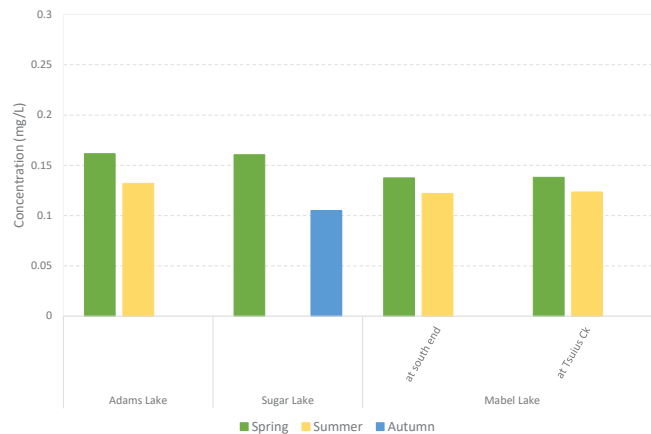
Adams, Sugar, Mabel, and White Lakes 2022

PHOSPHORUS



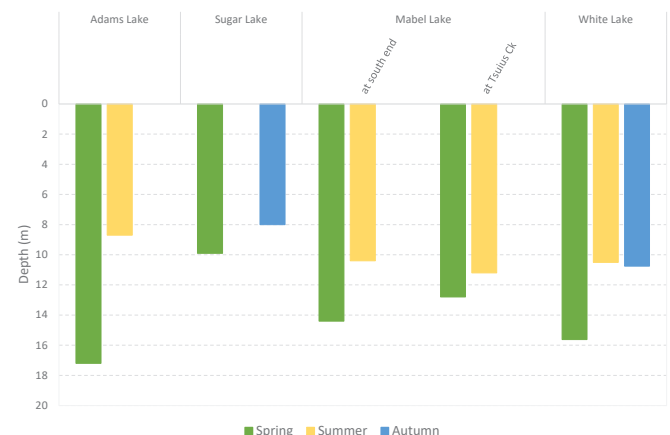
Adams, Sugar, Mabel, and White Lakes 2022

TOTAL NITROGEN



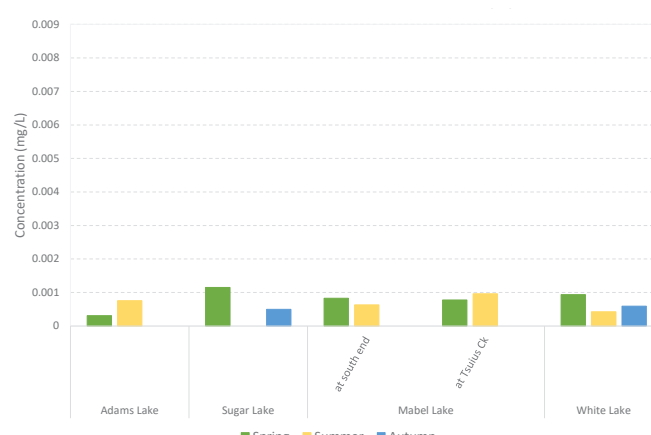
Adams, Sugar, Mabel, and White Lakes 2022

SECCHI DEPTH



Adams, Sugar, Mabel, and White Lakes 2022

CHLOROPHYLL *a*



Chlorophyll *a* is a pigment used by plants for photosynthesis. By measuring chlorophyll *a* in water samples, we can gain an understanding of how much algae there is.

Have you ever read our water quality reports and wondered, 'What do these data mean?'. As of late last year, there are now Water Quality Objectives (WQOs) for Shuswap Lake set by the Province of BC in partnership with Pespesellkwe te Secwepemc. WQOs are benchmarks against which water quality measurements can be compared and evaluated. See page 9 for more information about this and to see a summary of some of the new WQOs for Shuswap Lake.

Notice the differences in phosphorus and Chlorophyll *a* between the lakes reported on this page, and Shuswap and Mara Lakes reported on the opposite page. We've used the same scale on the y-axis (the vertical axis) of the charts for easy comparison. The values are lower for Mabel Lake, Sugar Lake and Adams Lake—this is indicative of the naturally very low-nutrient water quality in the upper reaches of the Shuswap watershed.

Are you wondering where these sites are located? See the map on page 3 to find out.

Salmon Arm Bay and Tappen Bay (Shuswap Lake) experienced a prolonged algal bloom from July to September, 2022. The long-term evidence of this is apparent in the data—see the measurements for phosphorus and chlorophyll *a* in the data charts on page 4. **The algal bloom was largely driven by nutrient inputs to the lake from the Salmon River and some of the smaller tributaries.** Other favourable conditions for algal growth in this region of the lake include the shallower depths and warmer temperatures of water. To learn more about the unique conditions in this region of the lake, see the article on page 8.



About algae and algal blooms

Algae are a diverse group of simple plants that live in freshwater and marine environments. **Algae provide important ecosystem functions, including providing food for fish and supplying oxygen into the environment.**

When conditions are favourable, algae reproduction and growth can be prolific resulting in a dense mass of algae called a bloom. It is difficult to predict algae growth or to pinpoint exact causes for it. Several factors including water temperature, nutrients, sunlight, weather, waves and water currents can all contribute to algal blooms. Sometimes these favourable conditions occur naturally, other times they are caused by people through land use activities such as agriculture and horticulture, or by industrial or domestic waste waters.

It's not uncommon for small isolated pockets of algae to occur in Shuswap Lake or any of the smaller lakes in our region, especially in spring and early summer when a fresh supply of nutrients enters the lakes during spring run-off and there is more sunlight. That time of year there can also be organic debris such as pollen in the lakes, which can make identifying algae a challenge.

You can learn more about algae and how to recognize an algal bloom from a Provincial government website, Algae Watch: www.gov.bc.ca/algaewatch.

What are cyanobacteria?

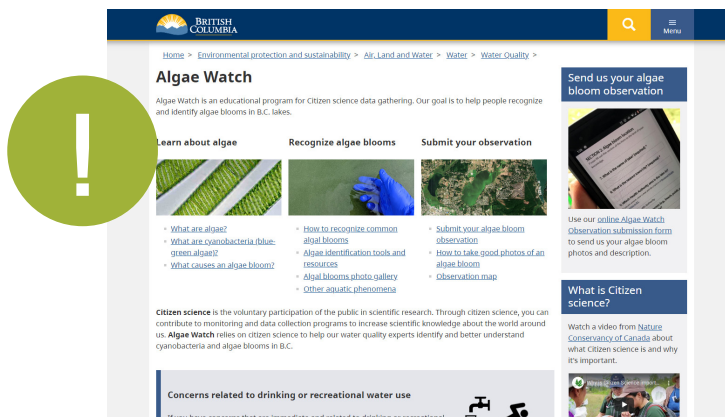
Cyanobacteria, also known as blue-green algae, are several species of microscopic bacteria that occur in lakes across BC and beyond. Similar to algae, when conditions for their growth and reproduction are favourable they can form a bloom. **Cyanoblooms are of particular concern because some species of cyanobacteria can produce toxins called microcystins that are harmful to people, pets, and livestock.** Not all cyanobacteria are toxic, and even toxic species do not always produce toxins.

Staying safe around cyanoblooms

Beach owners/operators are responsible for monitoring beaches throughout the swimming season to ensure they meet the *Canadian Recreational Water Quality Guidelines*. In the event of a cyanobloom, a beach owner/operator may issue a cautionary notice advising against swimming in a particular location. If water quality monitoring detects microcystins at a beach impacted by a cyanobloom, the health authority may issue a beach closure notification.

In the Shuswap, cyanoblooms are uncommon but they can happen. **You can reduce your risk of becoming exposed to cyanobacteria toxins by never drinking untreated water from lakes or ponds, and never swimming or recreating in water with a visible bloom.**

For the most up-to-date conditions at popular beaches, you should contact the beach owner/operator. Additionally, you can view beach closure notifications issued by Interior Health online: <https://www.interiorhealth.ca/health-and-wellness/environmental-health-and-hazards/public-beaches>.



If you've spotted an algal bloom, submit your observations via the **BC Algae Watch** website.

Your submission will go directly to staff at the BC Ministry of Environment & Climate Change Strategy. You can also view an **interactive map** of algae observations submitted by citizen scientists across BC.

www.gov.bc.ca/algaewatch

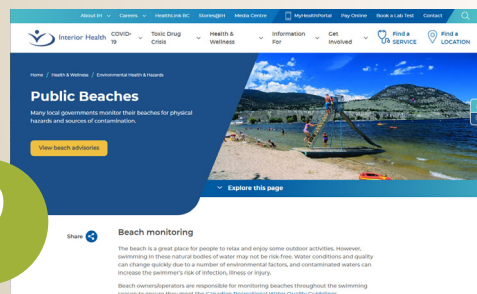
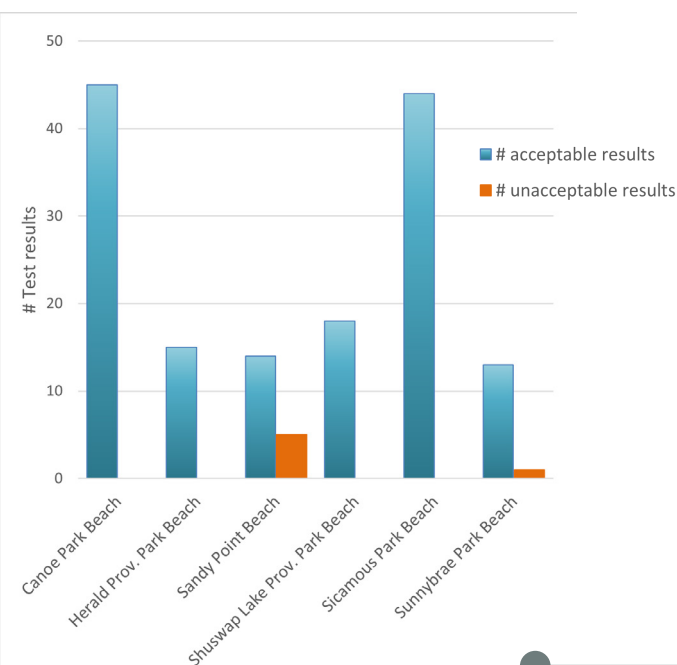


Photo Credit: Victoria Haack / Shuswap Tourism

Swimming Beaches

Water quality monitoring at popular swimming beaches is a joint responsibility of Interior Health, First Nations Health Authority, and local and Provincial government beach owners/operators. Water samples are collected and tested throughout the summer months for *E. coli*, a type of bacteria that is an indicator of water contamination.

Some beaches in the Shuswap are tested more frequently than others. Out of 155 water samples collected from these six popular beaches in 2022, all but six met the federal water quality guideline for swimming and recreation.



Did you know you can access beach water quality data online for samples collected over the past 120 days? Visit the Interior Health Public Beaches website: <https://www.interiorhealth.ca/health-and-wellness/environmental-health-and-hazards/public-beaches#>

What is an acceptable or unacceptable result?

There are federal guidelines for water quality for swimming and recreation that are different from guidelines for aquatic life or for drinking water. The recreation guidelines recommend that a safe bacteria level is less than 400 *E. coli* in a 100 mL sample, or an average of less than 200 *E. coli* in five consecutive 100 mL samples collected on a weekly basis. If results are above these, a swimming advisory may be issued.

Did you know?

Shuswap Lake has an average depth of 62 m, a maximum depth of 171 m, and a surface area of 310 km².

Local voices for local issues

The Shuswap Watershed Council serves in an important role as an advocate for the Shuswap watershed. Over the past several years, the SWC has called upon Provincial and Federal government regulators to take additional steps and make new investments to ensure the long-term health of the Shuswap watershed. Recently, the SWC shared its concerns about deteriorating water quality in Salmon Arm Bay with the Province of BC and called for additional monitoring and action to correct the issues. The SWC has also asked the Province to expand their Invasive Mussel Defence Program such that all routes into BC from Alberta and Washington have a watercraft inspection and decontamination station to better protect BC from invasive mussels. You can find the SWC's advocacy correspondence on their website.

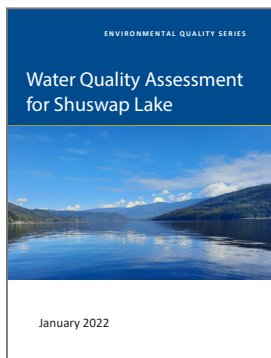




Photo Credit: Darren Robinson / Shuswap Tourism

New from the Province of BC

Water Quality Assessment for Shuswap Lake



The BC Ministry of Environment & Climate Change Strategy undertook a water quality assessment for Shuswap Lake as part of developing new Water Quality Objectives for the lake, as well as to provide information for future management decisions. The assessment examined water quality data from

the past 20 years (2000–2020). The assessment acknowledges that the most sensitive designated uses of Shuswap Lake are aquatic habitat, recreation, and domestic source water.

The assessment report describes Shuswap Lake as oligotrophic: having low biological productivity, clear water, and low nutrient concentrations. However, higher nutrient levels and productivity in the Salmon Arm reach of the lake indicate mesotrophic conditions in that area. Water quality in Shuswap Lake is strongly influenced by the rivers and streams that flow into the lake.

Influences on water quality

There are many activities which influence Shuswap Lake water quality. However, elevated nutrient levels are the primary water quality concern in Shuswap and Mara Lakes. The large rivers—the Salmon and Shuswap Rivers—are the largest sources of phosphorus and nitrogen to Shuswap and Mara Lakes. Agriculture is a key contributor of nutrients to the lakes, via these large rivers, through fertilizer application to fields and manure from livestock. A much smaller proportion of nutrients come from point-source discharges to surface water and groundwater (e.g., wastewater treatment plants). Private on-site wastewater (septic) systems are likely contributing very small proportions of nutrients to the lake in localized areas, especially around lakeshore areas and riparian habitat.

There are other anthropogenic activities in and around Shuswap Lake which may influence water quality. The lake provides significant recreational opportunities, and water quality could be impacted by activities around boat launches, docks, beaches, houseboats, and motorboats, as well as in parks and campgrounds. While the risk of impacts from recreation are highest during the summer months, the overall contributions of nutrients from these activities is low. Additionally, transportation and utility corridors—and the vehicles that use them—are often important sources of pollutants. In addition to nutrients, transportation activities can be a source of hydrocarbons, metals, and other contaminants.

Source: Water Quality Assessment for Shuswap Lake. January 2022. BC Ministry of Environment & Climate Change Strategy.

Would you like to learn more? You can find the full assessment report published by the Ministry online. It includes information about nutrients, chlorophyll *a*, dissolved oxygen, water clarity, bacteria, fish, invertebrates, and more.



Also check out this mini-report published by the Shuswap Watershed Council: **Understanding Nutrients and Water Quality in the Shuswap River and Salmon River.** Find it on the SWC website.

What is trophic condition?

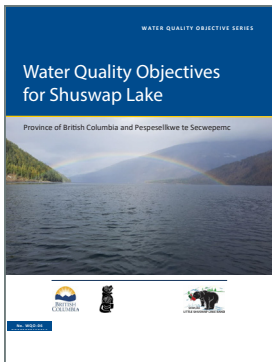
Biologists classify lakes according to their productivity, or ability to support plant growth. This is referred to as a lake's 'trophic status' or 'trophic condition'. Generally, trophic condition ranges from oligotrophic (low levels of nutrients and productivity) to mesotrophic (moderate levels of nutrients and productivity) to eutrophic (high levels of nutrients and productivity). 'Eutrophication' is the progress of a lake toward a higher trophic condition, which naturally occurs very slowly over time, and can also be sped up by anthropogenic activities (people-caused) such as settlement and agriculture.

“Phosphorus and nitrogen concentrations are the primary water quality concern, especially in Tappen Bay near the mouth of the Salmon River where algal blooms have been occurring. Setting Water Quality Objectives for nutrients to decrease the potential for algal blooms is a key aspect of this WQO policy.”

Source: Shuswap Lake Water Quality Objectives Policy Report. September 2022.
Province of BC and Pespesellkwe te Secwepemc.



Water Quality Objectives for Shuswap Lake



The BC Ministry of Environment & Climate Change Strategy has the authority and mandate to utilize a variety of regulatory tools to protect water quality in this province. One of these is the publication of Water Quality Objectives (WQOs). WQOs are Provincial policy statements that apply to specific waterbodies. They are intended to protect water quality, and are used in Provincial management decisions and permitting processes. They also serve as benchmarks against which water quality measurements can be compared and evaluated.

Water Quality Objectives were developed by the Ministry in partnership with Pespesellkwe te Secwepemc and published in September 2022. A water quality assessment was completed with data from four water quality sampling stations in Shuswap Lake, from 2000–2020, to inform the development of the WQOs.

Water Quality Objectives for Shuswap Lake were published for seven parameters. The WQOs for nutrients are summarized below:

	WATER SAMPLING LOCATION			
Parameter	E208723 Armstrong Point	0500123 West of Sorrento	0500124 Marble Point	E206771 Sandy Point (Tappen)
Total Phosphorus (µg/L)	10	10	10	15
Total Nitrogen (µg/L)	300	300	300	300
Nitrogen : Phosphorus	> 30:1	> 30:1	> 30:1	> 20:1

* to convert µg/L to mg/L, divide by 1000. For example, the above-noted WQO for Total Phosphorus at the West of Sorrento location is 10 µg/L which is equal to 0.01 mg/L.



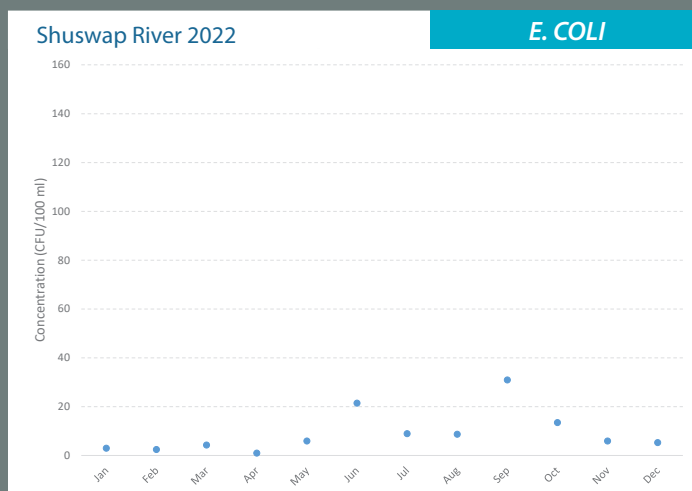
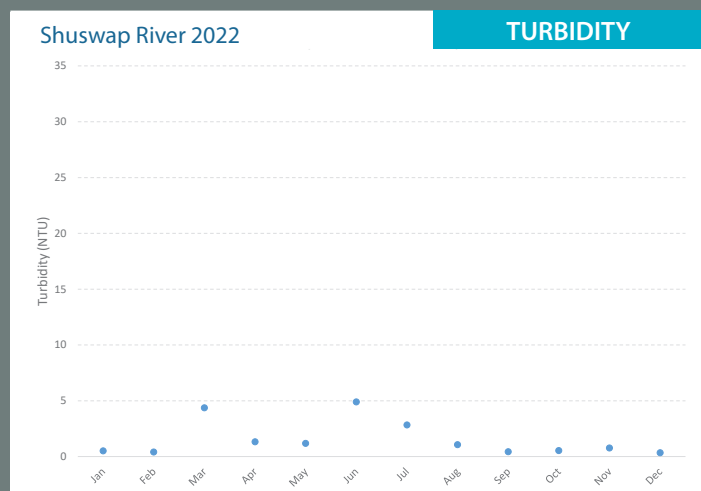
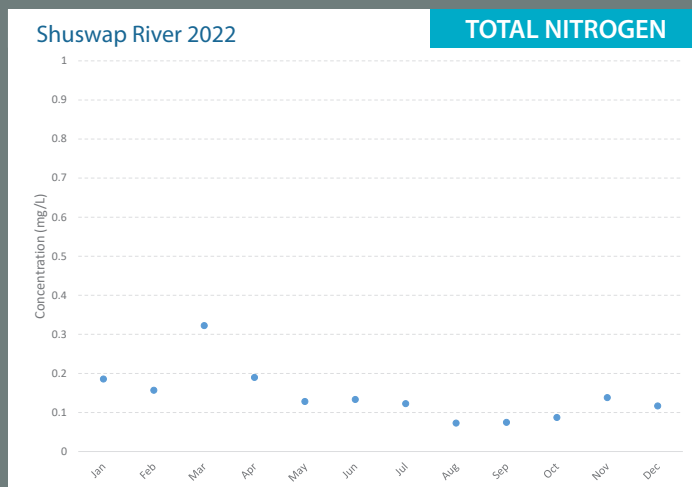
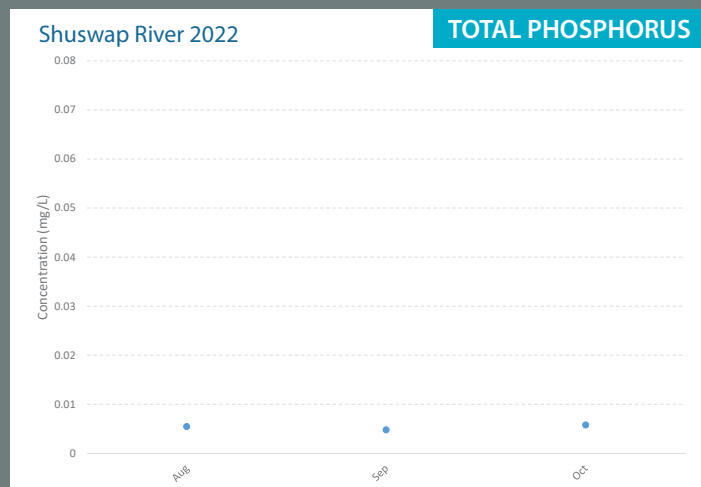
Photo Credit: Victoria Haack / Shuswap Tourism

Did you know?

Shuswap Lake is one of only a few large lakes in BC without a dam or flow control structure on the outlet. The lake level fluctuates three to four metres annually!



Shuswap River



Salmon in the Shuswap watershed

Did you know that the Shuswap watershed is important habitat for migration, spawning, and juvenile rearing for four species of Pacific salmon? The Lower Adams River is the most well-known, being the site of a world-famous Sockeye return. Many other rivers and creeks are important migration and spawning sites. The South Thompson River and Little River are 'salmon highways' into the Shuswap watershed, and both are significant for spawning by chinook, sockeye, and pink salmon.

Some of the other dominant spawning sites include the Salmon River for sockeye, chinook and coho; the lower Shuswap River for sockeye and chinook;

middle Shuswap River for chinook; Eagle River for sockeye and coho; Scotch Creek for sockeye; and Seymour River for sockeye and chinook.

There are many areas throughout the Shuswap watershed that provide important habitat for juvenile salmon before they migrate to the ocean. These include smaller streams such as Bessette and Duteau Creeks in the Shuswap River drainage, the wetlands along the Eagle River, and the nearshore zones of Mara, Shuswap, and Little Shuswap Lakes.

The Shuswap watershed with all its rivers, streams, wetlands and shorelines is very important in various stages of the salmon life cycle.

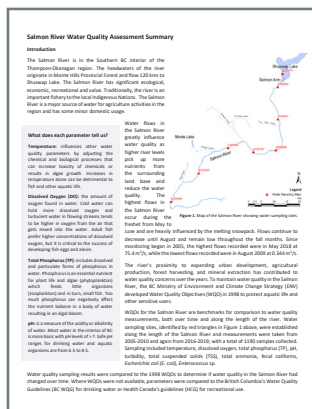
Salmon River



Salmon River attainment monitoring program

A detailed water quality assessment for the Salmon River is now available from the BC Ministry of Environment & Climate Change Strategy

Water Quality Objectives were established for the Salmon River by the Province of BC in 1998. From 2005–2010 and again from 2016–2019, the BC Ministry of Environment & Climate Change Strategy (MOE) carried out attainment monitoring programs on the Salmon River that involved collecting water quality samples from up to seven sites on a monthly basis. The results of the attainment monitoring programs have been assessed by MOE staff and contractors, and a full water quality assessment report is now available.



For more information about the water quality in the Salmon River, check out this summary report from the Province of BC published in September 2022. Find the website address in the Works Cited section on p. 16.

Attainment monitoring is the collection of water quality data from a waterbody to evaluate if that waterbody is meeting its water quality objectives. You can see that the water quality samples collected from the Salmon River in 2022 did not meet the established WQO for Total Phosphorus, which is set at 0.015 mg/L.

Water Quality Grant Program

The Shuswap Watershed Council launched a Water Quality Grant Program in early 2020. The grant program provides funding to farms, landowners, and stewardship groups for projects that protect and improve water quality, with a focus on mitigating the risks associated with nutrient-loading from land into surface waters. The grant program is administered through a call for applications, application review, and approval. Applications to the grant program must describe how their project will improve nutrient management on the landscape by retaining nutrients in the soil, and not washing off or leaching into nearby streams and rivers.

The SWC's Water Quality Grant Program is helping improve nutrient management and soil health, and ultimately reducing the amount of nutrients that wash off or leach out of soils into nearby creeks, rivers, and lakes within the Shuswap watershed. By keeping nutrients in soils and preventing their movement to nearby watercourses, a win-win situation is created for farms and for water quality.

2022 Water Quality Grant Funding recipients



Crystal Lake Ranch in Malakwa restored a 600-m section of riverbank along the Eagle River. This project involved bank stabilization, riparian habitat restoration, and new fencing to control livestock access to the riparian area and river.



Gardom Lake Stewardship Society constructed an expansion to the wetland along upper Gardom Creek, which flows into Gardom Lake. Wetlands are exceptional for improving water quality in streams and creeks, and to the lakes downstream. They also provide important habitat for a variety of species.



The SWC produced a short, informative video with Salmon Valley-based farms that received grant funding from the Council in 2020. Find the video on the SWC's YouTube channel!

A Phosphorus Action Plan for the Shuswap watershed

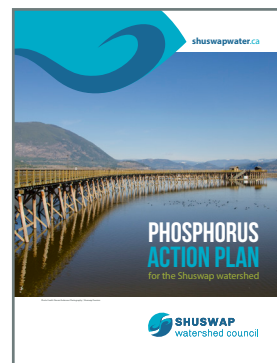
Phosphorus (P) is a non-replaceable, non-renewable mineral resource that is essential to many forms of life, and to the agriculture sector for food production. There is no substitute for it and it's important for supporting a healthy ecosystem. But, excessive amounts of phosphorus in aquatic environments can increase algal growth, reduce water clarity, create odours, reduce the quality of water for drinking and recreation, and in a worst-case scenario it can contribute to the formation of harmful algal blooms that are toxic to people, pets and livestock.

Elevated phosphorus levels have contributed to algal blooms in Salmon Arm Bay and Tappen Bay in recent years.

The Shuswap Watershed Council published a Phosphorus Action Plan in October 2022 to

provide guidance to everyone in the Shuswap on actions they can take to protect water quality by reducing the amount of phosphorus being released into the watershed. Additionally, the Plan summarizes the regulatory framework for P. The use of P and the discharge of phosphorus-rich effluents is regulated in many ways, with the Provincial government having the most specific regulations to directly manage P and other nutrients as well as having responsibility for regulating agriculture and other resource management activities in the watershed.

Find the Phosphorus Action Plan on the SWC's website.



Here is a snapshot of some of the actions identified in the P Action Plan for a variety of groups:

Taking Action: WHO	Taking Action: WHAT
Shuswap Watershed Council	<ul style="list-style-type: none"> • Continue to offer the Water Quality Grant Program, focusing on mitigating the risk of nutrient loss from the landscape to surface water • Create a Wetland Strategy for the Shuswap.
Farms and Agriculture Sector	<ul style="list-style-type: none"> • Follow the Provincial <i>Agricultural Environmental Management Code of Practice</i> • Utilize various beneficial management practices (BMPs) such as conservation tillage, conservation buffers, livestock exclusion fences, and more • Utilize regenerative agriculture practices such as cover crops • Develop an Environmental Farm Plan and access funding for implementing BMPs.
Forest Industry	<ul style="list-style-type: none"> • Manage roads, culverts and bridges to ensure drainage patterns are maintained • Promptly reforest upland areas following harvesting and wildfire.
Transportation Sector	<ul style="list-style-type: none"> • Avoid building over, filling in, or destructing wetlands in highway maintenance and expansion.
Homeowners, waterfront property owners, and boaters	<ul style="list-style-type: none"> • Properly maintain septic systems. Access the CSRD SepticSmart Program for helpful resources • Be aware of soap from home and vehicle maintenance that goes into stormwater drains • Maintain waterfront natural shoreline as much as possible • Minimize use of fertilizers on lawn, especially close to storm drains • Minimize boat wake near shorelines to prevent erosion • Don't discharge watercraft blackwater or greywater into waterbodies.

Did you know?

All mammals, including humans, produce P in our feces and urine based on the foods we eat. On average:

- an adult excretes 1.5 g of P per day, or 0.547 kg of P per year
- a dairy cow excretes 57 g of P per day, or 20.8 kg of P per year.



We are all stewards of the Shuswap watershed, and we can all play a part in protecting water quality whether we are agriculturalists or silviculturists, building or maintaining roads, tending to parks, lawns and gardens, choosing household products and minding what we flush down our drains, properly maintaining septic systems, and more.





Potential Economic Impact of Zebra and Quagga Mussels in B.C.
May 2023



Ministry of Water, Land and Resource Stewardship

Preventing the spread of invasive Zebra and Quagga Mussels to BC

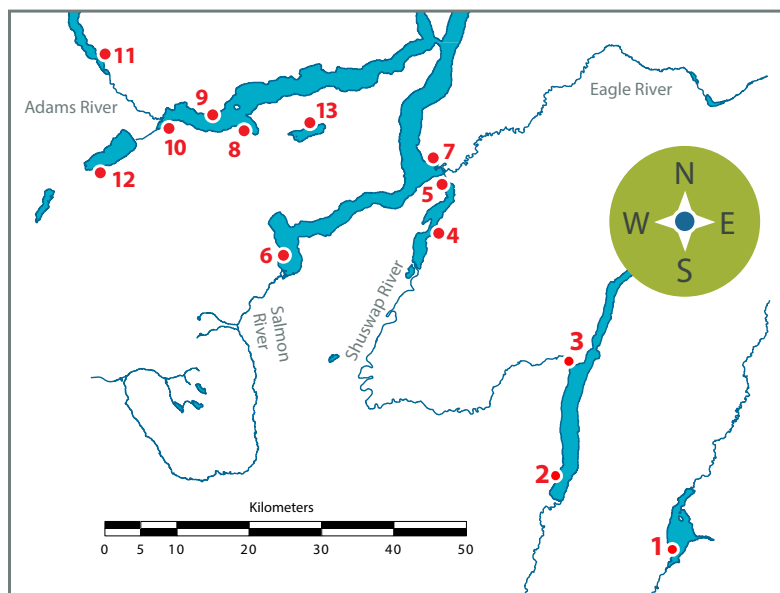
Zebra and quagga mussels are two species of freshwater mussels native to Europe and Asia with tremendous destructive potential due to their ability to attach and grow in clusters on objects in the water. They also impact water quality and aquatic food webs, and reduce biodiversity by out-competing native species for food and space. When they die, they produce foul odours and they litter beaches with their small razor-sharp shells.

A new report from the Province of BC, *"Potential Economic Impact of Zebra and Quagga Mussels in BC"* (May 2023) estimates an annual cost range from \$64–129 million to deal with the impacts of invasive mussels if they were to arrive in BC waters. This takes into consideration impacts on hydro-electric infrastructure, municipal and domestic water supply infrastructure, agriculture and golf course irrigation, maintenance to boats and marinas, losses to the tourism industry, and

loss in residential property values and property taxes due to reduced water quality and shoreline values, and more.

Since arriving in North America in the 1980s in ship ballast water, invasive mussels have spread to new water bodies by 'hitch hiking' on boats and other watercraft. Fortunately, **zebra and quagga mussels don't exist in the Shuswap**—or in any of BC's lakes—but they do occur in Manitoba, Ontario, Quebec, and 24 American states.

With financial support from the Shuswap Watershed Council, the Columbia Shuswap Invasive Species Society (CSISS) has monitored several sites throughout the Shuswap for invasive mussels for the past eight years. All their test results have been negative, meaning that invasive mussels have not been detected.



ZQM Monitoring Sites in 2022

1. Sugar Lake—2 Mile Rec Site
2. Mabel Lake—Provincial Park
3. Mabel Lake—Kingfisher
4. Mara Lake—Swansea Point
5. Mara Lake—Sicamous Narrows
6. Shuswap Lake—Pierre's Point
7. Shuswap Lake—Old Town Bay
8. Shuswap Lake—Blind Bay
9. Shuswap Lake—Captain's Village Marina
10. Shuswap Lake—Little River Boat World
11. Adams Lake—The Point on Adams Lake
12. Little Shuswap Lake—Chase Memorial Park
13. White Lake—Provincial Park



Invasive freshwater clams in the Shuswap

In 2019, invasive freshwater clam shells were discovered on the shores of Shuswap Lake. Surveys done on beaches confirmed low-density populations of the clams at Sunnybrae and Canoe (in the Salmon Arm of Shuswap Lake). Invasive clams are very difficult to eradicate from a complex waterbody like Shuswap Lake.

Invasive freshwater clams have a light brown triangular shell, usually less than 2.5 cm in length with visible growth rings.



Photo credit: Columbia Shuswap Invasive Species Society

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Did you know?

Shuswap Lake and other lakes in our region are at high risk of a mussel infestation because the temperature, pH levels, and calcium concentrations are well suited to mussel survival. Additionally, the high influx of watercraft that the Shuswap receives in the summer from outside of BC also puts our lakes at greater risk of an invasion.



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to prevent the spread of
aquatic invasive species

If Zebra or Quagga Mussels were to arrive in BC waters, it will impact all of us. We will start to see increased costs for hydro-electricity and domestic water due to the extra maintenance that will be required. Property values could decrease, and tourism could be very negatively impacted. We all need to do our part to stop the spread of invasive species.

What can you do?

- **Clean, drain and dry** watercraft when moving from one waterbody to another
- Stop for **watercraft inspection** when travelling
- Don't use invasive species as fishing bait
- Never release or dump aquarium plants or animals into the environment or down a drain
- Report sightings of invasive clams and other invasive species using the **Report Invasives BC** app



CSISS collected 87 samples from 13 sites on 7 lakes throughout the Shuswap in 2022. Invasive mussels weren't detected at any of these locations!

87

13

7



Who We Are

About the Shuswap Watershed Council

The SWC was established in 2014 as a watershed-based partnership of several organizations with an interest or responsibility for protecting water quality. There are up to 22 members that represent three regional districts, two municipalities, the Secwepemc Nation, three Provincial government agencies, and Shuswap communities. The SWC is a collaborative, non-regulatory group that focuses on strategic initiatives to protect, maintain, and enhance water quality and promote safe recreation in the Shuswap.

Staff

The Fraser Basin Council, a provincial non-government, non-profit organization, provides staff services to the Shuswap Watershed Council.

Our Vision

Enhanced water quality that supports human and ecosystem health and the local economy in the Shuswap watershed.

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Works Cited

- BC Ministry of Environment & Climate Change Strategy. 2022. Water Quality Assessment for Shuswap Lake. Environmental Quality Series. Province of BC, Victoria BC. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/monitoring-water-quality/thompson-okanagan-wq-docs/shuswap_water_quality_assessment.pdf
- BC Ministry of Environment & Climate Change Strategy. Algae Watch website. www.gov.bc.ca/algaewatch.
- BC Ministry of Water, Land & Resource Stewardship. 2023. Potential Economic Impact of Zebra and Quagga Mussels in BC. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/invasive-mussels/zqm_economic_report_2023_05_26_final.pdf
- Chalifour, A., A. Schein, and J. Sinclair. 2022. Salmon River Water Quality Assessment. Environmental Quality Series. Province of BC. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/monitoring-water-quality/thompson-okanagan-wq-docs/salmon_river_water_quality_assessment_nov_2022.pdf
- Columbia Shuswap Regional District. CSRD Liquid Waste Management Plan Updates (includes link to Septic Smart Homeowner Guide). <https://csrd.civilspace.io/en/projects/csrd-liquid-waste-management-plan-updates>.
- Fraser Basin Council. Strategic Review of Fisheries Resources for the South Thompson - Shuswap Habitat Management Area. Version II. 2016.
- Interior Health. Cyanobacteria Blooms (Blue-green Algae). <https://www.healthlinkbc.ca/healthlinkbc-files/cyanobacteria-blooms-blue-green-algae>
- Interior Health. Public Beaches webpage: <https://www.interiorhealth.ca/health-and-wellness/environmental-health-and-hazards/public-beaches>
- NHC (Northwest Hydraulic Consultants). Integrated Water Quality Monitoring Plan for the Shuswap Lakes, BC. November 2010.
- Province of BC and Pespesellkwe te Secwepemc. 2022. Water Quality Objectives for Shuswap Lake. Water Quality Objective Series, WQO-06. Province of BC, Victoria BC. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-objectives/shuswap_lake_water_quality_objectives_oct_17_2022.pdf
- Salmon River Water Quality Assessment Summary. (Province of BC). 2022. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/monitoring-water-quality/thompson-okanagan-wq-docs/salmon_river_water_quality_assessment_summary_sept_2022.pdf
- Shuswap Watershed Council. Understanding Nutrients in the Shuswap River and Salmon River. January 2020. https://www.fraserbasin.bc.ca/Water_Quality_Reports.html#nutrient.
- Shuswap Watershed Project. https://shuswapwatershed.ca/pdf/Watershed_Poster.pdf
- Tri-Star Environmental Consultants. SLIPP Water Quality Report: Sources of Nutrients 2014.