SHUSWAP
watershed council

2018

WATER QUALITY REPORT

Photo Credit: Darren Robinson Photography

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Photo Credit: Darren Robinson Photography

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

Why monitor water quality? There are many reasons why water quality is monitored:

- To observe and record water quality, repeatedly over a period of time, to ensure a healthy ecosystem
- To identify change, trends, existing or emerging water quality problems
- To identify sources of pollution
- To understand the cause of water quality events, such as high turbidity or algal blooms
- To protect public health and manage risk by ensuring water is safe for drinking and recreation
- To ensure compliance with pollution regulations or permit requirements
- To gather information so that pollution prevention or remediation programs can be designed
- To measure how goals or targets for water quality are being met
- To understand how specific activities affect water quality

SHUSWAP watershed council

The Shuswap Watershed Council (SWC) is **a partnership of many organizations** with an interest in or responsibility for **monitoring and enhancing water quality**. The SWC is pleased to present a summary of water quality monitoring results, research, information, and water quality improvement projects on behalf of its partners for 2018.

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

- Shuswap Lake, Mara Lake, Mabel Lake, and Adams Lake
- Shuswap River and Salmon River
- Popular beaches
- Research in the Shuswap River and Salmon River
- Algal blooms and cyanobacteria
- Water quality improvement and stewardship initiatives
- Keeping invasive zebra and quagga mussels out of the Shuswap watershed

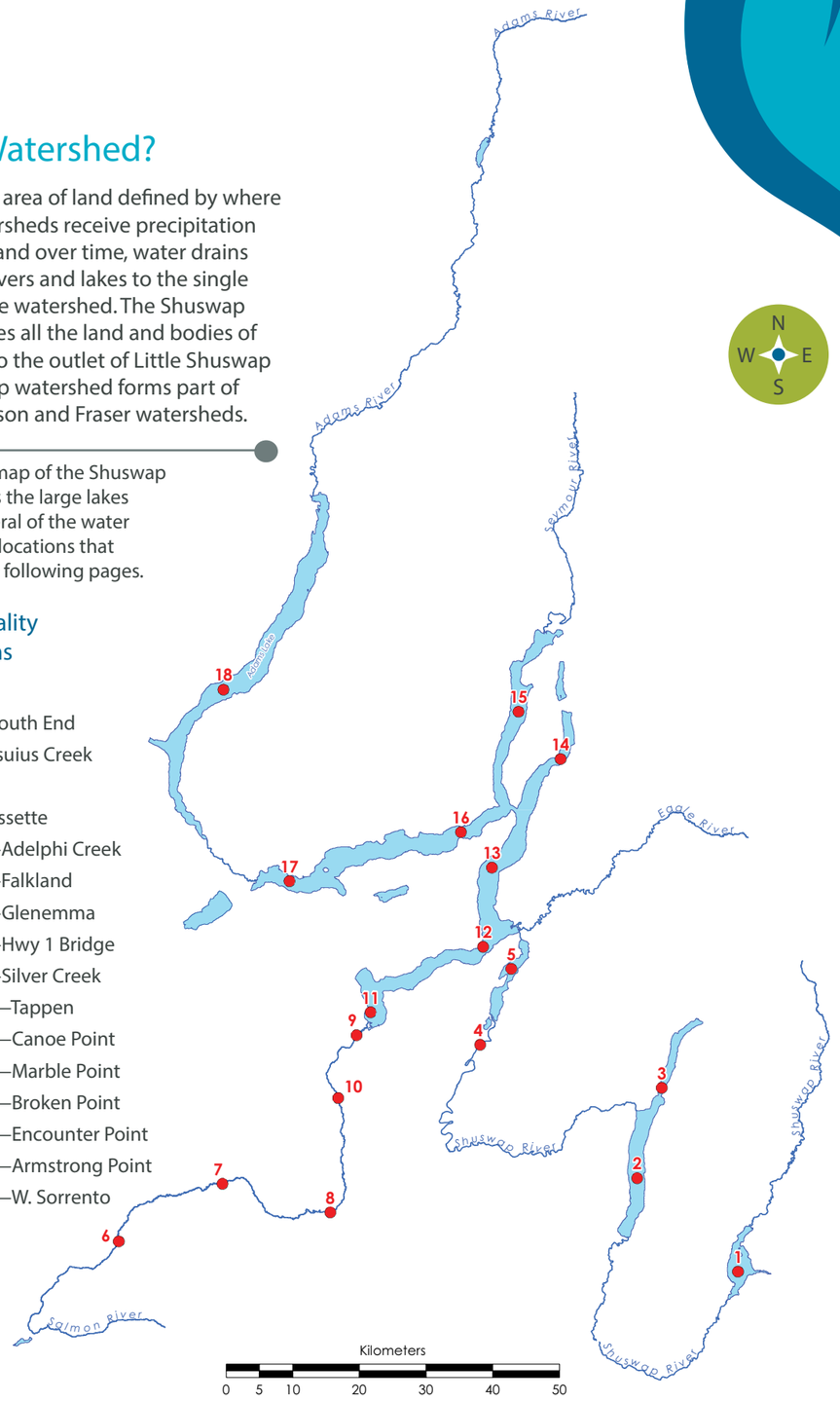
What is a Watershed?

A watershed is an area of land defined by where water flows. Watersheds receive precipitation —rain or snow—and over time, water drains through creeks, rivers and lakes to the single lowest point in the watershed. The Shuswap watershed includes all the land and bodies of water that drain to the outlet of Little Shuswap Lake. 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, and several of the water quality monitoring locations that are reported on the following pages.

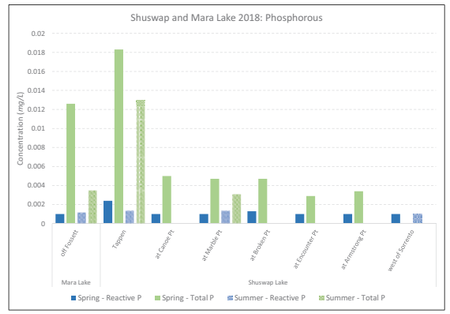
Select Water Quality Sample Locations

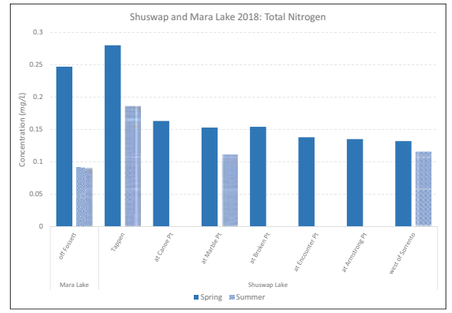
1. Sugar Lake
2. Mabel Lake—South End
3. Mabel Lake—Tsuius Creek
4. Shuswap River
5. Mara Lake—Fossette
6. Salmon River—Adelphi Creek
7. Salmon River—Falkland
8. Salmon River—Glenemma
9. Salmon River—Hwy 1 Bridge
10. Salmon River—Silver Creek
11. Shuswap Lake—Tappen
12. Shuswap Lake—Canoe Point
13. Shuswap Lake—Marble Point
14. Shuswap Lake—Broken Point
15. Shuswap Lake—Encounter Point
16. Shuswap Lake—Armstrong Point
17. Shuswap Lake—W. Sorrento
18. Adams Lake

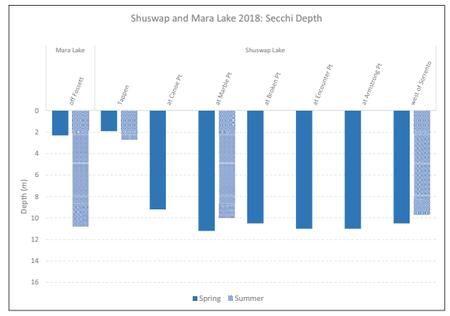


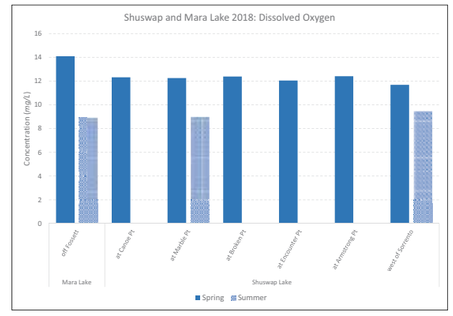
The BC Ministry of Environment and Climate Change Strategy (BC MOE) monitored water quality at the lakes covered in this report twice per year at several locations. Here is a snapshot of water quality monitoring results from 2018.

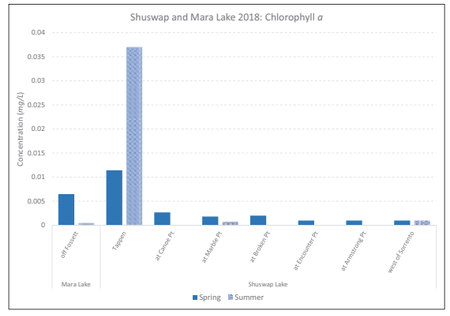
Shuswap and Mara Lakes











Shuswap and Mara Lakes are part of a larger province-wide network of lakes that the BC MOE monitors each year. This type of water quality monitoring is done in open water at deep points in the lakes. It determines the biological productivity and health of a lake system, and the data provide valuable information about current conditions, climate change, and trends across the province.

Phosphorus (P) and **Nitrogen (N)** are important to monitor because they are vital nutrients in an aquatic ecosystem. Aquatic life such as algae, invertebrates and fish need these nutrients to grow and reproduce. Therefore, nutrients are important for supporting a healthy ecosystem. But, excessive nutrients and algae growth can reduce water clarity, create odours, and reduce 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.

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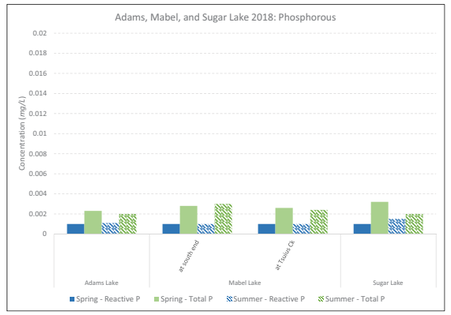
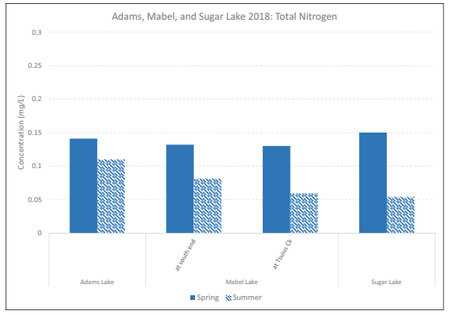
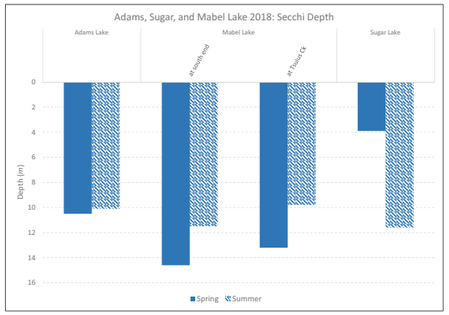
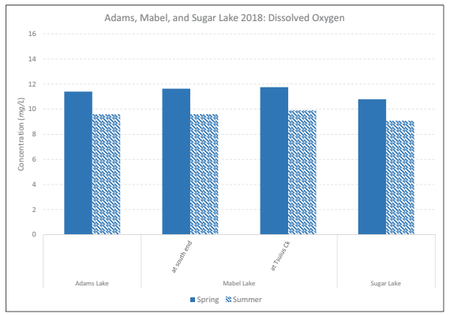
This device is a called a sonde. It has several probes on it for measuring temperature, dissolved oxygen, pH, and turbidity of water.
Photo credit: Erin Vieira

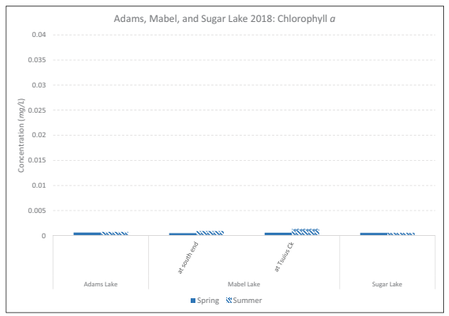
Sugar Lake, Mabel Lake, and Adams Lake











Are you wondering where these sites are located?
See the map on page 4 to find out.

More About Nutrients

In a watershed there can be many sources of nutrients. Some are natural, and some are created by people. Of the latter, these include municipal wastewater effluent, septic drain fields, domestic and commercially used fertilizers, such as those in agriculture, horticulture and forestry, and agricultural wastes and by-products.

Notice the differences in phosphorous and Chlorophyll *a* between the lakes reported on this page, and Shuswap and Mara Lakes reported on the previous page. 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 our watershed.

Did you know?
In the Shuswap, decaying salmon are a natural source of nutrients—especially nitrogen.

Photo Credit: Darren Robinson Photography

Making sense of the data—a biologist's explanation

All about the monitoring cycle

Water quality is sampled in the spring, just after surface ice melts and before the surface water temperatures begin to rise. This is known as "spring turnover". This is the period when lake water circulates: upwelling currents bring water from deep areas of the lake to the surface, and return oxygen-rich waters to the bottom. The upwelling deep water usually contains essential nutrients and dissolved organic materials that dropped down through the water during the previous summer growing season. Water and algae samples collected during this period can be used to predict growing season productivity (i.e., algae, plankton and fish) and the ecological health (known formally as "trophic condition") of the lake.

Summer or fall samples are collected later in the growing season, before the surface temperatures cool and the lakes still display distinct layers of warm surface water separated from cool deep water (this is known as "stratification"). The samples collected at this time indicate how the lakes reacted to the spring nutrient inputs (algal growth is the primary indicator) and oxygen levels, and how much of the surface nutrients and organic material fell through the water and collected in the deep parts of the lakes. Data like these collected over several years provides information on trends in water quality, algal growth, and impacts of local climate changes.

What do the 2018 results tell us?

The 2018 monitoring results on the previous pages show nutrients, water clarity (represented by Secchi depth), dissolved oxygen, and algae (represented by Chlorophyll *a*). The highest total phosphorus (P) levels were noted during spring sampling at Tappen on Shuswap Lake and Fossette on Mara Lake. The summer total P values were also high at Tappen, but not at the Mara Lake site. The highest total nitrogen was also observed during the spring sample period at both sites, with the summer sample at Tappen higher than the values observed at Fossette. Chlorophyll *a* values, representing algal productivity, were much higher at these two sites than other locations on the lakes, with the highest value observed at Tappen during the summer. These results are similar to the results recorded during the 2017 season, indicating no change in the overall results between years. All other Shuswap and Mara Lake sites showed very low nutrient and algae values in 2018, also similar to the results reported in 2017.

In the other lakes—including Adams, Mabel, and Sugar—there was little change since 2017. Water monitoring sites on Mabel and Sugar Lakes show much lower concentrations of nutrients and algae, similar to parts of Shuswap Lake. In general, the data suggest that Adams, Sugar and Mabel are in the 'oligotrophic' range (i.e., low productivity due to low nutrients), similar to the outer arms and main body of Shuswap Lake.

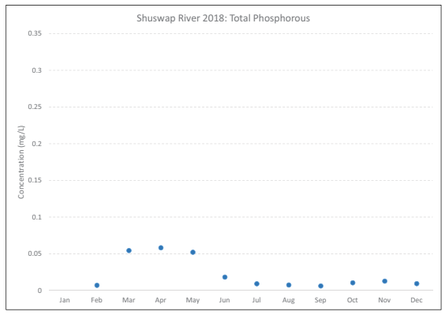
The long-term trends for total P and Chlorophyll *a* during the spring and summer samples generally indicate that concentrations are higher during the warmer growing season than the cool spring conditions. With the exception of the Tappen site, the values for total P during the growing season across the watershed are low ('oligotrophic'). The higher P values at Tappen in Salmon Arm Bay likely reflect contributions from the Salmon River, White Creek, and Tappen Creek, similar to results reported in earlier years (ref: Tri-Star Environmental Consultants, 2014).

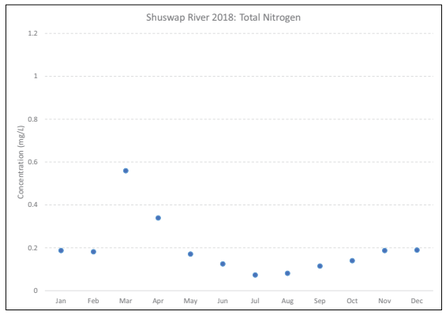
—submitted by Dennis Einarson, R.P.Bio

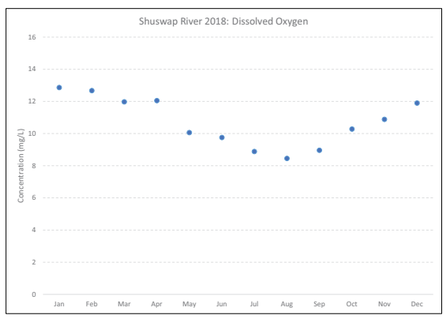
Did you know?
Did you know that lakes' ecological health is assessed and classified according to its productivity? This is known as "trophic condition".

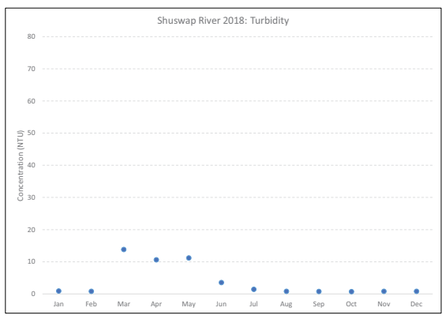
Most of the Shuswap watershed is "oligotrophic", meaning it has relatively low productivity due to low levels of nutrients.

Shuswap River









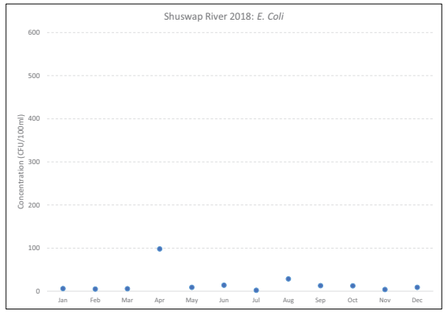
Shuswap Nutrient Research

Nutrients have long been of interest in the Shuswap because of their importance to lake health and productivity, and their ability to trigger an algal bloom. Water quality monitoring in our region has indicated that generally, water quality is good in most locations at most times of year; it has also shown us that the largest loads of nutrients to the lakes are coming from the Shuswap and Salmon Rivers.[1]

For the past three years, the Shuswap Watershed Council has been working with researchers at UBC–Okanagan to better understand nutrients in the rivers flowing into the lakes. To do this, the research team has collected and analyzed water samples from 20 different sites on the two rivers, and from over 80 additional sites at ditches, seasonal streams, and from wells.

This project essentially creates a 'nutrient budget' for the two rivers, illustrating the change in nutrient concentration as the rivers flow from the upper reaches through the valley bottoms. The results will help answer the following questions:

- Are there excess nutrients in the rivers that are not from the natural environment?
- If so, where are they coming from and how are they getting into the rivers?

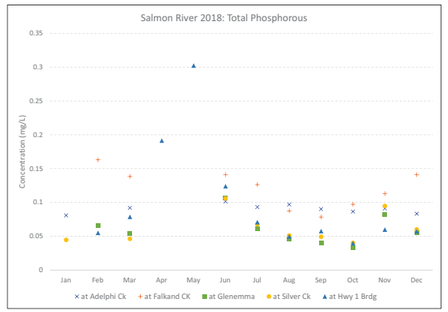


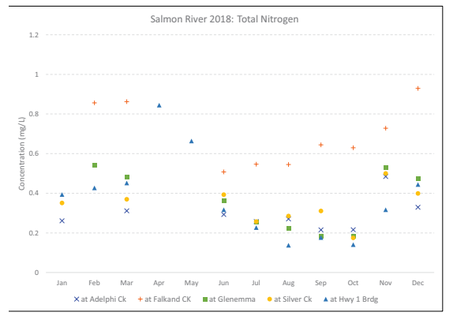
What we've learned so far

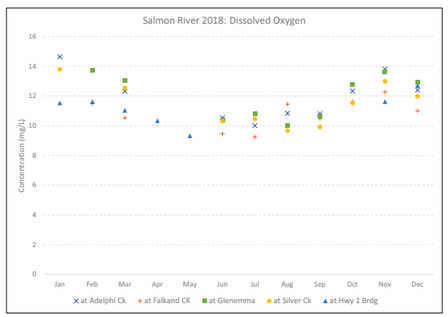
The project is now in its third and final year. Here's what we've learned so far:

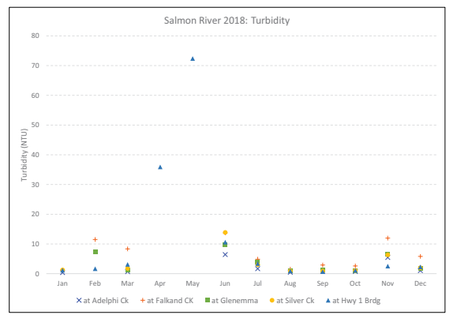
- The upper reaches of the rivers are very low in nutrients relative to the vast amounts of land they drain. As the rivers flow through the valley bottoms, the nutrient concentrations in the rivers increase. This corresponds to anthropogenic activity in the valley bottoms such as homes, farms, and commercial development.
- The naturally very low nutrient concentrations in the upper reaches mean that our watershed is sensitive to nutrient inputs.

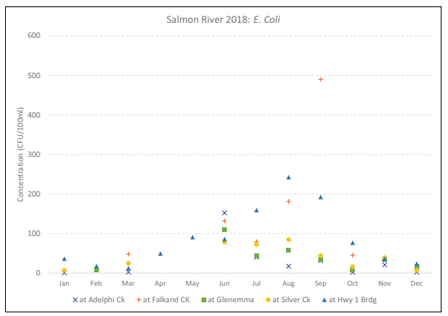
Salmon River











- Seasonal streams, groundwater, and ditches are contributing the highest proportion of nutrients to the rivers. Even though they are small volumes of water, they have the highest concentrations of nutrients relative to the small tracts of land that they drain.[2]
  > The high proportions of nutrients here, especially phosphorus, is partly attributable to 'Legacy Phosphorus'—that is, P that has built up in agricultural soils over decades. The P has built up faster than it has been used by plants or seeped out by ground-water.[3]

What's next?

A full research report will be ready later in 2019. Meanwhile, the SWC is working with UBC-Okanagan on a subsequent phase of research to understand the historic nutrient loads to Mara Lake from the Shuswap River. This follow-up phase of research will allow us to see how human settlement and development in this part of the watershed is correlated to long-term changes in water quality.

The SWC's mandate is to protect and enhance water quality through non-regulatory means. Its next steps will be to seek out community partners to apply new methods to capture or divert phosphorus from soils so they don't end up in our rivers and lakes.

For more information on this or to discuss a partnership opportunity, call the SWC program manager care of Fraser Basin Council.

[1] TriStar, 2014 • [2] Ludwig, M., 2018 • [3] McDougall, R., 2014

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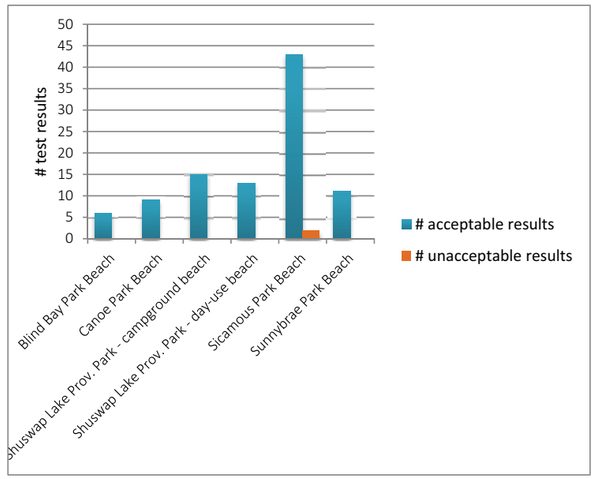
Photo Credit: Darren Robinson Photography

Swimming Beaches

Interior Health Authority is the regulatory agency that oversees water quality monitoring at popular swimming beaches in the Shuswap. Water samples are collected and tested throughout the summer months for *E. coli*, a type of bacteria that is an indicator of water contamination. Here are the results from their beach sampling program in 2018.



What is an acceptable or unacceptable result?

There are federal guidelines for water quality for swimming and recreation (these are different from guidelines for aquatic life, or drinking water). They 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.

Some beaches are tested more frequently than others. **Out of 99 water quality samples collected from these six popular beaches in 2018, all but two met the federal water quality guideline for swimming and recreation.**

About algal blooms

Algae are a natural and important part of an aquatic ecosystem. An algal bloom occurs when the number of algae rapidly increases, usually due to a change in environmental conditions such as an influx of nutrients or increased sunlight. There are many different species of algae, with different impacts. An algal bloom can discolour the water and create an unsightly scum; in a worst-case scenario, an algal bloom can produce toxins harmful to people, pets, livestock, and wildlife.

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 water levels rise and fresh supply of nutrients enters the lakes. That time of year there can also be organic debris in the lakes, which can make identifying algae a challenge.

What about blue-green algae?

Blue-green algae, also known as cyanobacteria, are **naturally-occurring but can form toxic blooms** in water bodies that are nutrient-enriched. Sometimes blue-green toxins can be present even if there isn't a visible bloom. People can be exposed to blue-green toxins by drinking or recreating in water with blue-green algae. Pets and livestock can also become sick by drinking water with blue-green algae.

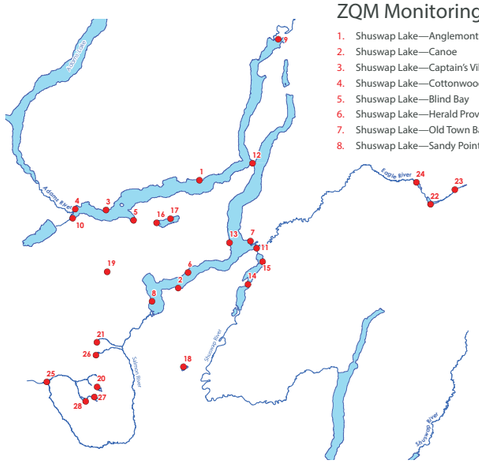
In BC, there is a provincial protocol for monitoring and analyzing water quality for blue-green algae, for both drinking and recreational purposes. In the event of a blue-green algae bloom, the local health authority may recommend or require a public notification. It is the responsibility of the drinking water provider or beach owner/operator to post public notifications.

In the Shuswap, blue-green algae blooms are rare but they can happen. You can reduce your risk of becoming exposed to blue-green toxins by never drinking untreated water from lakes or ponds, and never swim or recreate in water with a visible bloom.

If you think you've spotted an algal bloom, call the Provincial RAPP line at **1-877-952-RAPP** (7277).

Are you curious about the how water quality is monitored in the Shuswap watershed? We wrote a blog about that! Look for it on our website.

shuswapwater.ca



ZQM Monitoring Sites

1. Shuswap Lake—Anglemont Marina
2. Shuswap Lake—Canoe
3. Shuswap Lake—Captain's Village
4. Shuswap Lake—Cottonwood RV
5. Shuswap Lake—Blind Bay
6. Shuswap Lake—Herald Provincial Park
7. Shuswap Lake—Old Town Bay
8. Shuswap Lake—Sandy Point
9. Shuswap Lake—Seymour Arm
10. Shuswap Lake—Sorrento
11. Shuswap Lake—Sicamous Narrows
12. Shuswap Lake—The Narrows
13. Shuswap Lake—Totem Pole Marina
14. Mara Lake—Swansea Point
15. Mara Lake—Waterway Houseboats
16. White Lake—Sunny Shores
17. White Lake—Provincial Park
18. Gardom Lake
19. Skimikin Lake
20. Spa Lake
21. Wallenstein Lake
22. Three Valley Gap Lake
23. Victor Lake
24. Griffin Lake
25. Joyce Lake
26. Kernaghan Lake
27. Arthur Lake
28. Bolean Lake

CSISS collected samples from 28 sites throughout the Shuswap in 2018. Invasive mussels weren't detected at any of these locations!

This unidentifiable object has been in mussel-infested water and is now encrusted in a thick layer of invasive mussels. Adult zebra and quagga mussels are about the size of your thumbnail (much smaller than our native freshwater mussels). As larvae, zebra and quagga mussels are microscopic and free-swimming, and are undetectable to the human eye. Photo credit: Columbia Shuswap Invasive Species Society

Keeping invasive Zebra and Quagga Mussels out of the Shuswap

Zebra and quagga mussels (ZQM) are two species of freshwater mussels native to Europe and Asia with tremendous destructive potential due to their ability to attach to any object in the water: boats, water supply pipes, irrigation systems, dock pilings, hydro-electric facilities, and more. They also litter beaches with their small razor-sharp shells, pollute water quality, impact aquatic food webs, and they produce foul odours.

Fortunately, **zebra and quagga mussels don't exist in the Shuswap**—or anywhere in BC—but they do occur in Ontario, Manitoba, and as far west as California. Since they arrived in North America in the 1980s, contained in ship ballast water, they have spread to new water bodies by 'hitch hiking' on boats and other watercraft.

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

I CLEAN DRAIN DRY
cleandraindry.ca
to prevent the spread of aquatic invasive species

Did you know?

Shuswap Lake and many other lakes in our regions are especially at risk of a mussel infestation because our water quality— temperature, pH, and calcium concentrations—are well suited to mussel survival. Additionally, the high influx of watercraft in the summer from nearby provinces and states also puts our lakes at greater risk of an invasion.

We all need to do our part to keep BC free of invasive mussels. If mussels were to establish here, it would cost property owners and tax-payers over $43 million per year to deal with the impacts! Watercraft owners need to be very vigilant. **Anyone bringing a watercraft of any kind into BC is required to stop a watercraft inspection station** along their travel route, where watercraft will be inspected and decontaminated, free of charge. Additionally, watercraft owners ought to Clean-Drain-Dry their watercraft every time they move from one water body to another.

Livestock exclusion fencing was installed and riparian vegetation was planted at Alderson Creek in 2016

Improving water quality in the Shuswap

The Shuswap Watershed Council has been pleased to support water quality improvement projects in our watershed. Since the SWC began its programs in 2016, it has provided two grants of $10,000 each toward to different water quality projects.

In 2016, the SWC provided a grant to **Yucwmenlucwu**, a resource management company owned and managed by Splatsin First Nation, to install livestock exclusion fencing and riparian vegetation at Alderson Creek which is a tributary to Fortune Creek and ultimately to the Shuswap River. These restoration techniques reduce erosion, siltation, and fecal pollution by livestock, and help stabilize stream banks and provide more shade and cover.

In 2017, the SWC provided **Gardom Lake Stewardship Society** with a grant for a wetland restoration project. This work was conducted through 2017 and 2018, and the Society has additional plans to continue enhancing the new wetland.

Wetlands are exceptional at improving water quality because they capture nutrients and sediment. Size for size, small wetlands such as this are the most effective.

Looking forward

In the years ahead, the Shuswap Watershed Council would like to work with community partners and provide financial support for water quality projects that focus on reducing nutrient inputs to rivers and lakes.

SHUSWAP watershed council

Help keep the Shuswap clean

Here's what you can do as a resident of the Shuswap to help maintain our water quality:

- Make sure you know where your wastewater goes. Is your household on a septic system, or connected to sewer? If it's septic, you're responsible for keeping it in good repair. The Septic Smart Homeowner's Guide is a good place to start: **csrd.bc.ca/septicsmart/homeowners-guide**
- If you're a farmer or have an agricultural operation of any kind, get familiarized with the new provincial *Code of Practice for Agricultural Environmental Management*. This new regulation was enacted by the Ministry of Environment and Climate Change in February 2019, and it aims to ensure agricultural practices are consistent with the protection of clean, safe drinking water and clean air. Learn more at **https://bit.ly/2ToGpu2**
- Properly dispose of unused medications. Don't throw them out or flush them—return them to a pharmacy
- Don't ever flush personal care products such as wipes, floss, swabs and hygiene products—not even if it says "flushable" on the package!
- Don't put fats, oils or grease down the drain. Cool it, scrape it, and dispose of it in your garbage. Large quantities of liquid fats and oils should be dropped off a hazardous waste facility (e.g., Salmon Arm landfill).

Acknowledgements

Thanks go to members of the SWC's Water Quality Monitoring Group for their contributions to this summary. In particular, the SWC wishes to acknowledge the BC Ministry of Environment and Climate Change Strategy, Interior Health Authority, Gardom Lake Stewardship Society, the City of Salmon Arm, and the Columbia Shuswap Invasive Species Society.

Works Cited

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What do you think?

Would you like share your feedback on this water quality report with us? Please contact the SWC, care of the Fraser Basin Council in Kamloops:

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Photo Credit: Darren Robinson Photography

SHUSWAP watershed council

Who We Are

About the Shuswap Watershed Council

The SWC was established in 2014 as a watershed-based partnership to enhance water quality and safe recreation in the Shuswap. There are 18 members that represent three regional districts, two municipalities, the Secwepemc Nation, two provincial government agencies and Shuswap communities. The SWC is a collaborative, non-regulatory group. It works alongside organizations that have regulatory roles in managing the Shuswap watershed, complimenting their work and carefully avoiding duplication.

Staff

The Fraser Basin Council, a provincial non-government 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.

What We Do

Our Objectives

The SWC's objectives are to maintain and enhance water quality in the Shuswap watershed through collaboration with water quality monitors; to coordinate and report on water quality in the Shuswap; to inform residents and visitors about water quality in the Shuswap, and advocate for good practices to prevent water quality degradation; and to encourage safe behaviour by recreationists on and near water.

The Work

The SWC's work on water quality and safe water-based recreation is guided by its five-year plan.