Severn Sound
Environmental Association

Citizen Science in Severn Sound: 2020 Data Report

Citizen Science in Severn Sound

2020

Acknowledgements

The SSEA is grateful for the support we received from the TD Friends of Environment Foundation and the Lake Huron Georgian Bay Community Action Initiative in developing these programs, which will help promote environmental awareness and stewardship in the Severn Sound watershed.

We also want to acknowledge and thank YOU, the citizen scientists who volunteer your time and energy in collecting information about the places that are important to you. Your efforts help to collect and analyze data that will assist in making conservation related decisions across the watershed. Without your contributions, this program would not be possible.

TD Friends of the Environment Foundation

Lake Huron - Georgian Bay Watershed
A Canadian Framework for Community Action

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Introduction

Lakes and rivers have value to us all, whether we own waterfront property, visit waterfront parks and beaches, spend time fishing or boating, use it for drinking water, or appreciate aquatic ecosystems as a passer-by. The more we know about our local lakes and tributaries, the better we can protect them. Citizen science programs allow the Severn Sound Environmental Association (SSEA) to increase our capacity to observe environmental conditions across the Severn Sound watershed while increasing community engagement and knowledge of local environmental issues. Citizen scientists can collect valuable water quality data in areas that staff would otherwise either be unable to visit or to collect data from with enough frequency to be meaningful.

When collected consistently and frequently, observations from lakes and tributaries allow us to track indicators of climate change, such as changes in thermal stability of streams, habitat quality, invasive species spread, or algal bloom events. This data can be used in multiple ways to monitor environmental conditions in Severn Sound, including:

- Tracking relationships between blue-green algae blooms and environmental factors such as wind direction and temperature
- Collecting sightings of invasive species and species at risk for proactive management
- Identifying areas in need of beach clean-ups or habitat restoration
- Tracking indicators of climate change, such as water temperature and wind speed
- Determining thermal classification of streams, which provides rationale for protection of cool and cold water fish habitats


Observation site on Copeland Creek

Noticing these events or changes early allows more preventative measures to be taken to protect vulnerable areas and improve areas of concern.

The COVID-19 pandemic made 2020 a significantly challenging year. The closure of water quality laboratories and inability of SSEA field staff to be out together in the field for much of the season led to reduced watershed monitoring. This made our citizen scientists critical to our ongoing monitoring of environmental conditions in Severn Sound.

Two citizen science programs were initiated in 2020, Shore Watch and Stream Watch. Collectively, these programs had 23 volunteers gathering observations from 21 sites

across the Severn Sound watershed. Water quality data collected by volunteers provided valuable information about algae growth, water temperature, weather conditions, human impacts and restoration needs. Volunteers also recorded sightings of invasive species (IS) and species at risk (SAR) to assist the SSEA in identifying areas of concern, and proactively identify outbreaks and promote species conservation.

Shore Watch and Stream Watch complement SSEA's existing Ice Spotters program, which tracks dates of ice on and ice for Severn Sound and local lakes, and Water Level Watchers, which tracks water levels on Farlain Lake. These programs also complement SSEA's lake and tributary environmental quality and climate monitoring programs.

Monitoring Methods

Prior to monitoring, volunteers were provided with field kits containing scientific equipment to ensure consistency when measuring variables, which are described below. Volunteers chose a consistent monitoring site on their chosen water body, and it was left to volunteers to decide on monitoring frequency. Details on methods can be found in the Shore Watch and Stream Watch Field Manual, which was provided to volunteers.

Weather Conditions

Air Temperature:
Air temperature is an important climate change indicator, and influences many physical and biological environmental processes, such as timing of lake ice out and plant growth. Air temperature was recorded in the shade using a pool thermometer or Hanna meter.

Wind Direction and Speed (Shore Watch program only):
High winds can have an impact on water quality by stirring up sediment, causing temporary changes in water levels, and preventing harmful algae blooms from rising to the surface. Wind direction can also affect wave and water quality conditions depending on whether it is onshore or offshore. Volunteers determined wind direction using a weathervane and a compass. Using the Beaufort wind force scale, which relates wind speed to observed conditions on the water or on land, volunteers gauged the wind strength at the time of each of their monitoring sessions. Each Beaufort number corresponds to a range of wind speeds, and the average of this range was used as a wind speed estimate.


Rain gauge mounted on a pole

Rainfall:
Rainfall can have an impact on water quality and temperature depending on the potential for local overland runoff on each monitoring site. Volunteers installed rain

gauges away from any objects that could prevent rainwater from entering the gauge (e.g. buildings, trees), and were instructed to check the rain gauge daily to ensure it was free of debris and record any accumulations of rainfall.

Water Conditions

Water Temperature:
Water temperature is closely linked to air temperature, and plays a large role in controlling algae growth as well as determining the timing of biological processes such as fish reproduction. This was recorded using either a pool thermometer or Hanna meter at the water surface. Some volunteers also installed Onset Tidbit temperature loggers, provided by SSEA, at their site. Loggers were placed approximately 1 metre below the water surface and recorded water temperatures every 30 minutes. This provided detailed information on temperature fluctuations, which can be influenced by air temperature as well as water currents and wind events.

Conductivity and pH:
Conductivity measures the capacity of water to pass electrical currents, which is related to the amount of dissolved material in the water. It can be used to indicate the influence of storm events, or changes in water sources like groundwater versus surface water inputs. pH indicates whether the water is considered “acidic” (low pH), or “basic” or “alkaline” (high pH), based on a scale of 1-14. A value of 7 is neutral. Waters on the Canadian Shield have a lower pH compared to waters off the Shield. Using a Hanna meter, conductivity and pH levels were measured at the water surface.

Wave Direction (Shore Watch program only):
Wave direction is important for putting water quality observations into context since large onshore waves can stir up sediment, while calm conditions can favour algae growth. Volunteers utilized a compass to determine wave direction.

Secchi Depth (Shore Watch program only):
Secchi depth provides an estimate of turbidity, or cloudiness, which can be caused by suspended particles, algae or tea coloured tannins in the water, and provides an indicator of water quality. A higher Secchi depth number indicates clearer water, and often better water quality. A Secchi disk with a rope attached was used to determine Secchi depth, which is a measure of water clarity. On the shaded side of a dock or boat, a Secchi disk was lowered into the water until the volunteer could no longer see it, and clothespins were used to mark the rope at the water surface. After raising the disk out of the water, volunteers measured the distance from the disk to the clothespins to determine the Secchi depth in metres.


Measuring Secchi depth

Site Depth:
Using the same method as for Secchi depth, site depth was measured by lowering the disk down to the lakebed and measuring the length of rope used.

Stream Watch participants measured stream depth in the centre of the stream using a metre stick.

General Observations

Plants and Animals, Invasive Species (IS), and Species at Risk (SAR):
Volunteers were encouraged to record any observations of wildlife that they saw while monitoring. Observations include sightings of IS and SAR.

Algae, Water Colour:
Volunteers submitted observations and photos of algae and algal blooms, along with water colour.

Water Level Impact and Human Disturbances:
Volunteers were encouraged to record any sightings of shoreline or streambank damage (e.g. erosion, storm damage) and signs of human disturbance (e.g. litter, signs of vehicle presence, shoreline alterations).

Restoration Work:
If volunteers believed restoration work was warranted (e.g. invasive species removal, beach cleanup, shoreline stabilization), this was documented.

Results

In this first part of this section, results are shown by lake or tributary. In some cases, there were multiple observers on one water body (Figure 1), and in this case, data were aggregated. For each water body, a summary showing the number of sites and observations is given, along with the range of site depths and a summary of measurements taken with the Hanna meter, or pool thermometer, and/or Secchi disk. The minimum, average and maximum values are shown for each variable measured.

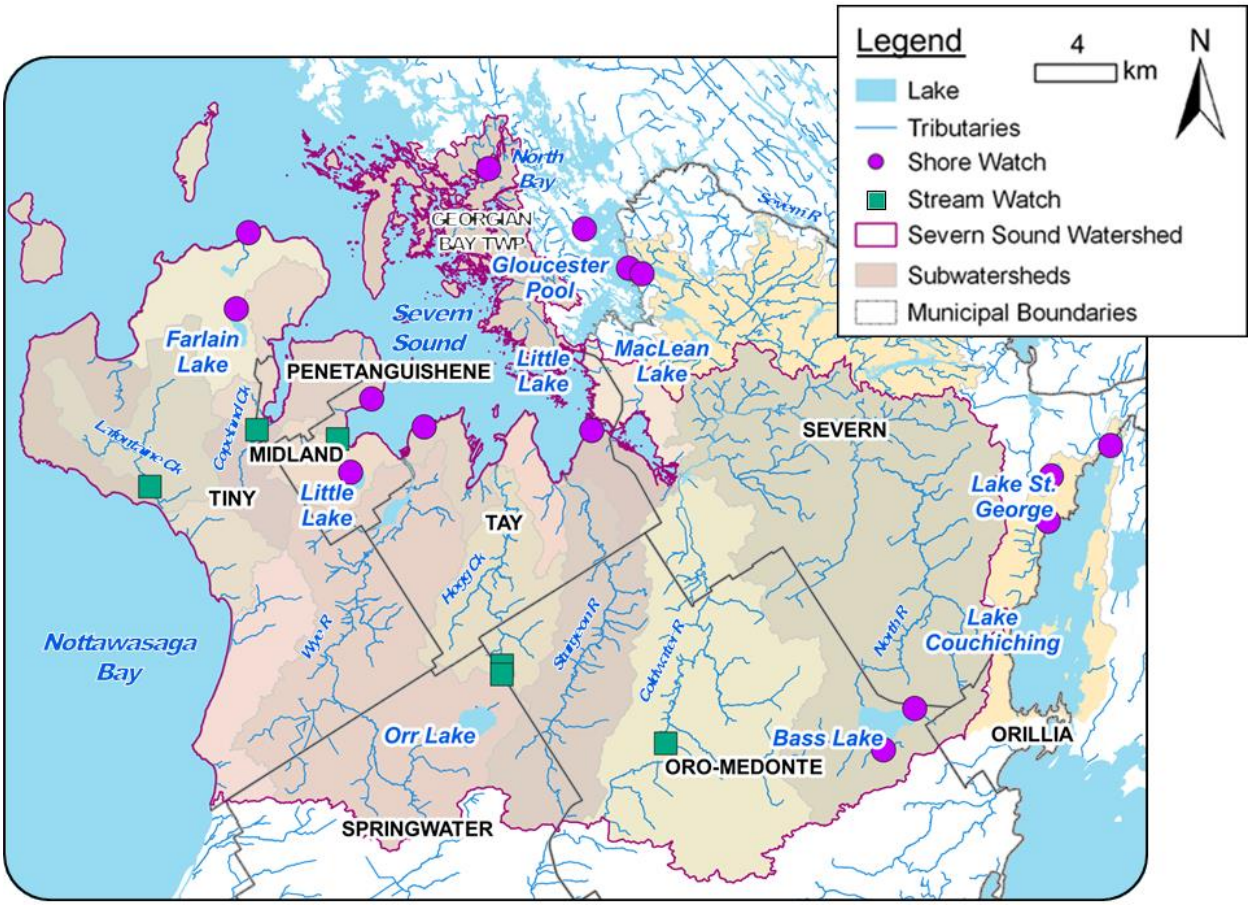


Figure 1. Overview map showing all monitoring sites, along with the Severn Sound watershed and major tributary subwatershed boundaries.

Site Maps: The approximate monitoring location is shown. In order to protect the privacy of volunteers who were monitoring on their own private property, monitoring areas are shown as larger circles so that a specific location is not discernable. Monitoring sites that are on public land are shown as small filled circles.

Plants and Animals: Sightings of common flora and fauna, as well as SAR and IS are documented in this section. Note that SAR and IS are listed as observed by volunteers; sightings have not been confirmed by SSEA staff.

Other Observations: This section includes observations on algae, water colour or debris, water level impacts from lake levels or tributary flood conditions, human impact, and whether restoration was needed at the site.

Water Temperature (logger): For sites that had a temperature logger installed, a graph is shown that displays water temperature as a 3 hour moving average. Loggers record data every half hour, so using a moving average is useful for smoothing the data. A table is also provided showing water temperature statistics, including minimum, average and maximum over the entire monitoring period, minimum, average and maximum daily range, and monthly average.

Thermal Stability: Specific to tributaries, this refers to the ability of a tributary to maintain cool water temperatures while air temperature rises. For example, a stream that gets very warm during the hottest days of the summer would have low thermal stability, and would be classified as a warm-water tributary that would likely support warm water fish communities. Conversely, a stream that remains cold even as air temperature rises would have high thermal stability and would be classified as a cold-water tributary that would likely support cold water fish communities. Cool-water tributaries are somewhere in the middle. Thermal stability increases with more groundwater inputs to a tributary, and also with increasing amounts of vegetation cover on the streambank, known as the riparian zone. Stewardship efforts that maintain the thermal stability of cool and coldwater streams, or increase the stability of warm water streams, will help to protect cool and coldwater fish communities, which are important for ecosystem health.

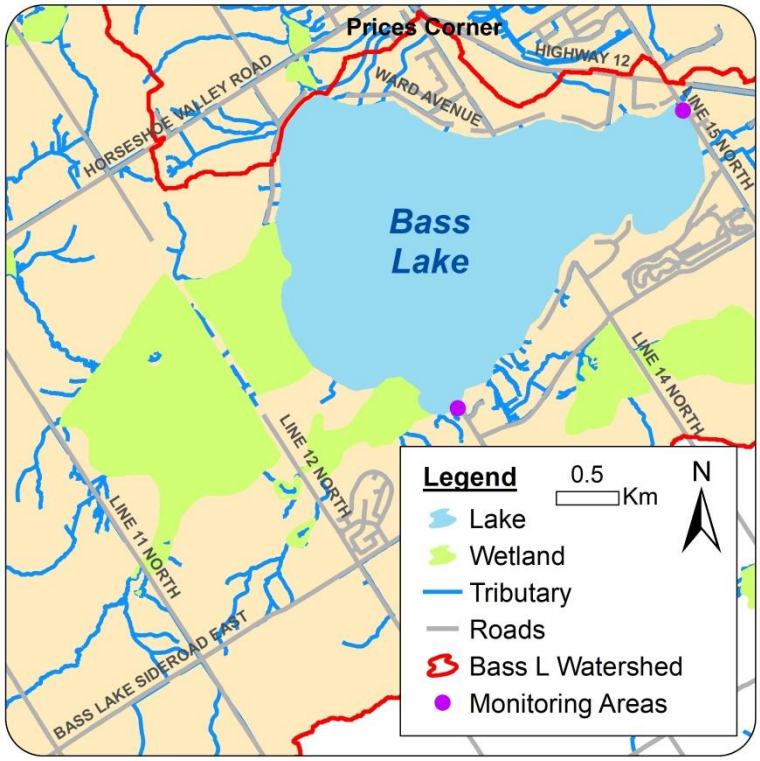
Thermal stability is calculated by comparing water and air temperature at 4:00 pm, based on the method described in Stoneman and Jones (1996). Note that temperature data must be recorded from the beginning of July to the end of August in order for the classification to be valid.

In the second part of the Results section, results are compared to other data sources for verification purposes.

INLAND LAKES

BASS LAKE

Bass Lake is located just west of Orillia in Oro-Medonte, and forms the headwaters of the North River, which flows into Severn Sound at Matchedash Bay.



Number of Sites: 2

Number of Observations: 4

Summary: Aug 13 - Sept 1

	Water Temp (°C)	Cond (µS/cm)	pH
Min	20.8	284	7.10
Avg	23.4	287	7.98
Max	26.0	293	8.55

	Air Temp (°C)
Min	21.3
Avg	24.5
Max	27.5

Plants and Animals:

- Shiners, Seagull, Snails
- SAR – nothing reported
- IS – mystery snails

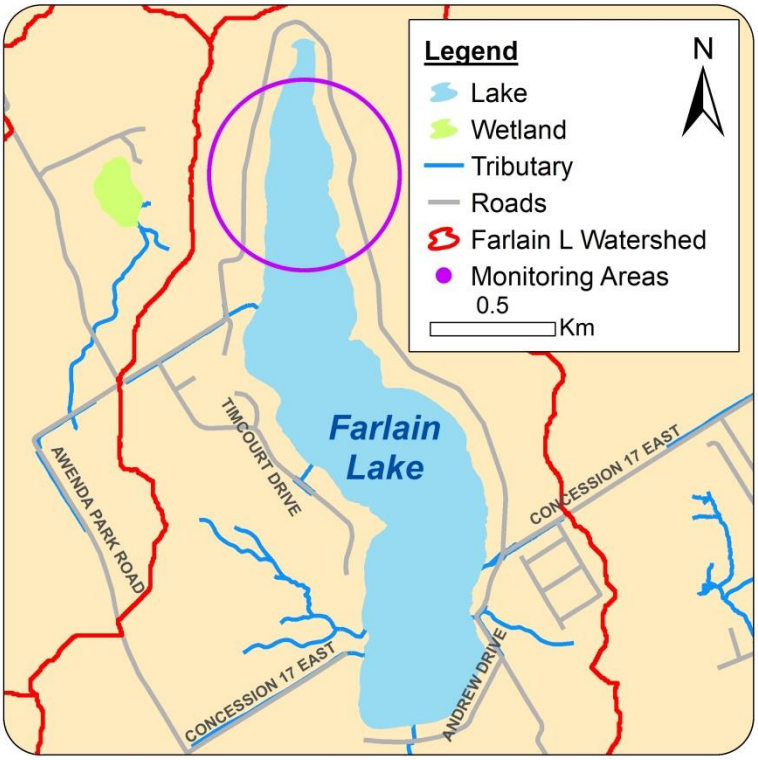
Other Observations:

- Water Colour/Debris – foam on the shore
- Human Impact – suspended grass clippings & plant material, some litter


Mystery snails

FARLAIN LAKE

Farlain Lake is a kettle lake with no surface outflow located south of Awenda Provincial Park in Tiny Township.



Number of Sites: 1

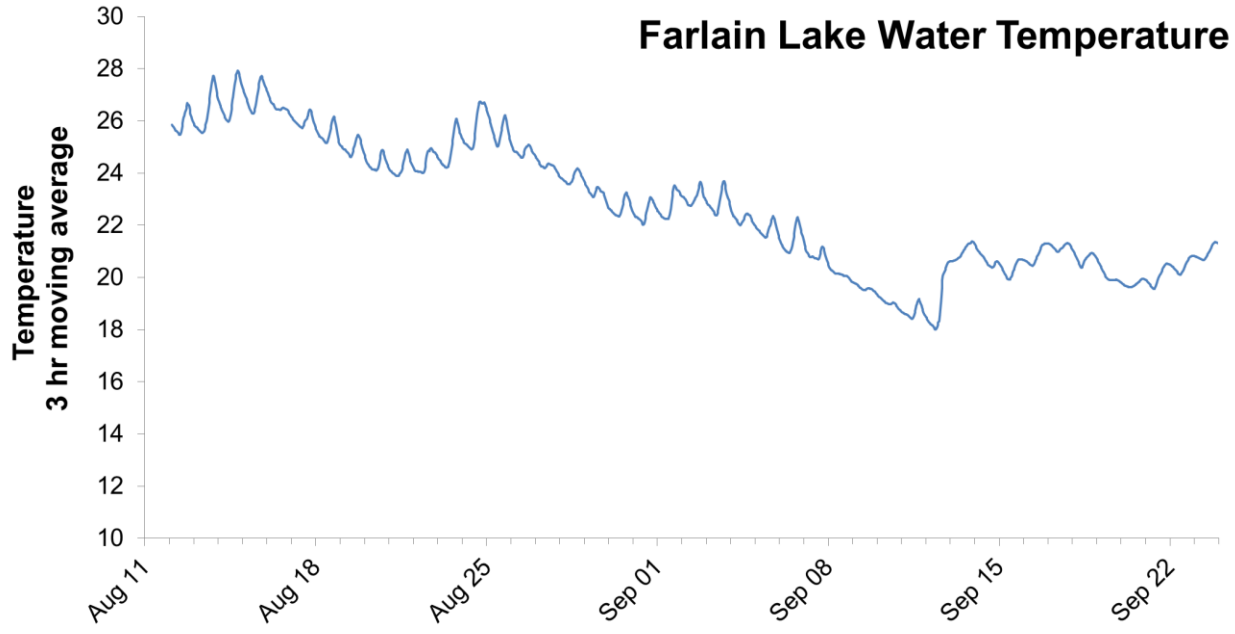
Number of Observations: 1

Site Depth: 2.1 m

Summary: Aug 11

Water Temp (°C)	Cond (µS/cm)	pH	Secchi Depth (m)
26.7	95	8.22	1.95

Water Temperature (logger):



Temperature Logger Stats:
August 12 - September 24, 2020

Overall Minimum	18.0
Overall Average	22.7
Overall Maximum	28.1
Minimum Daily Range	0.4
Average Daily Range	1.2
Maximum Daily Range	2.7
Aug 12-31 Avg	25.0
Sept 1-24 Avg	20.8

Plants and Animals:

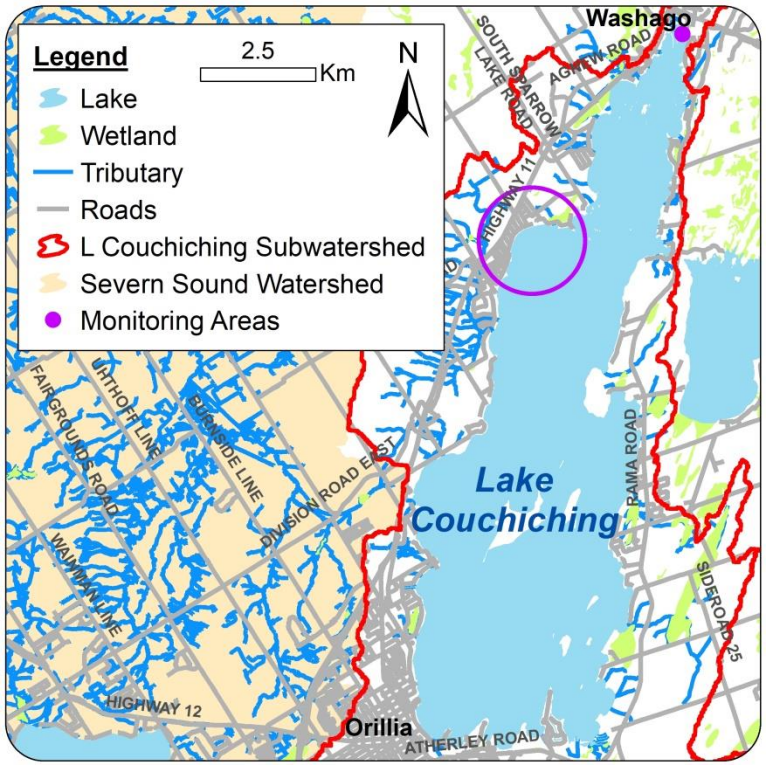
- Otters, Common Terns
- SAR – nothing reported
- IS – nothing reported

Other Observations:

- Water Colour/Debris – blueish green

LAKE COUCHICHING

Lake Couchiching is a large inland lake that is connected to Lake Simcoe at the Atherly Narrows and is part of the Trent Severn Waterway. The Severn River flows out of the north end of the lake, and discharges into Severn Sound.



Number of Sites: 2

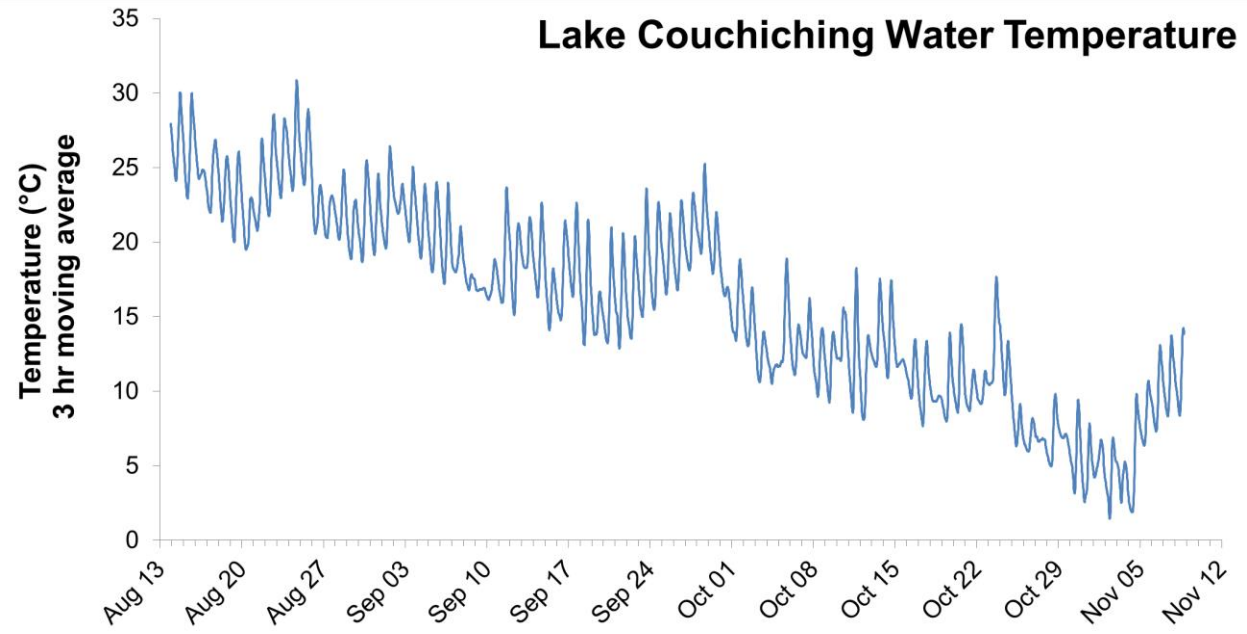
Number of Observations: 2

Summary: Aug 13 - Sept 1

	Water Temp (°C)	Cond (µS/cm)	pH
Min	20.6	296	8.50
Avg	21.9	343	8.55
Max	23.2	390	8.60

	Air Temp (°C)
Min	20.9
Avg	21.0
Max	21.0

Water Temperature (logger):



Temperature Logger Stats:
August 13 - November 11, 2020

Overall Minimum	1.2
Overall Average	15.9
Overall Maximum	31.3
Minimum Daily Range	1.1
Average Daily Range	5.8
Maximum Daily Range	11.3
Aug Avg	23.8
Sept Avg	18.8
Oct Avg	10.9
Nov 1-11 Avg	8.6

Plants and Animals:

- nothing reported
- SAR – nothing reported
- IS – nothing reported

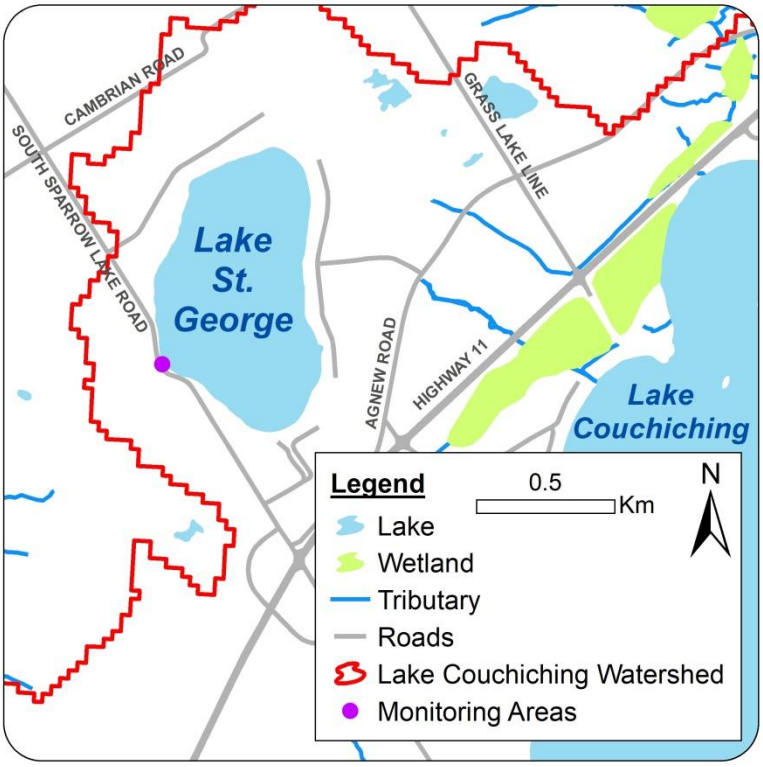
Other Observations:

- Algae – algae on rocks
- Water Colour/Debris – foam and plant debris
- Human Impact – some litter on shore

Lake Couchiching, western monitoring site

LAKE ST. GEORGE

Lake St. George is a small inland lake west of Lake Couchiching in Severn Township. It has no mapped outflow, but lies within the Lake Couchiching watershed.



Number of Sites: 1

Number of Observations: 2

Summary: Aug 17 - Sept 1

	Water Temp (°C)	Cond (µS/cm)	pH
Min	22.2	244	8.70
Avg	23.9	248	8.73
Max	25.6	252	8.75

	Air Temp (°C)
Min	21.6
Avg	23.8
Max	26.0

*The Lake Couchiching watershed was derived using the Ontario Flow Assessment Tool (MNRF, 2015) and is shown as a proxy for the Lake St. George watershed. Lake St. George has no mapped outlet, preventing delineation of its watershed using the tool.

Plants and Animals:

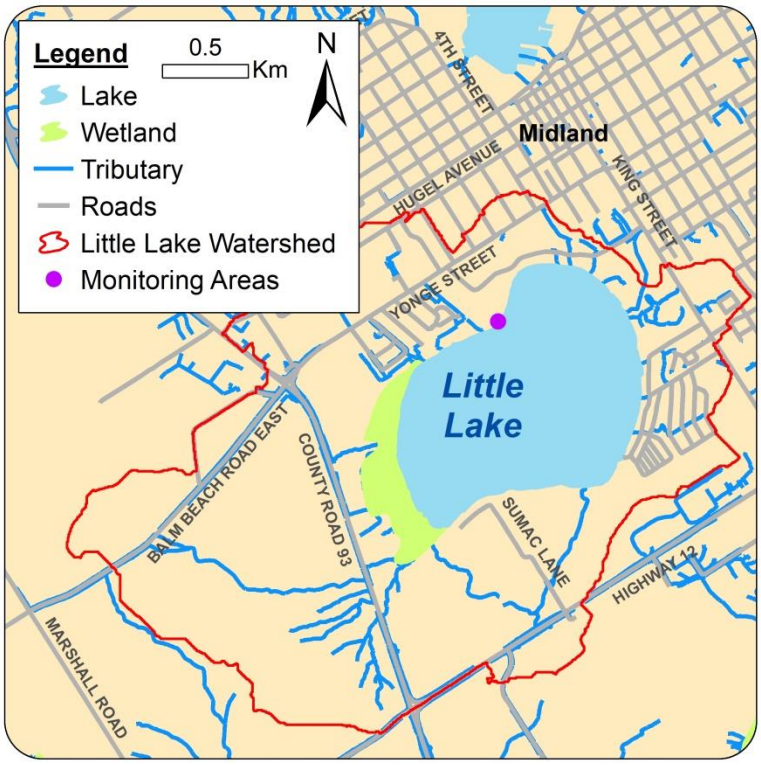
- Seagulls
- SAR – nothing reported
- IS – nothing reported

Other Observations:

- Water Colour/Debris – brown tinge, small amount of foam

LITTLE LAKE

Little Lake is a small inland lake in Midland, with an outflow that discharges into Midland Bay.



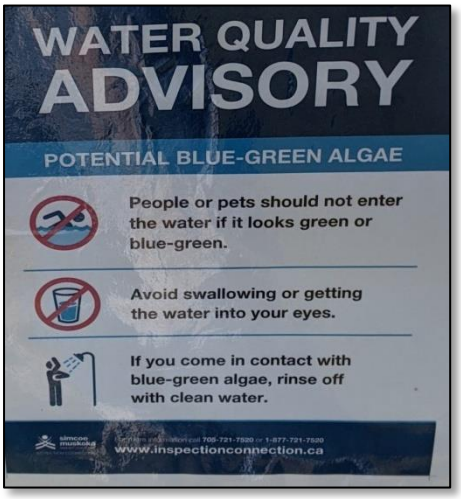
Number of Sites: 1

Number of Observations: 1

Site Depth: 0.14 m

Summary: Sept 20

Water Temp (°C)	Cond (µS/cm)	pH	Air Temp (°C)
15.8	252	8.56	16.0



Plants and Animals:

- Bumblebee
- SAR – nothing reported
- IS – nothing reported

Other Observations:

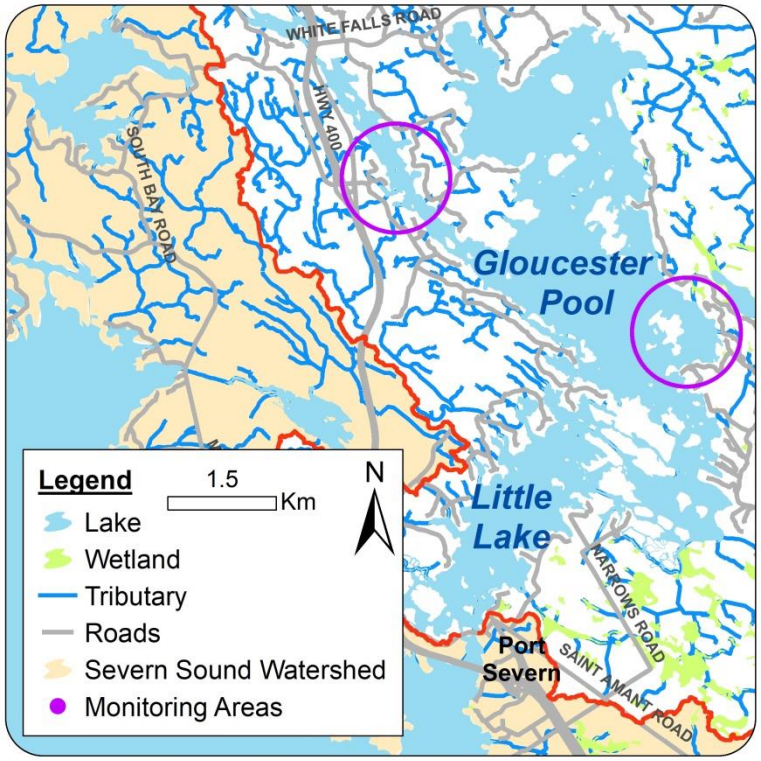
- Water Colour/Debris – clear brown
- Algae – investigation needed into causes of blue-green algae bloom this summer (posted by Simcoe Muskoka District Health Unit)


Shoreline at monitoring site


Bumblebee

GLOUCESTER POOL

Gloucester Pool is an embayment of the Severn River in Severn and Georgian Bay Townships which functions as an inland lake. It is part of the Trent Severn Waterway and discharges into Severn Sound via Little Lake and the Severn River. Monitoring was done in the Burrows Bay and Little Go Home Bay areas.



Number of Sites: 3

Number of Observations: 26

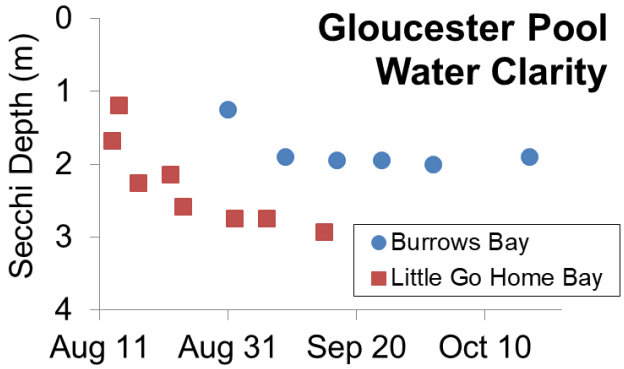
Site Depth: 1.2-3.0 m

Summary: Aug 13 - Oct 17

	Water Temp (°C)	Secchi Depth (m)	Air Temp (°C)
Min	12.0	1.20	8.0
Avg	22.3	2.12	20.7
Max	29.0	2.93	31.0

Plants and Animals:

- Mink, Turtles, River Otters, Water Snake, Bass, Mallard Ducks, Double Crested Cormorant, Caspian Tern, Common Loon, Ringed Billed Gulls
- SAR – Northern Map Turtle
- IS – Zebra or Quagga Mussels, Round Gobies, Eurasian Water-milfoil



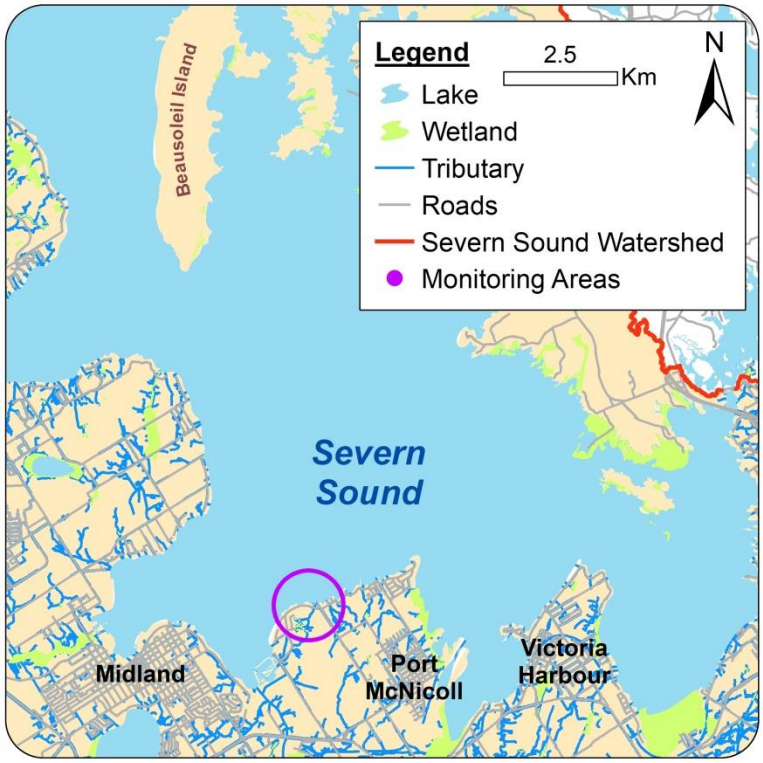
Other Observations:

- Algae – filamentous green algae on rocks at multiple observation sites
- Water Colour/Debris – water green to brownish, yellow brown
- Human Impact – leaves/branches in the water in fall, massive wake from the increasing number of wake boats causing shoreline erosion

SEVERN SOUND AND GEORGIAN BAY

OPEN SEVERN SOUND

Severn Sound is a collection of bays in the Southeastern portion of Georgian Bay. It receives inflows from seven major tributaries. Monitoring was done along the Tay Township shoreline just east of Midland Bay.



Number of Sites: 1

Number of Observations: 3

Summary: Jun 15 - Nov 12

	Water Temp (°C)	Air Temp (°C)
Min	7.0	5.0
Avg	13.3	13.3
Max	24.0	27.0

Plants and Animals:

- nothing reported
- SAR – nothing reported
- IS – Eurasian Water-milfoil, Dog-Strangling Vine, Parrot Feather [*note: Parrot Feather has not been detected/reported in Ontario since 2006 and is not typically found in open water areas; this sighting may have been the native Coontail, or the native or invasive species of milfoil*]

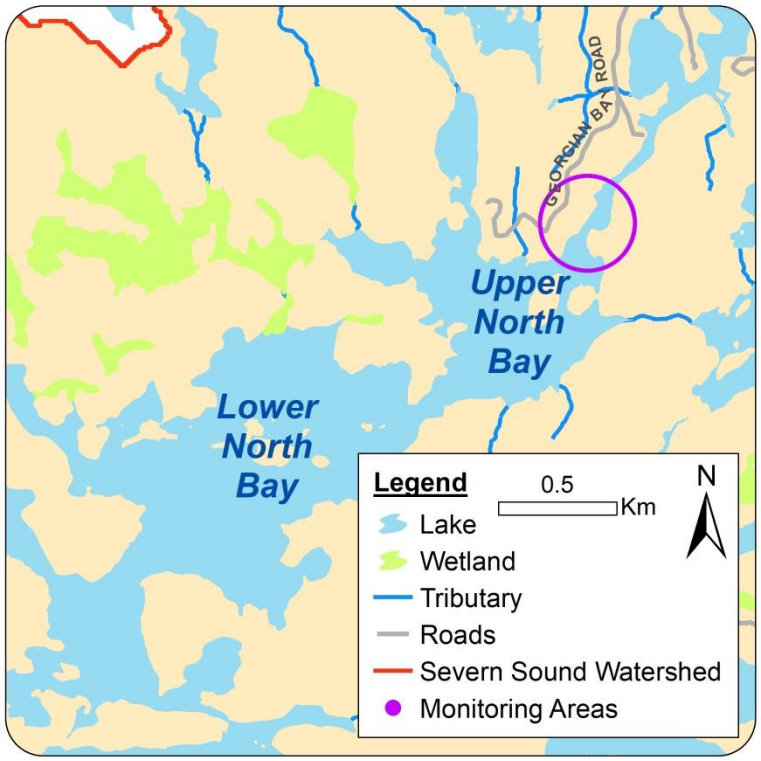
Other Observations:

- Water Colour/Debris – ranged from light to dark green to clear, foam collected on shore
- Algae – light green fuzz on rocks
- Restoration Needed – shore erosion Midland Bay Woods Park, needs shoreline stabilization


Erosion at Midland Bay Woods Park

NORTH BAY

Upper and Lower North Bay is located in the northern portion of Honey Harbour in Georgian Bay Township. Its waters are considered tributary to Severn Sound.



Number of Sites: 1

Number of Lake Observations: 6

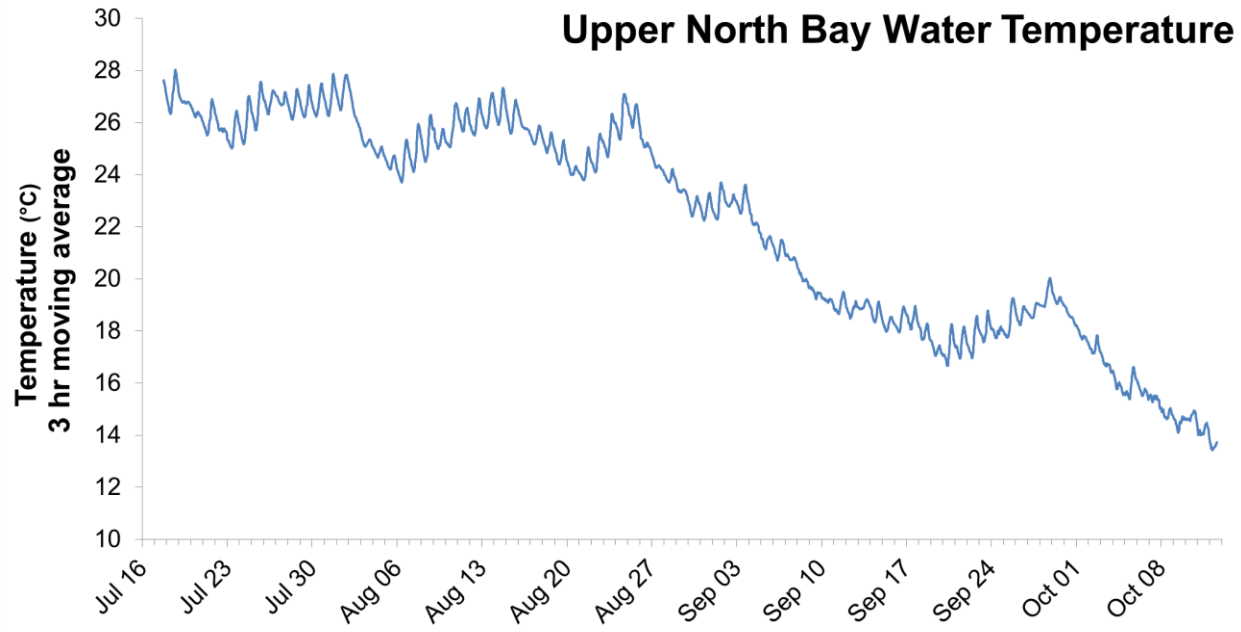
Site Depth: 2.8 m

Summary: Jul 9 - Sept 7

	Water Temp (°C)	Cond (µS/cm)	pH
Min	20.4	180	8.70
Avg	25.2	194	8.96
Max	27.4	222	9.60

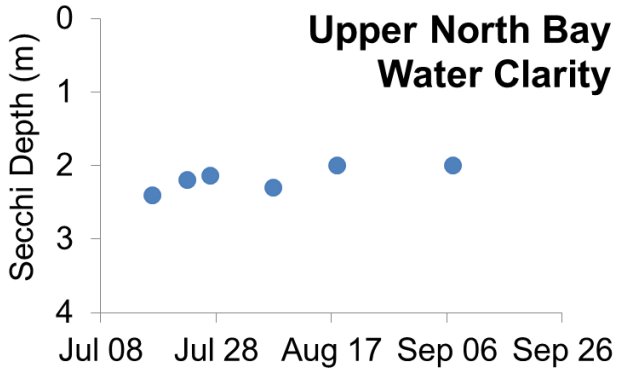
	Secchi Depth (m)	Air Temp (°C)
Min	2.0	19.7
Avg	2.2	27.1
Max	2.4	34.0

Water Temperature (logger):



Temperature Logger Stats:
July 17 -October 12, 2020

Overall Minimum	13.2
Overall Average	22.1
Overall Maximum	28.2
Minimum Daily Range	0.6
Average Daily Range	1.2
Maximum Daily Range	2.3
July 17-31 Avg	26.5
Aug Avg	25.2
Sept Avg	19.3
Oct 1-12 Avg	15.6

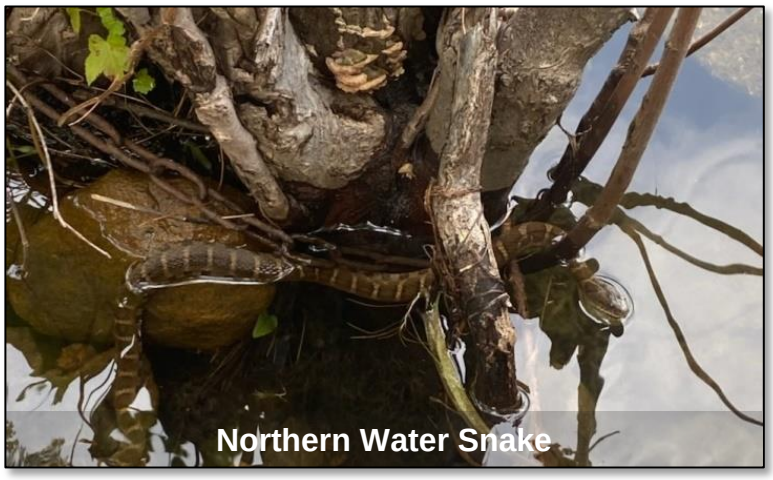


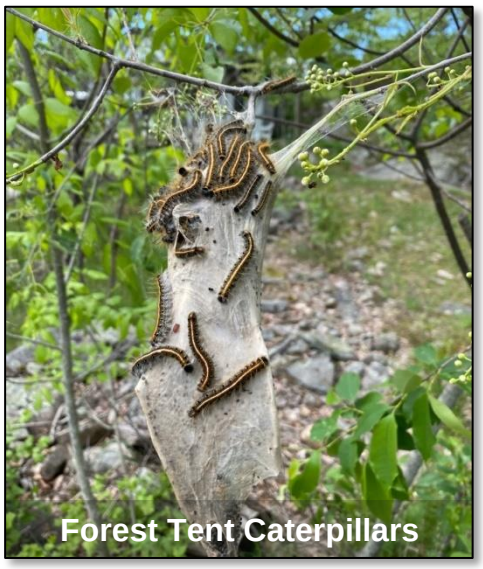
Plants and Animals:

- Blue Heron, Seagulls, Muskrat, Canada Geese, Ducks, Terns, Dragonflies, Northern Water Snake, Forest Tent Caterpillars, Tick, Garter Snake
- SAR – Massasauga Rattlesnake
- IS – Gypsy Moth caterpillars

Other Observations:

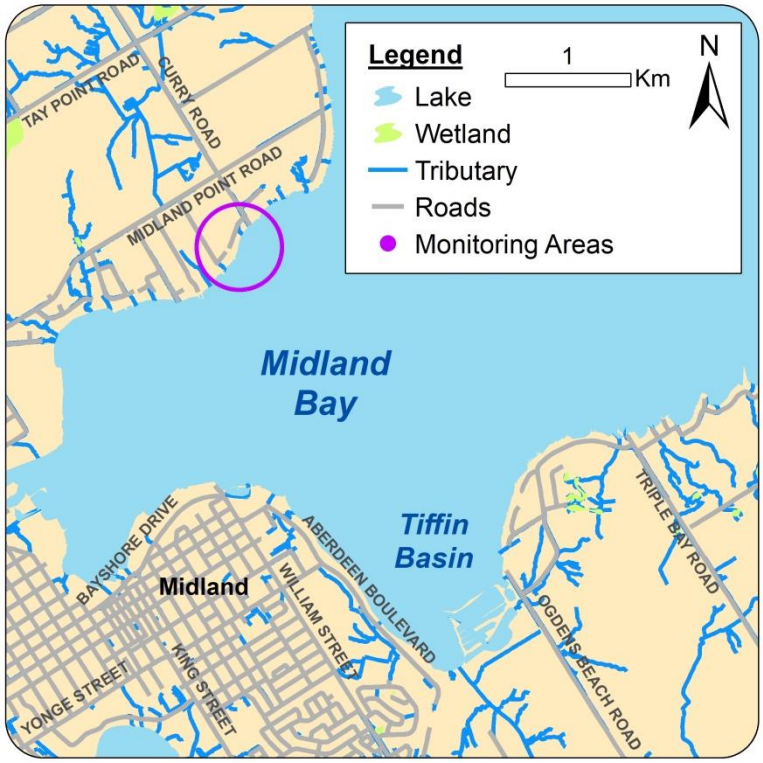
- Water Colour/Debris – light brown
- Algae – greenish/brown algae on rocks
- Human Impact – fishing tackle washed up on shore


Northern Water Snake


Forest Tent Caterpillars

MIDLAND BAY

Midland Bay is in the southern portion of Severn Sound, and receives flows from Vindin Creek and the Wye River. Midland Bay is bordered by Midland, Penetanguishene and Tay Township.



Number of Sites: 1

Number of Observations: 32

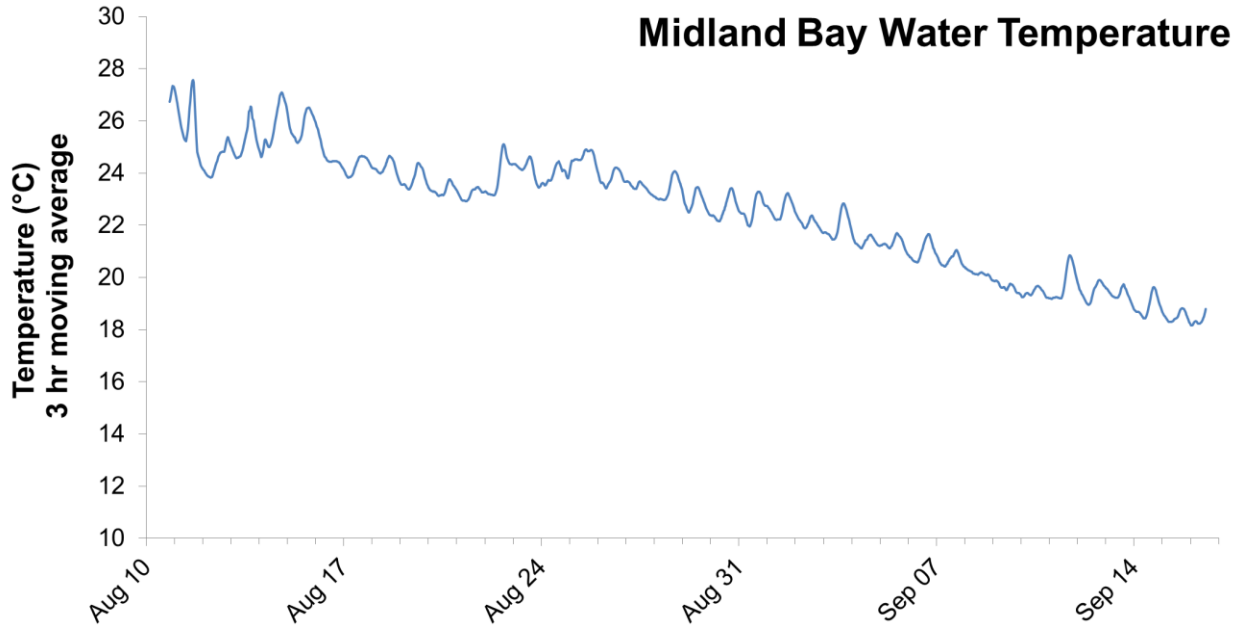
Site Depth: 3.4-6.5 m

Summary: Jul 27 - Sep 19

	Water Temp (°C)	Cond (µS/cm)	pH
Min	18.2	212	8.29
Avg	23.0	218	8.64
Max	26.6	226	8.94

	Secchi Depth (m)	Air Temp (°C)
Min	2.5	15.0
Avg	3.0	22.3
Max	3.3	27.5

Water Temperature (logger):



Temperature Logger Stats:
August 10 - September 16, 2020

Overall Minimum	18.1
Overall Average	22.5
Overall Maximum	27.8
Minimum Daily Range	0.5
Average Daily Range	1.4
Maximum Daily Range	4.0
Aug 10-31 Avg	24.1
Sept 1-16 Avg	20.3


Zebra mussels on Eurasian Watermilfoil

Plants and Animals:

- Tree Swallows, Ducks, Flycatcher, Dragonfly, Sand Flies, Otter, Tadpole Madtom, Smallmouth Bass, Yellow Perch, Mink, Canada Geese, Seagull, Mallards, Blue/Silver Baitfish, Mergansers, Minnow (Bluntnose or Fathead), Loon, Green Frog, Duckweed
- SAR – nothing reported
- IS – Round Gobies, Phragmities, Zebra Mussels (on plant stems), Eurasian Water-milfoil, Hydrilla [*note: Hydrilla has not yet been reported in Canada; this sighting was likely the native Canada Waterweed*]

Other Observations:

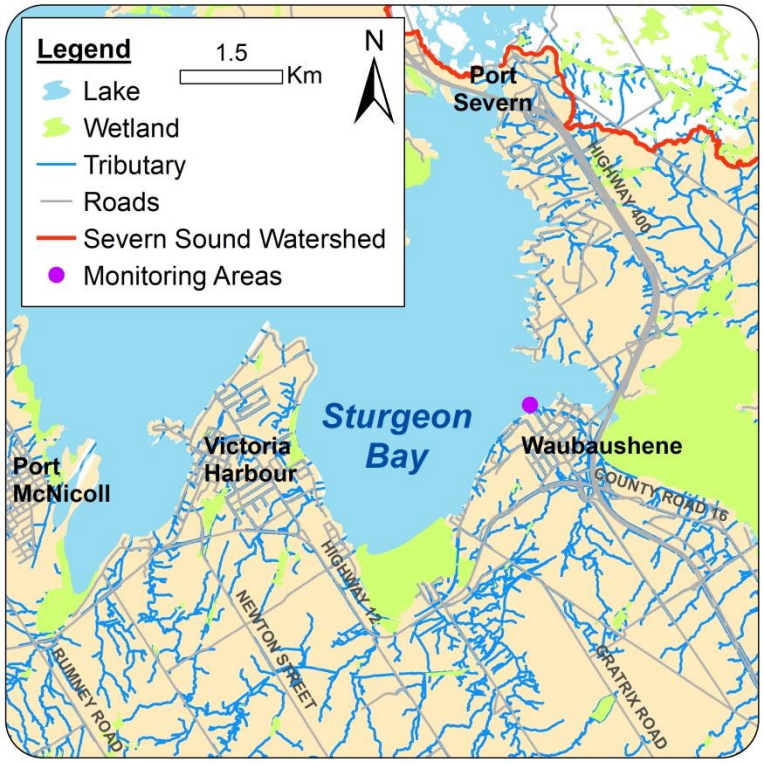
- Algae – green tufts growing between sections of concrete boat ramp, green slimy thin layer growing on boat ramp where waves wash back, green growth on shore rocks
- Water Colour/Debris – foam/bubbles floating, many plant fragments
- Human Impact – tiny bits of green sediment get disturbed by boat traffic and are suspended, tire tracks, ruts from stuck vehicle


Aquatic plants, including Eurasian Watermilfoil


Yellow Perch, Minnows, Round Gobies

STURGEON BAY

Sturgeon Bay is a plant-dominated shallow bay in the east end of Severn Sound in Tay Township. It receives flows from the Sturgeon River, and is also influenced by flows from Matchedash Bay and the Severn River.



Number of Sites: 1

Number of Observations: 15

Site Depth: 4.0-5.5 m

Summary: Aug 7 - Nov 1

	Water Temp (°C)	Cond (µS/cm)	pH
Min	7.1	235	6.17
Avg	17.6	348	8.07
Max	25.7	442	8.50

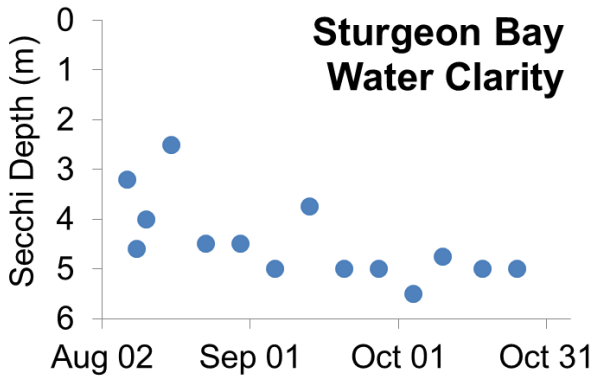
	Secchi Depth (m)	Air Temp (°C)
Min	2.5	6.8
Avg	4.5	18.3
Max	5.5	27.3

Plants and Animals:

- Caspian Terns, Ospreys, Trumpeter Swans, Muskrat, Great Egret, Turkey Vultures, Ring-billed gulls
- SAR – Map Turtles
- IS – nothing reported

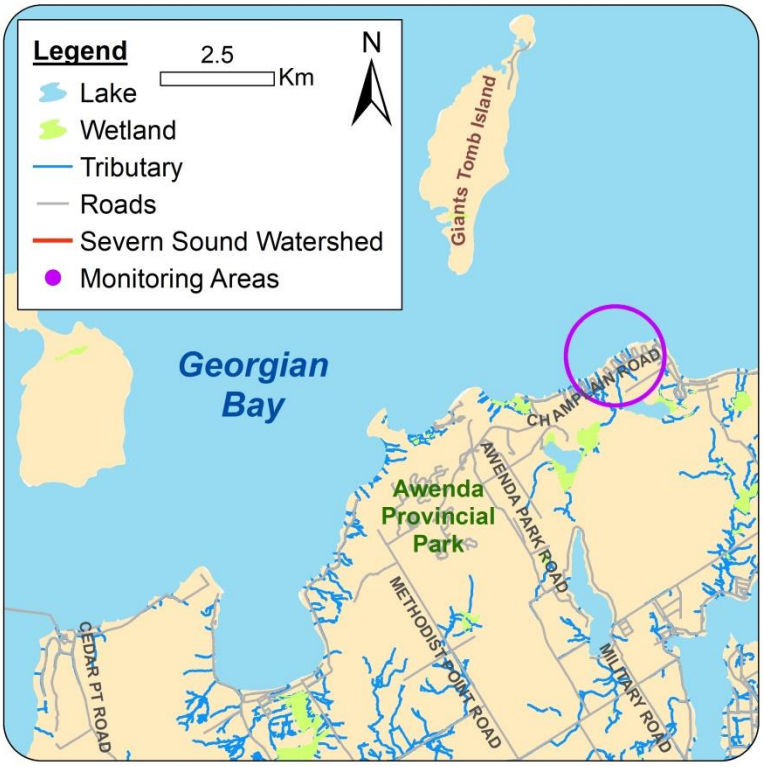
Other Observations:

- Water Level Impacts – Canada Geese nesting sites flooded



OPEN GEORGIAN BAY

The open waters of Georgian Bay lie to the west of Severn Sound. The monitoring site is located along the Tiny Township shoreline, across from Giant's Tomb Island.



Number of Sites: 1

Number of Observations: 15

Summary: Jul 13 - Oct 26

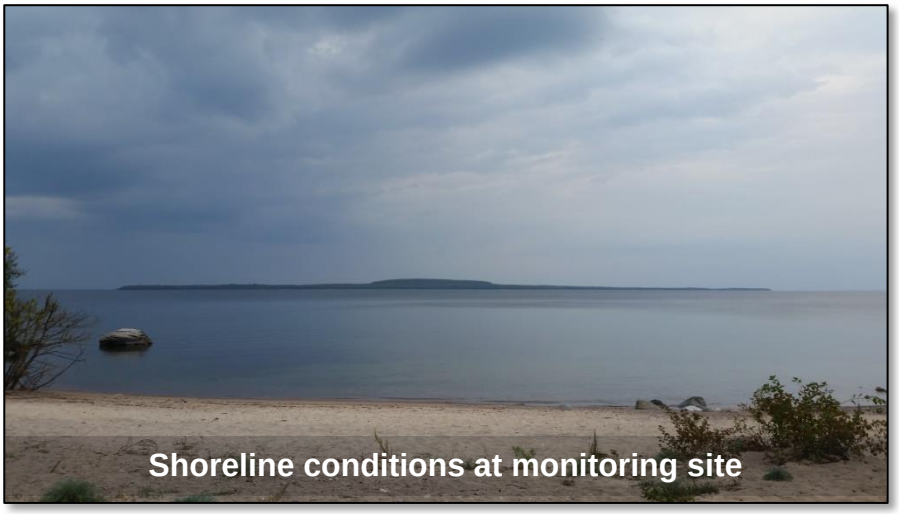
	Water Temp (°C)	Air Temp (°C)
Min	13.6	10.0
Avg	21.5	19.6
Max	25.4	27.2

Plants and Animals:

- Seagulls, Crows, Robin, Ducks
- SAR – nothing reported
- IS – nothing reported

Other Observations:

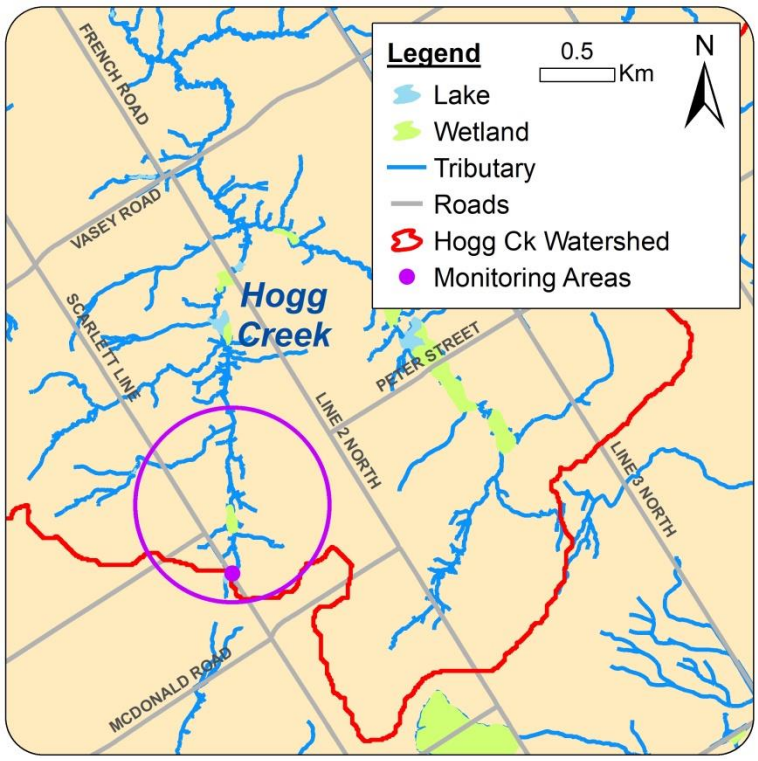
- Water Colour/Debris – ranged from varying shades of grey, blue, brown, green


Shoreline conditions at monitoring site

TRIBUTARIES

HOGG CREEK

Hogg Creek runs through Springwater, Oro-Medonte and Tay Townships, and discharges into Hogg Bay. Monitoring sites are located in the headwaters of the creek.



Number of Sites: 2

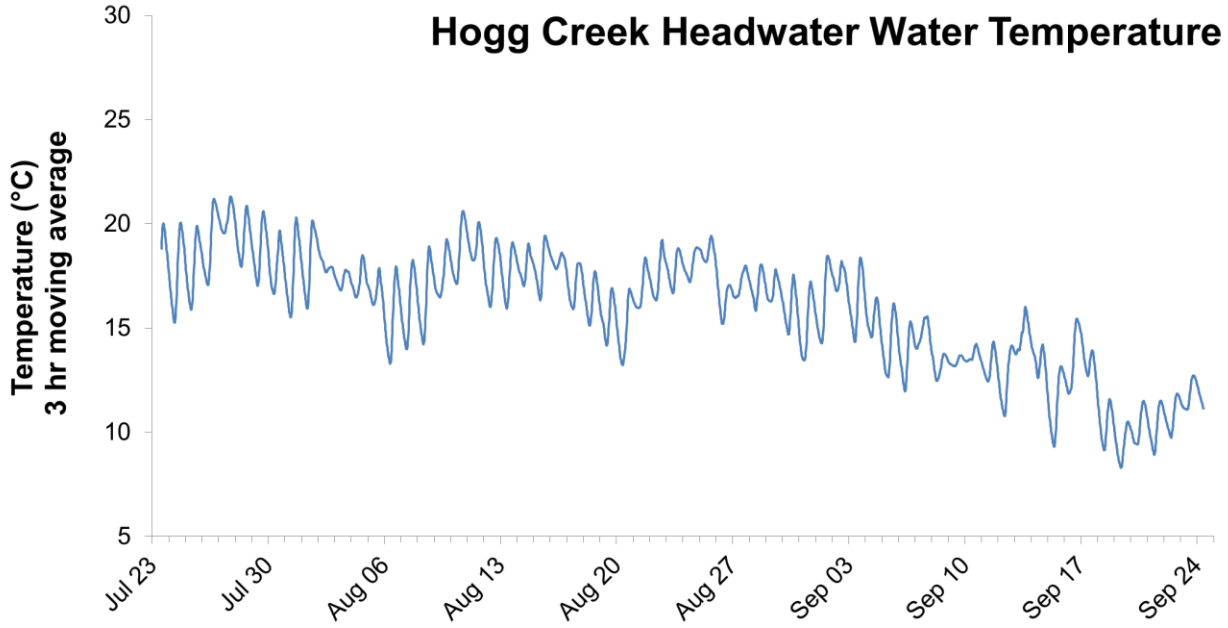
Number of Observations: 6

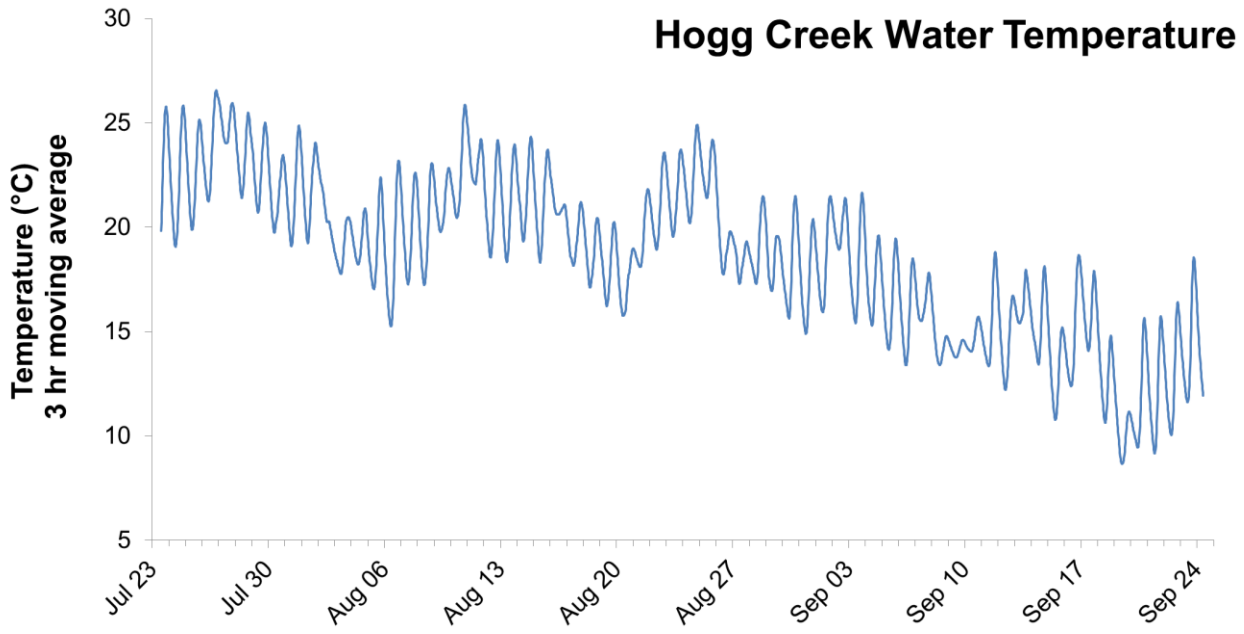
Stream Depth: 18.8-21.3 cm

Summary: Aug 7 - Oct 6

	Air Temp (°C)
Min	17
Avg	21
Max	25

Water Temperature (logger):



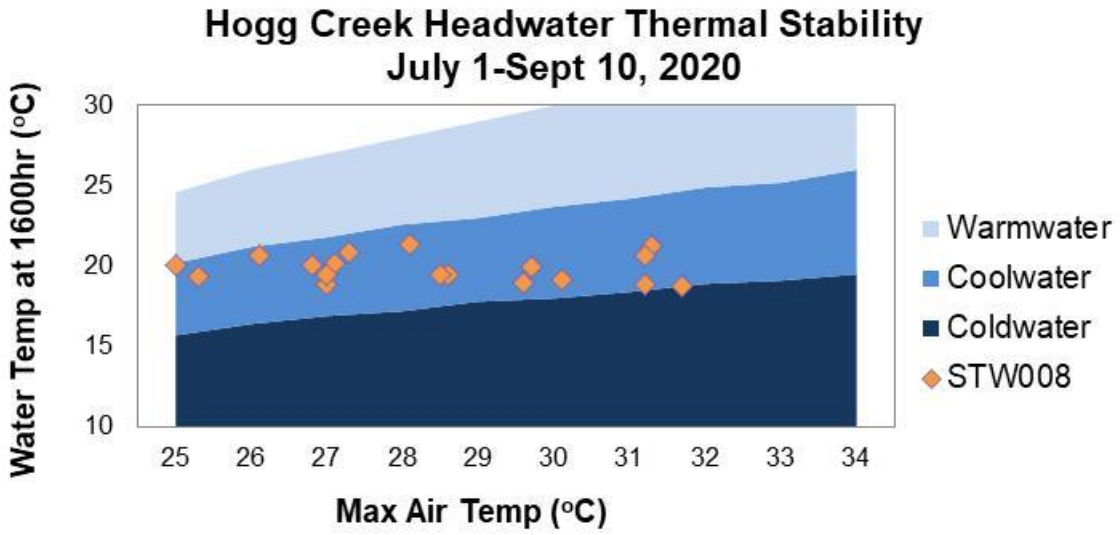


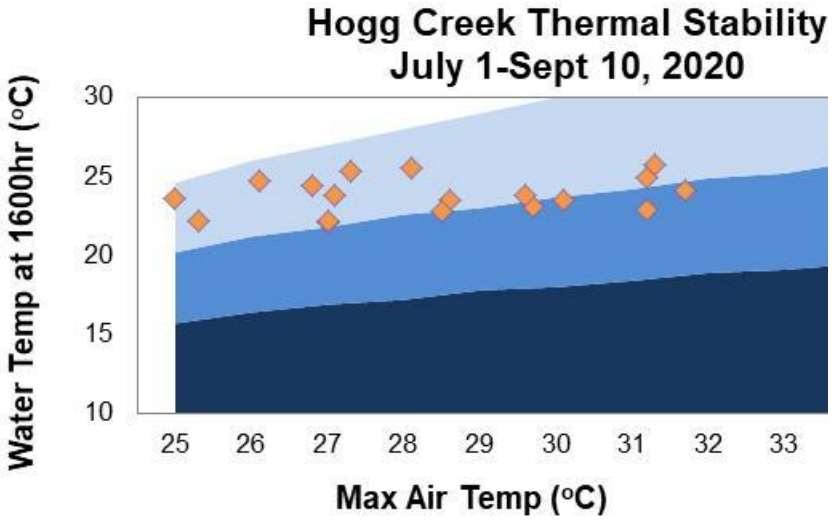
Hogg Creek Headwaters Temperature Logger Stats: July 23 - September 24, 2020	
Overall Minimum	8.2
Overall Average	15.9
Overall Maximum	21.4
Minimum Daily Range	0.5
Average Daily Range	3.3
Maximum Daily Range	5.0
July 23-31 Avg	18.6
Aug Avg	17.2
Sept 1-24 Avg	13.2

Hogg Creek Temperature Logger Stats: July 23 - September 24, 2020	
Overall Minimum	8.7
Overall Average	18.6
Overall Maximum	26.6
Minimum Daily Range	0.9
Average Daily Range	4.8
Maximum Daily Range	8.1
July 23-31 Avg	23.0
Aug Avg	20.2
Sept 1-24 Avg	15.1


Conditions near downstream temperature logger site

Thermal Stability:





Plants and Animals:

- Frogs
- SAR – nothing reported
- IS – nothing reported

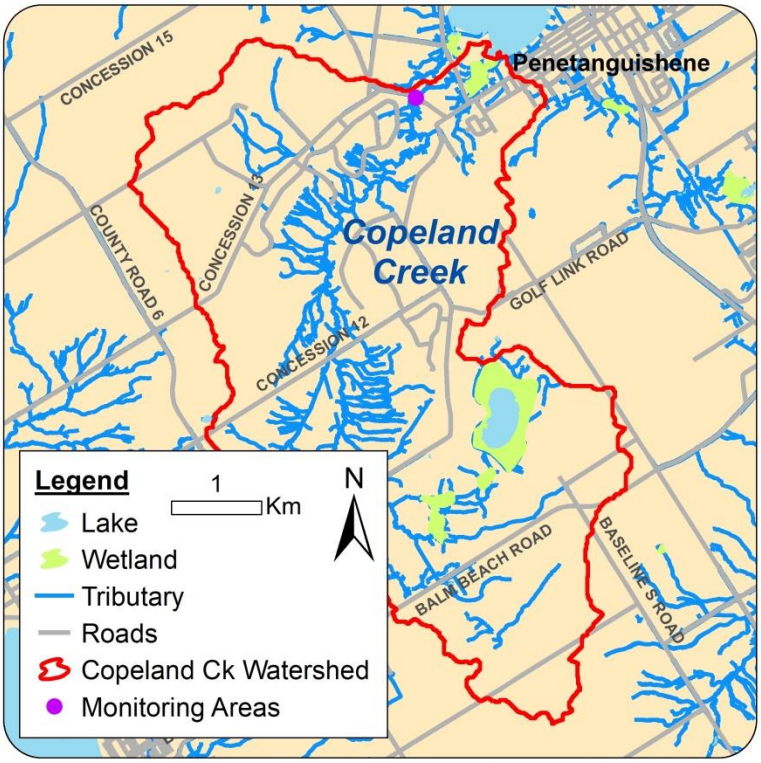
Other Observations:

- Water Colour/Debris – brownish water at end of creek, not into running stream

Iron and manganese films near Hogg Ck headwaters

COPELAND CREEK

Copeland Creek runs through Tiny Township and Penetanguishene, and discharges into Penetang Harbour. The monitoring site is located in the lower portion of the creek.



Number of Sites: 1

Number of Observations: 16

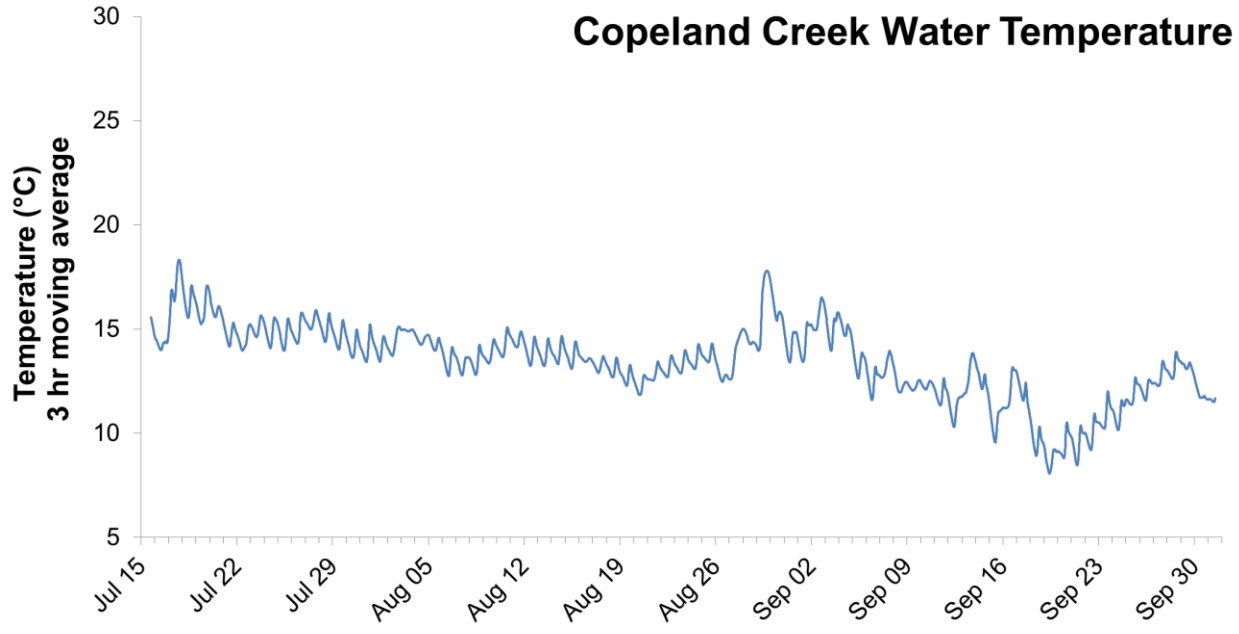
Stream Depth: 9-15.5 cm

Summary: Aug 9 - Nov 10

	Water Temp (°C)	Cond (µS/cm)	pH
Min	6.9	223.0	7.9
Avg	12.5	347.3	8.2
Max	17.6	386.0	8.4

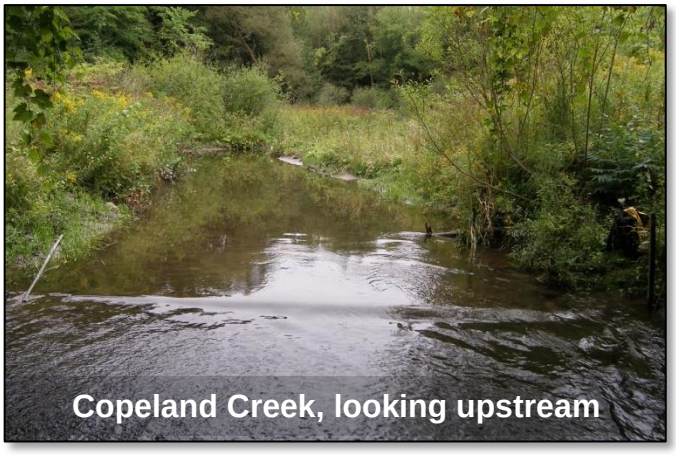
	Air Temp (°C)
Min	5
Avg	19
Max	30

Water Temperature (logger):

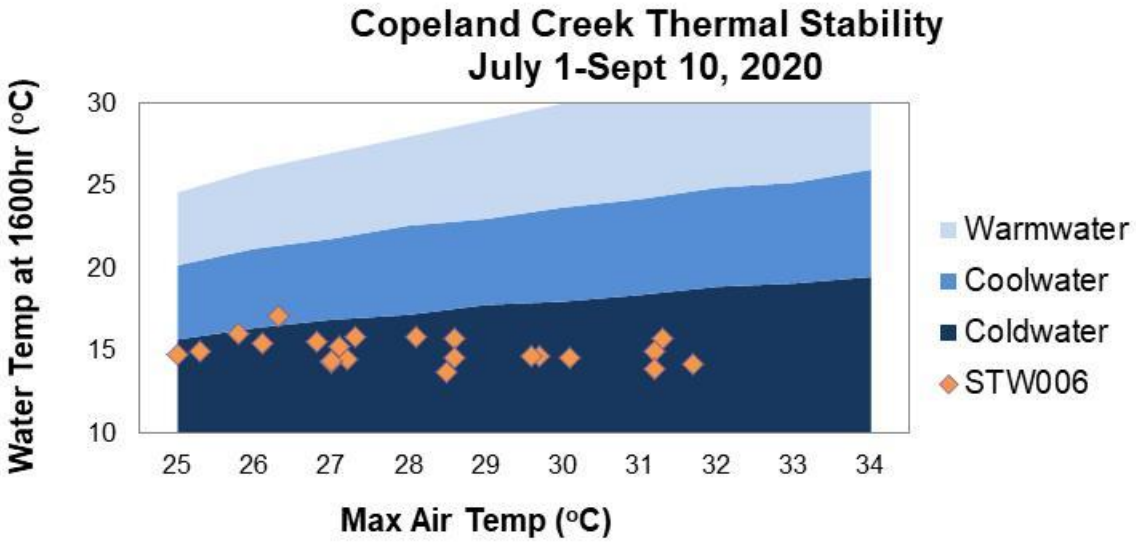


Temperature Logger Stats:
July 15 - October 1, 2020

Overall Minimum	8.0
Overall Average	13.4
Overall Maximum	18.3
Minimum Daily Range	0.4
Average Daily Range	1.5
Maximum Daily Range	3.4
July 15-31 Avg	15.1
Aug Avg	13.9
Sept Avg	12.1


Copeland Creek, looking upstream

Thermal Stability:



Plants and Animals:

- Silver spotted skipper, lots of stream invertebrate activity (Caddisflies)
- SAR – nothing reported
- IS – empty Zebra Mussel shell

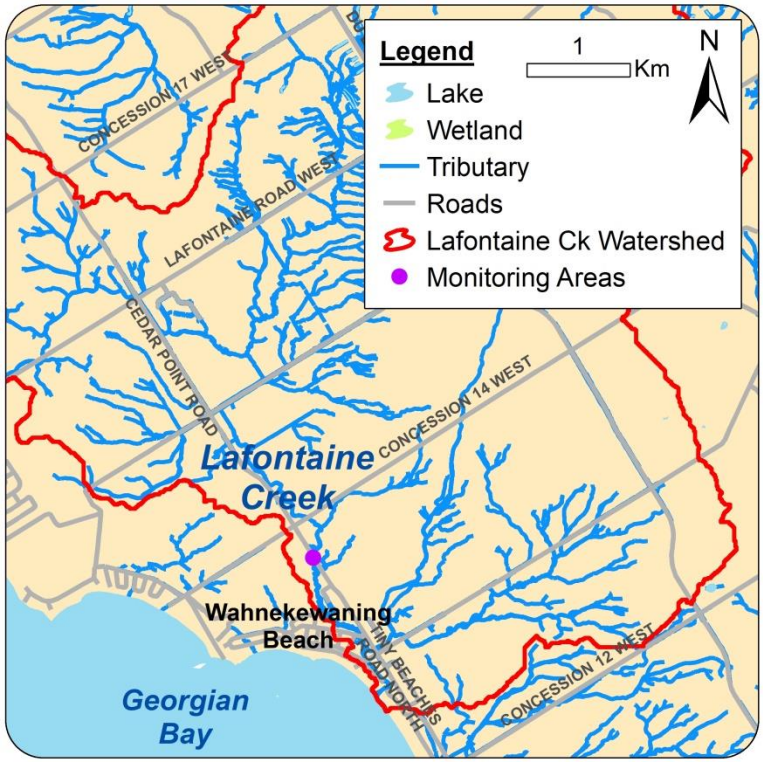

Silver spotted skipper

Other Observations:

- Water Colour/Debris – brown, turbid
- Algae – attached filamentous green algae greening up at end of season (Nov)

LAFONTAINE CREEK

Lafontaine Creek in located in western Tiny Township, and discharges into Nottawasaga Bay at Wahnekewaning Beach. The monitoring site is located in the lower portion of the creek.



Number of Sites: 1

Number of Observations: 11

Stream Depth: 32-48 cm

Summary: Aug 2 - Nov 19

	Water Temp (°C)	Cond (µS/cm)	pH
Min	4.4	334.0	8.1
Avg	16.2	360.8	8.2
Max	22.0	403.0	8.4

	Air Temp (°C)
Min	5
Avg	20
Max	26

Plants and Animals:

- Watercress, Bumblebee, Minnows
- SAR – nothing reported
- IS – Cow Vetch (*Vicia cracca*), Colt's-foot (*Tussilago farfara*), Spotted Knapweed (*Cenraurea stoebe*), Wild Carrot (*Daucus carota L.*)

Other Observations:

- Water Colour/Debris –brownish water, some foam collecting in eddy
- Algae – small amount of green algae in eddy
- Water Level Impacts – major erosion occurring at bend immediately downstream/beside sampling site; Large overhanging bank
- Human Impact – Beer can and some plastic collected from stream; cow pastures upstream of site (no exclusion fencing); small inuksuks along stream
- Restoration Needed – livestock exclusion fencing upstream; major bank erosion project required a few meters downstream from site at cut bank (some restoration efforts look recent: bank stabilization beside culvert and tiered slope)

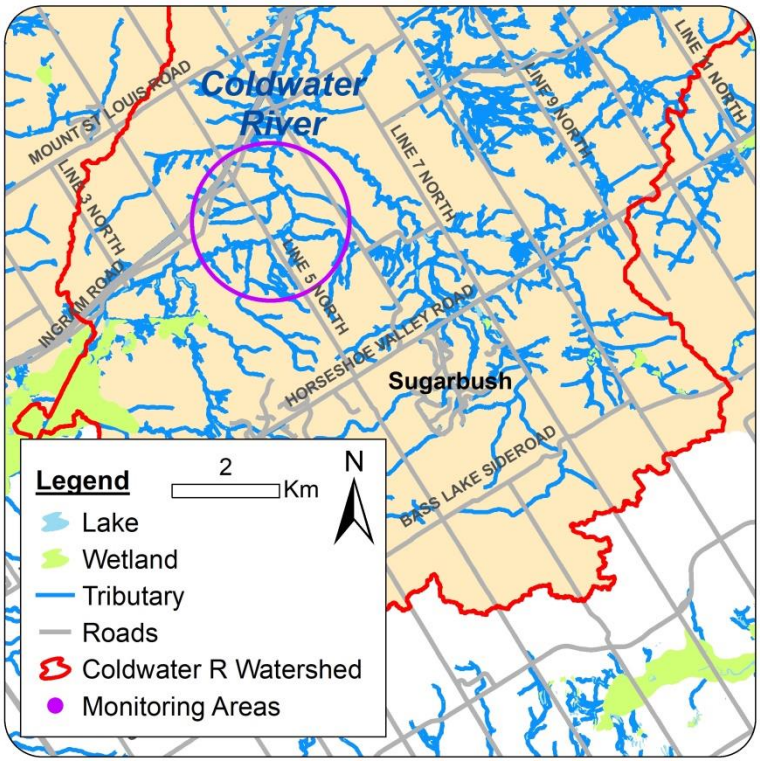
Lafontaine Creek, looking downstream

Filamentous green algae

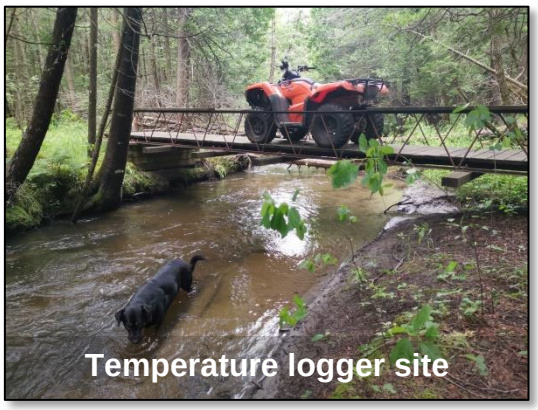
Spotted Knapweed

COLDWATER RIVER

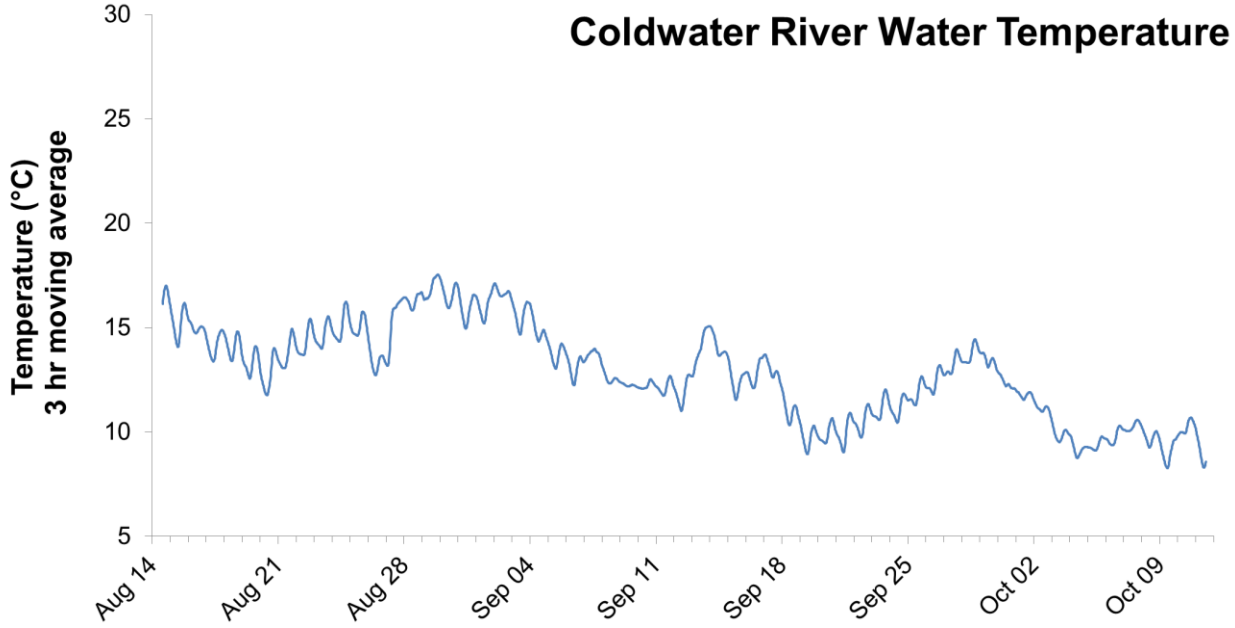
The majority of the Coldwater River headwaters are located in Oro-Medonte Township. The river flows north through Severn Township and the village of Coldwater. The river discharges at Matchedash Bay where it meets the North River. The monitoring site is located in the headwater portion of the river, east of Copeland Forest.



Number of Sites: 1



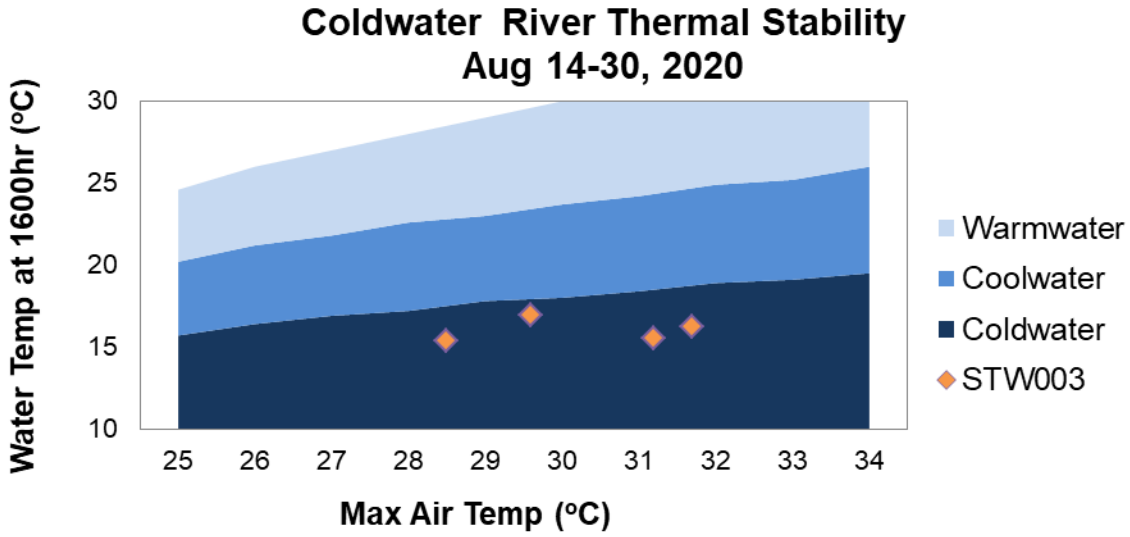
Water Temperature (logger):



Temperature Logger Stats:
August 14 - October 11, 2020

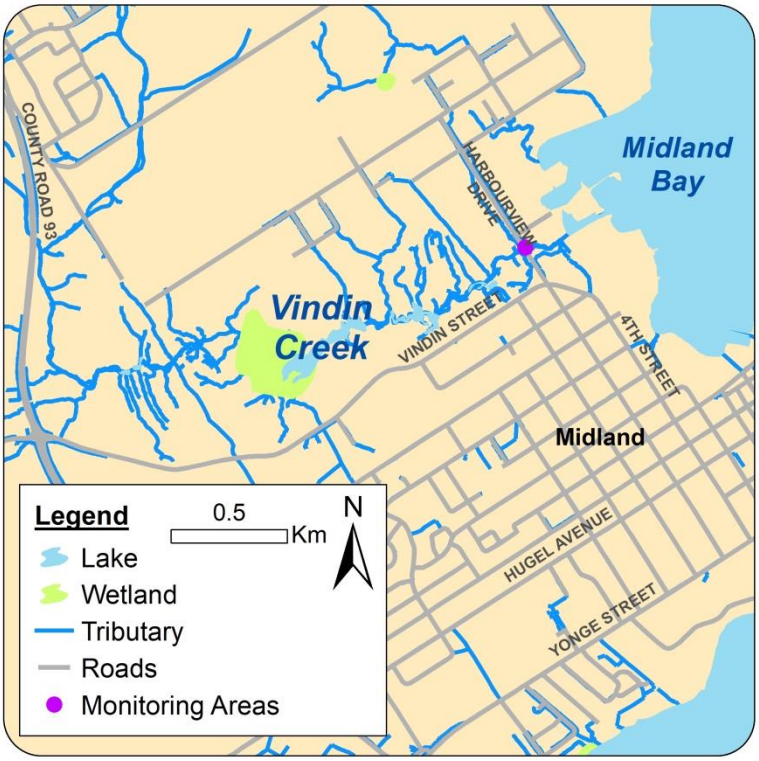
Overall Minimum	8.2
Overall Average	12.9
Overall Maximum	17.6
Minimum Daily Range	0.2
Average Daily Range	1.5
Maximum Daily Range	2.8
Aug 14-31 Avg	14.9
Sept Avg	12.7
Oct 1-11 Avg	10.0

Thermal Stability:



VINDIN CREEK

Vindin Creek is located in Midland, and discharges into Midland Bay. The monitoring site is located in the lower portion of the creek.



Number of Sites: 1

Number of Observations: 16

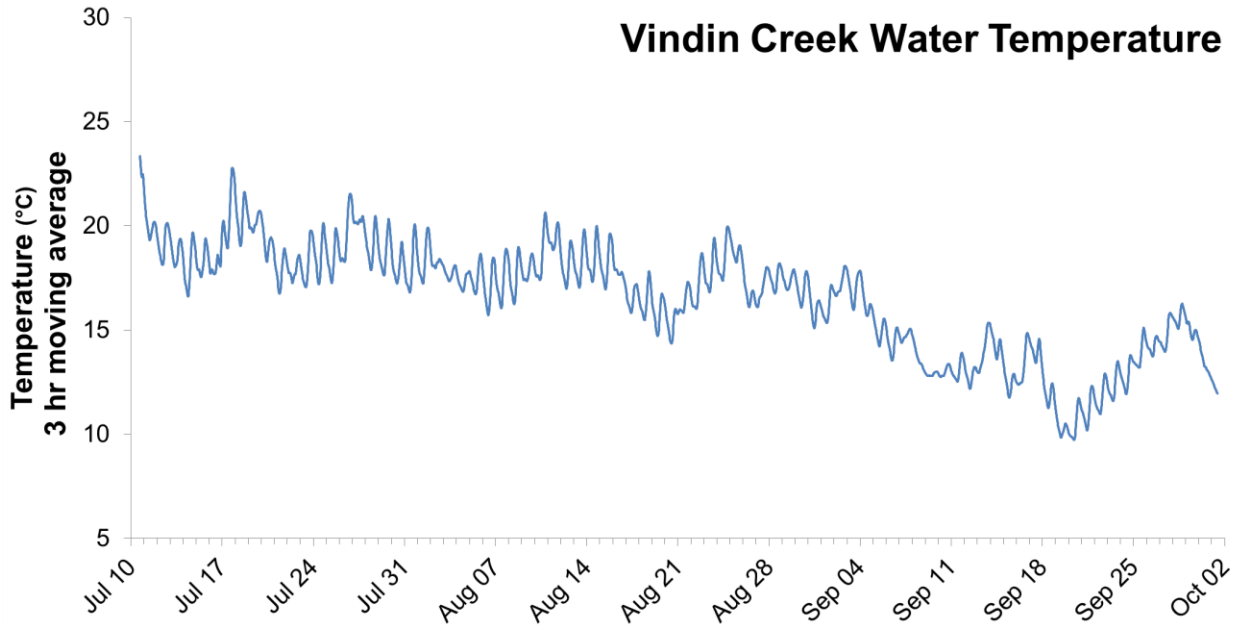
Stream Depth: 16.5 - 46 cm

Summary: Aug 9 - Nov 10

	Water Temp (°C)	Cond (µS/cm)	pH
Min	7.1	331.0	7.7
Avg	14.1	552.1	8.1
Max	21.4	602.0	8.5

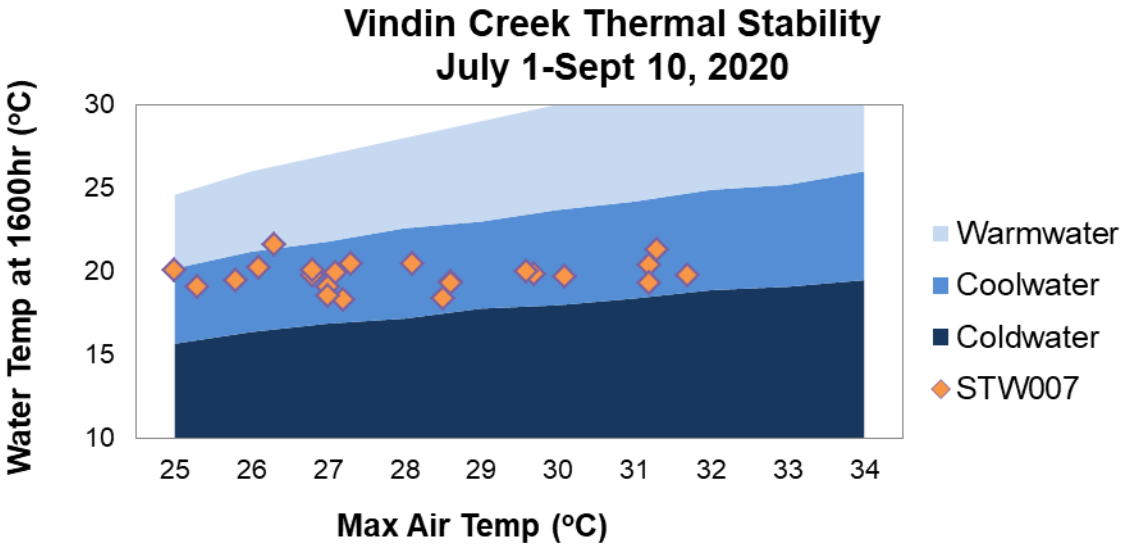
	Air Temp (°C)
Min	5
Avg	19
Max	30

Water Temperature (logger):



Temperature Logger Stats: July 10 - October 1, 2020	
Overall Minimum	9.7
Overall Average	16.5
Overall Maximum	23.7
Minimum Daily Range	0.2
Average Daily Range	2.1
Maximum Daily Range	4.0
July 10-31 Avg	19.0
Aug Avg	17.5
Sept Avg	13.7

Thermal Stability:



Plants and Animals:

- Sedge Sprite Damselfly
- SAR – nothing reported
- IS – Glossy Buckthorn

Other Observations:

- Water Colour/Debris – clear to turbid
- Algae – increased attached filamentous green algae

Data Validation

In any environmental monitoring program, it's important to examine results for data quality, and compare to other data sources if available. Weather related variables collected by volunteers (temperature, rainfall, and wind conditions) can be compared to data collected at Environment and Climate Change Canada (ECCC) weather stations, and to data collected by SSEA. Strong comparisons between datasets give confidence that volunteer data can be considered representative of conditions in the watershed.

Rainfall

Rainfall was measured using rain gauges by participants at 6 different locations. In two cases, rain gauge locations were not the same as the stream or lake site being monitored, however they were close enough to be representative of local precipitation conditions (Midland gauge site used for Vindin Creek, and Port Severn gauge site used for Gloucester Pool). Participants recorded several large rain events greater than 30 mm, the most significant being at the end of August (Figure 2, top).

Volunteer data can be compared to rainfall measured at SSEA rain gauges across the watershed (Figure 2, bottom). Volunteer and SSEA data appeared to be more comparable during the first half of the monitoring period compared to the second half. Note that SSEA rain gauges were removed at the end of October, and some volunteers were still recording until late November. Overall, large rainfall events that were recorded by SSEA gauges were also captured through volunteer monitoring.

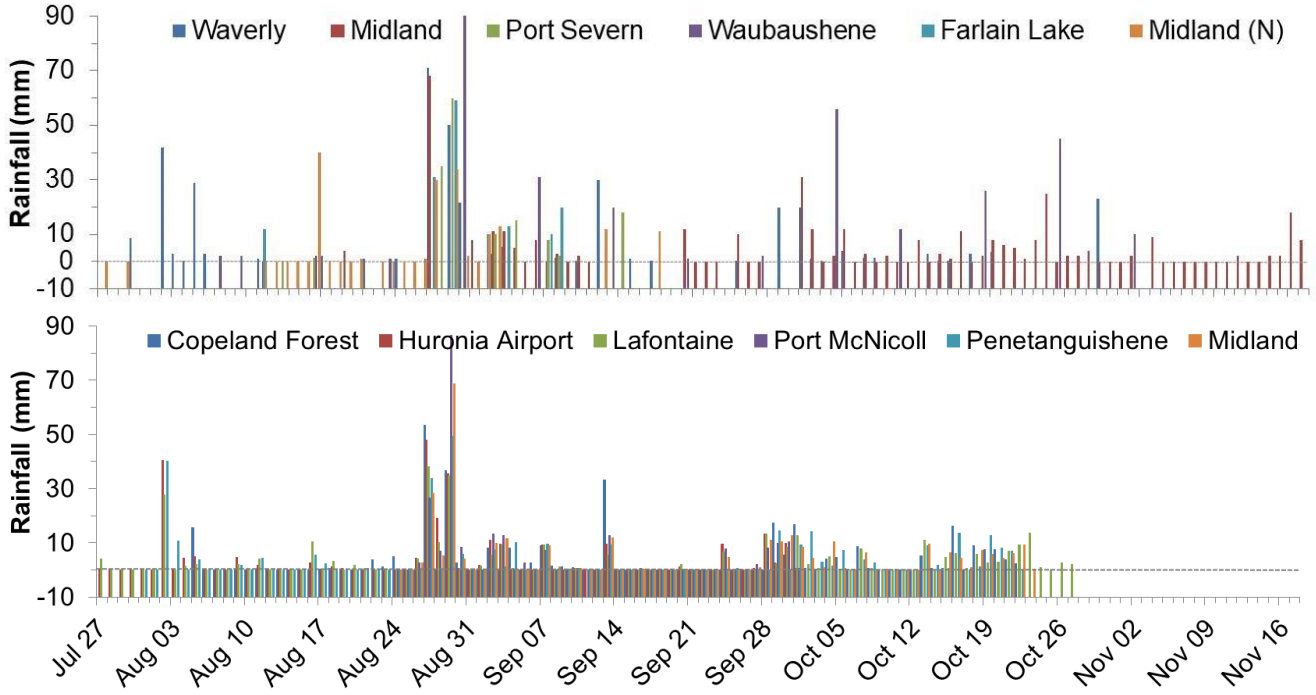


Figure 2. Rainfall (mm) measured at all volunteer sites (top) and at SSEA rain gauges (bottom).

Air Temperature

As expected, there were some differences in air temperatures measured by volunteers compared to daily maximums from ECCC's Coldwater station, and SSEA's Huronia Airport station (Figure 3). Overall however, the data compared very well as indicated by the high correlation coefficient (r^2) and small deviation from a 1:1 line (Figure 4). This means that volunteer observations are reliable. Factors causing differences include: site conditions where air temperature was measured (sheltered vs exposed location, sun vs shade), proximity to a large water body, and time of day the measurement was taken.

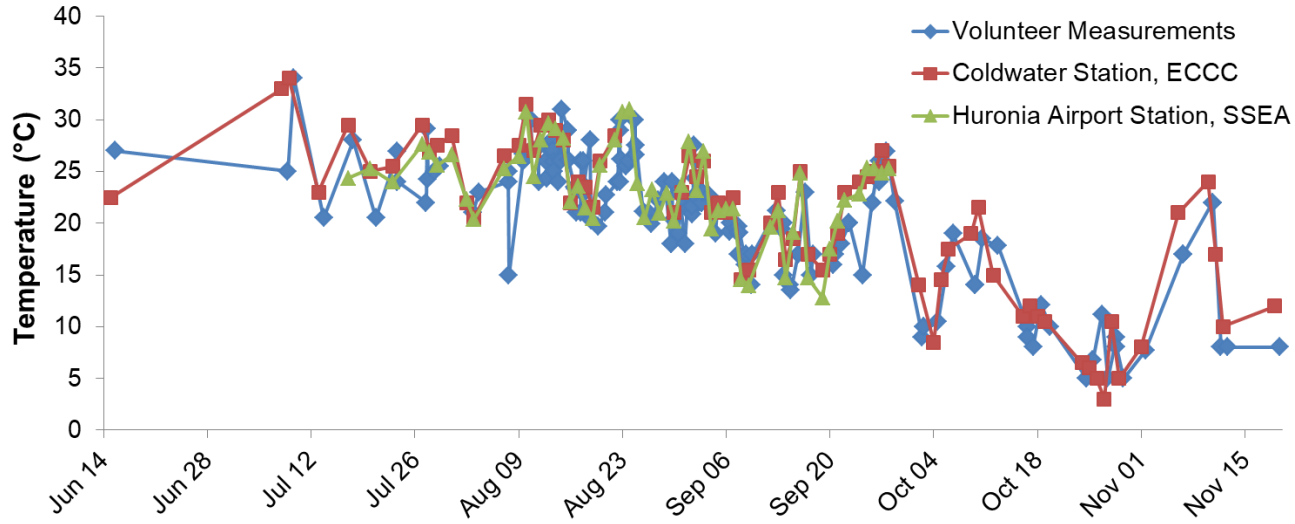


Figure 3. Comparison of air temperature from volunteers versus maximum daily temperatures from ECCC Coldwater and SSEA Huronia Airport stations.

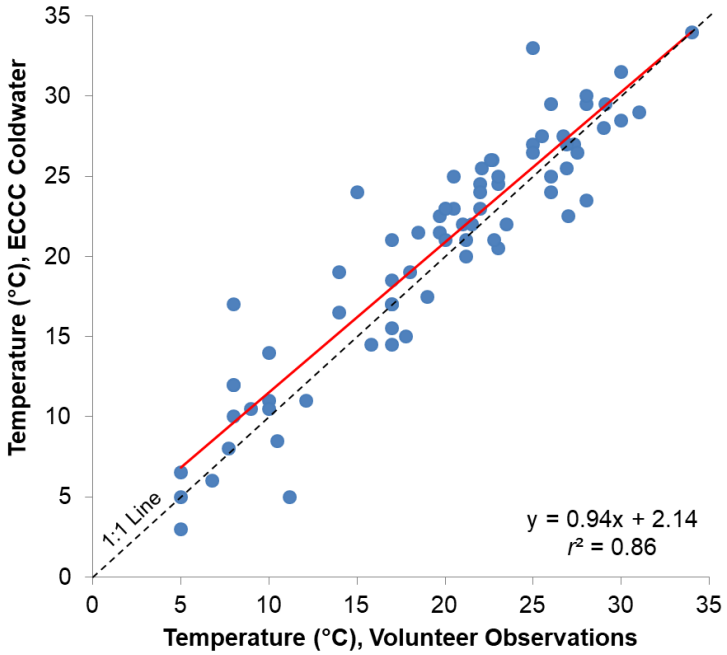


Figure 4. Air temperature measured by volunteers versus maximum daily air temperature at ECCC Coldwater Station. A 1:1 line (black dashed) and regression line (blue solid) are also shown, along with the regression equation.

Water Temperature

Comparisons were made between temperature logger data and data from Hanna meters for five participants that had both loggers and meters. The data correlated very closely, indicating that the Hanna meters provided reliable temperature data (Figure 5).

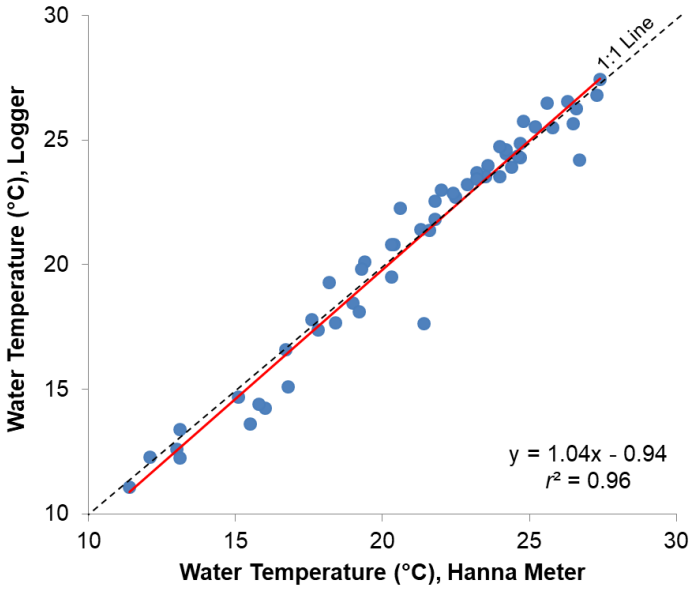


Figure 5. Temperature measured using a Hanna meter versus using a temperature logger.

Wind

Wind data is very difficult to validate since it varies so much from place to place, and reliable sources of wind data are relatively far from the Severn Sound area. Depending on the location, volunteer data was compared to hourly wind data from one of three ECCC weather stations: Lake Simcoe Airport, Western Islands, and Muskoka Airport. Volunteers used the Beaufort Wind Scale, which uses observations of waves and movement of trees and loose objects to estimate wind speed, along with a weather vane and compass to estimate wind direction. This method introduces additional variability, as does the location of measurement (sheltered vs exposed) and whether winds were gusty or steady. Comparisons show that volunteers tended to underestimate wind speeds, and that wind direction was often not comparable between volunteer locations and ECCC weather stations (Figure 6).

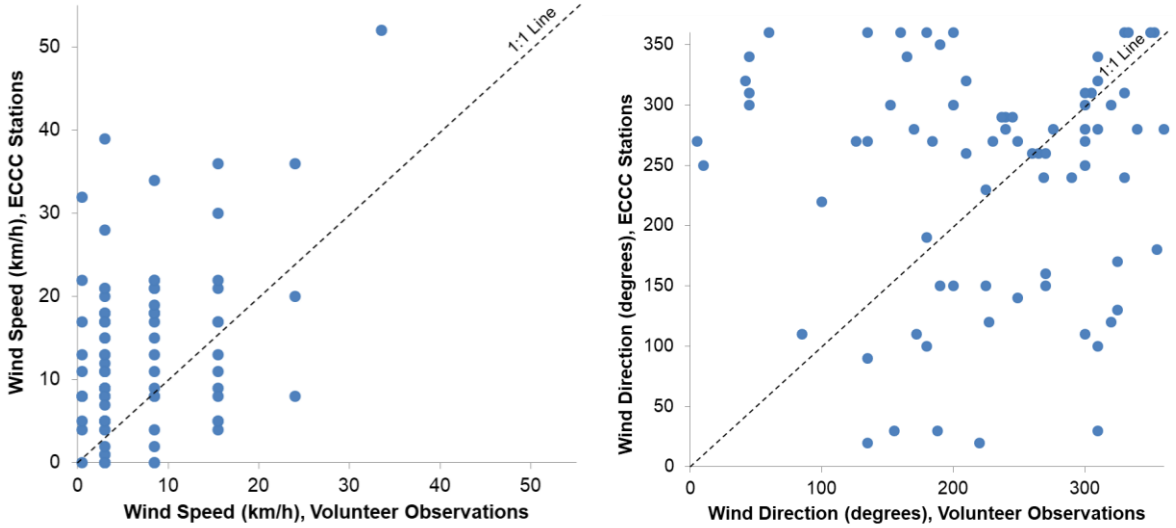


Figure 6. Wind speed (left) and wind direction (right) measured by volunteers versus measurements at ECCC stations. A 1:1 line (black dashed) is shown to aid comparison.

Conductivity and pH

SSEA has conducted water quality surveys on all of the lakes and most of the tributaries sampled by volunteers, and data can be used to verify expected values. SSEA values are from samples taken from the deepest part of each lake or bay, and analyzed at a lab, so it is not unexpected for there to be differences between volunteer and SSEA data. Overall, volunteer data fell within the ranges measured through SSEA monitoring, with the exception of conductivity for Farlain Lake, which was lower than expected and pH for Little Lake, Midland Bay and North Bay, which was higher than SSEA ranges (Table 1). The Hanna meters sometimes overestimate pH compared to analysis by a lab, so this was not unexpected. Conductivity for Sturgeon Bay was higher than expected, which may have been due to localized influences at the site.

Table 1. Minimum, average and maximum conductivity and pH values measured by volunteers compared to data collected in the most recent survey by SSEA for each lake or bay.

Waterbody	Latest SSEA Survey	Volunteer Conductivity (µS/cm)			Volunteer pH			SSEA Conductivity (µS/cm)			SSEA pH		
		Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Bass Lake	2018	284	287	293	7.10	7.98	8.55	264	277	297	8.15	8.29	8.39
Farlain Lake*	2016		95			8.22		165	170	175	7.69	8.00	8.22
Lake Couchiching	2019	296	343	390	8.50	8.55	8.60	375	388	406	8.06	8.25	8.34
Little Lake*	2019		252			8.56		251	257	266	7.49	7.87	8.24
Midland Bay	2019	212	218	226	8.29	8.64	8.94	214	228	247	7.86	7.96	8.10
North Bay	2019	180	194	222	8.70	8.96	9.60	136	160	176	7.32	7.49	7.69
Sturgeon Bay	2019	235	348	442	6.17	8.07	8.50	197	284	329	7.78	8.12	8.48

*only 1 measurement collected by volunteer

Interpretation and Discussion

Water Quality

Using monitoring data collected by volunteers, water quality can be assessed by examining patterns in conductivity, water clarity (Secchi depth), and using observations of water colour and algae growth. Many Shore Watch volunteers reported a greenish hue to the water, which likely indicates the presence of algae. In some areas, water was observed to have a brownish colour. Dissolved organic carbon from the breakdown of plant matter contributes to this “tea” colour in lakes, particularly those that are on the Canadian Shield and receive inflows from wetlands.

Water clarity was measured at deeper sites off docks or from boats, where the lake bottom was generally not visible from the volunteer’s vantage point. Clarity was low on Farlain Lake, low to moderate on Gloucester Pool, moderate in North Bay, moderate in Midland Bay, and moderate to high in Sturgeon Bay.

As mentioned, conductivity and pH were generally within expected ranges for lake and tributary sites, however there were a few observations of particular note:

- Conductivity was much higher on the second sampling event on the northern Lake Couchiching site, which was likely due to stronger southerly winds stirring up lake sediments.
- Conductivity readings increased over the season in Sturgeon Bay, a pattern which is also seen in SSEA data. The reason for this is unclear, but may be related to dissolved material coming from the Severn River or Matchedash Bay, or growth and decay of aquatic plants.

Shore Watch observers also frequently reported foam on the water or on shore. As wind or currents stir the water of a lake or river, foam is produced and may accumulate on windward shores in bays or in stream eddies. When aquatic organisms (such as algae, aquatic plants and invertebrates) die and decompose, a variety of organic compounds are released. These act as surfactants, and if sufficiently aerated, can produce foam. Organic compounds leached from soil can also cause foam.

Stream Watch observers occasionally reported turbid conditions, which were associated with rain events. This likely indicates sources of erosion or stormwater runoff upstream. Interestingly, at Copeland and Vindin Creeks, conductivity was lower during rain events despite high turbidity, which could indicate a dilution of dissolved constituents despite an increase in particulates which causes higher turbidity.

Water Temperature

Lake temperature was very closely related to water temperature, with 80% of the changes in water temperature being explained by changes in air temperature (Figure 7). As climate change continues, it is expected that water temperatures will continue to rise. This increase may be more pronounced in shallow, sheltered locations compared to deeper exposed sites. Higher water temperatures can increase the growth of aquatic plants and algae, and also increase the risk for blue-green algae blooms.

A comparison of temperatures between lake sites showed that areas across Severn Sound and in local inland lakes were generally similar (Figure 8).

Among all lakes sites, temperature logger measurements continued the longest in Lake Couchiching (Nov 11). It was interesting to note that water temperature increased from 1°C to 15°C over a nine day period due to the early November heat wave across Southern Ontario. Warmer fall lake temperatures generally lead to later ice-on, which was observed over the 2020/2021 winter season.

The relationship between air and water temperature was less pronounced from stream sites, with a much lower correlation coefficient of 65%. This is due to influences of groundwater inputs and shading along the streambank.

Thermal stability analysis for stream sites yielded the classifications in Table 2. These classifications are specific to the monitoring site, and can change upstream or downstream depending on groundwater influences, inputs from other tributaries, and shading. Classifications indicate the type of fish community that would be supported in a particular location.

Table 2. Thermal classifications for tributary sites.

Tributary	Thermal Classification
Hogg Creek, headwater	Coolwater
Hogg Creek	Warmwater
Copeland Creek	Coldwater
Coldwater River	Coldwater*
Vindin Creek	Coolwater

*There was insufficient data to calculate thermal classification according to the standard method, however limited data points all fall into the coldwater category, and likely reflect the correct classification.

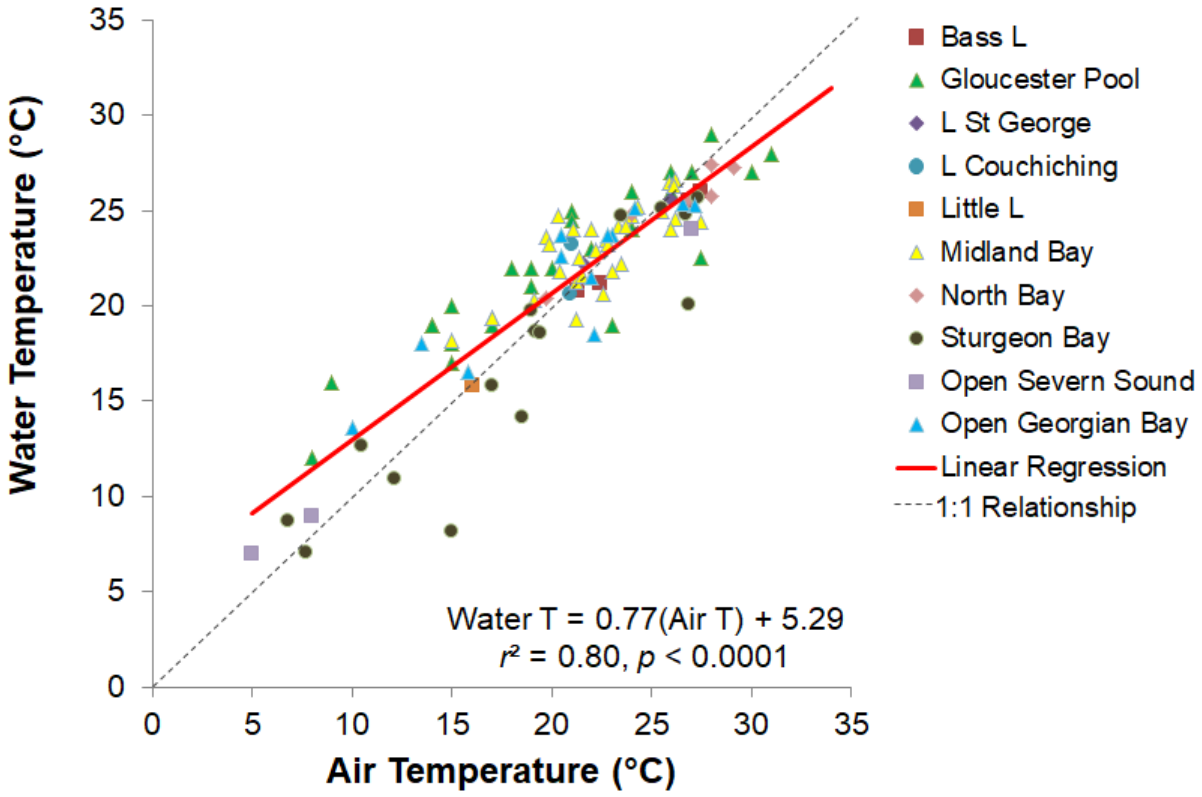


Figure 7. Water vs air temperature at all lake monitoring sites. The red line shows the linear relationship between the two variables. The dashed line shows a 1:1 relationship, which allows deviations from this relationship to be easily seen.

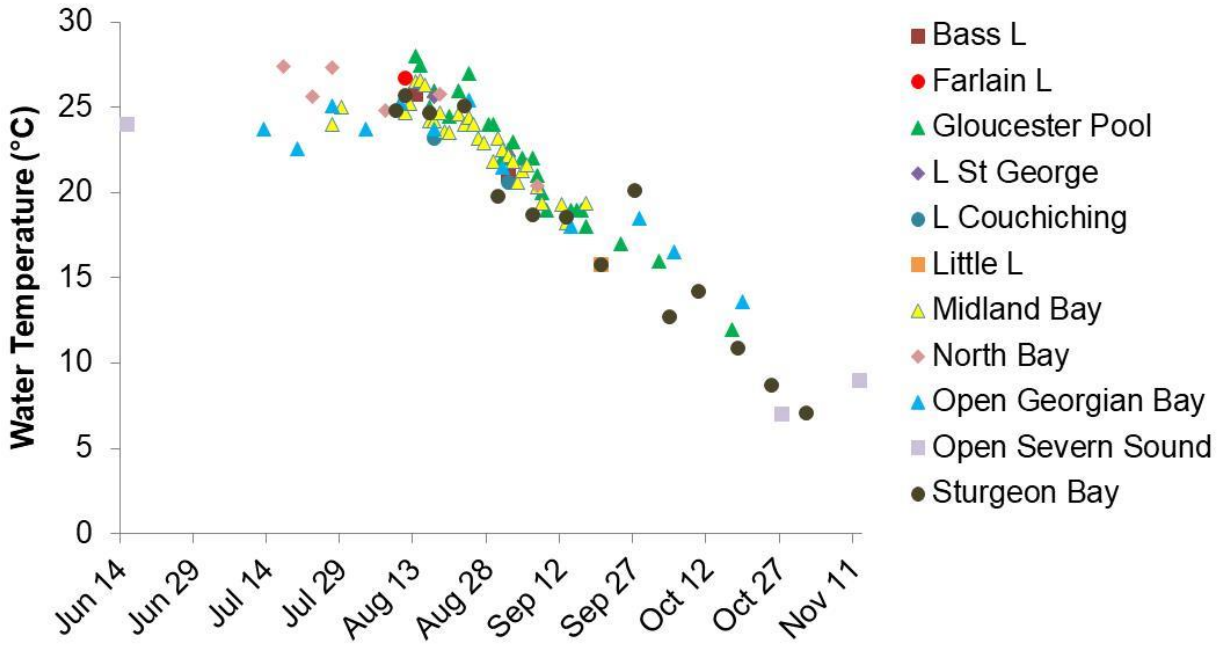


Figure 8. Water temperature at all lake monitoring sites.

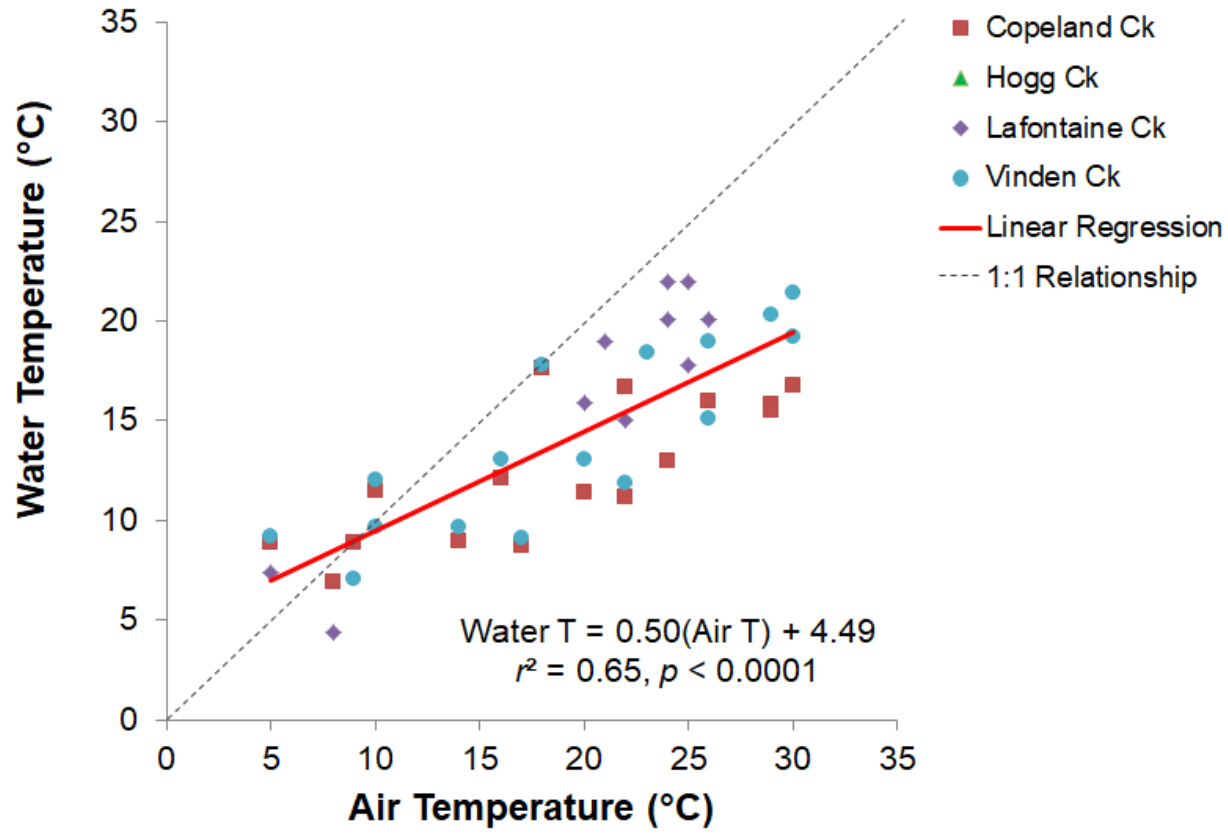


Figure 9. Water vs air temperature at all tributary monitoring sites. The red line shows the linear relationship between the two variables. The dashed line shows a 1:1 relationship.

Plant and Animal Sightings

Sightings included various types of mammals, birds, reptiles, amphibians, fish invertebrates and plants including:

- Mammals – Otter, Mink, Muskrat
- Birds – Common Tern, Ring-Billed Gull, Loon, Caspian Tern, Mallard, Cormorant, Blue Heron, Canada Goose, Merganser, Flycatcher, Tree Swallow, Osprey, Trumpeter Swans, Great Egret, Turkey Vultures, Crow, Robin,
- Reptiles – Northern Water Snake, Garter Snake
- Amphibians – Green Frog
- Fish – Shiner, Minnow, Catfish, Perch, Smallmouth Bass
- Invertebrates – Bumble Bee, Dragonflies, Tick, Tent Caterpillar, Sandfly, Caddisfly, Sedge Sprite Damselfly
- Plants – Duckweed, Watercress

Species at Risk Sightings

Sightings included Northern Map Turtle (*Graptemys geographica*) and Massasauga Rattlesnake (*Sistrurus catenatus*), both of which are known to occur in the area. Northern Map Turtle is listed as Special Concern, and Massasauga Rattle Snake is listed as Threatened (MECP, 2018).

A Madtom catfish was also reported, however this common name is sometimes used to refer to other species of catfish, and not the Endangered Northern Madtom (*Noturus stigmosus*), which is only known to occur in the St. Clair River, Lake St. Clair, the Detroit River, and the Thames River.

Invasive Species Sightings

Sightings included:

- Eurasian Watermilfoil (*Myriophyllum spicatum*),
- Japanese Knotweed (*Fallopia japonica*),
- Round Goby (*Neogobius melanostomus*),
- Phragmites (*Phragmites australis spp. australis*),
- Dog-Strangling Vine (*Cynanchum rossicum*),
- Glossy Buckthorn (*Frangula alnus*)
- Zebra & Quagga Mussels (*Dreissena polymorpha* and *bugensis*)
- European Gypsy Moth (*Lymantria dispar*)
- Cow Vetch (*Vicia cracca*),
- Colt's-foot (*Tussilago farfara*),
- Spotted Knapweed (*Centaurea stoebe*),
- Wild Carrot (*Daucus carota L.*)
- Mystery Snails (*Cipangopaludina chiensis & Viviparus georgianus*)

All of these invasive species have been reported as occurring extensively across the watershed. Sightings of Hydrilla (*Hydrilla verticillata*) and Parrot Feather (*Myriophyllum aquaticum*) were also reported. Neither of these species is currently reported to occur in Ontario, so these sightings may have been misidentifications; if possible, confirmation of species will be made in 2021 (Invasive Species Centre, 2021; OFAH/MNRF, 2016).

Algae

Several areas (Lake Couchiching, Gloucester Pool, Midland Bay, open Severn Sound) experienced filamentous and film-like algae growth on hard surfaces. While not harmful to human health, these types of algae can cause slipping hazards, and can indicate an imbalance in the aquatic ecosystem. This imbalance can be the result of excess nutrients entering the water, changing physical conditions (temperature, light), or a lack of grazers (mainly invertebrates). There was a blue-green algae bloom in July 2020 in the shallow area around Little Lake Park which was posted by the Simcoe Muskoka District Health Unit. No reports of blue-green algae blooms were submitted by volunteers.

Filamentous green algae patches were also reported in Copeland, Lafontaine, and Vindin Creeks, and may also be a sign of high nutrient conditions.

Human Impacts

Indications of human impact included: litter and fishing tackle (Bass Lake, Lake Couchiching, North Bay, Lafontaine Creek) yard waste (Bass Lake, Gloucester Pool), boat wakes and associated erosion and turbidity (Midland Bay, Gloucester Pool), and vehicles being driven on beach areas (Midland Bay).

Water Level Impacts

Impacts of high Georgian Bay water levels included nesting sites of waterfowl being flooded (Sturgeon Bay) and shoreline erosion (Midland Bay Woods Park).

High streamflow impacts included severe bank erosion, particularly at a river bend on Lafontaine Creek.

Restoration Needs

One volunteer pointed out the need for shoreline stabilization in Midland Bay Woods Park to deal with impacts from high Georgian Bay water levels. Another suggested livestock exclusion fencing upstream from the monitoring site, along with streambank stabilization on Lafontaine Creek.

Summary

Over the 2020 season, conditions were observed across the Severn Sound area. Major findings are summarized below:

- Several rain events over 30 mm occurred.
- Climate variables (rainfall, air temperature and wind) measured by volunteers compared well to other data sources, with the exception of wind conditions, which are highly variable from place to place.
- Water quality variables were generally within expected ranges based on existing SSEA data.
- Water clarity was low on Farlain Lake, low to moderate on Gloucester Pool, moderate in North Bay, moderate in Midland Bay, and moderate to high in Sturgeon Bay.
- Water clarity in tributaries was generally related to rain events.
- Lake water temperature was closely related to air temperature, while stream temperature was not as closely related.
- Tributaries ranged in thermal classifications from cold to warm water.
- Two species at risk were reported, Northern Map Turtle and Massasauga Rattlesnake.
- Numerous invasive species were reported.
- Several lake and tributary sites had filamentous green algae growth. No blue-green algae blooms were reported by volunteers, although a bloom did occur on Little Lake, which was posted by the Health Unit.
- Human impacts included littering, excessive boat wakes, yard waste and vehicle impacts.
- High water level and streamflow impacts included shoreline and streambank erosion and flooding of waterfowl nesting sites.
- Some restoration needs were pointed out relating to shoreline and streambank stabilization and livestock exclusion fencing.

This information will allow SSEA to identify sites for future restoration work as opportunities arise (e.g. invasive species removal projects, streambank stabilization), identify sites in need of protection (e.g. SAR habitat, coldwater tributaries), and track climate impacts on algae growth and on tributary runoff.

The 2020 citizen science monitoring season was a successful start to programs that will hopefully continue to grow and help to document changes in the watershed. As more information is gathered for each site, year to year changes can be documented.

A huge Thank-You to all of our volunteers for making this year such a success!

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Lake Couchiching, north end