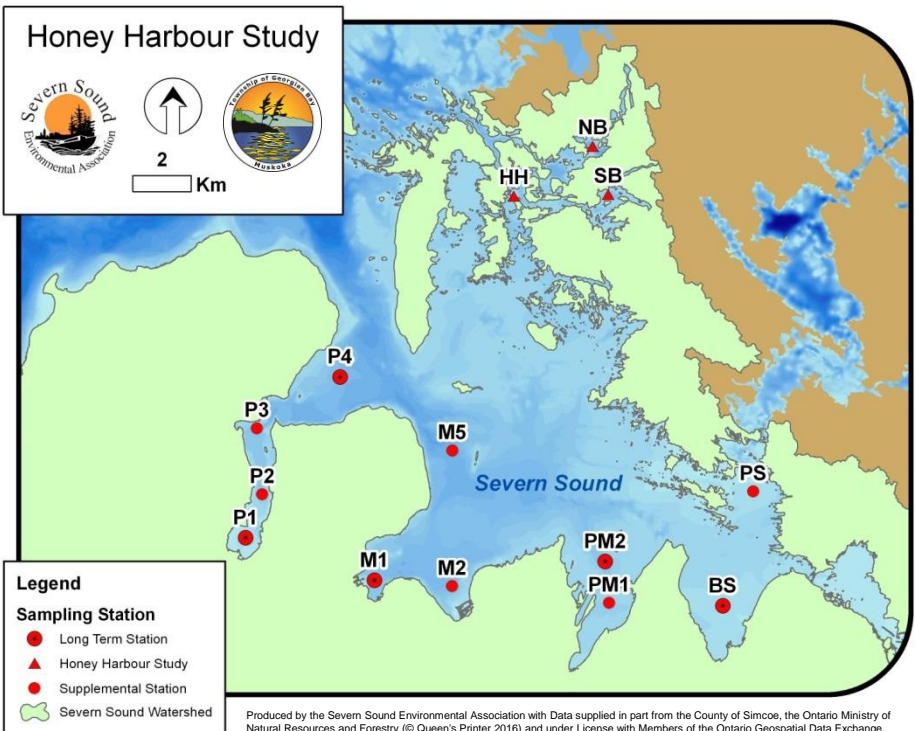


LONG TERM WATER QUALITY IN HONEY HARBOUR

The Honey Harbour area of Southern Georgian Bay is unique in many ways. The shoreline is rugged, and there are many small embayments, such as the upper portion of North Bay, that function more like inland lakes than open water. The Honey Harbour area is also more highly developed than the majority of the eastern Georgian Bay coastline. In this sensitive area, increased nutrient and sediment loading as well as introductions of invasive species can negatively impact water quality conditions without the implementation of sustainable management practices.

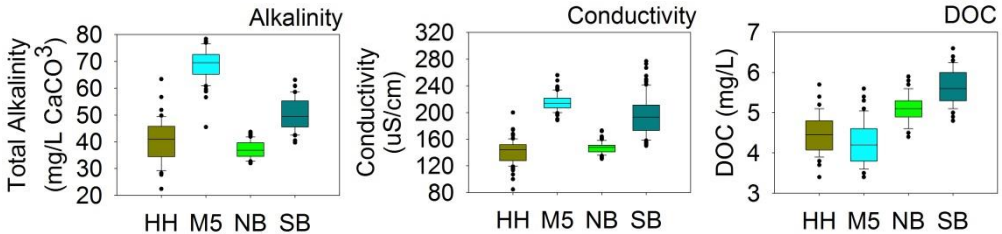
The Severn Sound Environmental Association has been monitoring water quality at three locations in the Honey Harbour area since 1998. Samples are collected every two weeks from ice out in late April/early May until fall turnover, which in upper North Bay can be as late as the end of November! Samples are analyzed for many water quality variables such as nutrients and basic chemistry, as well as algae and zooplankton communities. Water column profiles of temperature, dissolved oxygen, conductivity and algae pigments are also taken from the surface to just above the lakebed.



LONG TERM WATER QUALITY IN HONEY HARBOUR

Basic Water Chemistry

We can use basic water chemistry variables to tell us something about the influence of geology and land cover at each location. Data for alkalinity and conductivity, which indicate ionic composition, show that Honey Harbour (HH) and upper North Bay (NB) have similar water chemistry which is typical of Canadian Shield lakes, while open Severn Sound (M5) has much higher concentrations of ions due to the influence of the moderately hard waters of Georgian Bay. South Bay (SB) is somewhere in between, due to the connection with the Severn River via Baxter Lake. High concentrations of dissolved organic carbon (DOC), which impart a tea colour to the water, show the influence of wetlands on NB and SB.






Nutrient Enrichment Indicators

Several indicators are used to determine the level of nutrient enrichment, or trophic status, of a water body. Phosphorus and nitrogen are essential nutrients that, when present in high amounts, can lead to excessive algae and/or aquatic plant growth. Algae growth is measured by chlorophyll *a* concentration and by microscope counts. Water clarity, as measured by Secchi disk depth, can indicate the amount of algae present as well, but is also related to the concentration of DOC and sediment in the water.

Large quantities of algae can be problematic for aesthetic and health reasons, and can also contribute to low oxygen in the bottom waters. When algae cells die, they sink to the bottom where they are consumed by bacteria – a process which uses oxygen. This oxygen cannot be replenished if strong temperature gradients are present, as they are in NB and SB, since the zone of rapid temperature decline acts as a lid, cutting off the cooler bottom waters from the atmosphere. Low bottom water oxygen can occur naturally under the right conditions of basin shape and temperature gradients, and does not always indicate impact from human-caused nutrient enrichment.

LONG TERM WATER QUALITY IN HONEY HARBOUR

Trophic Status Variable	North Bay	South Bay	Honey Harbour	Open Waters
Phosphorus	↔	↔	↔	↔
Nitrogen	↔	↔	↔	↓
Water Clarity	↓	↓	↓	↔
Chlorophyll <i>a</i>	↔	↔	(insuff. data)	↔
Algae Counts	↔	↑	↑	↔
Min. Bottom DO	↔	↔	↑	↑

 No change
  Increase
  Decrease
 Based on Mann Kendall trend tests

Water Quality Trends in Honey Harbour

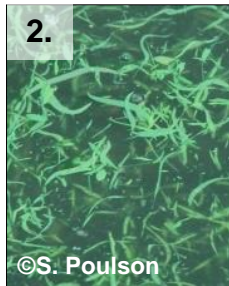
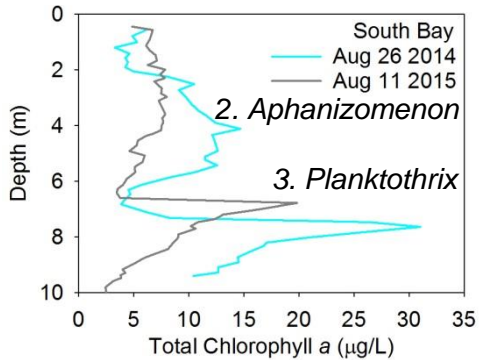
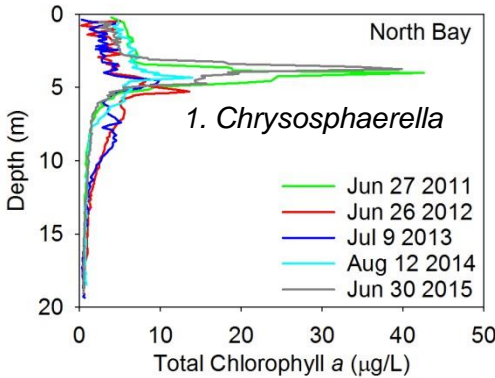
Since monitoring began, total phosphorus (TP) and total nitrogen (TN) concentrations have held steady at a long term average [and 95% confidence interval] of 13 [± 0.8] µg/L TP and 365 [± 16] µg/L TN for NB, 15 [± 1.4] µg/L TP and 385 [± 19] µg/L TN for SB, and 10 [± 0.4] µg/L TP and 347 [± 17] µg/L TN for HH. Water clarity is decreasing at all locations monitored in the Honey Harbour area. The amount of algae measured by counts has increased at HH and SB in recent years. The bottom waters of NB and SB consistently go anoxic by mid-summer with the strengthening of temperature gradients. Minimum concentrations of bottom water (1 m off bottom) dissolved oxygen (DO) have remained steady at NB and SB and have increased at HH and M5.

Algae in Honey Harbour

Algae respond readily to changes in temperature, light, and nutrient concentration and availability. Most algae obtain all of their energy through photosynthesis and require high amounts of light and nutrients. Some groups, called mixotrophs, are able to ingest organic material and bacteria as a way to deal with low light or low nutrient concentrations. One particular mixotroph called *Chryso-sphaerella* is present in large amounts at specific depth ranges in NB.

LONG TERM WATER QUALITY IN HONEY HARBOUR

The type of algae dominant in nearby South Bay, a mere 4.5 km away as the fish swims, is very different from North Bay. A low-light adapted species of blue-green algae called *Planktothrix agardhii* is dominant in August in a narrow depth range deep in the water column around 7 m. Another blue-green species called *Aphanizomenon flos-aquae* dominates over a wider depth range, peaking around 4 m. The photos below correspond with the algal taxa responsible for the peak in total chlorophyll *a*, as measured using a device that measures pigment called a fluorometer.



Both blue-green species have the potential to produce cyanotoxins under the right conditions, which can be harmful to pets and can cause skin and gastrointestinal irritation in humans. Monitoring of the density and distribution of these various species is important. Fortunately the depth of the blue-green layers in SB do not generally correspond to where people swim.

For more information, check out the 2010-2012 Honey Harbour report on our website, www.severnsound.ca. To report a suspected algae bloom, or to learn more about our Shore Watch program, call our Midland office at (705) 527-5166. Funding from the Ministry of Environment and Climate Change through the Canada-Ontario Agreement is gratefully acknowledged.

