BLACKSTONE LAKE WATER QUALITY TESTING 2016

Conducted by Digby and Valerie Sale

BLACKSTONE LAKE COTTAGERS ASSOCIATION

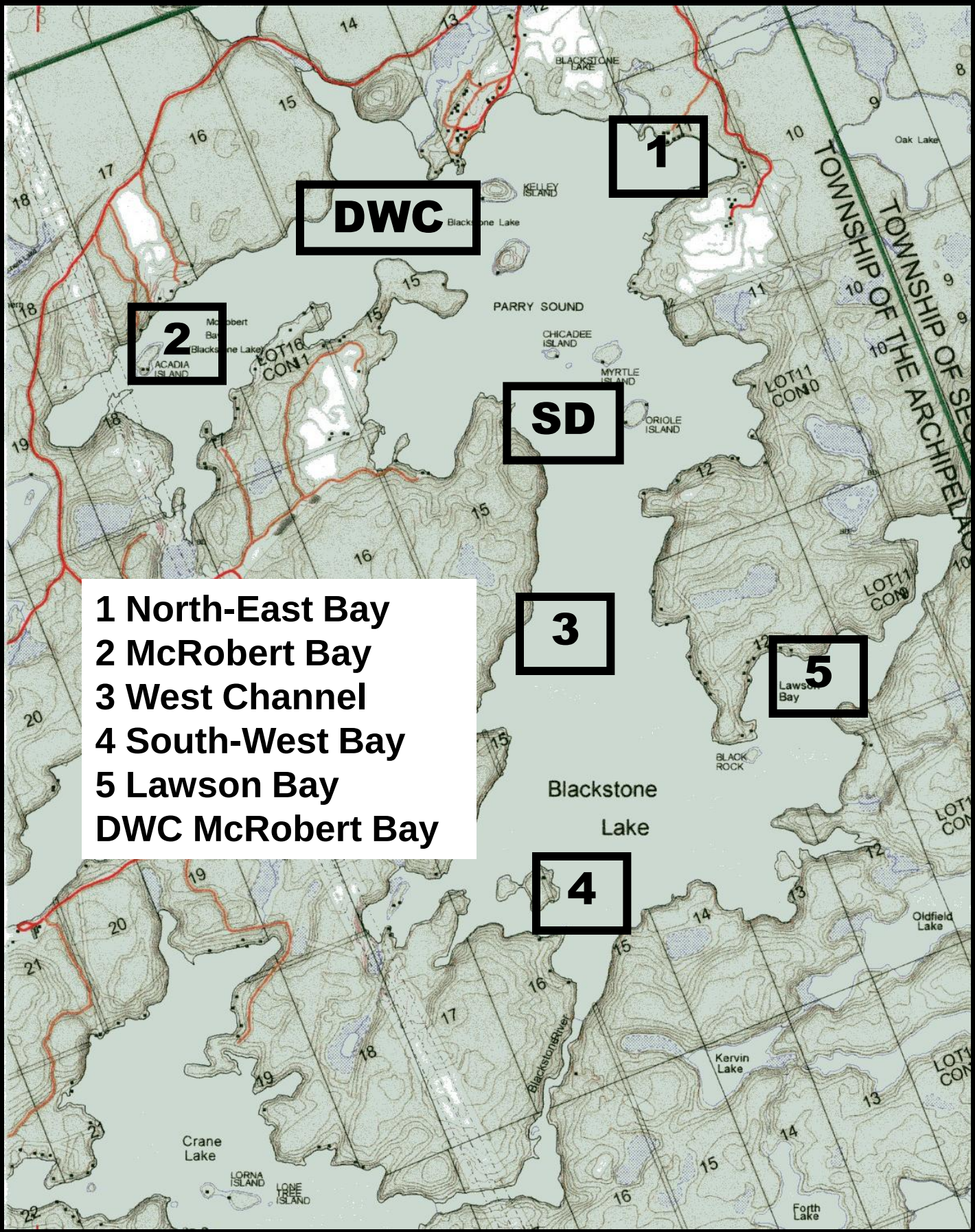
BLACKSTONE LAKE WATER QUALITY TESTING 2016

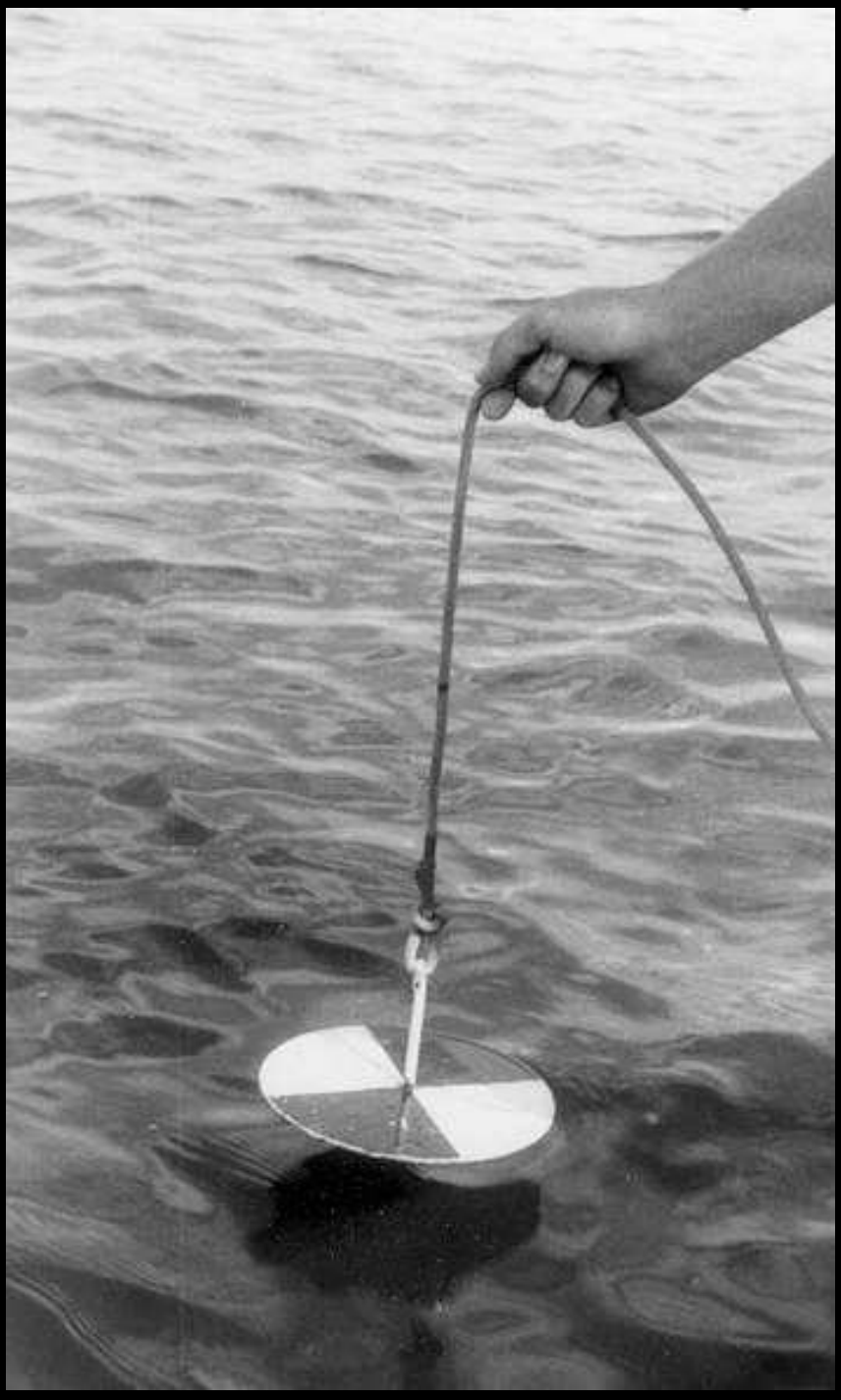
The Blackstone Lake Cottagers Association conducts three tests of water quality each season: 1) bacterial concentration; 2) water clarity; 3) phosphorus and calcium concentration. The bacterial and water clarity tests are sponsored by the Township of the Archipelago. The phosphorus /calcium concentration test is sponsored by Ontario's Lake Partner Program (LPP). The LPP also includes water clarity test results; therefore, water clarity results are submitted to both the township and the Lake Partner Program.

Bacterial Concentration. Blackstone Lake was sampled for total coliform (TC) and *E. coli* (EC) at six sites on several dates during the summer season. The six sites are named: 1) North-East Bay ; 2) McRobert Bay ; 3) West Main Channel; 4) South-West Bay); 5) Lawson Bay; 6) Deep Water Control (DWC). DWC is done in deep water in McRobert Bay in line with the outflow from the Blackstone River. The DWC site provides a comparison to sites 1-5, at which samples are taken is shallow water (see below). All sample sites are marked on the map on page 2. The bacterial tests consist of taking water samples in shallow water (50 cm or 1.5 ft). (The exception is site 6, Deep Water Control, in which the sample is taken in deep water.) The sample bottle is lowered to a depth of 22-30 cm (9-15 in.) for sample collection. Once all samples have been collected, sampled water is transferred from the collection bottles onto coliplates and incubated at 35ºC (95ºF) for 24-26 hours. To test for reproducibility, water from one site is transferred to two coliplates so that duplicate readings can be made. An additional control is provided by transferring distilled water onto one coliplate. After incubation, coliplates are viewed to determine bacterial concentration. The number of "blue" wells (out of a total of 96) in each coliplate indicates TC concentration. The number of blue wells that fluoresce (out of 96) indicates EC concentration. Using a provided table, the number of blue and fluorescent wells is converted to ***Most Probable Number (MPN)*** of (bacterial) colony-forming units (cfu) per 100 ml sample.

Water Clarity. Water clarity was assessed with Secchi disk readings. These readings were made under controlled conditions (calm water with sunshine at similar time of day) at a designated site (main channel, marked as SD on the map on page 2). On each test date, two measurements were made and averaged. An illustration of a Secchi disk is on page 3.

Phosphorus and Calcium Concentration. Phosphorus and calcium concentration is measured once (duplicate samples) early in the season (May-June) at the SD site (central location of lake). Water samples are sent to Lake Partner Headquarters for analysis.


1
DWC
2
SD
3
5
4
1 North-East Bay
2 McRobert Bay
3 West Channel
4 South-West Bay
5 Lawson Bay
DWC McRobert Bay
BLACKSTONE LAKE
KELLEY ISLAND
PARRY SOUND
CHICADEE ISLAND
MYRTLE ISLAND
ORIOLE ISLAND
ACADIA ISLAND
LOT16 CON1
LOT11 CON10
TOWNSHIP OF THE ARCHIPELAGO
Oak Lake
BLACK ROCK
Blackstone Lake
Oldfield Lake
Kervin Lake
Crane Lake
LORNA ISLAND
LONE TREE ISLAND
Forth Lake



Secchi disk (SD) about to be lowered into water. SD depth is the greatest depth (measured in metres) at which disk pattern can be visualized

SUMMARY OF RESULTS

Bacterial Concentrations

The **Total Coliform (TC) Concentration** for 2016, averaged across test sites and dates, was **123 ± 194 MPN** (average ± standard deviation). This average exceeded the Township of Archipelago (TOA) objective (100 MPN). Past Provincial Regulatory Guidelines for TC were >1000 MPN being unsuitable for recreational use, >200 indicating deteriorating water quality, and >10 being unsafe for human consumption. *However, TC is no longer used as a regulatory guideline in Provincial Water Quality Objectives, since TC levels have been found to be too variable and are largely considered to be a natural component of ecosystems. Therefore, undue significance should not be placed on TC values that exceed the former provincial guideline.* The **E. *coli* (EC) Concentration** for 2016, averaged across the 5 test sites and 5 test dates, was **1.4 ± 1.9 MPN**. This average met (i.e., was lower than) the Township of Archipelago (TOA) objective (10 MPN). Provincial Regulatory Guidelines for EC are >100 being unsuitable for recreational use, and >0 being unsafe for human consumption.

The results for 2016 continue a pattern of high (relative to TOA objective of 100 MPN) TC and low EC values relative to Township and Provincial objectives. At present there is no explanation for the high TC values; however, high variability in TC levels is considered to be a natural component of ecosystems.

Discontinuance of Bacterial Monitoring

In late 2016, the township relinquished its sponsorship of volunteer water quality testing, and transferred this responsibility to The Georgian Bay Biosphere Reserve (GBBR). GBBR has recommended ending the volunteer bacterial monitoring but continuing with participation in the Lake Partner Program. A review of the bacterial monitoring program came to the conclusion that the data produced had limited value. Instead, it is recommended that bacterial monitoring be done in the framework of scientific investigations focused on testing specific hypotheses on potential sources of contamination through a focused sampling program. For example, recreational sites (e.g. beaches) could be considered for bacteria monitoring as per the province's Beach Management Guidance Document. Presumably, the bacterial testing would be done by trained staff using methods more precise than those available to those participating in the volunteer program.

Therefore, beginning in 2017, Blackstone Cottagers Association's volunteer water quality testing will consist of participation in the Lake Partner Program, which consists of water clarity (Secchi disk) readings throughout the season and one-time (May-June) water sample tests for calcium and phosphorous.

LAKE PARTNER PROGRAM RESULTS

Water Clarity (Secchi Disk Depth)

The 2016 season average for Secchi disk (SD) depth was **5.5 ± 0.2 m**. There is no Township Objective or provincial guideline for Secchi disk depth. Greater disk depths indicate greater water clarity. Greater water clarity is associated with lower algae concentration, which in turn is associated with a lower phosphorus concentration. Blackstone's SD depths indicate excellent water clarity and thus a relatively low phosphorus concentration (which was confirmed with direct phosphorus measurements, see below).

Phosphorus and Calcium Concentration

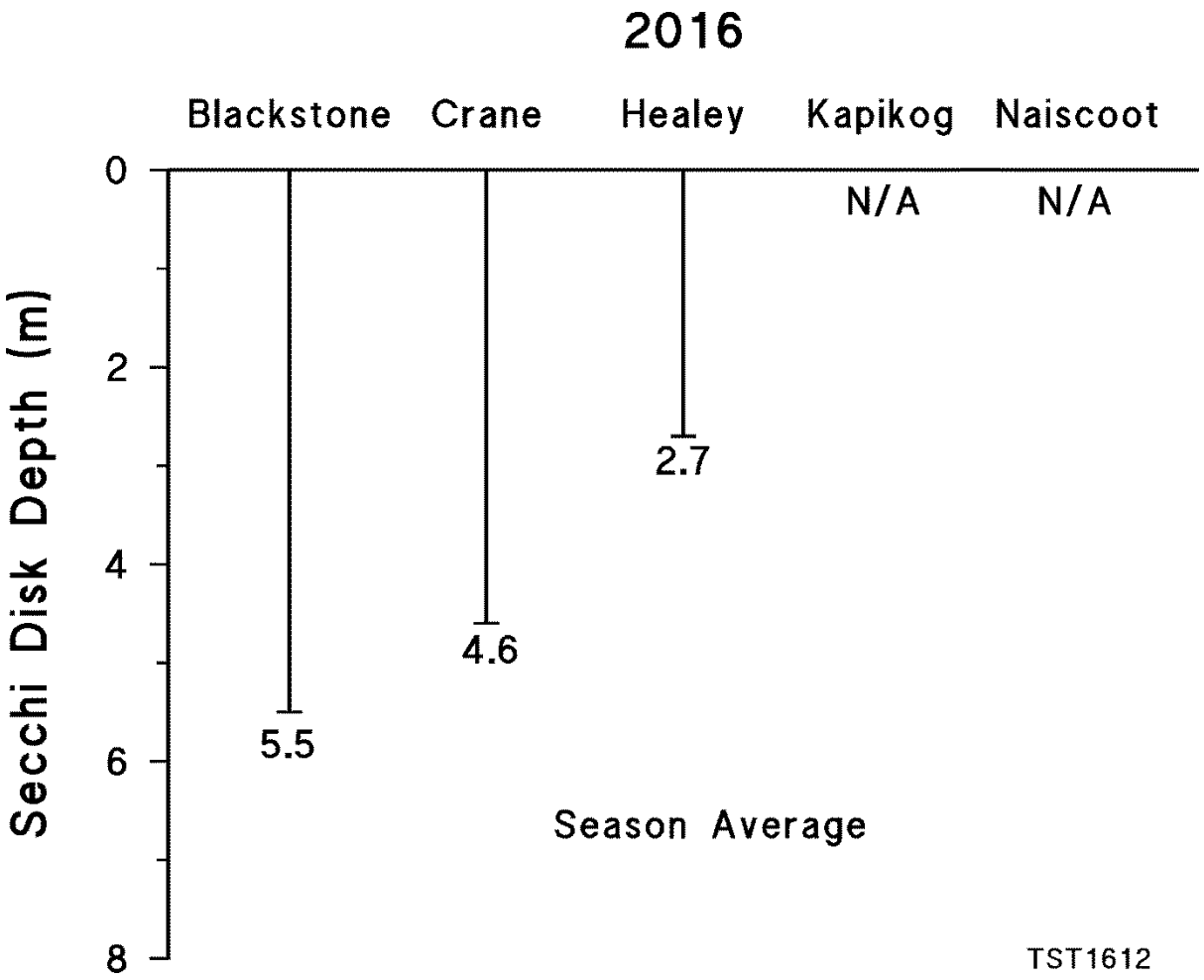
Blackstone Lake's phosphorus concentration for 2016 was **5.7 µg/L**. Lakes are classified as *Oligotrophic* (<10 µg/L), *Mesotrophic* (10-20 µg/L) and *Eutrophic* (>20 µg/L). Based on phosphorus concentration recorded over a period of years, Blackstone Lake would be classified as Oligotrophic. Oligotrophic lakes, because of their low phosphorus concentration, do not support dense aquatic vegetation and are much less susceptible to algae growth and algae blooms.

Calcium results are not yet available for 2016, but are likely to be similar those of six measurements made from 2009 to 2015, indicating a relatively low calcium concentration (3.8 mg/L).

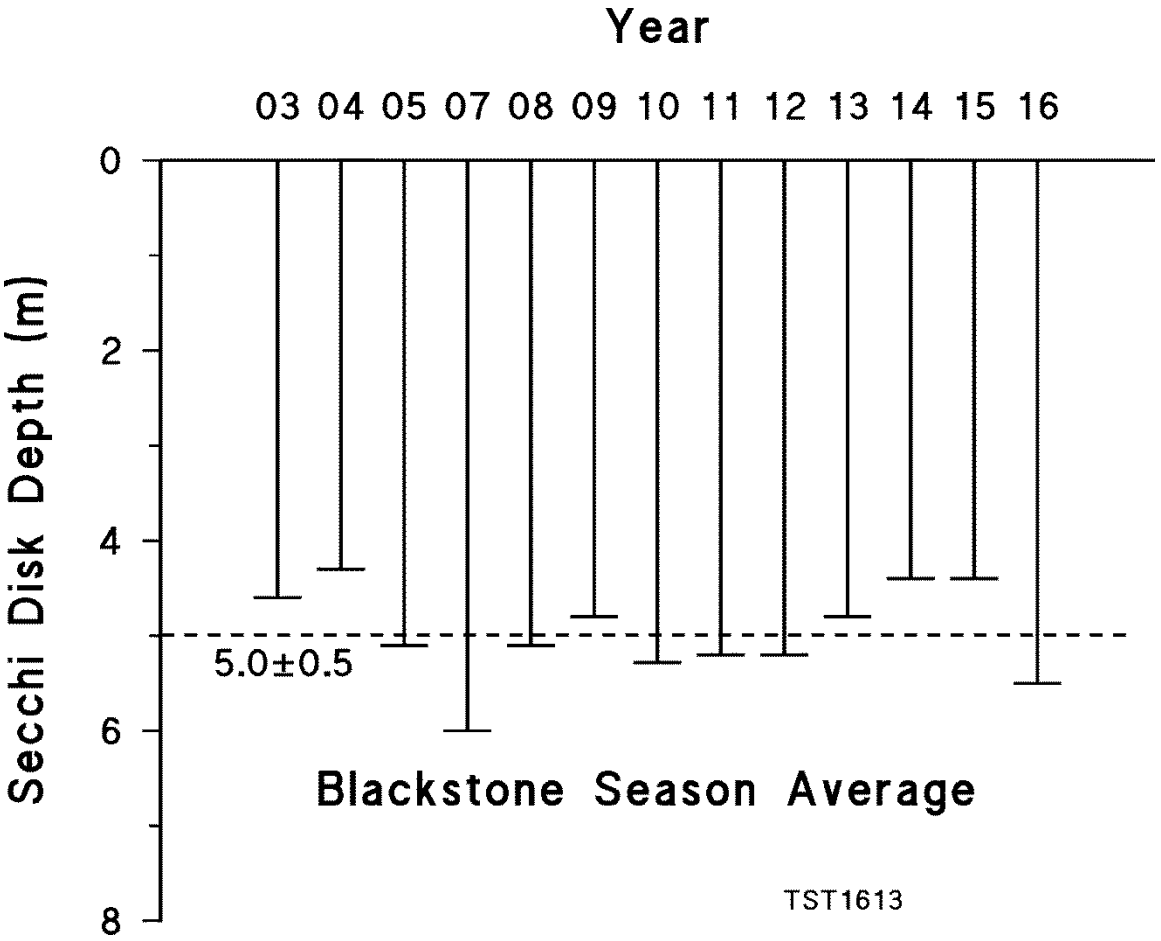
Note: detailed results are given in the following pages.

Water Clarity (Secchi Disk Depth)

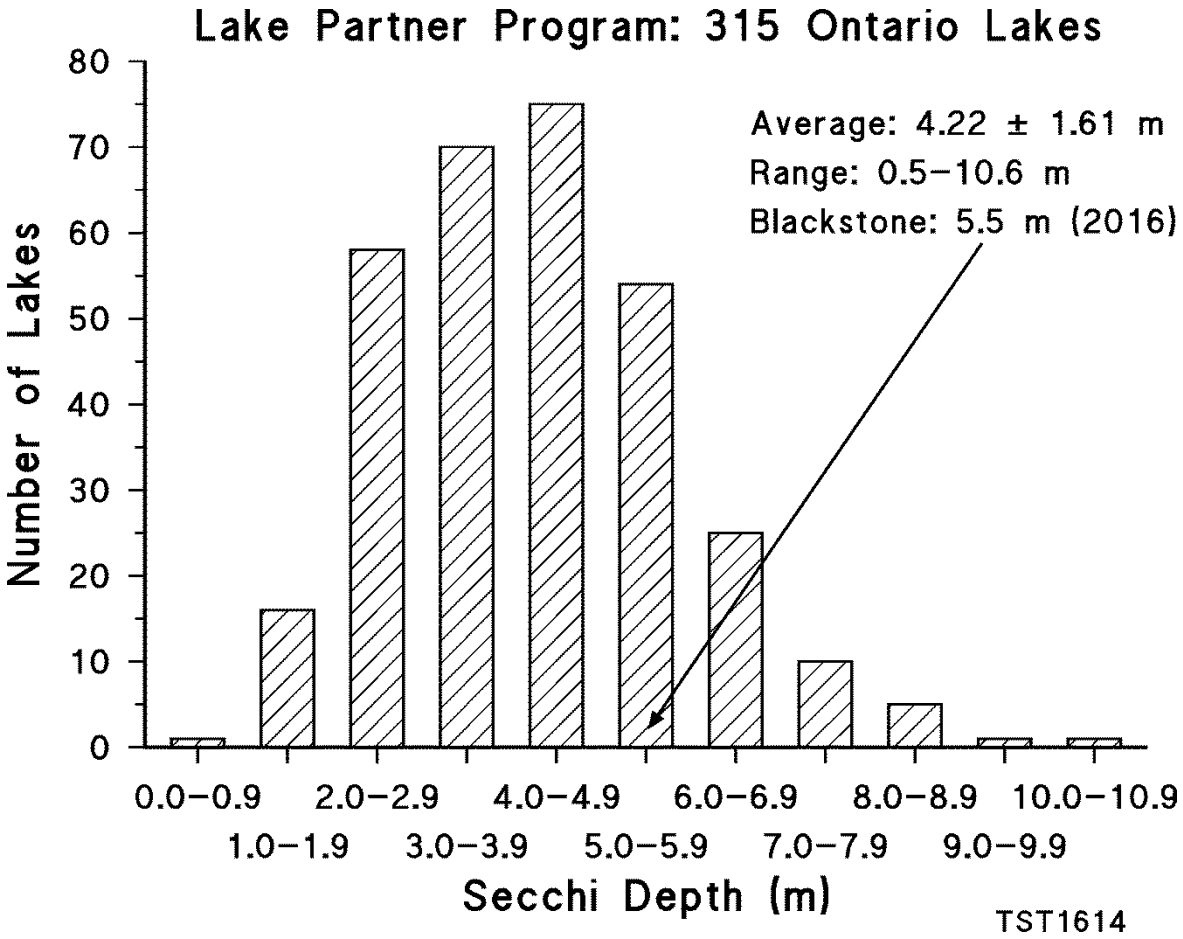
The figure below shows the average Secchi disk depth for 2016, along with depth recorded for some neighbouring lakes. Blackstone's average depth was 5.5 m. There is no Township Objective or provincial guideline for Secchi disk depth. Greater disk depths indicate greater water clarity. Greater water clarity is associated with lower algae concentration, which in turn is associated with a lower phosphorus concentration. Blackstone's disk depths indicate very good water clarity and thus a relatively low phosphorus concentration.



Blackstone's Secchi Disk Depth readings from 2003 to 2016. Disk depths are shown as season averages. The average over this period is 5.0 m. There is no Township Objective or provincial guideline for Secchi disk depth. Greater disk depths indicate greater water clarity. Greater water clarity is associated with lower algae concentration, which in turn is associated with a lower phosphorus concentration. Blackstone's disk depths indicate very good water clarity and thus a relatively low phosphorus concentration.

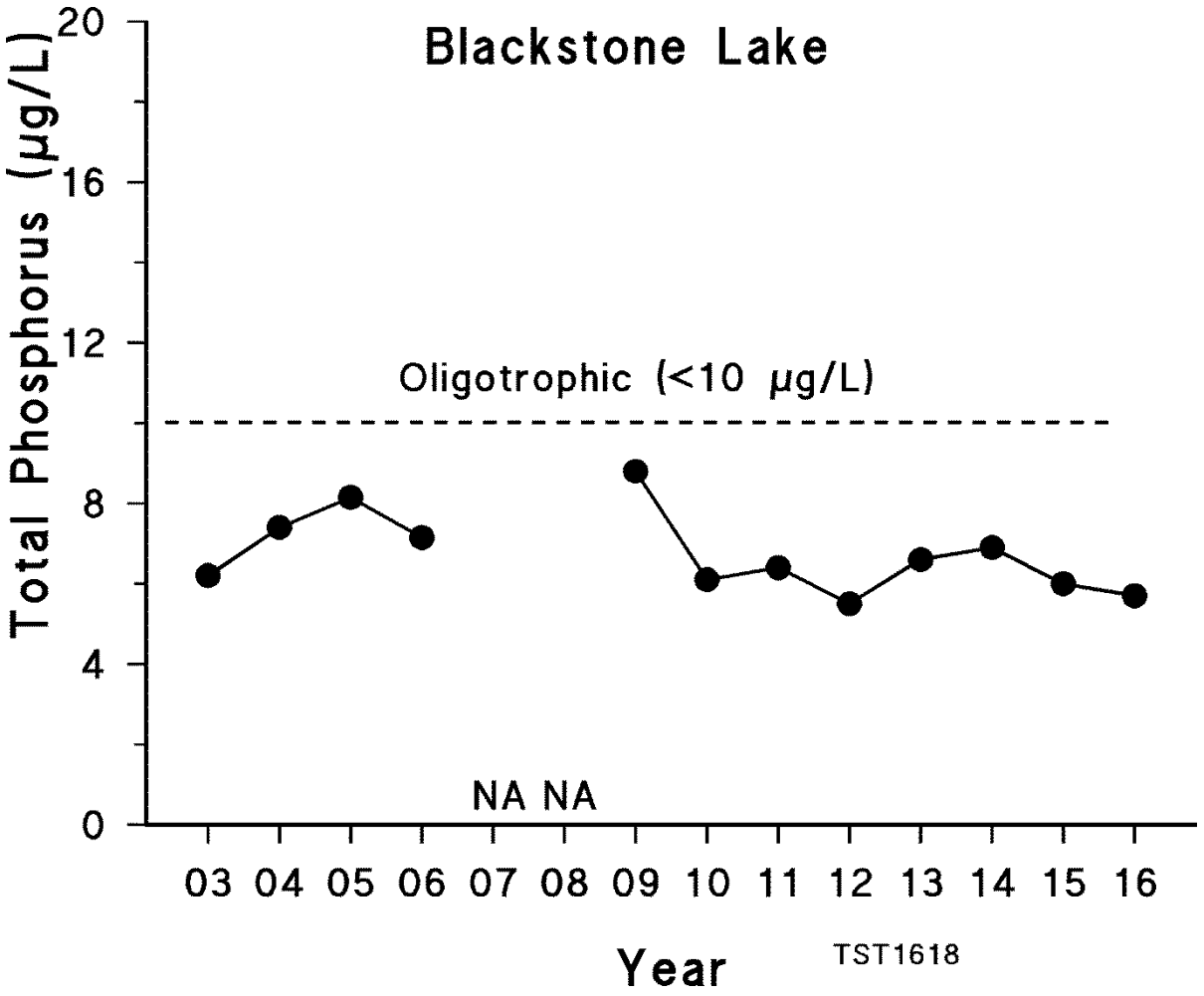


Blackstone's 2016 Secchi Disk Depth compared to the distribution of readings made in 315 Ontario Lakes. Blackstone's 2016 season average (5.5 m) was greater than the average depth (4.22 m) for 315 lakes. There is no provincial guideline for Secchi disk depth. Greater disk depths indicate greater water clarity. Greater water clarity is associated with lower algae concentration, which in turn is associated with a lower phosphorus concentration. Blackstone's disk depths indicate very good water clarity and thus a relatively low phosphorus concentration.

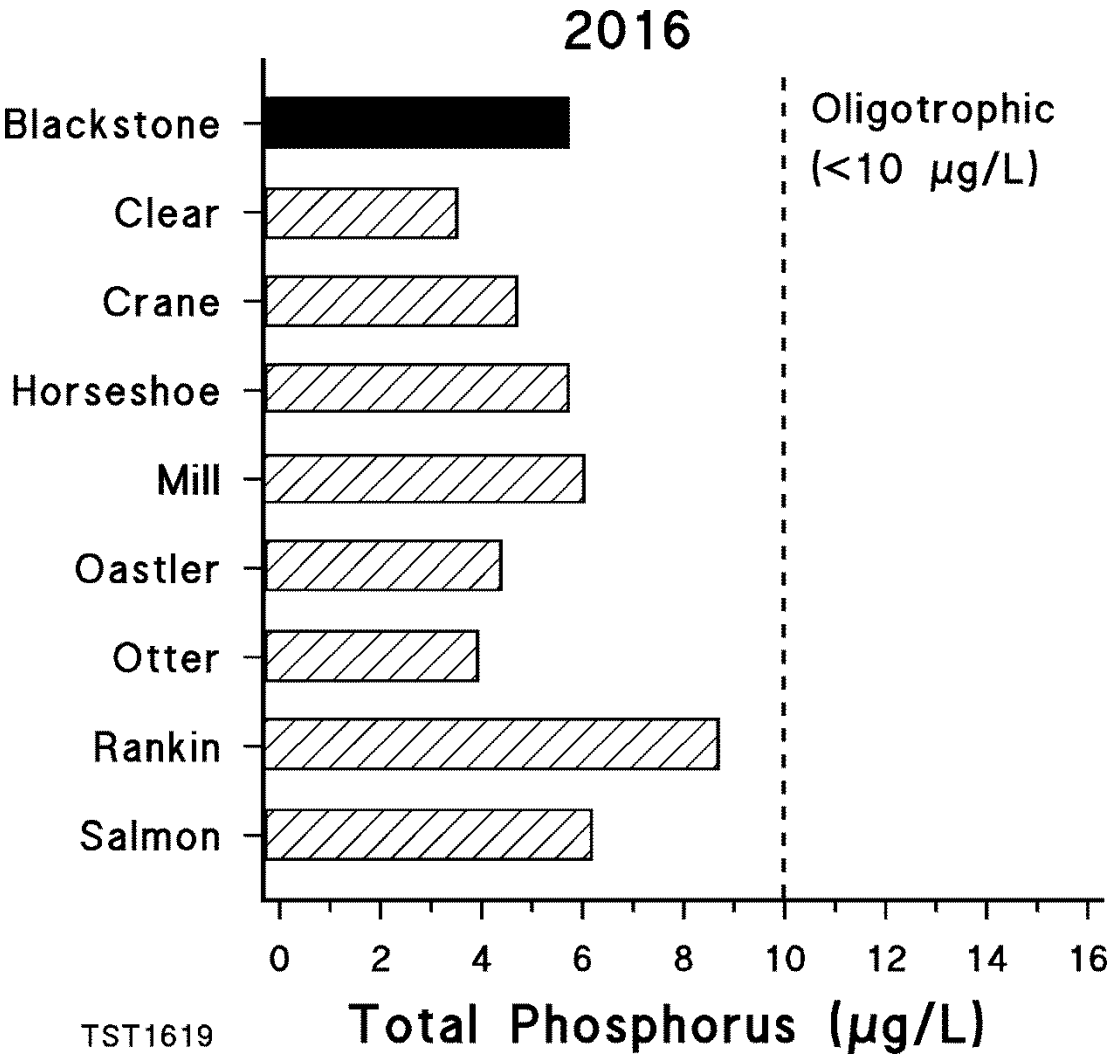


Phosphorus Concentration

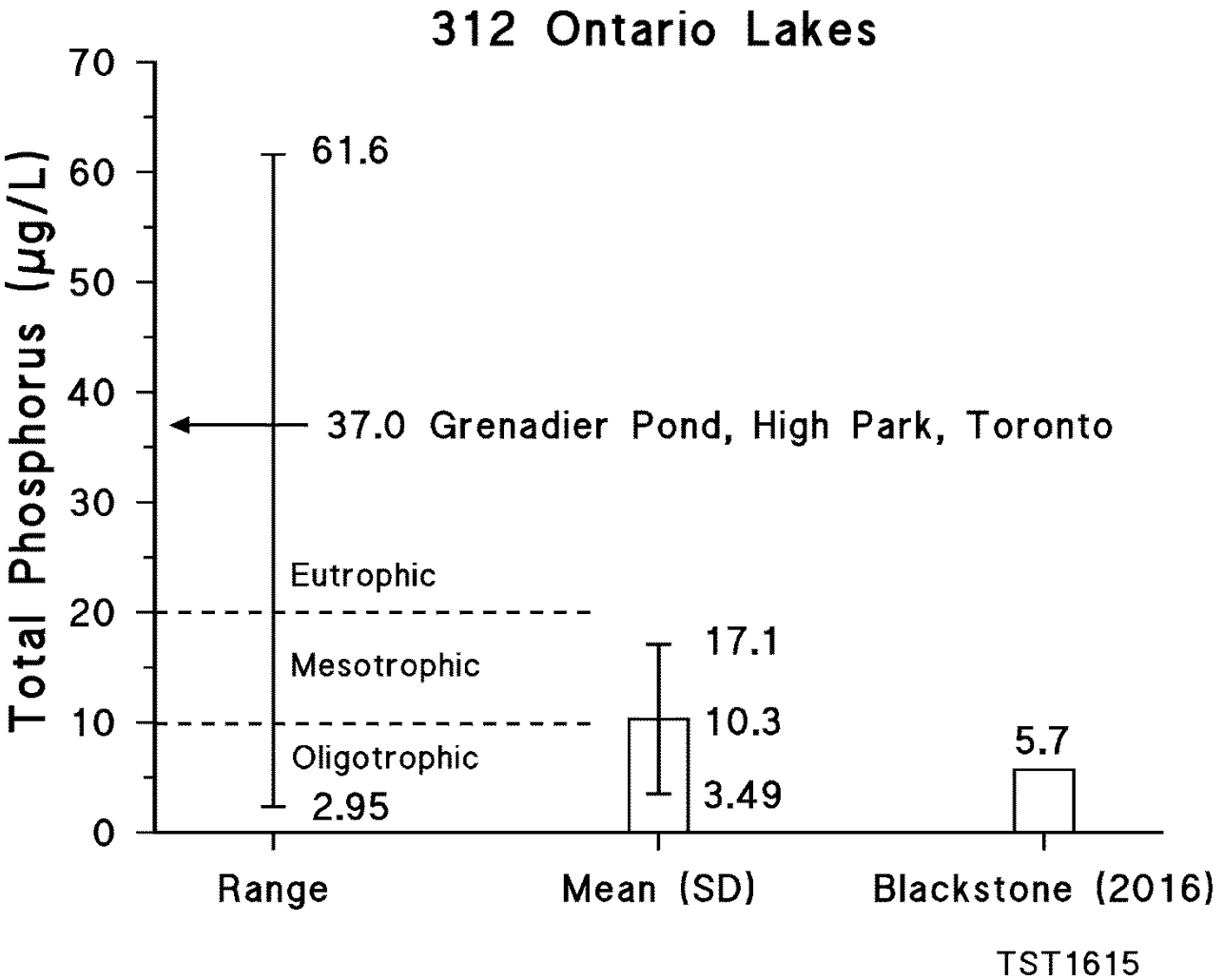
The figure below shows Blackstone Lake's phosphorus concentration from 2002 to 2016. For 2016, Blackstone Lake's phosphorus concentration was 5.7 µg/L. Since 2003, all phosphorus concentrations have been below 10 µg/L. Lakes are classified as *Oligotrophic* (<10 µg/L), *Mesotrophic* (10-20 µg/L) and *Eutrophic* (>20 µg/L). Based on phosphorus concentration recorded over a period of years, Blackstone Lake would be classified as Oligotrophic. Oligotrophic lakes, because of their low phosphorus concentration, do not support dense aquatic vegetation and are much less susceptible to algae growth and algae blooms.



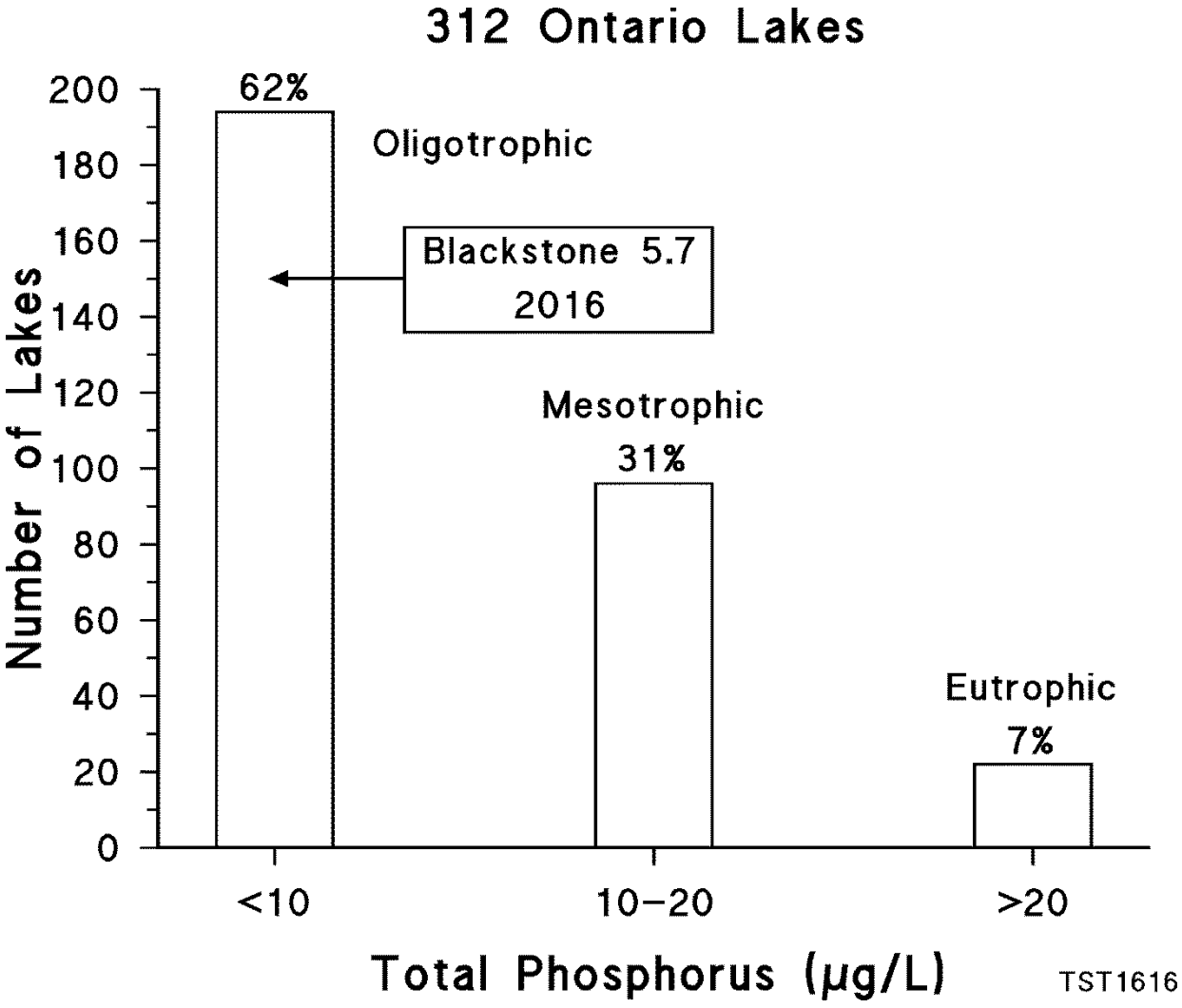
This figure compares Blackstone Lake's 2016 phosphorus concentration with some other lakes in the region. For each lake values are from 2016 All of these lakes would be classified as Oligotrophic (<10 µg/L). Oligotrophic lakes, because of their low phosphorus concentration, do not support dense aquatic vegetation and are much less susceptible to algae growth and algae blooms.



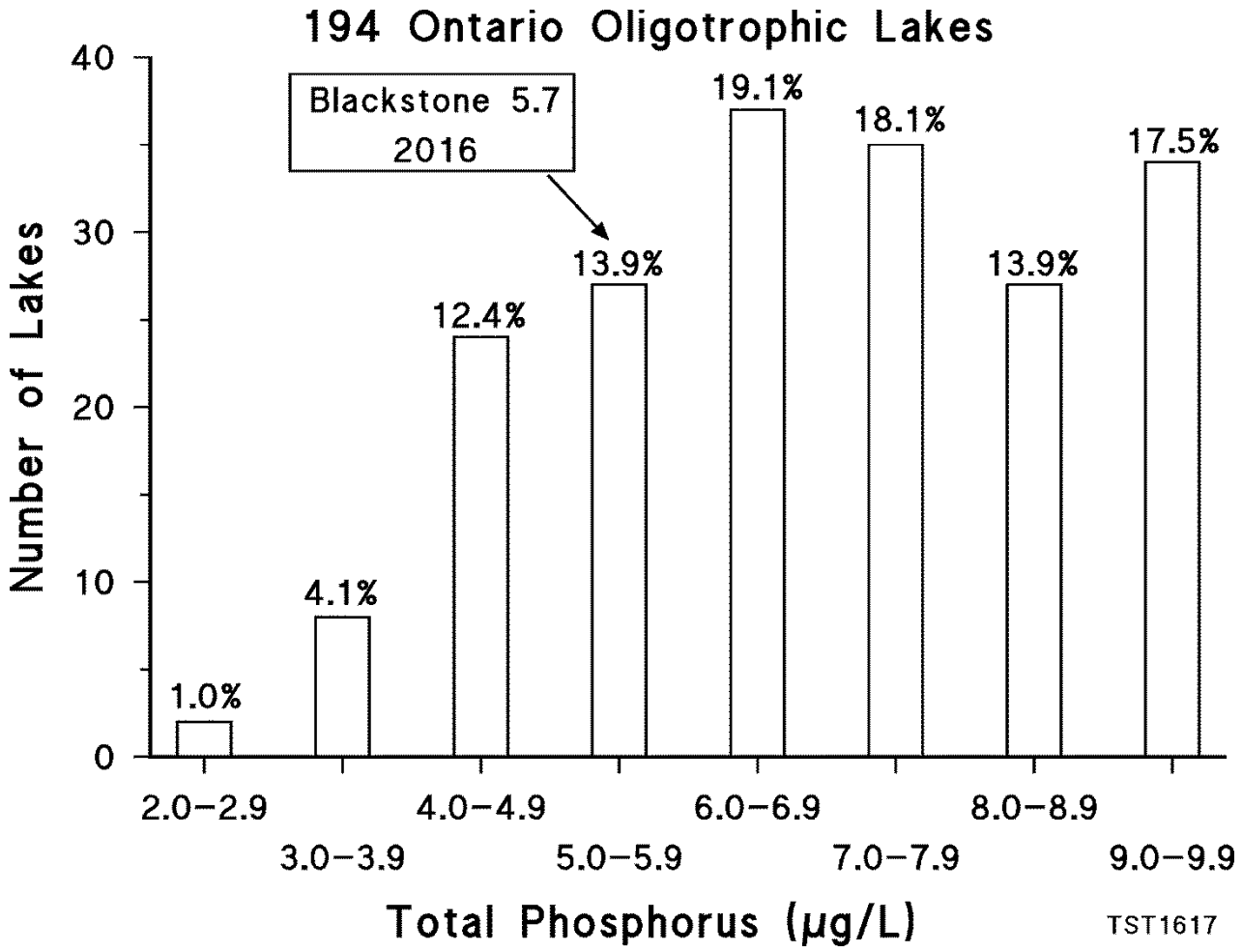
This figure puts Blackstone Lake's phosphorus concentration into a larger perspective. In 312 Ontario lakes, phosphorus concentration ranged from ~3 to 60 µg/L. Grenadier Pond is an example of an Eutrophic body of water. The average (mean) concentration across all 312 lakes was 10.3 µg/L. The standard deviation (SD) indicated that about 70% of the lakes had concentrations between 3.5 and 17.1 µg/L. Lakes are classified as *Oligotrophic* (<10 µg/L), *Mesotrophic* (10-20 µg/L) and *Eutrophic* (>20 µg/L). Thus, the average phosphorus concentration of 10.3 µg/L is just above the Oligotrophic limit (<10 µg/L). Blackstone Lake's value for 2016 (5.7 µg/L) and in previous years puts it in the Oligotrophic group. Oligotrophic lakes, because of their low phosphorus concentration, do not support dense aquatic vegetation and are much less susceptible to algae growth and algae blooms.



This figure puts Blackstone Lake's phosphorus concentration into a larger perspective in a different way. The majority (62%) of tested lakes were classified as Oligotrophic (<10 µg/L). Blackstone Lake's phosphorus concentration in 2016 (5.7 µg/L) and in previous years puts Blackstone in the majority Oligotrophic group.

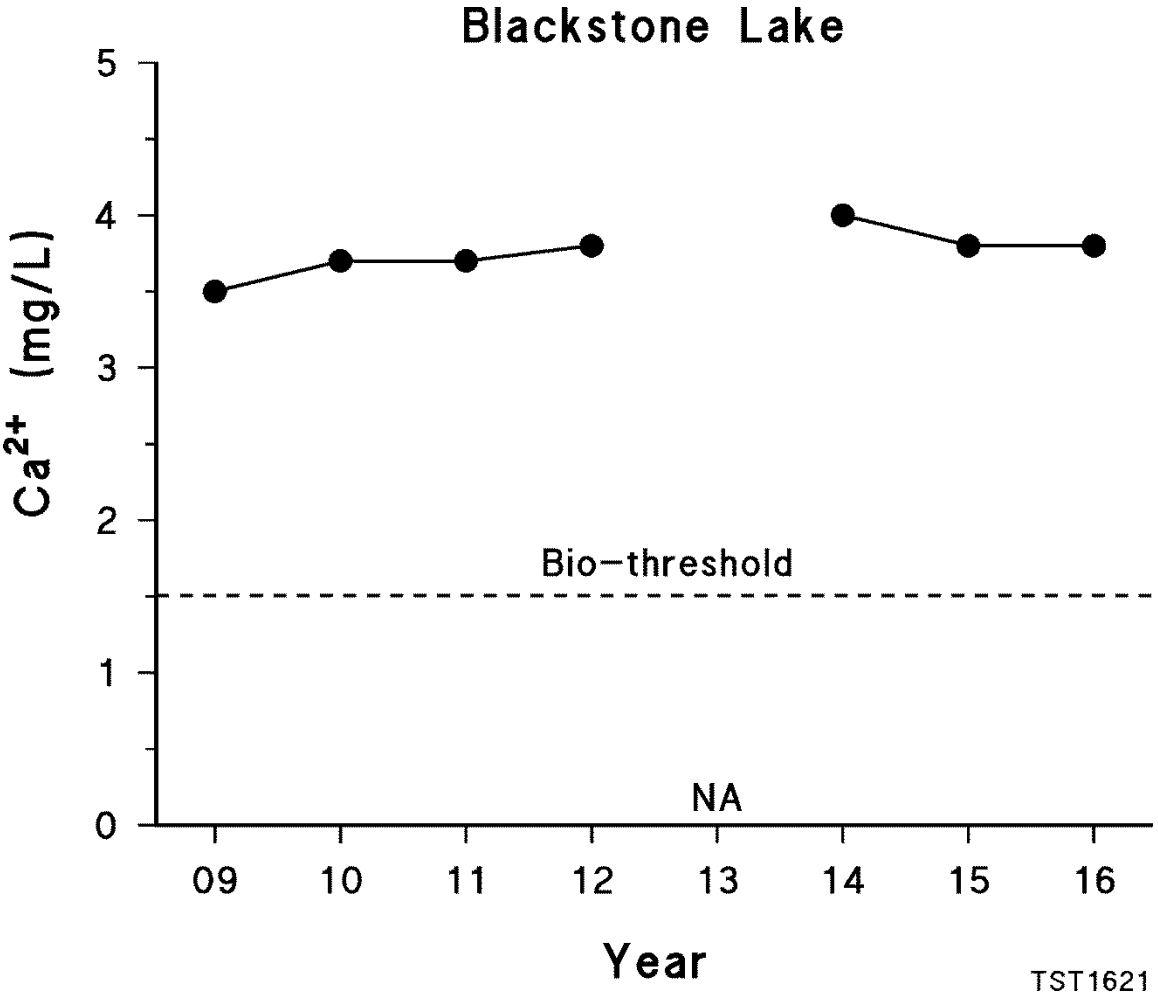


This figure shows the distribution of phosphorus concentration in 194 Ontario lakes classified as Oligotrophic (<10 µg/L). Blackstone Lake's phosphorus concentration for 2016 (5.7 µg/L) falls approximately in the middle of the distribution.



Calcium Concentration

The figure below shows Blackstone Lake's calcium concentration (Ca^{2+}) from 2009 to 2016. The 2016 value was estimated because there was as yet an unidentified problem with the calcium analysis. Canadian Shield lakes like Blackstone, with granite rock beds, tend to have relatively low calcium. Calcium at or below the bio-threshold of 1.5 mg/L is a threat to some forms of aquatic life. Climate change and re-growth of harvested forests are two factors tending to decrease calcium in lakes.



The figure below shows Blackstone Lake's 2016 estimated calcium concentration (Ca^{2+}) in comparison to other area lakes that share a similar granite rock bed. Also included is Lake Huron, which has sections of both granite and limestone rock beds. The limestone contributes to Huron's relatively high calcium level. The survival threshold for Zebra mussels is a calcium concentration of about 15 mg/L; therefore, Zebra mussels can colonize Lake Huron. Blackstone, with its low calcium level, would not support Zebra mussel colonization if they were inadvertently introduced into the lake.