Rebecca Rossi
Federation of Ontario Cottagers' Associations
September, 2017

Secchi Trends Across the Province

The Secchi disk is one of the simplest and most effective tools to measure your lake's water transparency (or clarity). This factsheet provides background information on the Secchi disk, describes recent trends in Lake Partner Program water transparency data, and provides helpful answers to questions that we commonly receive.

The Lake Partner Program

Since 1996, the Ministry of the Environment and Climate Change's Lake Partner Program (LPP) has organized volunteers to monitor lake water quality across Ontario. The LPP now includes over 600 volunteers monitoring 550 inland lakes at 800 sampling locations. Volunteers collect water samples for total phosphorus and calcium concentrations, and take regular water clarity measurements using a Secchi disk.

Water Clarity & the Secchi Disk

The Secchi depth is a measure of lake water clarity, and is measured with a black-and-white disk called a **Secchi disk** (Figure 1). Water clarity (or transparency) is affected by the amount of sunlight that can penetrate into the lake. Thus, water clarity is impacted by fluctuations in algae, detritus, dissolved organic carbon, and other suspended solids in a lake. These, in turn, may be influenced by shoreline development, climate change, acid rain and invasive species, such as zebra mussels. Water clarity impacts the depth at which plant (including algal) photosynthesis can occur. Understanding a lake's water clarity, and how it changes over time, can help us to recognize the changes that may be occurring in a lake's water quality.

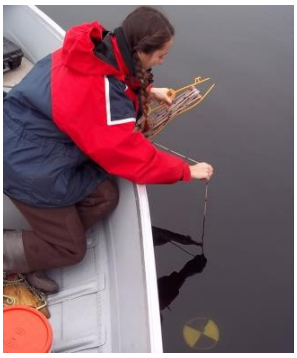

Figure 1. A Lake Partner Program volunteer takes a Secchi disk reading.

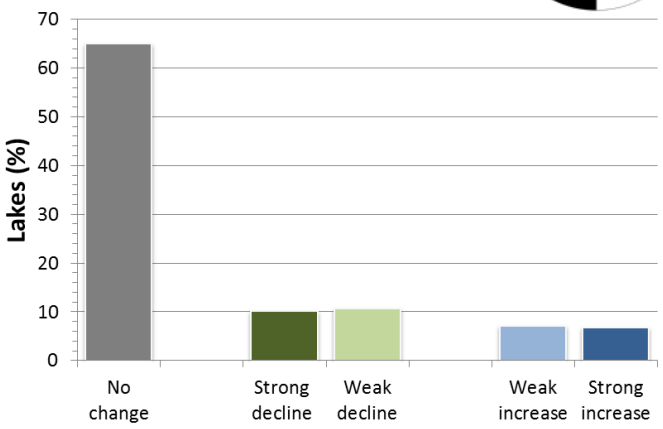

Figure 2: Summarized results from trend tests of changes in Secchi depth between 2000 and 2014 in 410 lake sampling sites from the LPP. Changes were categorized as showing a strong decline (10.3%); weak decline (10.8%); no change (65%); weak increase (7.1%); and strong increase (6.8%). Of the 21% of sites that have declined in Secchi depth over time, the majority are located within the Canadian Shield.

A lake's Secchi depth (and thus, water clarity) can change throughout the ice-free season, so it is best to take several readings per year. Ideally, volunteers of the Lake Partner Program take Secchi depth measurements at least 1-2 times per month from May to October.

Data trends

If Secchi depth is measured in a lake routinely for many consecutive years, the data can be analyzed for trends in water clarity.

The Lake Partner Program recently examined trends in Secchi depths for 410 volunteer-monitored lake sampling sites, using data between the years 2000 and 2014. **It was discovered that the Secchi depths of the majority (65%) of lakes studied had not changed significantly over this time period (Figure 2).** Of the lakes that have changed, 14% showed an increase and 21% showed a decline in Secchi depth over time. The majority of the lakes that showed a decline (less clear) over time were located within the Canadian Shield (Figure 2).

What does this mean?

This study shows that Ontario's inland lakes are experiencing changes in water clarity to varying degrees, although most lakes show no significant changes over time. The changes, where they occur, may be attributed to factors that include zebra mussel activity, changes in concentrations of algae, turbidity, total phosphorus, and/or dissolved organic carbon concentrations. These factors have different effects in every lake.

On the Canadian Shield, dissolved organic carbon (DOC) is an important determinant of water clarity. As DOC concentrations increase, water clarity (and in turn, Secchi depths) may show a corresponding decrease. This is due to dissolved solids preventing light from penetrating the water column. There is evidence that DOC concentrations are increasing in recent years in a subset of lakes on the Canadian Shield (MOECC, unpublished data). The reasons for this decline are hypothesized to be twofold: 1) climate change causing warmer temperatures, which enhances microbiological activity in lake watershed soils; this results in a higher amount of organic carbon entering the lakes; and 2) changes in soil chemistry resulting from the recovery of acid rain, causing the soil to retain less organic carbon. Starting in 2017, the LPP started measuring DOC as a water quality parameter, which will provide more information on how it affects water clarity in these lakes.

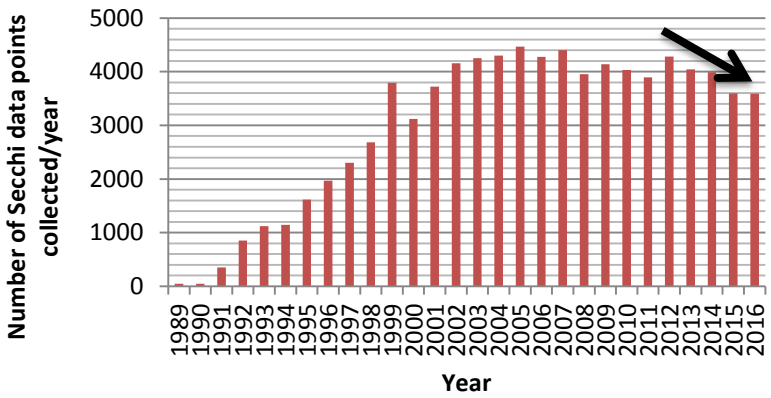

Figure 3: Number of Secchi depth readings recorded by Lake Partner Program volunteers each year from 1989-2016. The black arrow denotes a decrease in the number of measurements being recorded by volunteers in recent years.

Moving Forward

For the majority of Lake Partner Program lakes in Ontario, water clarity has not changed over time; for the lakes that have changed, most are becoming less clear over time, which may, in part, be due to recent climate warming. This information emphasizes the importance of continuing to collect Secchi depth readings as part of the Lake Partner Program.

Over the last 10 years**, there has been a 19% decline in the number of Secchi depth readings collected per year** by Lake Partner Program volunteers (Figure 3). This is concerning, because long-term trends are important indicators of the changes a lake is experiencing. These long-term datasets are valued, because without them, we wouldn't be able to detect trends.

What you can do

- Participate in the Lake Partner Program to help monitor Ontario's lakes;
- Record Secchi depth readings 1-2 times per month throughout the ice-free season;
- Send your Secchi data each November to the Lake Partner Program using the provided return envelope or by email to lakepartner@ontario.ca;
- Visit FOCA's "Resources" page to access a wealth of information (http://foca.on.ca/resources/);
- Follow proper protocol to get accurate Secchi depth readings:
  - follow the instructions provided with your kit each year;
  - take reading between 10 a.m. and 2 p.m.;
  - don't wear sunglasses;
  - take the reading on the shady side of the boat.

For more information…

- Contact the MOECC's Lake Partner Program by phone: 1-800-470-8322 or email lakepartner@ontario.ca, or visit the Dorset Environmental Science Centre webpage at www.desc.ca;
- Contact FOCA by phone: (705) 749-3622 or email info@foca.on.ca, or visit them on the web at www.foca.on.ca.