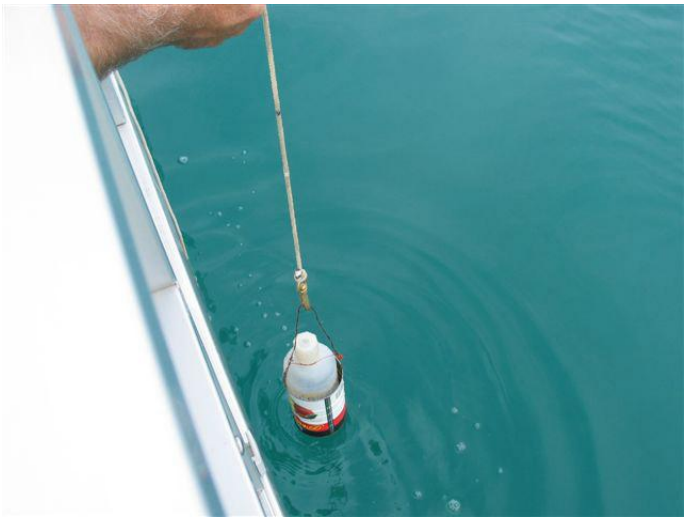
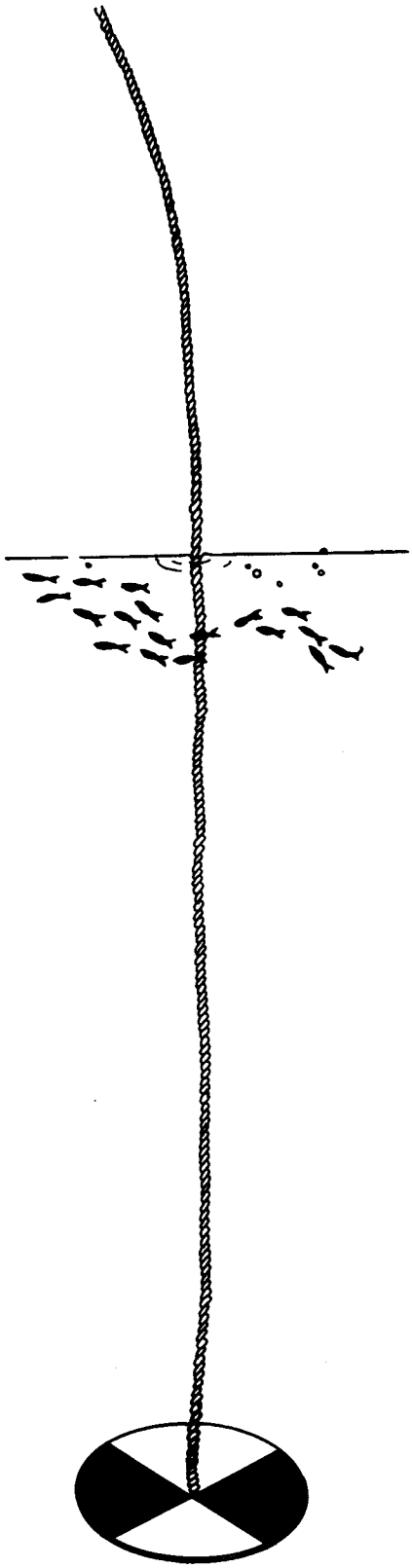
Long-term Water Quality Trend Analysis on Black Lake Thanks to Volunteer Monitoring Efforts

The Tip of the Mitt Watershed Council has been involved with water quality monitoring since our inception in 1979, but the success of our water quality monitoring endeavors rides on the back of volunteers. We have coordinated the Tip of the Mitt Volunteer Lake Monitoring Program since 1986, relying on hundreds of volunteers to help us keep tabs on the water quality of over 40 lakes in the Northern Lower Peninsula of Michigan. Black Lake was among the first included in the program, with volunteers from the local community monitoring the lake since 1987. Data collected by these volunteers have revealed ecosystem-wide trends in Black Lake with implications from the tiniest algae to the largest fish.

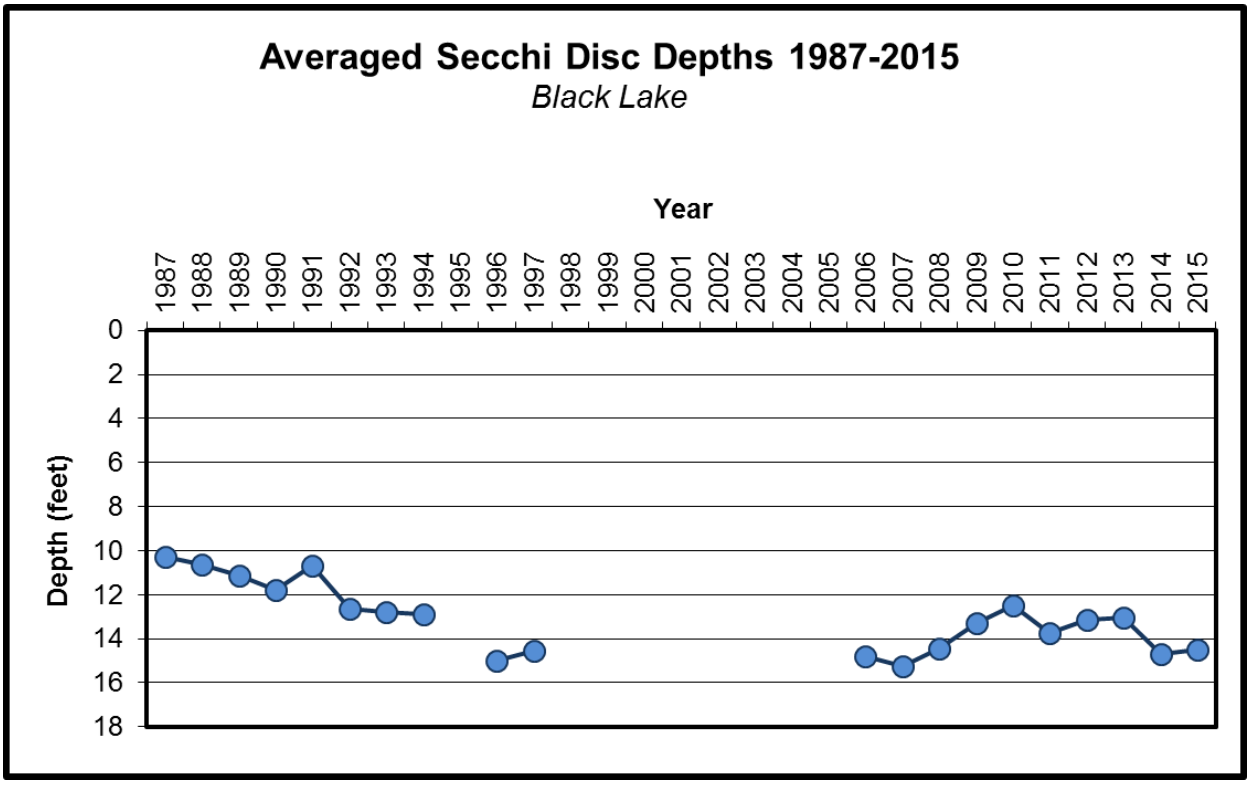
Volunteer lake monitors are devoted to protecting the lakes they monitor, going out on the water on a weekly basis every summer from early June through the end of August to collect data. They monitor water clarity, algae abundance (chlorophyll), and water temperature. Water clarity is measured by lowering an 8" disc of alternating black and white quarters, called a Secchi disc, down through the water column and noting the depth at which the disc disappears. Water samples are collected from the water column to determine chlorophyll-a concentrations. Chlorophyll-a is a green pigment found in all photosynthesizing algae and therefore, it provides a measure of algae abundance. Volunteers measure water temperature with a handheld thermometer within a foot or two of the lake's surface.

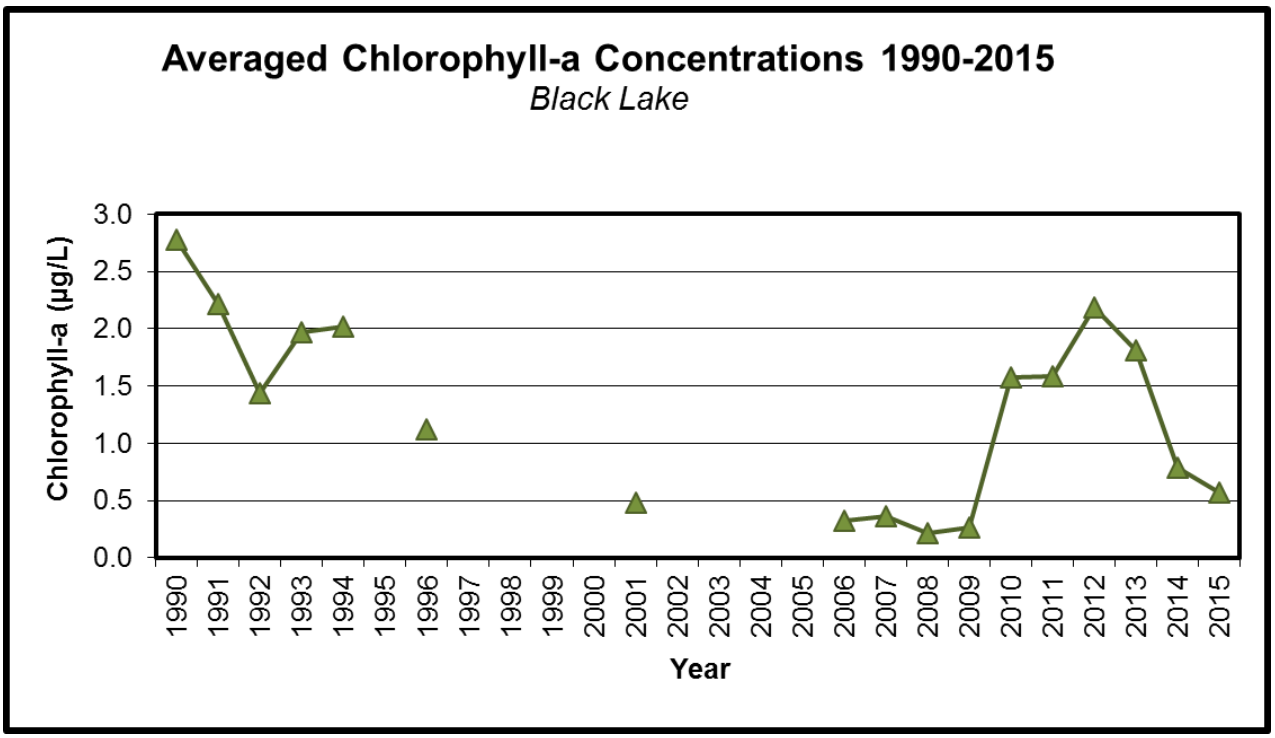




These data allow Watershed Council staff to characterize lakes in terms of trophic status, which is simply a biological productivity ranking. The volunteer data are also used to examine trends and evaluate whether changes are occurring in the lake ecosystem. If there are changes, then we try to determine causes, whether they are good or bad, and how lake managers and residents can remedy any problems that are identified.

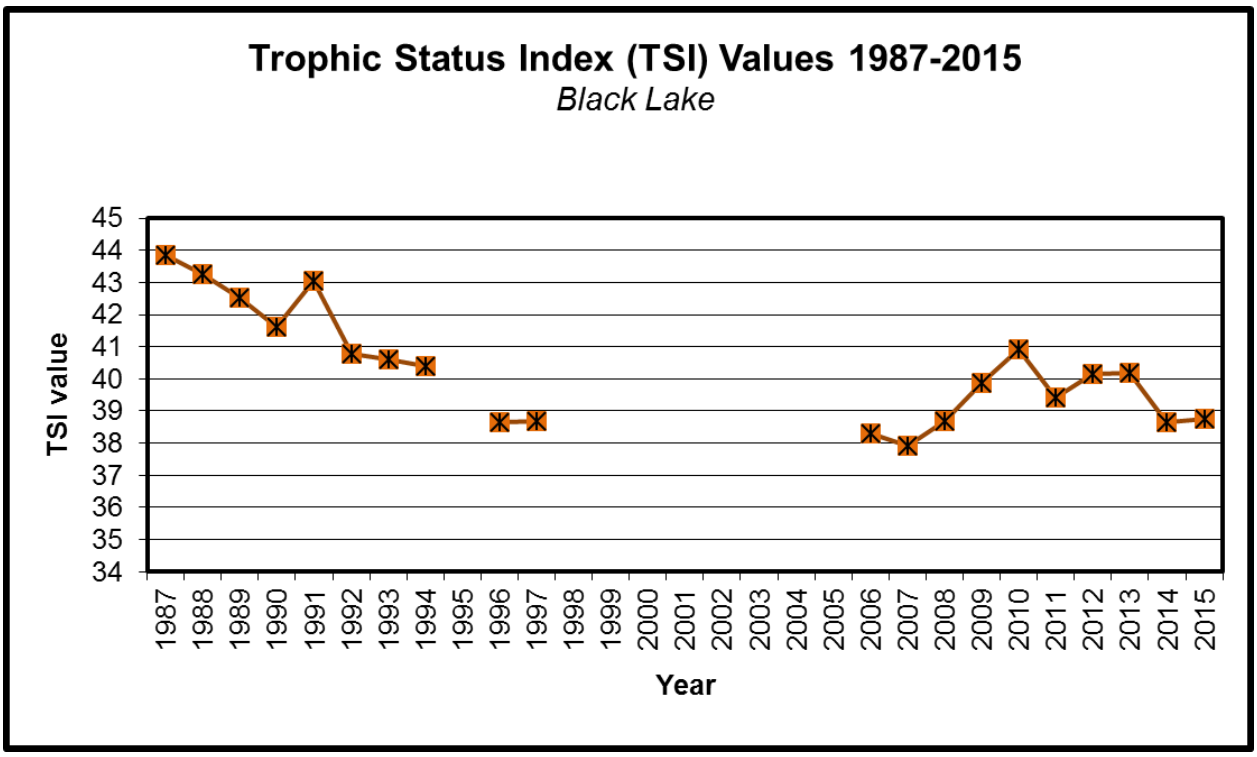
Volunteer data for Black Lake from the early years show a steady increase in water clarity from 1987 to 1997, with averaged Secchi depths increasing from about 10' to 15'. Water clarity increases in lakes throughout the tip of the mitt during the last few decades have commonly been attributed to invasive zebra mussels. Zebra mussels are filter feeders that prey upon phytoplankton (unicellular algae in the water), essentially clearing the water column. The chlorophyll-a data from this same time period show that chlorophyll concentrations decreased in tandem with increasing water clarity. Thus, the data support one another and provide a classic example of lake ecosystem changes brought on by invasive zebra mussels. However, residents have reported that zebra mussels were first seen in Black Lake sometime between 1997 and 1999. Did zebra mussels invade Black Lake earlier than thought or are the changes due to other factors? At this point, we do not have a definitive answer.





There was a gap in the volunteer data from 1998 through 2005, which was the result of insufficient data collected throughout the monitoring season or lack of volunteer help. Fortunately, outstanding lake resident Bob Williams stepped up to the plate and took over monitoring duties in 2006. Bob has proven to be very dedicated to Black Lake, monitoring water quality up to 15 times per season every year since then. Water clarity data collected by Bob show averaged Secchi depths in the range of 12-15' feet, decreasing for a few years and then, increasing again. Bob's chlorophyll monitoring data mirror the Secchi disc data, increasing and then, decreasing again. Unseasonably warm weather from 2010 to 2013 may explain this change because warmer water temperatures, and potentially more sunlight, can stimulate algal blooms. Data do show slightly warmer water temperatures during those years as compared to 2014 and 2015.

Where does Black Lake stand in terms of trophic status? The early volunteer data show that it was a mesotrophic lake, with trophic status index (TSI) scores in the low to mid 40s. Mesotrophic means that the lake had moderate biological productivity. Since that time, the TSI scores have dropped into the oligotrophic or low productivity category, the cut off value at 39. During Bob's tour of monitoring duty, TSI scores have wavered between oligotrophic and mesotrophic.



What are the implications of these changes evident in the monitoring data? Biological productivity has decreased in Black Lake and data clearly show a decrease in phytoplankton. Less phytoplankton means there is less (plant) energy available in the lake ecosystem. Zooplankton, minute water animals, feed on phytoplankton, aquatic insects and other macroinvertebrates feed on zooplankton, small fish feed on macroinvertebrates, and big fish feed on small fish. Thus, less algae in the water column reverberates throughout the food chain, ultimately resulting in fewer and smaller top predator fish like trout and walleye. Although the trophic status has gone up and down in recent years, perhaps due to climate variability, the lake ecosystem change to lower biological productivity appears to be long-term.