A Paleolimnological Study in the Comfort Lake–Forest Lake Watershed District

COMFORT LAKE

THE PROBLEM:
In Comfort Lake (pictured left), total phosphorus levels have been improving in recent years, however water clarity has been declining. This study used sediments from the lake bottom to tell us about the historical condition of the lake, and when it changed, to help inform lake management decisions.

ANALYSIS:
Lake sediments provide a record of physical, chemical, and biological clues for determining how and when a lake has changed. Scientists (paleolimnologists) work from an anchored boat or the surface of the ice to recover sediment cores. A piston corer uses a clear tube that is lowered to the lake bottom using alloy rods that thread together. The tube is fitted with a piston held in place with a cable; as the tube is pushed into the mud, the piston helps “pull” the sediment into the tube.

Physical, chemical, and biological indicators preserved in the sediment are analyzed to reconstruct the ecological history of the lake. For example, naturally occurring radioisotopes, which decay at a known rate, allow scientists to establish a age-depth relationship for the core; and fossil diatoms (algae that were preserved due to their biologically produced glass cell walls) tell us about historical water quality and ecology.

THE LAKE:
Comfort Lake has a surface area of 218 acres, making it the third largest lake in the Comfort Lake–Forest Lake Watershed District (CLFLWD). The lake is 13.7 m (45 feet) deep and the summer of 2016 average TP was 34 µg/l. Comfort Lake has a public boat launch and is heavily used for recreation. Comfort Lake is at the outlet of the CLFLWD, and has two main tributaries. One of the tributaries is from Little Comfort Lake, entering at the southeast end of Comfort Lake. The other main tributary is the Sunrise River, which enters at the west side of the lake after discharging from Forest Lake and flowing through wetland, residential, and agricultural lands. The Sunrise River flows out of Comfort Lake at the northwest end and discharges to the St. Croix River. In February of 2016, a sediment core was collected through the ice to determine the lake’s ecological history.
THE RESULTS:

The sedimentation rate (how fast sediment is accumulating) has changed over time in Comfort Lake. The sedimentation rate began to rise in the 1930s, and peaked in the early 1990s. The rate has been decreasing in recent decades, however the sedimentation rate at the core top (2016) remains about three times higher than it was in the 1800s and early 1900s.

Comfort Lake experienced a large shift in sediment composition; there was an increase in organic material being delivered to the lake that began in the 1930s and persisted through about 2005 (a similar and synchronous change was found in the sediment core from Shields Lake).

During the post-World War II era, agricultural practices shifted in many areas to include tile drainage, ditching, and increased fertilizer use; the pulse of organic matter from the landscape may have been the result of these practices in the watershed.

Diatom results indicated that Comfort Lake was nutrient-rich from the mid-1800s through the 1980s/90s. There was a significant shift in the diatom community composition around 1990, which indicated a decline in total phosphorus levels since that time.

However, algal pigment results showed that overall algal abundance has sharply increased in recent years. This includes cyanobacterial groups, including those that have the potential to cause toxic blooms.

Although monitoring efforts and diatom assemblage shifts both indicate a decrease in total phosphorus in recent years, observations of decreasing water clarity and algal pigment results show that there are still issues with the lake.