Northeast Glacial Lakes Watershed Improvement and Protection Project

Pickerel Lake Water Quality Update

During the last four years, nuisance blue-green algae blooms have become more prevalent on Pickerel Lake, alarming lake residents and recreational users. Recently, five species of blue-green algae were found in a sample of Pickerel Lake's water; Anabaena, Aphanizomenon, Gleotrichia, Microcystis, and Oscillatoria. Why is this occurring?

The recently completed water quality study of Pickerel Lake's tributaries showed both increases and decreases in nutrient loading between the 2008-2009 study and 2014-2015 study. During the period between these two tributary studies, almost all of the Conservation Reserve Program (CRP) acres located in Pickerel Lake's watershed were converted from grass back to cropland. Of the nutrients tested, the two that negatively impact water quality and are most prevalent in cropland runoff, ammonia and phosphorus, showed little change in concentration with ammonia actually decreasing in 2014-2015. It is probable that some of these nutrients, especially phosphorus, were greatly reduced in the soil during the twenty years these cropland acres were enrolled in CRP. However, phosphorus and ammonia levels in tributary runoff may increase in the future if watershed cropland is not carefully managed for nutrient levels. So recent changes in watershed land use have not yet increased external loadings of nutrients detrimental to Pickerel Lake's water quality.

While data shows little change in post CRP nutrient loading in the lakes tributaries, in-lake water quality data from 1991 to 2015 showed a strong upward trend in both total phosphorus and total dissolved phosphorus in Pickerel Lake's surface and bottom waters. This increase is caused by internal loadings of nutrients already present in the lake.

Phosphorus will collect in the bottom of a lake, and under normal circumstances will remain attached to soil particles. However, Pickerel Lake is deep enough to stratify and at times the bottom ten feet of the water column will go anoxic (no oxygen present). Stratification occurs during periods of relatively calm winds and warm surface water temperatures. The lakes bottom may also go anoxic during winter months, especially years when heavy snow covers the ice reducing light available for algae to produce oxygen. When a lake goes anoxic, phosphorus is released from the sediment and is readily available in a dissolved form to be utilized by algae when the lake mixes due to strong winds or fall and spring turnover. This often results in an algae bloom. The phosphorus located in the lake's bottom sediment has been collecting since the lake was formed some 12,000 years ago. As the lakes watershed was settled and the prairie converted to cropland, nutrient loadings from its tributaries no doubt increased. Unfortunately, we have no tributary or in-lake water quality data prior to 1991 to give us an idea of the concentrations of external and internal nutrient loadings during the years prior to the Conservation Reserve Program (1986 to 2006).

Anecdotal recollections of local residents familiar with Pickerel Lake in the 1970s and 1980s recall frequent heavy algae blooms occurring during these decades. An aerial photo from August 1958 shows a very severe algae bloom occurring on the lake. Also, during most years the lake suffers a short lived algae bloom in early October due to fall turnover (after many lake residents have closed up for the season). So the recent heavy algae blooms on Pickerel Lake may not be so unusual historically.

What is unusual is the frequency in which the lake is stratifying. From 1991 to 1995 the lake was found stratified just once in 1991. This caused a summer fish kill of mainly smaller bait fish (fathead minnows and spotted shiners). From 2002 to 2010 the lake was found stratified only during the summers of 2005 and 2009. However, beginning the summer of 2011 Pickerel Lake has stratified every year through 2015. It is still unclear what is triggering stratification. Water quality data from 1991 to 2015 shows an increase in surface water temperatures overtime. Stratification most often occurs when Pickerel Lake's surface temperature reaches 25° C or 77° F and high pressure systems set up several days of calm winds. Climatologists have noted an increase in overnight temperatures which may account for increased surface water temperatures on the lake. More

research needs to be completed to determine all the factors that cause Pickerel Lake to stratify.
So what can be done? We cannot undue nutrient loadings from the past. In 1958 there were 44 active farmsteads in the watershed located within a four mile radius of the lake (compared to five in 2016). Each of these farmsteads, many located adjacent to the lakes tributaries, had a mixture of livestock including dairy cows, pigs, horses and sheep. Small grains, especially wheat, were the major crops until the late 1970s and these acres would have been left fallow for at least 8 months of the year. Pickerel's shoreline was altered, especially beginning in the 1990s as smaller lake cottages were torn down and replaced with large permanent homes. The nutrients from all these sources are waiting in the lakes bottom to be released in the future. While the lakes watershed has fewer nutrient sources than in previous decades we still must continue to reduce external nutrient loadings thru conservation practices like no-till, nutrient management, cover crops, and buffers. An increase in future external nutrients loadings could enhance early diatom and green algae blooms in late spring and early summer that could trigger further stratification events that cause blue-green algae blooms later in the season.
There are no magic wands to fix stratification or internal nutrient loads. Floating islands and aerators will not work. Treating the bottom of the lake with alum may be one solution, but is very expensive and on South Dakota lakes has only proven to be a temporary fix.
Pickerel Lake residents and recreational users may have to get use to these nuisance blooms as with most lakes in South Dakota, and utilize the lake for contact recreation as they see fit. Residents should become familiar with health problems associated with blue-green algae's and take proper precautions. And most importantly, continue to support conservation activities in Pickerel Lake's watershed, and implement buffers and practices limiting nutrient runoff from their lake properties.

For more information on Pickerel Lake, non-point source pollution, and blue-green algae go to:
www.neglwatersheds.org