Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Pennsylvania

Adding Lime to Acidic Lake Restores Fishery

Waterbody Improved

Atmospheric deposition of sulfur dioxide and nitrogen oxide particles created low pH conditions in Pennsylvania's Lake Jean. As a result, the Pennsylvania Department of Environmental Protection (PA DEP) added the lake to the 1996 Clean Water Act (CWA) section 303(d) list of impaired waters for failing to support its aquatic life designated use. Semiannual liming of the lake has neutralized the lake's acidity. Lake Jean now meets the pH water quality standard and supports a healthy and diverse fish population, prompting PA DEP to remove the lake's aquatic life support impairment from the state's impaired waters list in 2010. (The lake is still listed as impaired because of mercury from atmospheric deposition.)

Problem

Lake Jean lies in northeastern Pennsylvania, on the border of Luzerne and Sullivan counties, within Ricketts Glen State Park (Figure 1). The lake covers approximately 245 acres and is relatively shallow, with an average depth of 5.9 feet. Kitchen Creek, also called Ganoga Tributary, flows from Ganoga Lake and feeds the western end of Lake Jean (Figure 2).

Coal-burning power plants, automobile exhaust and other emission sources in the Ohio River Valley contribute sulfur dioxide and nitrogen oxide gases to the air. As the gases are carried in atmospheric winds over the eastern United States, they combine with oxygen and water vapor in the air to form sulfuric and nitric acids. The acids gradually fall to the earth as wet or dry deposition. The soils and rocks in Lake Jean's watershed do not offer much buffering capacity to neutralize acid inputs.

Over time, atmospheric deposition caused a decline in Lake Jean's pH levels, which led to a loss of desirable fish species. Monitoring data for Lake Jean showed that the average pH in the summer of 1991 was 5.8—below the state standard, which requires a minimum pH of 6.0 for aquatic life use support. As a result, PA DEP placed the lake on Pennsylvania's 1996 CWA section 303(d) list of impaired waters for not supporting its aquatic life designated use because of low pH. The lake is also listed as impaired by mercury from atmospheric deposition.

A Diagnostic Feasibility Study of Lake Jean was completed in the mid-1990s using CWA section 314 funds provided by EPA as part of the Clean

Photo courtesy of Steve Means, PA DEP

Figure 1. A boat launch at Lake Jean.

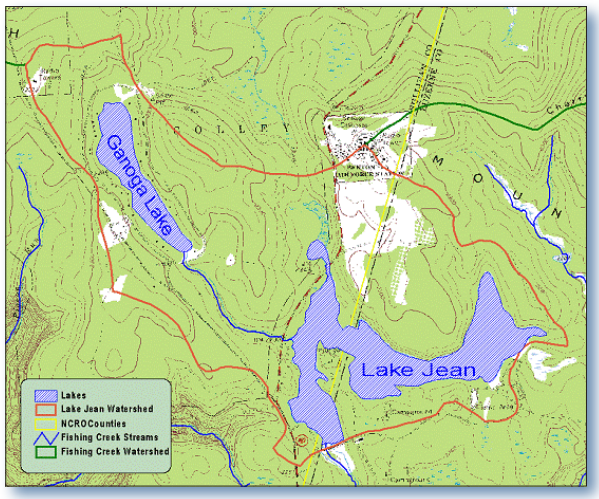

Figure 2. Ganoga Lake and Lake Jean in Pennsylvania's Fishing Creek watershed.

Lakes Program. In addition, PA DEP completed a total maximum daily load for Lake Jean in 2004. Rainfall monitoring data collected by the National Atmospheric Deposition Program indicated that the average rainfall in the area in 2002 had a pH of approximately 4.4.

The lake's acidic condition negatively affected the fish community. Studies documented low fish species diversity, and population and fish health were in poor condition as well. In addition, a nuisance aquatic plant plagued Lake Jean before lake restoration efforts. Bladderwort, an acid-tolerant floating-stem plant, dominated the lake's surface to the point that PA DCNR personnel needed to rake it from the beach daily.

Project Highlights

In 1995 the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) began adding lime (using ground agricultural limestone) to the lake and Ganoga Tributary, and continues to do so semiannually (spring and fall). An average total of approximately 19 tons of lime has been applied to the lake annually, except in 2001 and 2003 when less lime was needed because of lake drawdown and good water quality.

Results

Applying the recommended amount of lime over the years has raised the lake's pH and improved water quality and habitat conditions for aquatic life. Samples taken during a PA DEP study of the lake in 2007 found that the pH levels at various locations and depths throughout the lake ranged from 6.5 to 7.4, meeting the state's water quality criteria for pH (6.0 to 9.0).

Pennsylvania Fish and Boat Commission (PA F&BC) studies documented increasing fish populations, a greater diversity of species, and an overall improvement in fish health soon after lime was applied to the lake. Monitoring showed that the relative weight of several fish species (pumpkinseed, bluegill, largemouth bass, black crappie and yellow perch) increased between 1997 and 2007. The diversity of fish collected increased from 7 species in 1997 to 12 species in 2007 (Figure 3). In addition, PA F&BC lake assessments in 2003 and 2007 found a drastic

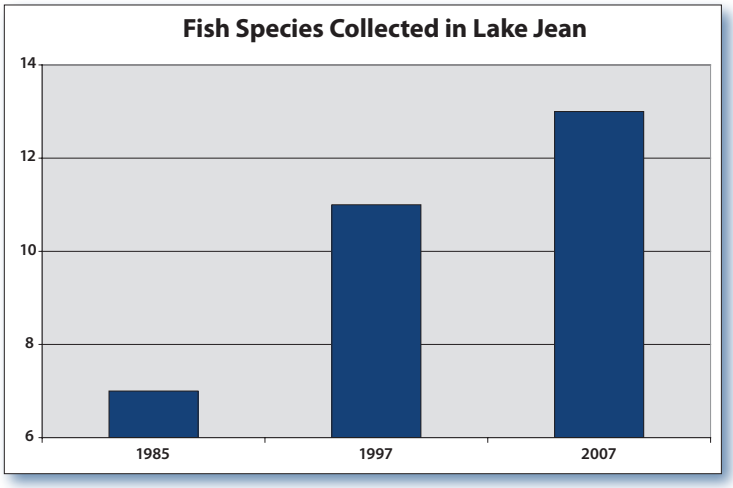

Figure 3. Fish surveys documented an increase in the number of fish species present in Lake Jean since 1985.

reduction of bladderwort due to the rise in pH. Less acidic conditions facilitated the growth of acid-intolerant plant species, which out-competed bladderwort, resulting in a more diverse plant community.

The pH in Lake Jean now meets water quality criteria and supports the aquatic life use. As a result, PA DEP removed Lake Jean's aquatic life support impairment from the state's list of impaired waters in 2010. Lake Jean remains on the impaired waters list because of elevated levels of mercury in fish tissue.

Partners and Funding

Since completion of the diagnostic study in the mid-1990s, state agencies (PA DCNR, PA F&BC, PA DEP) and the Fishing Creek Sportsmen Association have collaborated on efforts to create a more viable fishery. The PA DCNR, with assistance from the Fishing Creek Sportsmen Association, has been responsible for providing funding and applying lime to the lake. The PA DEP and PA F&BC have studied and sampled the aquatic vegetation and fish populations. Approximately $12,000 has been spent to add lime to Lake Jean and its main tributary since 1995. The most recent addition of lime to the Lake was April 2009. PA DCNR continues to add lime to the lake on an as-needed basis.

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