NONPOINT SOURCE SUCCESS STORY

Maine

Agricultural Best Management Practices and Erosion Controls Improve Sebasticook Lake

Waterbody Improved

Beginning in the 1950s, point source and nonpoint source (NPS) pollution in the Sebasticook Lake watershed contributed to excess nutrients, which resulted in algae blooms, oxygen depletion and decreased water clarity. Water quality improved after most of the municipal and industrial point sources were removed in the 1980s; however, the lake still experienced prolonged annual algae blooms driven by phosphorus sources (i.e., internal phosphorus loading from lake sediments, agriculture and developed areas). From 1981 to 2014, state, federal and local partners provided funding, including Clean Water Act (CWA) section 319 grants, to install best management practices (BMPs) throughout the watershed. Late summer drawdowns of the lake also flushed phosphorus downstream. Water quality monitoring shows significant improvements in the lake's water clarity, phosphorus levels, extent and duration of algae blooms, and phosphorus loading from lake sediments.

Problem

Sebasticook Lake, a 4,288-acre waterbody in south-central Maine, once supported a valuable fishery and was stocked with trout, landlocked salmon and rainbow smelt (Figure 1). The lake has historic and cultural significance as well—a complex of pre-historic fish weirs lay at the mouth of the Sebasticook River, on the north shore of the lake. This complex is one of the oldest known in North America. In the 1950s, the lake's water quality and coldwater fishery deteriorated precipitously because of point source and NPS pollution in the watershed. The severe water quality problems were largely attributed to municipal wastewater discharges from Newport, Dexter and Corinna, as well as three industrial discharges (including Corrina Woolen Mill, which was later designated as a U.S. Environmental Protection Agency [EPA] Superfund site). Most of these point sources were removed in the 1980s, and the last point source was eliminated in 2005. Water quality improved gradually, but watershed and internal phosphorus sources continued to fuel annual algal blooms. The 2001 Sebasticook Lake Total Maximum Daily Load report identified the most important remaining watershed phosphorus sources as agriculture (45%), roads (19%), residential (15%) and other development (8%). Internal phosphorus loading from lake sediments was also a significant source of phosphorus to the lake.

Figure 1. Sebasticook Lake is in south-central Maine.

Story Highlights

In 1982, seasonal drawdowns on Sebasticook Lake were initiated to release phosphorus-rich water in the fall (Figure 2). In 1988, the dam outlet was reconstructed to increase the annual lake drawdown and export of phosphorus released from lake sediments. The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) spearheaded over three decades of work to reduce the phosphorus export from farming activities in the watershed. From 1981 to 1992, NRCS (formerly the Soil Conservation

Figure 2. Seasonal lake drawdown (1982) flushed out excess phosphorus.

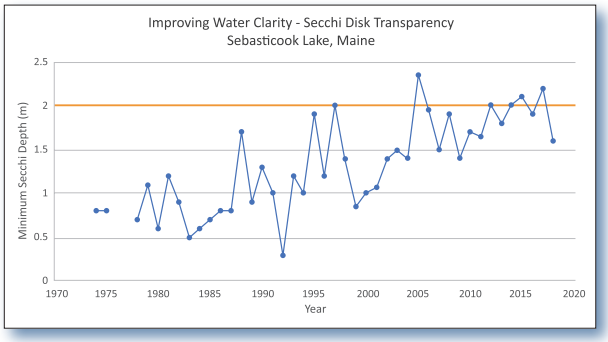

Figure 3. Minimum Secchi disk readings (1972–2018) show improving clarity over time.

Service) provided funding through the Watershed Protection and Flood Prevention Act (PL-566) to install 22 manure storage systems and treat 5,500 acres with conservation tillage, cover crops and other practices. In 1997 and 2001, NRCS carried out targeted Environmental Quality Incentives Program work in the watershed and funded animal waste, nutrient management and cropland erosion projects. From 2004 to 2014, NRCS applied 1,471 practices on dairy farms and cropland including seven waste storage facilities and 18,000 acres of cropland and nutrient management BMPs. From 2012 to 2014, the National Water Quality Initiative (NWQI) implemented cover crop, crop rotation and forage/biomass plantings on 1,500 acres on farms in the Alder Brook subwatershed.

From 2002 to 2007, Penobscot County Soil and Water Conservation District (SWCD) carried out three CWA section 319 grant projects to tackle nutrient and erosion problems on farms, town and private roads, and shorefront properties. The projects installed BMPs including vegetated buffers/filter strips and sediment basins to control runoff from livestock areas on 49 NPS sites; these reduced annual pollutant loading to the lake by an estimated 189 tons of sediment and 186 pounds of phosphorus. Project partners also raised local awareness through workshops, landowner technical assistance visits, and education about the importance of shoreline vegetated buffers.

Results

Sebasticook Lake's water quality significantly improved in terms of water clarity, total phosphorus (TP), and chlorophyll *a*. From the time water quality monitoring began in the early 1970s, Sebasticook Lake did not experience a year without nuisance algal blooms (defined as a Secchi disk reading < 2 meters) until 1997 and has since had 6 years with minimum clarity at or over 2 meters (Figure 3). Average epilimnetic phosphorus in the 1980s was 78 parts per billion (ppb), while from 2009 to 2018 the average was 25 ppb. Recent chlorophyll *a* measurements show an average value of 14 ppb (2009–2018) versus an average of 34 ppb in the 1980s. The pool of sediment phosphorus available for internal recycling, the major driving force for summer blooms in the lake, declined by an order of magnitude, from approximately 900 ppb to approximately 90 ppb, as a result of the annual lake drawdown. The lake still has occasional algal blooms in the summer; however, the blooms start later in the summer, have a shorter duration and are much less intense.

Partners and Funding

Many federal, state and local partners collaborated in the effort to improve the lake's water quality. Partners included NRCS, EPA, Maine Department of Environmental Protection, Sebasticook Lake Improvement Association, Penobscot County SWCD, USDA Farm Service Agency, U.S. Fish and Wildlife Service, Heart of Maine Resource Conservation and Development, University of Maine Cooperative Extension, Sebasticook Lake Association, nine municipalities, Penobscot Valley Council of Governments, Maine Department of Marine Resources, and many landowners.

From 1975 to 1985, NRCS provided $500,000 in NWQI funding and $1.4 million from PL-566. EPA's Clean Lakes program and local contributions funded the $0.43 million dam outlet reconstruction project. EPA also provided $157,310 in CWA section 319 funds for three watershed implementation projects. Towns, the Maine Department of Agriculture, landowners, and other partners contributed $112,711 in match for these three grant projects.

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