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Water Quality Remains Good for Park

Results of the 2011 Water Quality Monitoring Season for Weir Farm NHS

Background

The Northeast Temperate Network (NETN) monitors a variety of natural resource indicators, which it calls “vital signs”, for 12 parks in the northeast and the Appalachian National Scenic Trail. The vital signs for freshwater bodies are water chemistry, nutrient enrichment, water quantity, and the detection of invasive plant species. These were chosen to address the NPS Inventory and Monitoring Program objective to detect change in the status of physical, chemical, or biological attributes of the ecosystem.

Methods

Detailed descriptions of all monitoring methods can be found in NETN’s Freshwater Monitoring protocol available for download from the network’s website. Weir Pond, the largest fresh water body in the park, is sampled monthly from May through October by a cooperator from the University of Vermont or a NETN hydrologic technician. Physical and water chemistry parameters are measured each month and water samples are periodically collected for analysis at the University of Maine. All monitoring data are incorporated into a series of comprehensive databases that feed into an EPA data system.

Monthly sampling parameters included water quality measurements (pH, specific conductance, temperature, and dissolved oxygen), weather, stream flow (discharge), and stream stage (water level). Water samples obtained in June and August were analyzed for acid neutralizing capacity (ANC), color, and nutrients. Nutrient chemistry parameters were analyzed from a grab sample.

Results and Findings

Complete details of 2011 monitoring season findings can be found in the full report which is available for downloading from the website. Brief synopses of some findings are available below.

Specific conductance measures the ability of water to carry an electrical current. If it increases it can be an indicator of pollutants in the water. Specific conductance values for 2011 were within the appropriate range for all park waters.

The **pH** of a water body reflects how acidic or basic the water is, measured on a scale of 1 to 14, with 7 being neutral. Acid waters are below 7, and alkaline waters are above 7. A one unit change in pH represents a 10-fold change in acidity or alkalinity. Although Connecticut has no numeric pond water quality standards for

pH, the stream water quality standards, similar to those of most northeast states, indicate that a pH between 6.5 and 8.0 is within the acceptable range. Most of the pH values from the 2011 monitoring season were slightly acidic, in the lower range of variability of the historic NETN monitoring data from Weir Pond.

Temperature can affect water chemistry and biology. For example, the amount of oxygen that water can hold is directly related to the temperature of the water: the higher the temperature, the less oxygen it can hold. Temperature can also determine the kinds of plants and animals found in the lake or pond. Certain species of fish, insects, and algae will predominate during the cooler temperatures of the spring and fall, yet be less apparent during the warmer temperatures of summer. Surface water temperatures appeared to be within the normal range of variability in 2011, though the July values reflected the contributions of high air temperature and solar radiation.

Dissolved oxygen (DO) is a critical indicator of water quality because aquatic life generally needs certain concentrations to thrive. Low oxygen can directly kill or stress organisms such that they will not be able to successfully reproduce or grow. Weir Pond’s surface water was generally well oxygenated in 2011 although the May value is notable as the lowest surface DO measurement at the park to date.



Weir Pond in the early fall. NPS photo.



A Secchi disk helps measure a water body's transparency level. Pictured are a Secchi disk, measuring tape, and viewing scope (left) and view of submerged Secchi disk through viewing scope (right). NPS photos.

Color in pond and stream water is caused by natural metallic ions, humus and peat materials, plankton, weeds, and industrial wastes. **Apparent color** is determined using water samples that have not had suspended particles filtered out. Color can be a rough indicator for organic acidity. Color results from the 2011 samples were highly colored and greater than most in the 2006 to 2011 historic data values. This could be the effect of runoff and sediment input to the systems, rather than dissolved constituents, since the samples were not filtered before analysis.

Acid neutralizing capacity (ANC) is also known as alkalinity, or buffering capacity. It is due primarily to the presence of naturally available bicarbonate, carbonate, and hydroxide ions, with bicarbonate being the major form. Acid neutralizing capacity measured in the 2011 samples illustrates that Weir Pond is well-buffered, likely due to the underlying geology. The 2011 ANC measurements from June follow the typical seasonal pattern of being lower than August values. This is likely due to the contribution of episodic acidification from spring snowmelt and runoff (and also illustrates the ability of the robust ANC to counteract the acidification pulses).

Transparency measurements can provide simple and affordable assessments of pond and lake productivity. Variation in precipitation is one of the major factors contributing to annual shifts in transparency. Often during drier conditions lakes and ponds will become clearer due to lower runoff of nutrient and soil inputs. In contrast, decreased transparency readings can often be attributed to the effects of high levels of spring and fall precipitation, as well as the cumulative effects of a high rainfall year. It is difficult to obtain transparency measurements with a Secchi disk in Weir Pond. Due to the pond's shallow depth, the disk hit the pond bottom before disappearing from the observer's view in all NETN measurements. In measurements taken with a 120 cm turbidity tube, the small target disk on the bottom of the tube was always still visible through the 120 cm column of pond water. Beginning during the current monitoring season, NETN will measure light attenuation in ponds using an underwater photocell to provide additional information on the water clarity and trophic characteristics of Weir Pond.

Nutrient enrichment and the acceleration of eutrophication (when waters become rich in mineral and organic nutrients that promote a proliferation of plant life - especially algae) have been identified in most NETN parks as one of the stressors of greatest concern. Several forms of total and dissolved phosphorus and nitrogen are measured to give managers information regarding the status and productivity of freshwater systems. Test results for two forms of nitrogen were very low in 2011 samples with all results below the method reporting limit. August ammonia (NH_3) test results were also below the method reporting limit. Total Phosphorus and Total Nitrogen, however, exceeded state standards. The data indicate that there is some nutrient enrichment occurring in Weir Pond. Residential areas within the pond's watershed may be contributing to this nutrient input.

Most 2011 water quality parameters for Weir Pond in Weir

Summary

Farm National Historic Site are within state standards, and are slightly above the range of non-regulatory EPA ecoregional criteria, where applicable. The majority of values are within the ranges of the historic NETN monitoring data for the park as well.

Monitoring under the NETN protocol builds on the historic water quality monitoring by park staff and other agencies to provide critical baseline information on the chemical and physical status of the water resources at Weir Farm National Historic Site. Several changes have been implemented during the 2012 monitoring season, including the addition of sulfate, chloride, chlorophyll *a*, and dissolved organic carbon (DOC) analyses to the spring and summer water chemistry testing. These changes will expand the scope and usefulness of the monitoring data. As more data are collected, the ability to detect changes outside this natural range of variability will increase, which in turn will more clearly indicate the status of the vital signs of water quality, nutrient enrichment, water quantity, and the detection of invasive plant species.

More Information

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Full Report online at:
<http://science.nature.nps.gov/im/units/NETN/index.cfm>



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