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Water Quality Monitoring Update

Results of the 2012 Water Quality Monitoring Season for Morristown NHP

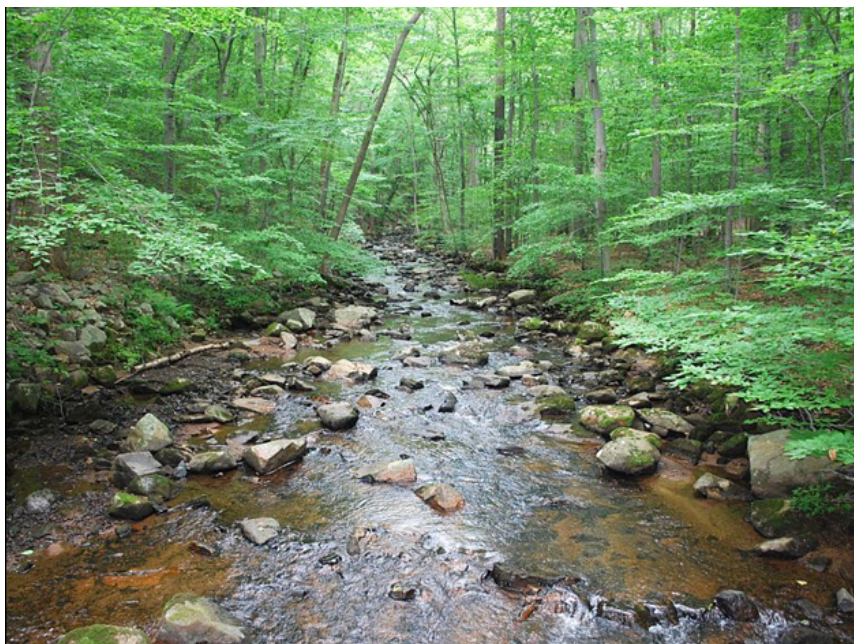
Background

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. In 2012, NETN hydrologic technician Brian Schuetz measured physical and water chemistry parameters each month and periodically collected water samples for analysis at the University of Maine. A total of three park streams are sampled monthly from May through October. All monitoring data are incorporated into a series of comprehensive databases that feed into an EPA data system.

Three of the selected sites are in the Primrose Brook Watershed within the Jockey Hollow Unit. These sites are on the East Branch of Primrose Brook, the West Branch of Primrose Brook, and the main stem of Primrose Brook. The other sites are on the Passaic



The Passaic River flows through the forests of Morristown NHP. Bill Gawley photo.

River and Indian Grove Brook in the New Jersey Brigade Unit. All streams monitored by NETN are classified as cold water fisheries, loosely defined as waters that can support, on a year-round basis, wild and stocked brook trout or other species requiring similar conditions. See NETN’s Google Earth park module for locations of monitoring sites.

Monthly sampling measurements includes pH, specific conductance, temperature, dissolved oxygen, weather, stream flow (discharge), and stream stage (water level). In May and August, water samples were obtained from grab samples and analyzed for acid neutralizing capacity, color, and nutrients. Beginning in 2012, fractions of these water samples were also analyzed for dissolved organic carbon, chloride, and sulfate.

Results and Findings

Complete details of 2012 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 2012 were within the appropriate range for 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. New Jersey standards, like those of most northeast states, indicate that a pH between 6.5 and 8.5 is within the acceptable range. Most pH values from the 2012 monitoring season were circumneutral or slightly basic and were all between the upper and lower New Jersey water quality standards.

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 a lake or pond. Certain species of fish, insects, and algae will predominate during the cooler temperatures of 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 2012.

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. All park sites were well oxygenated in 2012 and above the most stringent state DO standard.

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. Median color values from 2006 to 2012 monitoring show most streams to be moderately colored. A higher color was measured in the May 2012 Passaic River sample, indicating the possibility of runoff and sediment input to the stream prior to the monitoring visit, especially since the color samples are not filtered before analysis.

NETN began measuring **dissolved organic carbon (DOC)** in for the first time in 2012. Carbon is a nutrient required for biological processes. Sources of organic carbon in water include humic substances from plant and soil organic matter, wetland peat deposits, and atmospheric deposition. Certain forms of DOC can contribute to “tea” color in water, which can affect light penetration. DOC is also an important part of the energy balance and acid-base chemistry in many freshwater systems. It also affects the transport (solubility and bioavailability) of metals, including mercury, in aquatic systems. DOC concentrations in most streams in temperate zones range from 1 mg/L to 20 mg/L, with a worldwide mean of 5.75 mg/L. DOC concentrations for park streams were low in 2012.

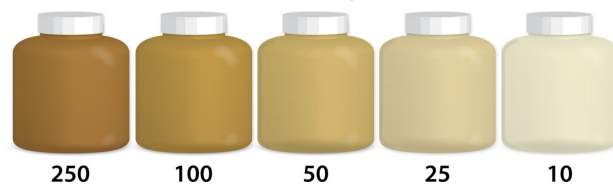
Nutrient enrichment and the acceleration of eutrophication (when waters become rich in mineral and organic nutrients that promote a proliferation of plant life - especially algae) have been identified in most NETN parks as one of the stressors of greatest concern. Several forms of total and dissolved phosphorus and nitrogen are measured to give managers information regarding the status and productivity of freshwater systems. Test results for Total Nitrogen and NO_3 were moderate in most 2012 samples. Results for NO_2 were very low at all sites. All ammonia (NH_3) test results were below the method reporting limit. All total phosphorus results for 2012 were moderate, and generally below EPA criterion. All Total Phosphorous results were well below the New Jersey state standard.

2012 was also the first year of turbidity testing for network waters.

Turbidity is the measure of the relative clarity of a liquid. It is measured by passing light through a water sample to determine how much light is scattered, and the results are reported in nephelometric turbidity units (NTU). Turbidity is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms. Turbidity can create aesthetic, ecological, and health issues, and could be an indication of runoff from construction, roads, agriculture, or other types of pollution. Suspended solids

Turbidity (NTU)

Water Samples:



Samples of different turbidity levels.

prevent sunlight from reaching aquatic plants, inhibiting photosynthesis which may reduce the amount of dissolved oxygen in the water. Sediment also absorbs heat, so turbidity can raise the surface water temperature. Turbidity can make it hard for fish to see their prey, and heavy loads of suspended solids can even clog fish gills and filter-feeding structures of aquatic macroinvertebrates. Turbidity values measured in all park streams during 2012 were in the low range of dry-weather turbidity of surface waters, which normally ranges from 0 to 10 NTU. Three outlying values may indicate sediment input from episodic runoff events.

Summary

Most water quality parameters for the monitored streams were within state standards, and were generally within the range of EPA criteria, where applicable. The majority of values were within the ranges of historic NETN monitoring data from the park. Monitoring under the NETN protocol builds on the historic water quality monitoring by the National Park Service and other agencies to provide critical baseline information on the chemical and physical status of the streams monitored in the park. Several changes implemented in the 2012 monitoring season will expand the scope and usefulness of the monitoring data. As more data are collected, the ability to detect changes outside the 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

Bill Gawley
Biologist (Air / Water / Data Mgmt)

E-mail
bill_gawley@nps.gov

Brian Mitchell
NETN Program Manager

Phone/E-mail
802-457-3368 ext. 37
brian_mitchell@nps.gov

Full Report online at:

<http://science.nature.nps.gov/im/units/netn/monitor/programs/lakesPonds/lakesPonds.cfm>



Northeast Temperate Network
54 Elm Street, Woodstock, Vermont 05091
802-457-3368
<http://www.science.nature.nps.gov/im/units/netn/>

