



ACADIA NP • APPALACHIAN NST • BOSTON HARBOR ISLANDS NRA • MARSH-BILLINGS-ROCKEFELLER NHP • MINUTE MAN NHP
MORRISTOWN NHP • ROOSEVELT-VANDERBILT NHS • SAINT-GAUDENS NHS • SAUGUS IRON WORKS NHS • SARATOGA NHP • WEIR FARM NHS

Water Quality Remains Good for the Park

Results of the 2011 Water Quality Monitoring Season for Acadia NP

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. A total of 37 park lakes and streams are sampled monthly from May through October, with 11 sites monitored annually and the remainder visited on a 2 year (streams) or 3 year (lakes) rotating schedule. Park staff measure physical and water chemistry parameters each month, and periodically gather water samples for analysis at the University of Maine. Additionally, stage height (water level) is recorded weekly at 17 lakes during the open-water season. All monitoring data are incorporated into a series of comprehensive databases that feed into an EPA data system. See NETN’s Google Earth Acadia module (available on website) for locations of monitoring sites.

Monthly sampling includes water quality measurements (pH, specific conductance, temperature, and dissolved oxygen), transparency (lakes only), weather, stream flow (discharge), and stream and pond stage (water level). In May (streams only), June (lakes only) and August (both), water samples were obtained and analyzed for acid neutralizing capacity (ANC), color, and nutrients.

Results and Findings

Complete details of 2011 monitoring season findings can be found in the full report. 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.

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. Most lake pH values from the 2011 monitoring season were slightly acidic, which is typical of poorly-buffered, unproductive Maine waters. Some of the lakes (Round Pond, Witch Hole Pond) with pH values in the lower range are rimmed by wetlands, which contribute natural acidity to the system.

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. Acadia NP water temperatures were generally within the normal range of variability in 2011, although the July and August values from lakes and less-shaded streams 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. The surface layers of all park lakes monitored in 2011 were well

A Fall morning on Jordan Pond. Brent Danley photo.

oxygenated, although mid-summer DO profiles of some of the shallow, more productive lakes showed some moderate oxygen depletion at lower depths. This is a common occurrence as water temperatures rise and temperature stratification inhibits oxygen replenishment to deeper waters. Although Maine has no numerical DO minimum standards for Class AA streams (which includes all streams in Acadia) the DO content of Class A waters (the next lowest classification) is required to be above 7 parts per million. The majority of the 2011 stream measurements were above this standard, with only two July measurements falling below it. This is not surprising as there was very low stream flow during both of these monitoring times.

Apparent color and transparency measurements indicated that Acadia waters remained clear, and there were no major runoff or sediment loading events detected by 2011 monitoring data. Nutrient levels (phosphorus and nitrogen) remained low in 2011, and chlorophyll *a* measurements suggested that most lakes retained their minimally to moderately productive status. The slightly elevated summer nutrient and chlorophyll values in Witch Hole Pond are not a major concern in this naturally productive lake, although future test results must be carefully interpreted to ensure that nutrient enrichment from anthropogenic (human) sources is not becoming a chronic problem.

Monthly **streamflow** measurements from partial record sites and continuous-record streamflow gage data have been effective at tracking water quantity in the park and will aid the quantification and interpretation of other water quality data such as the estimation of nutrient loads. Weekly lake stage measurements have continued to build on a thirteen year data history documenting the dynamics of lake water levels. Continued review of and refinements to stage measurement techniques, site selection, and QA/QC methodology will enhance the quality and utility of the water quantity data.

Several additional monitoring activities not included in the report complement the core NETN parameters. Water samples are collected annually from the eight permanent Acadia NETN lake sites (as well as two additional lakes) in April and October and are analyzed for acid-

base chemistry parameters. Results from 2011 were similar to those of the past several years, and suggest that the Clean Air Act and its subsequent revisions appear to be effective in reducing the effects of acid deposition.

Acadia NP staff also sampled benthic macroinvertebrates in four streams (Duck Brook [2 sites], Lake Wood Outlet, Otter Creek, and Stanley Brook) in August 2011, as part of an annual monitoring program conducted in cooperation with the Maine Department of Environmental Protection (MDEP). Products of this activity include identification of all collected organisms to the species level, voucher specimens, and analysis of taxonomic diversity and richness. An MDEP modeling program determines a stream water quality classification rating based on the taxonomic data. Taxonomic and deterministic modeling results from 2011 have not yet been delivered to park biologists.

Summary

The majority of the 2011 water quality parameters for the lakes and streams monitored in Acadia National Park were within state standards, and most were very close to non-regulatory EPA ecoregional criteria. Nearly all of the values were within the ranges of historic NETN monitoring data, with the notable exceptions being slightly higher summer ANC and pH measurements, which may reflect a reduction of acid deposition effects.

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 Acadia National Park. Several changes will be implemented in the 2012 monitoring season, including taking monthly stream turbidity measurements, and the addition of sulfate, chloride, 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

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/index.cfm>



Witch Hole Pond is a naturally productive waterbody in Acadia.
Brent Danley photo.



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

