



# Monitoring Matters Acadia's Jordan Pond Dips into Big Data

NETN monitors the water quality of select lakes, ponds, rivers and streams in its 13 member parks. Acadia, by far, has the most bodies of water that are monitored in the network (37 compared to just over 20 for all other parks combined). Most sites are only able to be sampled once a month from May through October. But thanks to a partnership between NETN, Acadia National Park, the University of Maine, and Friends of Acadia, one very popular waterbody in Acadia is getting exponentially more sampling events. Jordan Pond, considered a park crown jewel, has been described as the “clearest lake in Maine”, and is a major tourist draw. For the past 7 years, it has had a continuous monitoring buoy deployed in it that has been returning a tsunami of data.

## Oh buoy: that's a lot of data.

Since 2013, the continuous monitoring buoy has been compiling a massive dataset that is providing a host of insights into the health of Jordan Pond. Over 30 parameters are measured every 15 minutes, totaling about 16,000 sampling events throughout a monitoring season. Compare this to the mere six in-person sampling events during the pre-buoy days, and it is obvious how much clearer of a water quality health picture this buoy can paint.

Currently, trends in the changing water clarity and dissolved organic matter (DOM) of the pond are of particular interest. Acadia National Park has a dataset going back to 1980 for Jordan Pond that reveals from

1995 to 2010 water clarity was declining and DOM was increasing. It is important to note that a decrease in water clarity is not necessarily a bad thing, and could actually be a sign of increasing pond health. Prior to the Clean Air Act Amendments of 1990, the pond and surrounding soils were receiving significant amounts of acidic deposition (primarily from acid rain) that altered the water's very chemical make-up. Water that is too acidic may look “clean”, but that is only because it can support very little plant life and is actually a sign of a malfunctioning ecosystem. Water that is a little less clear could be a sign of a return to pre-acidification conditions, as surrounding soils can now more easily give up DOM which gets washed into the lake.

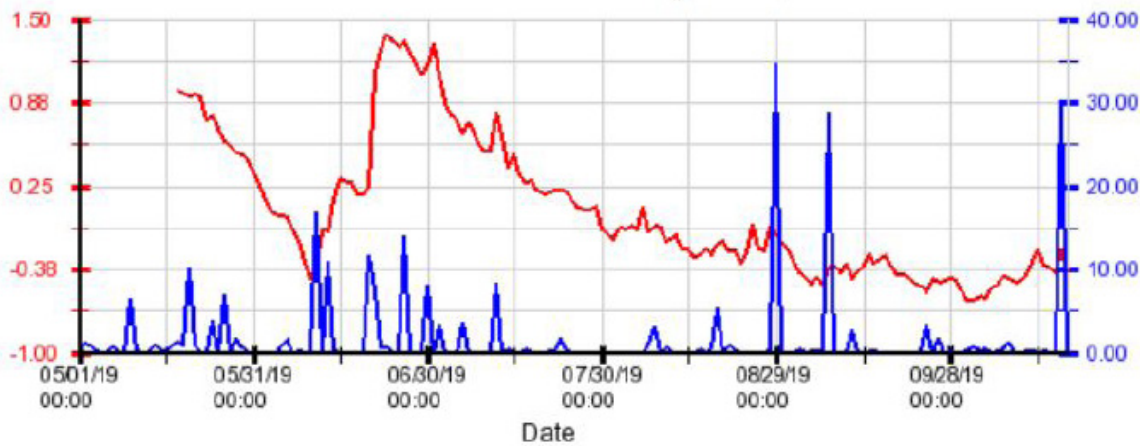
“We're constantly trying to find ways to understand the seasonal variation at our sites, but we only can visit most sites 6 times a year. The buoy documents conditions between these visits, and the data illustrate how our monitoring provides only a snapshot of daily and monthly cycles and trends.”

- Bill Gawley  
NETN Water Quality Lead



*Fall on Jordan Pond. Brent Danley photo.*

## Jordan Pond (2019)



*The continuous monitoring buoy shows that, over the course of the spring and summer, dissolved organic carbon (DOC) gets 'washed out' of the surrounding landscape and into Jordan Pond with decreasing abundance after significant rain events.*

— DOC  
— Daily Rain (mm)

### When it rains, it pours

Trends associated with climate change may also be impacting Jordan Pond's water quality. Since 2010, water clarity has been more variable than previous years which can in large part be attributed to the northeast now experiencing more frequent and severe heavy precipitation events than in previous decades.

The monitoring team has the ability to compare buoy data with that of a nearby weather station, which records precipitation, air temperature, wind conditions, and other related parameters. Back in the once-a-month sampling days, it was nearly impossible to tell how large storms affected water quality in Jordan Pond. Now the buoy records water quality data before, during, and after storms allowing for precise comparisons.

As NETN's water quality lead Bill Gawley notes, the buoy clearly shows "the relationship between weather events and water quality values, like the increase in dissolved organic carbon (DOC) after precipitation events. The interesting thing is how the response seems to decrease over the course of the season, suggesting that the DOC gets 'washed out' of the watershed over time, and since we see this pattern annually, we know the DOC re-accumulates over the winter."

### Buoyming Data for Other Lakes and Ponds?

Jordan Pond is what is known in the water world as an *oligotrophic* (minimally productive, with very dilute water chemistry) lake. Acadia and NETN are also curious about what kind of information could be attained from some of the more productive lakes and ponds in the park. A smaller sensor array that only measures a few parameters (temperature, conductivity, and dissolved oxygen) was put in Seal Cove Pond (a *mesotrophic*, or moderately productive, lake) in 2019, which will be re-deployed in 2020 as well, along with a

similar array in Witch Hole Pond, a highly productive *eutrophic* lake, which are generally shallow, turbid (cloudy), and supportive of abundant aquatic plant growth. Data from these additional, more diverse water bodies will help give a broader overview of the aquatic ecosystem as a whole for the park. NETN and the park have also installed continuous pH (acidity), conductivity, and temperature loggers in Otter Creek (a site with the US Geological Survey stream gage already measuring continuous water-levels and discharge) to get a better understanding of stream water quality.

### Mo' Data, Mo' Clarity

2019 wrapped up the 7<sup>th</sup> year of buoy monitoring on Jordan Pond. As data continues to pour in each year, the park is gaining insights into the aquatic workings of the Pond. One interesting finding is that the temperature profile of the water column and timing of thermal stratification (the phenomenon in which lakes develop two discrete layers of water of different temperatures: warm on top, *epilimnion*, and cold below, *hypolimnion*) vary year-to-year. In 2018, it happened at the beginning of June, and then the thermocline (the thin but distinct layer in which temperature changes more rapidly with depth than it does in the layers above or below) quickly dropped to 10 meters. In 2019, thermal stratification happened a bit later in mid-June. Throughout that summer, the depth of the thermocline was shallower, only about 8 meters. The park and research team hope to learn more about these types of year-to-year changes and how they may impact the ecology of the lake.

### For more information

See NETN's Water Quality & Quantity Monitoring webpage for more details about Acadia and other network park water quality programs: [www.nps.gov/im/netn/water-quality-quantity-monitoring.htm](http://www.nps.gov/im/netn/water-quality-quantity-monitoring.htm).