

High Pond Snowmelt Water Chemistry Survey #519118: Jonathan Fieroh, Region 5 Fisheries

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High Pond (R-P147) is a remote pond located in the Round Lake Wilderness in Hamilton County. It has a surface area of 42 acres, a maximum depth of 57 feet and an average depth of 18.7 feet. There is an abundance of water chemistry information for this pond as water chemistry surveys were performed in 1933, 1955, 1981, and 1984. Annual summer chemistry surveys were also performed from 2001 to 2018. This water was first stocked in 1934 and has been stocked annually since 1956. High Pond has consistently shown marginal acid/base chemistry with pH values ranging from 4.6 in 1981 to 5.5 in 2015. Despite the marginal chemistry, brook trout have been collected here repeatedly in fisheries surveys, #558011341, #581011342, a 1984 Adirondack Lakes Survey Corporation (ALSC) survey, and most recently in 2010 (#510036) when 61 brook trout were captured. This pond currently has a reputation as a good brook trout water.

Decreases in pH and increases in the concentration of Al and NO₃⁻ have been documented in surface waters draining acid-sensitive regions like the Adirondacks during periods of snowmelt, and these inputs may contribute to chronic as well as episodic acidification (Rascher, 1987). However, relatively recent improvements in the acid/base chemistry of some Adirondack waters have already been documented, and some of these waters, such as Brooktrout Lake (B-P874), now contain self-sustaining brook trout populations. In an effort to assess the effects of this "spring pulse" of acidity during a period of generally improving acid/base chemistry, a multi-year project was undertaken by NYSDEC and ALSC to collect weekly chemistry samples on five waters, including High Pond, analyzing selected chemical metrics (Table 1.).

Table 1. Spring 2019 High Pond selected water chemistry variables, snowmelt sampling.

Date	Air Eq. pH (pH units)	Acid Neutralizing Capacity (μ eq/L)	Inorganic Monomeric "toxic" Aluminum (μ M/L)	Base Cation Surplus (μ eq/L)	BC/ RCOOs-	Conductivity (μ mhos/cm)	Silica mg/L	Sodium mg/L
3/6/19	5.10	0.2	1.30	-19.5	1.8	12.6	2.3	0.34
3/14/19	5.07	4.8	1.89	-15.1	1.9	12.4	2.2	0.34
3/21/19	5.03	-0.1	1.37	-21.7	1.8	13.0	2.4	0.35
3/28/19	5.10	1.0	1.33	-21.6	1.8	13.2	2.4	0.36
4/5/19	4.98	6.7	1.59	-31.5	1.5	13.4	2.5	0.31
4/12/19	4.83	-5.6	1.22	-34.1	1.3	13.7	2.5	0.31
4/19/19	5.21	9.9	1.11	-15.5	1.7	11.0	2.0	0.29
4/26/19	5.21	0.4	1.00	-12.7	1.9	11.1	2.2	0.32
5/3/19	5.22	4.3	0.93	-10.4	2.0	10.7	2.2	0.32
5/10/19	5.18	2.5	1.04	-11.3	1.9	10.8	2.0	0.33
5/17/19	5.14	-1.3	1.04	-15.4	1.8	10.7	1.9	0.33

Average	5.10	2.1	1.26	-19.0	1.8	12.1	2.2	0.33
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High Pond was chosen as a water with a stocked brook trout population but marginal acid/base chemistry.

As expected, the “spring snowmelt” values for pH and ANC (acid neutralizing capacity) were consistent with an acidic water; with pH values centered around 5 and low (including some negative) ANC values. Additional chemical metrics, the Base Cation Surplus (BCS) and the ratio of Base Cations to Strong Organic anions (BC/RCOOs), were calculated and give a deeper understanding regarding the ability of this water to sustain a brook trout population. The BCS may be a more useful tool for the evaluation of recovery from acidification in the presence of increasing dissolved organic carbon (DOC) than ANC does, and the BC/RCOOs helps to quantify the strength of “naturally acidic conditions”, relative to base cations, found in some Adirondack waters. Inorganic monomeric or “toxic” aluminum is directly toxic to fish and levels below 2 $\mu\text{M/L}$ are desirable in summer samples. While a higher “toxic aluminum” value would generally be expected in a spring sample, no spring values at High pond reached even the summer thresholds. It may be noteworthy that in this water “toxic aluminum” values remained relatively low through the period despite the acid nature of this water in spring, as reflected in the pH, ANC, and other advanced metrics.

Preliminarily, it appears that for a water to support brook trout, BCS values should be above -15 $\mu\text{eq/L}$, and the BC/RCOOs ratio should be above 1.5. However, these thresholds were calculated for use with summer samples and it is not surprising that the thresholds were exceeded in some of these spring samples even in a water with a brook trout population. Silica and sodium levels, which can be indicative of groundwater influence were also measured.

These measurements may allow us to better understand the relationship between the “spring snowmelt” and summer sample values and to help illuminate the relationships between the spring pulse of acidity and brook trout survival.

Literature Cited:

Rascher, C.M., C.T. Driscoll, and N.E. Peters 1987. Concentration and flux of solutes from snow and forest floor during snowmelt in the West_Central Adirondack region of New York. *Biogeochemistry*. 3:209-224