

**Broomstick Lake Chemistry Survey #519007:  
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Broomstick Lake (M-P720) is located in the Ferris Lake Wild Forest, Hamilton County, and is accessed by an approximately 0.7-mile trail. It has a surface area of 19 acres, and a maximum depth of 18 feet. In a 2016 survey (#516029) there was sufficient dissolved oxygen for trout to a depth of 13 feet and the early August temperature at that depth was 57 °F. There is a natural fish barrier on the outlet of Broomstick Lake. Brook trout were stocked here in 1956 and 1957 but stocking was suspended after no fish were collected in a 1956 survey.

In 2016, samples were drawn from Broomstick Lake and advanced chemical analyses were performed by the Adirondack Lakes Survey Corporation to identify waters recovering from the effects of acid precipitation that may once again support native fish communities. 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. The 2016 chemistry values were such that an experimental stocking policy for 525 fin clipped Little Tupper strain brook trout fingerlings was initiated for the fall of 2019. There was a chance to gain additional information from Broomstick Lake in 2019 and a single chemistry survey was conducted in an effort to better assess the effects of the “spring pulse” of acidity. Decreases in pH and increases in the concentration of Al and NO<sub>3</sub>- 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).

Table 1. Broomstick Lake selected water chemistry values 1934 to 2019.

Date	Depth (feet)	Air Equilibrated pH (pH units)	Acid Neutralizing Capacity (µeq/L)	Inorganic Monomeric "toxic" Aluminum (µM/L)	Base Cation Surplus (µeq/L)	BC/RCOOs-	Conductivity (µmhos/cm)	Silica mg/L	Sodium mg/L
4/17/19	0	4.84	-7.7	2.74	-31.2	2.7	15.2	3.2	0.41
8/3/16	5	5.46	14.3	1.52	-3.2	1.8	11.0		
8/3/16	13	5.00	1.0				13.0		
1995	0	5.01							
6/25/58	0	5.80							
8/7/34	0	6.20							
8/7/34	0	5.50							
8/7/34	0	6.00							

In both the 2016 and 2019 samples additional chemical metrics such as the Base Cation Surplus (BCS) and the ratio of Base Cations to Strong Organic anions (BC/RCOOs) give a deeper understanding regarding the ability of this water to sustain a brook trout population. The



BCS provides a useful tool for the evaluation of recovery from acidification in the presence of increasing dissolved organic carbon and the BC/RCOOs helps to quantify the strength of “naturally acidic conditions” found in some Adirondack waters. 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 metrics were designed to apply to a summer sample, and it is not surprising the thresholds for some of these chemical metrics were exceeded in this single spring snowmelt sample. As well as the advanced metrics a “toxic aluminum” level below  $2 \mu\text{M/L}$  is thought to be critical for brook trout survival in a summer sample, and this summer threshold was also exceeded.

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