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NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Indian LakeWater Chemistry Survey #519108:

Jonathan Fieroh, Region 5 Fisheries

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Indian Lake (B-P852) is a remote 82-acre water located in Moose River Plains Wild Forest that also straddles the border of the West Canada Lakes Wilderness, Town of Morehouse, Hamilton County. The maximum depth of Indian Lake is 35 feet, and there is adequate dissolved oxygen almost throughout the entire water column. The flushing rate, calculated by Adirondack Lakes Survey Corporation (ALSC), was quite high at 9.6 per year. Indian Lake was a historic brook trout water that was first stocked with brook trout in 1942. Stocking ceased after a 1984 ALSC survey in which no fish were captured (the pH was 4.89) but brook trout stocking was restarted in 2013 due to improved water chemistry as measured by the ALSC Long Term Monitoring Project which provides wealth of additional chemistry information. A fish survey was performed in 2017 (#517048) and three year-classes of stocked brook trout (2013,2015,2016) were collected. Analysis of the water chemistry of Indian Lake and its tributaries continued in 2018 (#518084), and historic improvements in acid/base chemistry were documented.

In 2019, surface samples were drawn from Indian Lake over a 5-month period and advanced chemical analyses were performed by the ALSC to identify and better understand waters recovering from the effects of acid precipitation that may once again support native fish communities.

Table 1. Selected water chemistry variables for Indian Lake, 2019.

Date	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^{-1}	Sodium mg L^{-1}
2/28	5.23	7.5	1.74	-10.2	2.7	13.3	4.7	0.4
4/4	5.09	3.0	1.70	-14.2	2.4	13.3	4.3	0.4
6/11	6.46	9.8	1.30	4.2	2.4	9.4	1.1	0.4
7/18	5.64	12.3	0.59	8.5	2.1	8.8	0.7	0.4
9/17	5.96	14.1	0.11	17.5	2.6	8.9	0.9	0.4

Indian Lake is an example of a water with greatly improved acid/base chemistry now supporting a brook trout population. In the 2019 samples, inorganic monomeric “toxic” aluminum (ALIM) levels never reached the critical threshold for brook trout survival of 2 μML^{-1}despite the fact that ALIM levels in 2004 and 2006 reached 3 μML^{-1}in the August samples. Two advanced metrics, the Base Cation Surplus (BCS) and the ratio of Base Cations to Strong Organic anions (BC/RCOOs), were also 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 alone, and the BC/RCOOs helps to quantify the strength of “naturally acidic conditions” found in some Adirondack waters. Preliminarily, it appears that, in a summer sample, for a water

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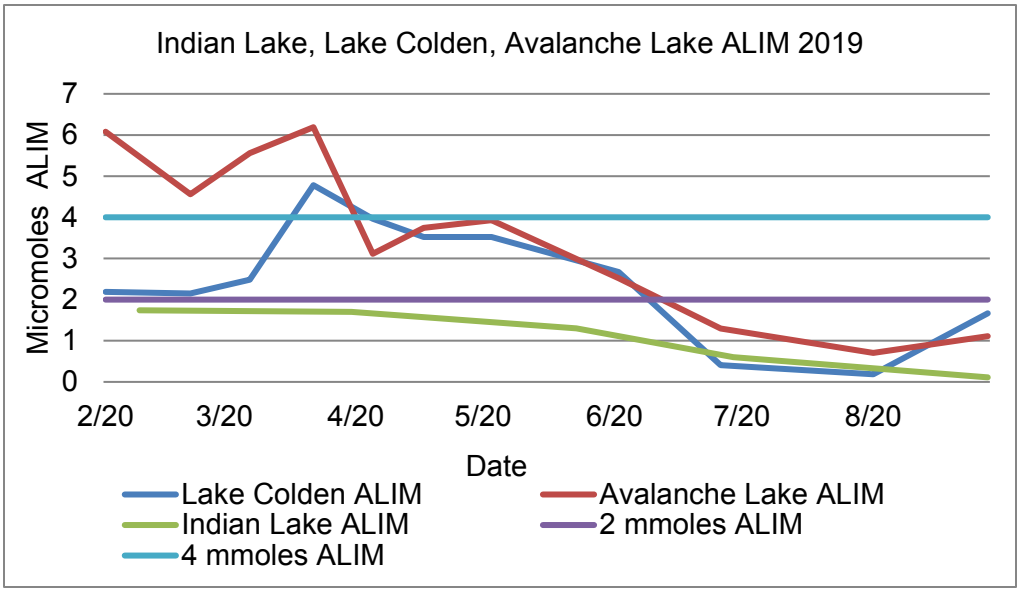
to support brook trout, BCS values should be above -15 µeq/L, and the BC/RCOOs ratio should be above 1.5. These thresholds were again easily met in 2019.

Multiple chemistry samples were drawn throughout the 2019 season in 3 waters, Avalanche Lake, Lake Colden, and Indian Lake. The chemistry of these waters illustrates different stages of recovery from serious acid deposition. Indian Lake supports a brook trout population, and Lake Colden also has a (self-sustaining) brook trout population, while the status of the fishery in Avalanche Lake was last determined in a 1987 ALSC survey when no fish were caught. Recent research (Baldigo et. al. 2019), furthers our knowledge of the toxic effects of various ALIM levels on caged brook trout in streams. They found (in 30 day toxicity tests) mortality of juvenile brook trout was negligible below (medians of) 1 µM/Lof ALIM, was 20% at 1-2 µM/L, was 20-50% at 2-4 µM/L, and was 90-100% above 4 µM/L. It has also been documented (Schofield, 1996) that brook trout fry confined at shallow depths during acidic snow melt episodes experienced high mortality rates when fry at greater depths did not. Additionally, it was observed that young brook trout avoided lethally acidic near shore water by moving to greater depths. Indian Lake never reached 2 µML-1 in any of the 2019 samples but several monthly samples contained more than 1 µML-1 while in Lake Colden the majority of 2019 monthly samples were in excess of 2 µML-1 of ALIM despite the fact both these waters have brook trout populations. The ALIM levels in Avalanche Lake were notably higher early in the year than the other 2 lakes but the existence of any refugia here is unknown.



The stocking of 2,250 fin-clipped Horn Lake strain brook trout fingerlings should continue in Indian Lake to allow for the status of natural reproduction to be re-evaluated within 5 years. Because of its simple fish community, the use or possession of baitfish at Indian Lake should be prohibited by adding the pond to 6 NYCRR 10.6 (g) (8) pending an evaluation of the pond's outlet.

Baldigo,B.P., S. George, G.B. Lawrence and E.A. Paul 2019. Acidification Impacts and Goals for Gauging Recovery of Brook Trout Populations and Fish Communities in Streams of the Western Adirondack Mountains, New York, USA. Trans. Am. Fish. Soc., 148, 19 pp.

Schofield C.L. and Keleher C. 1996. Comparison of Brook Trout Reproductive Success and Recruitment in an Acidic Adirondack Lake Following Whole Lake Liming and Watershed Liming. Biogeochemistry. 32 3: 323-337.