

**Avalanche Lake Fisheries and Chemistry Survey (#520075, 520099)**  
**Jonathan Fieroh, Region 5 Fisheries** **02/05/2021**

Avalanche Lake is just upstream of and flows into Lake Colden, in the High Peaks Wilderness of Essex County. It is a 10-acre water with a maximum depth of 23 feet and a mean depth of 10.8 feet, the calculated flushing rate is 5 times/year and at an elevation of 2964 feet. Documents indicate that Avalanche Lake was likely privately stocked with brook trout at least once in 1921. The lake was a quality brook trout fishery until the mid-1950s when it began to acidify. In 1981 and 1982 the lake was limed and then stocked in 1982 and 1983 with domestic yearling and Temiscamie x Domestic (TxD) hybrid fingerling brook trout. TxD hybrid stocking continued until 1987. No fish were caught in a 1987 (ALSC) survey, so stocking was terminated. Avalanche Lake is classified as an Adirondack Brook Trout Lake in the High Peaks Unit Management Plan.

In 2019, water samples were drawn from Avalanche Lake and advanced chemical analyses was performed by the Adirondack Lakes Survey Corporation (ALSC) to identify and better understand waters recovering from the effects of acid precipitation that may once again support native fish communities. Inorganic monomeric or “toxic” aluminum (ALIM) was measured along with two advanced metrics, Base Cation Surplus (BCS) and the ratio of Base Cations to Strong Organic Anions (BC/RCOOs). These metrics provide a deeper understanding regarding the ability of waters to sustain brook trout population in acid impacted waters. BCS may be a more useful tool for the evaluation of recovery from acidification in the presence of increasing dissolved organic carbon (DOC) than acid neutralizing capacity (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 to support brook trout, BCS values should be above  $-15 \mu\text{eq/L}$ , the BC/RCOOs ratio should be above 1.5 and the “toxic” aluminum level should be less than  $2 \mu\text{M}^{-1}$ . These thresholds were surpassed in summer the 2019 samples (#519117).

Avalanche Lake was included in the ALSC Long Term Monitoring Project (LTM) and thus there is a wealth of additional water chemistry information available, mostly from monthly sampling between 1992 and 2017. The LTM data show significant improvement over time in a variety of chemical parameters including pH, ANC and in the levels of ALIM. In general, improvements in the water chemistry of Avalanche Lake have certainly improved but they still lag behind the chemistry in other lakes like Lake Colden.

Recent research (Baldigo et. al. 2019), furthers our knowledge of the toxic effects of various ALIM levels on caged brook trout in streams. The duration as well as the severity of ALIM levels was found to be an important factor in determining brook trout survival in streams. However, the duration of the high ALIM spikes in lakes is likely quite variable and as such important for lacustrine brook trout survival. This appears to be the case in Lake Colden where three year-classes of brook trout were discovered in late 2019 despite some measurements of ALIM near or above  $4 \mu\text{M}^{-1}$ , and many consecutive measurements in excess of  $2 \mu\text{M}^{-1}$ . Additionally, it has been documented (Schofield, 1996) that young brook trout avoided lethally acidic shallow water by moving to greater depths during acidic episodes. It seems that in Lake Colden, an inlet (likely Cold Brook) or deeper water is providing that refuge. The Avalanche Lake summer water samples meet the established experimental metrics for brook trout stocking, despite some high winter and spring ALIM values. So, while ALIM levels are noticeably higher for some of the year in Avalanche Lake, brook trout are persisting possible utilizing a still unknown refuge. A fisheries survey of Avalanche Lake has not been conducted since the 1987 ALSC survey so



the status of the fish population was unknown. The 2020 fisheries survey was undertaken to see if a suitable refuge was providing for the survival of a brook trout population, as is the case in Lake Colden.

On 9/22/2020 two 150-foot Swedish experimental gill nets, a 30-foot minnow net and a minnow trap were set in Avalanche Lake. Despite the presence of dissolved oxygen sufficient for trout almost throughout the water column no fish were collected in this survey.

Several chemistry samples were drawn in 2020 and the metrics have improved when compared to the analogous metrics from 2019, (Table 1.). While brook trout are not currently present, the water chemistry continues to improve and should be monitored. Avalanche Lake should be stocked with brook trout when improvements in the chemistry allow for brook trout survival.

Table 1. Selected water chemistry variables for Avalanche Lake, 2020.

Date	Depth (feet)	Air Equilibrated pH (pH units)	Acid Neutralizing Capacity ( $\mu\text{eq/L}$ )	ALIM "toxic" Aluminum ( $\mu\text{M/L}$ )	Base Cation Surplus ( $\mu\text{eq/L}$ )	BC/ RCOOs-	Conductivity ( $\mu\text{mhos/cm}$ )	Silica $\text{mg L}^{-1}$
3/2	0	5.68	15.1	2.37	-25.5	1.5	11.4	3.7
6/1	0	5.08	8.4	2.37	-4.2	2.1	9.5	2.6
7/30	0	6.22	29.2	0.63	12.5	2.2	8.9	2.9
9/16	2	6.24	32.9	0.93	13.9	2.3	10.1	5.0
9/16	16	6.31	40.55	0.93	12.3	2.2	10.9	4.9

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: 3223-337.