Executive Summary

Limnological monitoring of the Rainbow Lake Chain has been carried out by the Rainbow Lake Association and the Adirondack Watershed Institute since 1997. This report serves as a project update. It presents the results of the 2015 field season and describes long term trends in the historical data of the Rainbow Lake Chain. Though the data and accompanying analysis provided in this report give insight into the water quality of the Rainbow Lakes, more detailed limnological studies may be necessary to produce management recommendations. Raw water quality data can be provided upon request. The bullets below represent the primary findings contained within this report.

- The dissolved oxygen profiles of the study lakes are typical of most productive lakes in the Adirondacks, where dissolved oxygen is greatest in the epilimnion (surface water) and gradually decreases towards the bottom. The bottom four meters (13 feet) of Rainbow Lake were hypoxic (D.O. less than 2 mg/L). We only observed hypoxia in Rainbow Lake, although it typically exists in Clear Pond as well.

- Transparencies of Rainbow Lake and Clear Pond have remained relatively constant over the study period and have exhibited no statistical trend. The water of Lake Kushaqua has exhibited a statistical decrease in transparency at a rate of approximately 7 centimeters per year. Since we detected no change in nutrients or algal productivity (chlorophyll-a), the decrease in transparency of the lake may be related to changes in dissolved organic material entering the water from the watershed.

- Total phosphorus concentrations in the Rainbow Lake chain have been notably lower over the past 6 years. Some of the observed decrease may be related to improved analytical capabilities of the new AWI laboratory which went online in 2010. Total phosphorus concentrations were 2-4 times greater in the hypolimnion (bottom water) of the study lakes. The increase in hypolimnetic phosphorus is typical for these lakes, and is related to the hypoxic condition of the hypolimnion, were low dissolved oxygen concentration create a reducing environment and allow phosphorus to move into the water from the sediment (internal P loading).

- Chlorophyll-concentrations in the Rainbow Lake chain have remained relatively constant over the 19 years of monitoring.

- Carlson's Trophic Status Index based on transparency, chlorophyll-a, and total phosphorus suggests a mesotrophic classification for the three study lakes. The mesotrophic classification for the lakes has been consistent since the monitoring program began. In all of the lakes the TSI values for transparency and chlorophyll are in close agreement, however the TSI for total phosphorus tended to score the lakes in the oligotrophic range in some years. A disparity of this nature typically indicates that the lakes experience periods of phosphorus limitation.

- The waters of the Rainbow Lake chain are typically circumneutral in terms of their acidity (pH 6.5-7.5). The average pH of Rainbow Lake exhibited a slight but significant downward trend over the 19 years of monitoring. The average alkalinity of the lakes ranged from 10-16 mg/L, indicating that the lakes were fairly well buffered, and as a result are not particularly sensitivity to acid deposition.

- Apparent color values of the lakes were elevated, and historically highly variable. Elevated color is indicative of an increase in dissolved organic matter in the water and is typically due to watershed characteristics such as wetland, bogs, and coniferous forest cover.

- Non-impacted Adirondack Lakes have very low levels of sodium and chloride, the only substantial sources being road salt, septic output, and industrial fertilizers. For example, Adirondack lakes in watersheds without paved roads typically have sodium and chloride concentrations less than 0.55 mg/L and 0.24 mg/L respectively. (Kelting et al 2012). Rainbow and Kushaqua Lakes have slightly elevated concentrations of these chemicals compared to non-impacted baselines. The paved roads in the watershed, along with shoreline development, were likely responsible for the slightly elevated levels of these chemicals. No statistical trend was detected in the historic chloride levels of Rainbow Lake of Clear Pond. However, a slight, yet significant decrease in chloride was detected in Lake Kushaqua.

Aerial view of Rainbow Lake and Clear Pond, looking south east (photo courtesy of the Rainbow Lake Association webpage).