From: Robert L. Johnson: Researcher and Owner of Racine-Johnson Aquatic Ecologists **Date:** March 24, 2020

To: Chautauqua Lake & Watershed Management Alliance & Stakeholders of Chautauqua Lake

Re: Racine-Johnson Aquatic Ecologists' Research at Chautauqua Lake on the Aquatic Plant Community Ecosystem and the 2019 Spring and Late Summer/Early Fall Plant Survey Reports

The Racine-Johnson Aquatic Ecologists is a consulting company that collected scientific data on Chautauqua Lake in 2019 for the 18th consecutive year, which focuses on submersed aquatic vegetation and the associated ecosystem. As a researcher, I (Bob Johnson) began collecting scientific data on the aquatic plants and correlated insect herbivores at Chautauqua Lake first at Cornell University in 2002-2008, then continuing with Racine-Johnson Aquatic Ecologists from 2008 to the present. Beginning in 1966 at Cornell, my freshwater research informed NYS stakeholders: individuals, lake associations, and local and state governments about the importance of aquatic plant ecosystems. This included the management of excessive plant growth, when appropriate. Additionally, my research focused on using common methods of plant control that included mechanical harvesting, bottom barriers, shading, and herbicides. All methods employed were consistent with sound methodology for aquatic research, and included extensive experience with old herbicide chemistries 2,4-D (1959) and endothall (1960).

My current research also includes studying the biology of *Hydrilla verticillata* a new plant invader in Upstate NY since 2011, and evaluates herbicides and other methods to eradicate the species in NYS. My research findings on insect herbivores that feed on the non-native plant Eurasian watermilfoil, which limits the plant's growth, has worldwide recognition by the scientific community. Today, Racine-Johnson Aquatic Ecologists continue to study these herbivores as biological control agents on Chautauqua Lake, and other NYS lakes. Racine-Johnson has 18 years' experience conducting scientific research at Chautauqua Lake on behalf of my sponsor, the Chautauqua Lake Association, which benefits stakeholders: the property owners, community members, fishing groups, and visitors. Racine-Johnson's ongoing research on Chautauqua Lake is multi-faceted, but it primarily documents the presence and density of submersed aquatic plants (macrophytes) in the lake. For 18 years, through yearly annual research reports along with public presentations and "hands-on" workshops to diverse groups about this large shallow lake, Racine-Johnson has long-advocated that a robust aquatic macrophyte community in Chautauqua Lake is desirable and essential to a healthy vibrant lake. Importantly, this "world-class" warm water, multi-species fishery **requires** a flourishing aquatic plant community.

Racine-Johnson Aquatic Ecologists have emphasized that excessive phytoplankton (algae) blooms are a much greater threat to the viability of freshwater ecosystems than thick macrophyte beds. Chautauqua Lake has phytoplankton blooms including cyanobacteria, which are an important part of its ecosystem. In 2008, Racine-Johnson conducted a lake-wide study describing phytoplankton species and concentrations. Racine-Johnson's long-term aquatic plant data sets of Chautauqua Lake indicate that it has a **relatively stable freshwater ecosystem** because of the macrophyte growth in the littoral zone (area where rooted plants can grow). In presentations at Chautauqua Institution in the last two years, Racine-Johnson emphasized the **critical importance of rooted plants in the littoral zone area as a primary stabilizing force in Chautauqua Lake's ecosystem**. However, the research data from Racine-Johnson's long-term monitoring of the aquatic plant community in Chautauqua Lake (2002-2019) indicates that the **present littoral zone** with growing rooted plants **has shrunk**, compared to the littoral zone area depicted on current and historical maps.

Standard Research Methods Developed and Used by Robert Johnson Since 1988- Briefly this describes the standard rake-toss, bottom-drag method used to gather and evaluate aquatic plant growth in Chautauqua Lake. (My yearly-published research reports detail the specific procedures). In predetermined locations, our biologists collect **two samples** of aquatic plants at the same location by our **rake-toss bottom-drag** method by extending two double-sided rakes attached to ropes out from the boat 15m (~50') to **retrieve any plant mass,** by **pulling very slowly** along the lake bottom 10m (~33') at each of the sampling points. A biologist places the plant mass into a large tray, and makes an estimate of mass retrieved based on previous Chautauqua Lake research. Then a biologist separates the mass into piles of individual species, and assigns and records a percentage of the whole mass to each species. A vital part of Racine-Johnson's research is the ability to **collect exact data** on the **existing aquatic plants and invertebrates,** at specific times and sampling points on the lake. The staff of aquatic biologists is highly trained. There is generally 60 plus years of collective aquatic plant experience of personnel who evaluate macrophytes on our survey boat. In 2020, the same employees will use these sampling techniques. Racine-Johnson Aquatic Ecologists' **hands-on plant sampling** methodology is **crucial to the accuracy** of the research findings of the **actual plant community: the species and amounts found in each location**. It is extremely important to note that collecting less than two rake-toss bottom-drags at any location, or deviating from this collection method, will **not** give accurate results.

The Loss Of The Aquatic Plant Community In Chautauqua Lake's South Basin in 2019

May 13-14- Princeton Hydro, a consultant for the Chautauqua Lake & Watershed Management Alliance collected, measured, and recorded relative density and biomass of aquatic plants (macrophytes) growing in Chautauqua Lake.

May 15-17- SOLitude Lake Management applied aquatic herbicides 2,4-D and endothall to lake areas south of Long Point on Chautauqua Lake, to control the growth of macrophytes.

May 21- Princeton Hydro collected lake water samples from the chemically treated and non-treated areas of the lake, seven days after the application of herbicides. They sent these samples to a testing lab to determine herbicide residue concentrations. Lab results showed chemical concentrations of both 2,4-D and endothall in lake areas **not permitted for herbicide treatment**. The results also showed that **both chemicals drifted** at least 1 mile from the herbicide treatment.

May 22, 23 & 29- Racine-Johnson Aquatic Ecologists conducted a Spring Aquatic Plant and Insect Herbivore Survey in the southeast end of the south basin of Chautauqua Lake. The data collection showed several plant species growing. However, the plant *Potamogeton crispus* had **severe structural damage** to leaves and stems expected after an endothall application. Additionally, there was **noticeable herbicide injury** to the leaves and stems of the plant species *Myriophyllum spicatum*, *Ceratophyllum demersum and Elodea sp*.

June 12- Princeton Hydro took plant biomass measurements less than one month after the herbicide treatments. They found **outside of the treated area** a **considerable decline** of native plant biomass, compared to the plant biomass measurements they took on May 13-14 **before** the herbicide treatment.

July 1- Racine-Johnson conducted a second Insect Herbivore Survey at four sampling stations in the southern end of the south basin. On this date, there were **no species of plants present at three of the four sampling stations**. In addition, there were no visible phytoplankton blooms, and the water clarity was slightly turbid from soil particles in the water column produced by wind-driven waves.

Spring/Summer- The Chautauqua Fishing Alliance (CFA), (part of a Northern U.S. Fishery Research and Education Network) described the progressive loss of vegetation in the south basin beginning in late May, through June, and into summer. The CFA also observed as the summer progressed, increasingly turbid water, and a barren lake bottom. Further, Professional Fishing Guides on the Lake, who are writers for the Musky Hunter magazine described in their Dec. 2019/Jan. 2020 articles, the same conditions of lost vegetation in the south basin.

September 19-October 1- Racine-Johnson Aquatic Ecologists conducted a Late Summer/Early Fall Plant Survey in the north and south basins of Chautauqua Lake. (a) In the north basin north of Long Point, the aquatic plant community survey showed normal plant growth, good-to-excellent water clarity, along with a robust growth of desirable macrophytes. (b) In the south basin, Racine-Johnson observed an increase in phytoplankton blooms. (c) In the southeast section of the south basin, the survey measurements showed a **nearly bare lake bottom**, and only a **few plant fragments lying over several hundred acres.**

Summary

Based on Racine-Johnson's long-term aquatic plant database for Chautauqua Lake (2002-2019), the data suggests that the official aquatic plant management decisions taken to apply the herbicides 2,4-D and endothall on May 15-17, targeting *Myriophyllum spicatum* and *Potamogeton crispus* the naturalized, now colonized plant species, may have high environmental costs.

These environmental costs of a diminished plant community include the loss of: 1) other plant species, 2) habitats that macrophytes create in a shallow freshwater lake, 3) populations of many species within the lake's food web, as well as other losses.

The littoral zone is a critical part of the very complicated nutrient cycling in Chautauqua Lake and can directly affect the Lake's ongoing struggle with cyanobacteria, the harmful algae blooms (HABs). Removing aquatic macrophytes from large littoral areas is not prudent planning for Chautauqua Lake's future.

To repeat, the littoral zone is a stabilizing force in the Chautauqua Lake ecosystem. For a healthy lake, it is essential to have a robust rooted aquatic plant community. (Racine-Johnson Aquatic Ecologists' research reports include scientific references that support these statements).