EFFECTIVE CONTROL OF HYBRID WATERMILFOIL AND PURPLE LOOSESTRIFE ON LAKE MITCHELL, WEXFORD COUNTY, MICHIGAN: A SUCCESS STORY

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Lake Mitchell aerial photo

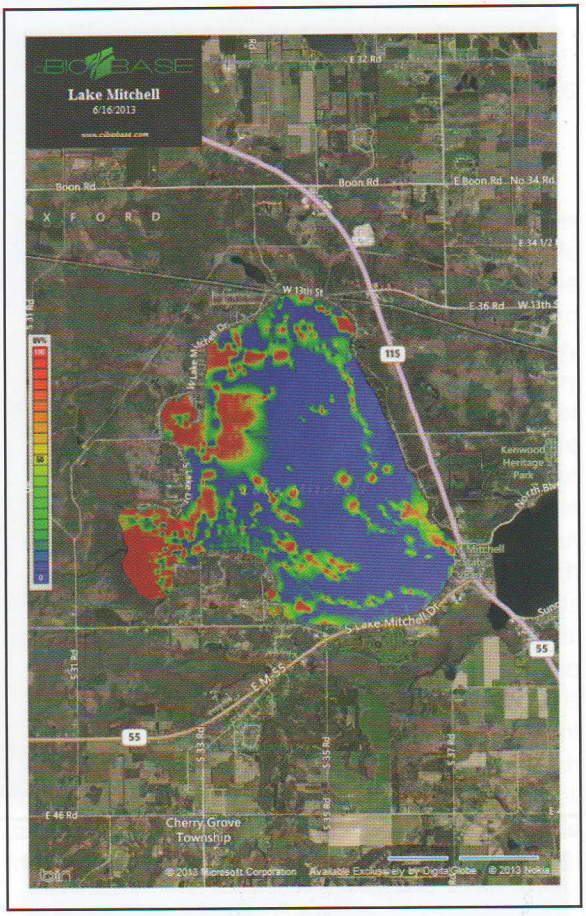
Lake Mitchell is a 2,580-acre natural, glacial lake located in Sections 1, 2, 3, 4, 10, 11, 12, 34, 35, and 36 of Cherry Grove and Selma Townships in Wexford County, Michigan (T. 21, 22N, R. 10W). The lake has three major tributaries including Mitchell Creek which enters the lake from the west side of Big Cove, Brandy Brook which enters the lake at the north end of Little Cove, and Gyttja Creek which enters the lake at the north region of the lake. There are five individual and smaller water bodies connected to the main lake that include Little Cove, Big Cove, Franke North Cove, Franke South Cove, and the Torenta Canal. A significant challenge arises due to the need to manage each

of these water bodies and the main lake which all require different management strategies.

Lake Mitchell has approximately 11.4 miles of shoreline and a mean depth of approximately 8.7 feet (Restorative Lake Sciences, 2014). The lake contained approximately 20 acres of invasive hybrid watermilfoil (Myriophyllum spicatum var. sibiricum) in 2015, relative to the approximate 400 acres of the plant that once colonized the lake in 2009. This particular plant threatens the biodiversity of the submersed native aquatic plant (macrophyte) communities, threatens navigation and recreational activities, and also may harbor bacteria and other nuisance algae that are not beneficial to the lake's ecosystem. Furthermore, the plant may reduce waterfront property values. The native aquatic plant diversity in Lake Mitchell is very high with 27 native aquatic plant species present so protection of these is paramount for lake health.

Eurasian Watermilfoil

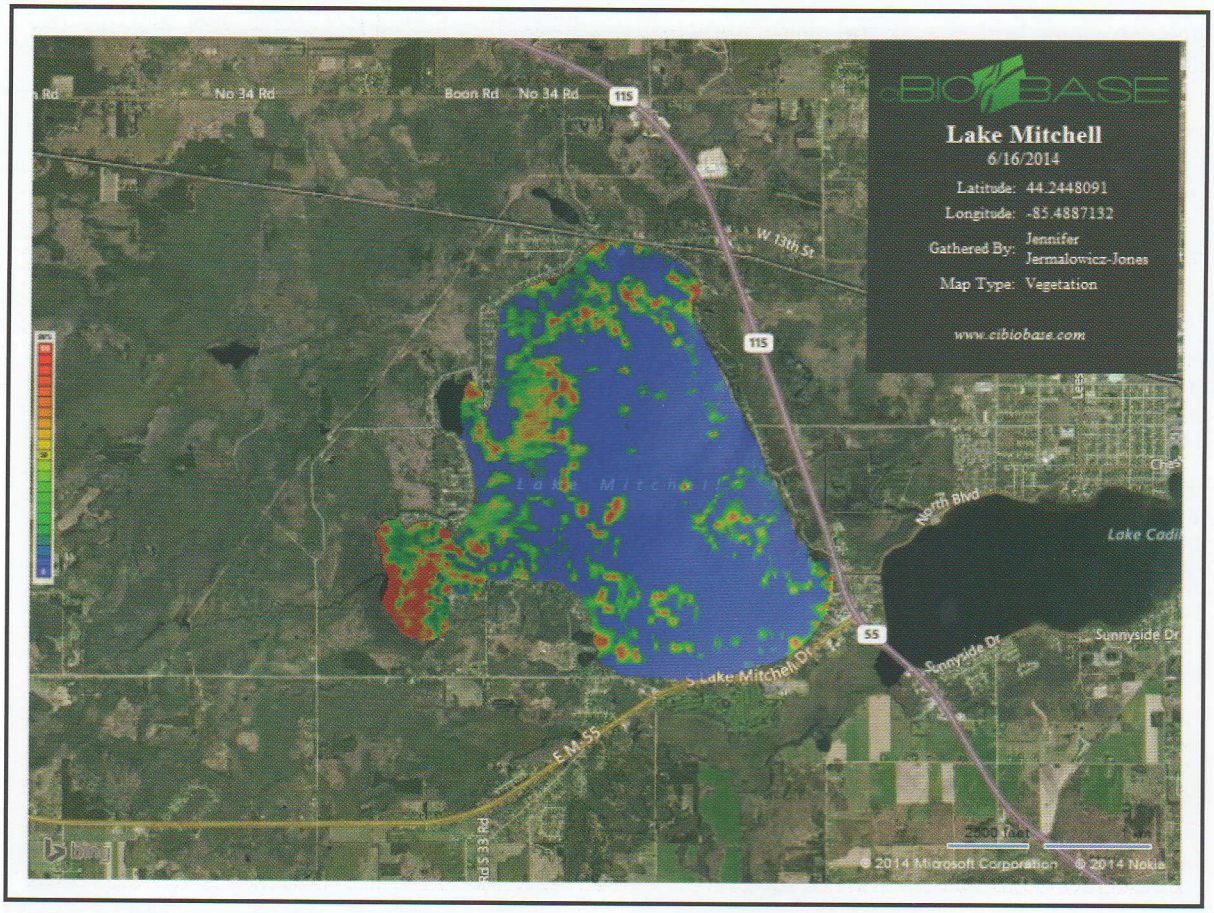
Restorative Lake Sciences (RLS) recommended that selective spot-treatments with highly selective granular systemic aquatic herbicides be used to treat the exotic hybrid watermilfoil within the lake and that strong contact herbicides be used to control the nuisance native aquatic plant and algae overgrowth in the Coves and in Torenta Canal. A reduction in the herbicide treatment areas is projected for ongoing years of the program if no other invasives enter the Lake Mitchell ecosystem. RLS also recommended continued education of lake riparians on nutrient reduction to the lake and lake protection Best Management Practices (BMP's). The current successful reduction of the invasive species present in and around Lake Mitchell have been a result of multiple factors including thorough aquatic vegetation surveys, research on innovative aquatic management methods, oversight of all management activities, integrated management methods, and the development of prioritized goal statements, aquatic plant management guidelines for the Coves and Canal, and by-laws by the Lake Mitchell Improvement Board.



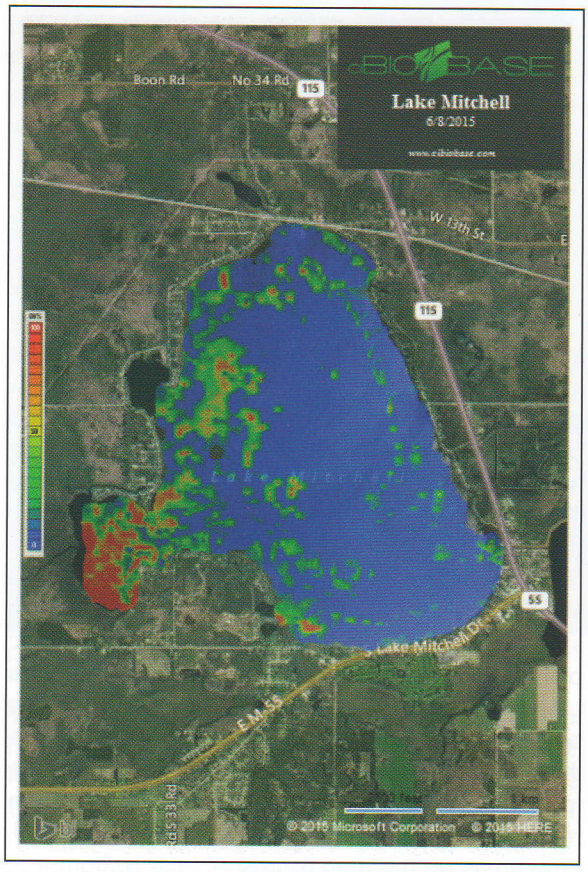
Lake Mitchell Aquatic Vegatation Biovolume Map(2013)

AQUATIC VEGETATION SURVEYS: THE IMPORTANCE OF GOOD DATA

The Point-Intercept GPS aquatic vegetation survey method should be conducted on most inland lakes following large-scale aquatic herbicide treatments to assess the changes in aquatic vegetation structure and to record the relative abundance and locations of native aquatic plant species. Due to the large size and shallow mean depth of Lake Mitchell, a bi-seasonal GPS Point-Intercept grid matrix survey (Madsen et al. 1994; 1996) is conducted annually to assess all aquatic plants, including submersed, floating-leaved, and emergent aquatic plant species. Additionally, in 2013-2015, the use of a side-scan sonar GPS device to scan the aquatic plant biovolume of the lake was conducted using a Lowrance® HDS 8 unit with BioBase® software. The scans for 2013-2015 are shown in Figures 3-5. Note the substantial reduction of red color in 2015 relative to 2013 and 2014. This represents a reduction in high-growing canopy-forming plants such as milfoil. Blue areas on the map represent lake bottom that lacks vegetation.



Lake Mitchell Aquatic Vegatation Biovolume Map(2014)



Lake Mitchell Aquatic Vegatation Biovolume Map(2015)

INNOVATIVE AQUATIC MANAGEMENT METHODS RESEARCH

Aquatic herbicides come in many different formulas that can be applied to aquatic vegetation in varying doses. Since the original watermilfoil infestation in 2009 was approximately 400 acres, scientists from RLS experimented with varying herbicide strengths and utilized several different systemic herbicide products for the watermilfoil control. The key is to not allow for the existing watermilfoil population to develop a tolerance for a specific herbicide and dose. This requires that both the type of herbicide and the dose be varied a few times throughout the treatment season and among years. When an aggressive hybrid watermilfoil was found in Lake Mitchell in 2012 and genetically verified, this approach was even more critical given the high resistance of hybrid watermilfoil to many herbicides.

Also noted was the use of biological control agents for the reduction of Purple Loosestrife, an invasive, exotic emergent aquatic plant that is found along the shoreline of Lake Mitchell. Galerucella sp., a beetle that feeds on the inflorescences of the mature plant was transplanted to each site using mature breeding colonies that produce multiple life cycles

in a single season. Thus far, the active colonies of beetles have increased and the Purple Loosestrife around the lake is controlled from further expansion.

The use of a mechanical harvester with a fine mesh was also used to reduce fine filamentous algae found in the Torenta Canal. This removed dense biomass of algae that may not have responded as well to solely the use of copper algaecides. This integrated management approach utilizes multiple natural and chemical methods to successfully manage the invasive aquatic plant species and algae in Lake Mitchell.

Purple Loosestrife

OVERSIGHT OF LAKE MANAGEMENT ACTIVITIES

Another key to the successful reduction of hybrid watermilfoil and other invasives in Lake Mitchell is due to the rigorous oversight of all management activities by professional lake scientists. These scientists accompany a member of the Lake Mitchell Improvement Board during the management activities and directly oversee all treatments by a licensed management contractor. When this process occurs, accountability to the lake improvement board is created and all stakeholders can actively participate in the management activities for the best outcome. Often, there are adjustments in the management plan made in the field due to the high environmental uncertainty encountered while working on complex aquatic ecosystems. Determination of the efficacy of lake treatments is conducted by a member of RLS and the Lake Mitchell Improvement Board.

DEVELOPMENT OF PRIORITIZED GOAL STATEMENTS AND BY-LAWS

Although the Lake Mitchell Improvement Board was one of the first lake boards in Michigan, the roles of the lake board have evolved with time. Specifically, the lake board created prioritized goal statements and by-laws for them and future members to follow. These statements define the constitution of the board, its purpose, and define specific management events and financial goals of the lake board. The goals created serve as guides for the lake board to attain each year to continue building accountability and support with the local riparian community. The lake board reviews these statements annually to determine if they need to be revised based on evolving lake conditions.

AQUATIC PLANT MANAGEMENT GUIDELINES FOR THE COVES AND CANAL

Since Lake Mitchell is a complex water body with multiple smaller coves and a canal, the management methods used in the main lake do not apply well to these areas since they are shallower, contain higher aquatic plant density, and are not necessarily responsive to the same techniques used in open waters. In other words, an integrated approach was recommended for each individual cove and the canal and these methods are employed annually specific to each individual water body. Many other lakes in Michigan also have a similar structure and could benefit from this approach. A document describing management preferences and methods specific to each water body was developed by the Lake Mitchell Improvement Board and this serves as a guide for each year. This has led to a very successful reduction of invasive aquatic plant species in the other water bodies and increased satisfaction of lake riparians that live in those areas.

The Lake Mitchell Improvement Board has worked hard to utilize innovative and scientifically sound lake management methods with effective oversight. The relationship between the lake improvement board and the consultant and management contractors has also been critical for the successful outcome. Rigorous lake vegetation surveys both prior to and after implementation of treatments have proven to be instrumental in determining treatment efficacy and in treating new areas of invasive aquatic plants that may occur. Due to the varied nature of Lake Mitchell with shallow coves and a canal, an integrated management approach with separate prioritized goals is critical for a complete reduction of invasives throughout the entire lake. Lastly, the Lake Mitchell Improvement Board has been able to save approximately $266,000 over a six year period by using these techniques.