Hybrid watermilfoil and herbicide resistance

The Wisconsin Department of Natural Resources conducts and supports a variety of projects that improve our understanding of aquatic invasive species (AIS) and the ways we manage them.

Background

Occasionally, two distinct species can reproduce with each other to produce a new genetically distinct hybrid species. Hybrid crosses between native and non-native species can result in additional management challenges. While many hybrid species are sterile and cannot continue to reproduce, some hybrid crosses, such as those created between watermilfoil species, are viable and can reproduce with parent species or other hybrids. Hybrid species tend to have greater genetic diversity which may make them more resilient to management techniques.

Hybrid watermilfoil

Hybridization among watermilfoils—particularly between non-native Eurasian watermilfoil (*Myriophyllum spicatum*, EWM) and native northern watermilfoil (*M. sibiricum*, NWM)—has garnered much attention recently. There is not one single hybrid watermilfoil, but rather multiple, genetically distinct strains (genotypes) that reflects reoccurring hybridization events. Hybrid watermilfoil oftentimes have identifying characteristics which overlap with EWM and NWM, and genetic DNA analysis is required to confirm hybridity. Some hybrid watermilfoil genotypes have thicker stems, more prolific flowers, and grow faster than pure-strain EWM. These characteristics may contribute to certain hybrids being particularly less susceptible to chemical control strategies.

John Halpop, Montana State University Extension

Summary of Findings

- Hybrid watermilfoil populations have been confirmed in ~170 lakes in Wisconsin, primarily those located in the southern and central portions of the state.
- An individual lake may have one or more unique genotypes of watermilfoil. Certain non-native genotypes have been found to be shared amongst multiple lakes, which suggests that some genotypes are being spread to new waterbodies via fragments on boats and trailers.
- A recent study of whole-lake 2,4-D treatments in Wisconsin found smaller population reductions and shorter longevity of control in lakes that contained hybrid watermilfoil populations compared to lakes with only pure-strain Eurasian watermilfoil.
- Laboratory and field studies have shown that many strains of hybrid watermilfoil have reduced sensitivity to several commonly used aquatic herbicides compared to pure-strain Eurasian watermilfoil.
- A study conducted in Michigan found that hybrid genotypes were more abundant in lakes with a history of 2,4-D use.
- Genetic variation in hybrid watermilfoil may allow for selection pressure to occur following management. For example, after an herbicide treatment the higher herbicide tolerance of some genotypes may allow them to survive whereas more sensitive strains will be controlled. The plants that survive and then subsequently spread within the lake will be those genotypes that are more tolerant to the specific herbicide.
- In some cases, herbicide resistant populations are still susceptible to the herbicide but may require a higher use rate to produce the desired level of control.

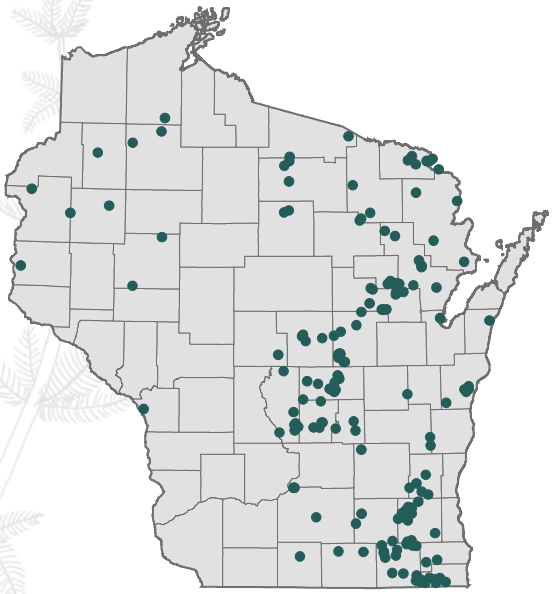

Figure 1. Map of verified hybrid watermilfoil locations in Wisconsin. For location information, visit: dnr.wi.gov/lakes/invasives/AISLists.aspx?species=MILFOIL_HYBRID

Projects and outreach like these are funded in part by our AIS Research Fund. To learn more or donate, visit dnr.wisconsin.gov/topic/Lakes/SayYesToLakes

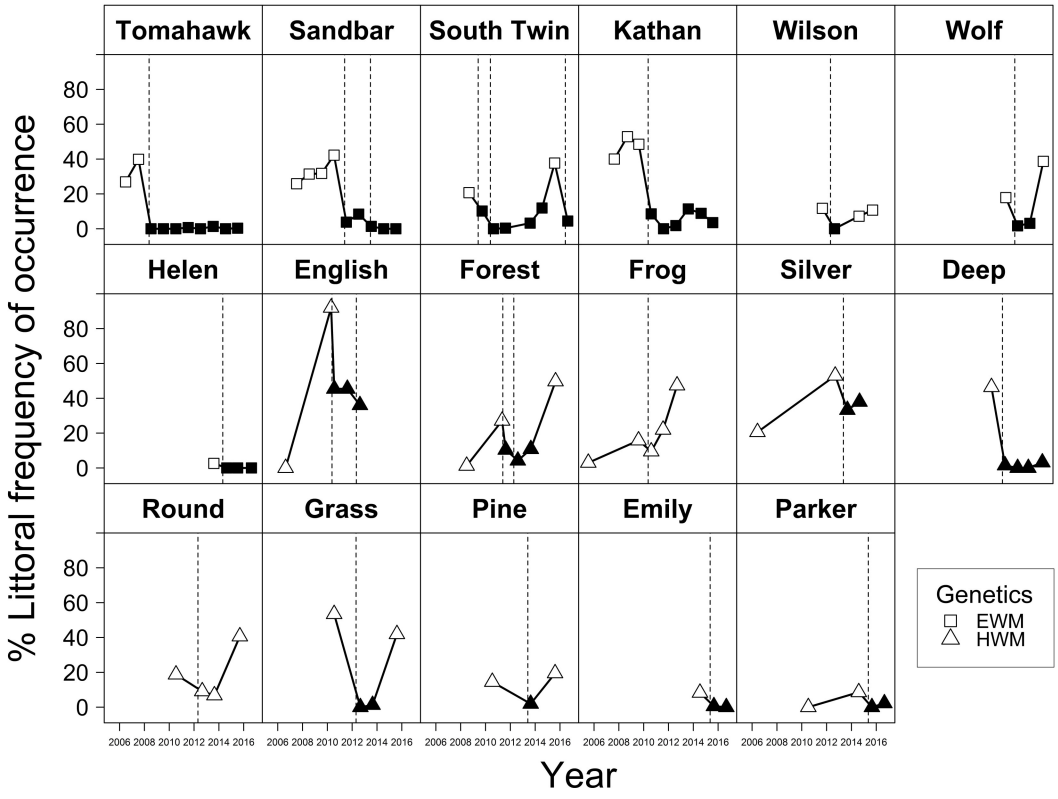

Figure 2. Milfoil littoral frequency of occurrence over time for lakes with multiple years of posttreatment surveys. Large-scale 2,4-D treatment dates displayed as vertical dashed lines and statistically significant decreases from pretreatment year indicated by solid fill symbols.

Potential Applications

Results from these studies have informed the department's approach to managing non-native watermilfoil in the state. The genetic diversity of watermilfoil populations within Wisconsin lakes suggests that a 'one size fits all' approach to managing non-native milfoil may not be appropriate. The overreliance and repeated use of a single management technique and the potential development of herbicide resistance threatens the effectiveness of current aquatic plant management practices. Increasing the diversity of plant control strategies (such as through the rotation of herbicide products and/or utilization of non-chemical management techniques), and incorporation of integrated pest management (IPM) is needed to maintain management efficacy in the long-term.

Related publications and resources:

Nault, M., M. Barton, J. Hauxwell, E. Heath, T. Hoyman, A. Mikulyuk, S. Provost, J. Skogerboe, S. Van Egeren. 2018. Evaluation of large-scale low-concentration 2,4-D treatments for Eurasian and hybrid watermilfoil control across multiple Wisconsin lakes. Lake and Reservoir Management 34(2):115-129.

Glisson W.J. and D.J. Larkin. 2021. Hybrid watermilfoil (*Myriophyllum spicatum* x *Myriophyllum sibiricum*) exhibits traits associated with greater invasiveness than its introduced and native paternal taxa. Biological Invasions 23(8):2417-2433.

LaRue, E.A. 2012. Hybridization facilitates the rapid evolution of reduced herbicide sensitivity in the widely-managed invasive aquatic plant, Eurasian watermilfoil. Master's Thesis. Grand Valley State University. Allendale, MI.

Moody, M.L. and D.H. Les. 2007. Geographic distribution and genotypic composition of invasive hybrid watermilfoil (*Myriophyllum spicatum* x *M. sibiricum*) populations in North America. Biological Invasions 9:559-570.

Zuelling, M.P. and R.A. Thum. 2012. Multiple introductions of invasive Eurasian watermilfoil and recurrent hybridization with native northern watermilfoil in North America. Journal of Aquatic Plant Management 20:1-19.