THE WEED, THE DRONE, AND THE TOURIST: MICHIGAN TECH RESEARCHERS SURVEY INVASIVE MILFOIL IN THE LES CHENEAUX ISLANDS

Down time, family, sunsets and life are better with water.

That's what the tourism association of the Les Cheneaux Islands says of its historic harbor and tourist economy within Michigan's Straits of Mackinac. But there's something the thirty-six island paradise didn't count on: invasive Eurasian Watermilfoil.

Long the bane of Midwestern lakes in summer, milfoil—specifically, invasive Eurasian Watermilfoil (EWM) and its hybrids—has been creeping into the northern Great Lakes over the past decade. The invasive is overrunning native milfoil and other aquatic plants, choking healthy ecosystems. EWM has also filled the narrow waterways between islands around Les Cheneaux. The result has hindered the area's water tourism economy.

Researchers at Michigan Technological University are collaborating with Les Cheneaux residents and organizations to better understand why EWM took over—and what they can do about it. The team starts with a drone.

Above and Below Water

Colin Brooks, a senior research scientist at the Michigan Tech Research Institute, has surveyed the Les Cheneaux waterways using a remote-controlled hexacopter.

Brooks has said "drone" is the d-word, explaining that he specifically uses UAVs, or unmanned aerial vehicles, which snap

high-resolution images of shorelines. This kind of remote sensing is so detailed that Brooks is able to tell apart different species of plants.

Brooks also relies on satellite data. One technique, using a spectroradiometer, reads the amount of visible light and near infrared wavelengths given off by different plants. EWM tends to be greener in the images, and Brooks says that he could see a lot of green patches—and that there were distinct patterns.

"Satellite imagery is useful for large spaces," he explains. "But for smaller areas, UAVs are better and more discerning, and able to be deployed rapidly to map areas of infestation, as well as understand the effectiveness of control efforts."

To that end, Guy Meadows, the director of the Great Lakes Research Center, uses a fleet of underwater drones to look at EWM up close. Meadows and his team—including several undergraduate technicians from Michigan Tech—maintain an Underwater Autonomous Vehicle and several Remotely Operated Vehicles that gather sonar data, camera footage, and selective samples with a small robotic arm.

Meadows is committed to more than just the science of EWM; he wants to make a difference for people and the water bodies they love.

"We want to be able to take what we've learned in the straits and inform other communities about what to look for in the early stages," Meadows says. "And tell them how to eradicate milfoil when it's possible to do something about it."

Invasive Biology

Knowing what to do comes down to knowing EWM inside and out. A single milfoil leaf is about the size of a pine needle and a single plant

can grow to several feet tall. EWM can propagate from a fragment of the stem—only a couple inches is needed to start a whole new plant.

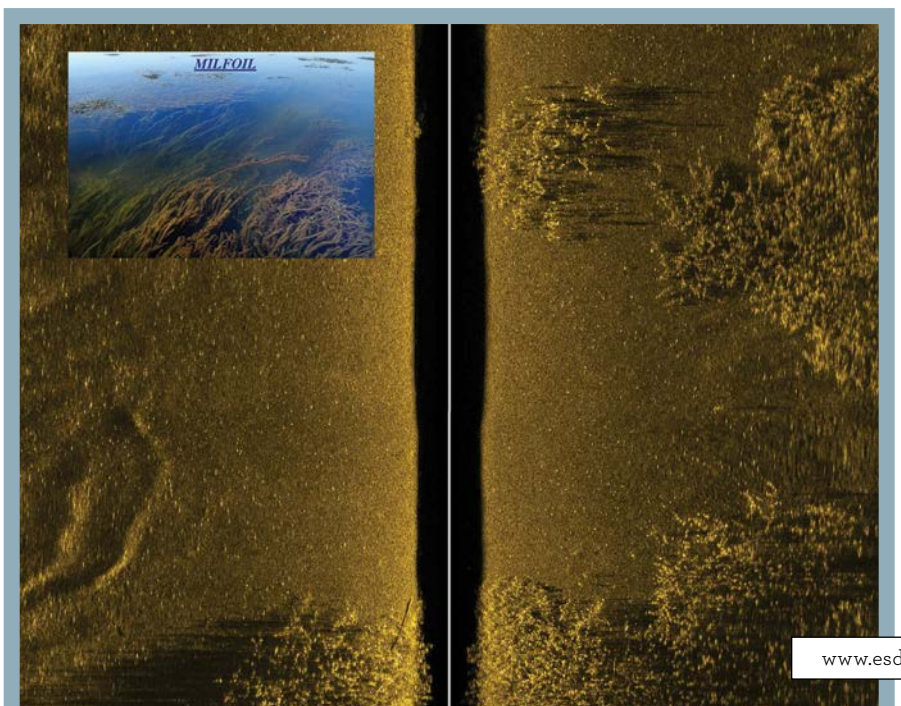
Casey Huckins, a professor of biological sciences at Michigan Tech, is the lead researcher for several EWM projects funded by the Environmental Protection Agency and Michigan Department of Natural Resources. As a biologist with research experience on the ecology of aquatic invasive species, he thinks of EWM as an invading plant—knowing that "controlling it like a weed" is a common management technique.

"Some people say, 'throw at it whatever you have, as much as you have,' so we can just get rid of it," Huckins says, explaining that EWM treatments can include mower-like harvesters, beetles, fungi and herbicide applications. "But then there are other communities that aren't comfortable with putting herbicides and other treatments in their water—so we're trying to figure out what's the level of the threat and at what point does that threat require treatment."

Connecting the threat and treatment is not straightforward. Huckins says that EWM is particularly difficult because there is a native species, an exotic species and many varieties in between, and each hybrid may be genetically different.

"What we're working on is linking the genetics of the plants and their sensitivity to herbicides," he says. "We also then want to understand alternative treatment methods—there are several of them that have been applied with varying degrees of success."

Additionally, understanding the physical and ecological needs of EWM is important. Several of Huckin's colleagues in the biological sciences, wetland ecology and plant genetics untangle these complex relationships. Their preliminary data shows that EWM doesn't do well in deep water, seeking shallow bays instead. Understanding these preferences—and potential adaptations—will help determine the best treatments and predict where EWM might spread next.



The Model Weed

Predicting EWM's next move is Pengfei Xue's game. An assistant professor of civil and environmental engineering, Xue runs supercomputer models on EWM. One of those models assesses water current patterns, water temperature, depth and other factors that favor EWM. Xue is finding new regions of Lake Superior where the characteristics match locations where the invasive plant has been successful in overtaking native vegetation.

Xue says the key is understanding patterns in lake currents. The Straits of Mackinac—where two large bodies of water contend for equilibrium—is an exceptionally complex region. The insight will help Les Cheneaux residents continue their efforts to remove milfoil and keep tabs on areas at risk for re-infestation.

The modeling data also could predict where EWM will show up next in the northern Great Lakes; the remote sensing and environmental research helps validate the predictions. All together, the team coordinates their work to better warn communities on the lookout for this invader and help prevent tourism declines like what happened in the Les Cheneaux Islands.

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