

# Hand-Pulling Aquatic Invasives

Mercedes Gallagher

Center Pond, a 125-acre public water body in Becket, Massachusetts, is primarily groundwater fed and hosts our town beach, two private beaches, two Summer Camps, and about 75 homes along its shoreline. The Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM) infestation likely began about five years before it was confirmed by a survey and had spread throughout the lake by 2000 when a whole-lake treatment with Reward (diquat dibromide) was done. This treatment of the lake was 62½ acres, the maximum area of a 125-acre lake allowed per treatment. Diquat is a contact herbicide that does not kill the roots and re-growth is expected. However, the initial treatment did provide almost two years of lake-wide control. Subsequent applications were spot treatments with lesser effect – 8.5 acres in 2004, and 1.45 acres in 2008.

Although additional diquat treatments were planned each of the three years following the initial treatment, none were done, and we took the opportunity to try out diver hand-pulling in 2002 (unofficially, as we did not yet have a name or a bank account) and committed to it in 2003 when we registered as a grassroots non-profit, got a permit, and put out press releases asking for volunteers and donations.

Before we even did our first dive we learned a few things from the experience of another lake in Massachusetts that had tried diver hand-pulling. They were successful in attracting lots of divers on two different weekends with events, prizes, and lots of EWM was pulled from their lake. However, they were not successful – the following year showed no significant reduction. I sought out opinions from professionals who were there, and learned two important things:

(a) this should be done all season long rather than only two weekends (same as weeding your garden); (b) EWM fragments abounded in the lake those two weekends, so it was critical to have people in boats with skimmer nets to pick up the fragments. The message was loud and clear that this would not work if it was done haphazardly.

## Methods

In 2002 after purchasing the basics – two green diver bags, a dive flag, and float – and borrowing a pool skimmer we went on our first dive and kept learning. The divers went down and we watched as their air bubbles started moving in opposite directions. We had one double kayak for

skimming and couldn't stay with both of them, learning that we needed one skimmer boat for each diver. Another time we went out in our diver's Zodiac inflatable motorboat to get the curly-leaf pondweed, which was found in the lake for the first time that year. With our diver in gear driving that boat and searching in vain, we wasted valuable time. So we learned that it made sense to mark where the plants were before the dives, initially using milk jugs with a line tied to a rock and lately substituting a colorful one-foot length of kids swim noodles (Figure 1).

Our two divers in 2002 developed good hand-pulling methods right away, so it wasn't until 2003 when we hosted lots of volunteer divers that we learned



Figure 1. EWM patch CLE#2 in June 2010 with our diver beginning the last dive pulling that one out. Patch CLE#3 can be seen marked in the background.

the importance of training them, and ultimately that there are lots of skills involved in doing this well. We developed training for new divers and ideally have them work at first on more scattered growth areas rather than dense patches, and pulling from mucky soils instead of rocky areas. Basic diver training includes identification of the invasives and the common natives, the Wrap Method (follow the stem down to the soil with forefinger and thumb, spread your hand and scoop out the roots, carefully pull the plant down while wrapping it around your arm, and place the wrapped plant in the diver bag you are holding in your other hand), body positioning and clearing an area as you swim through it so not to disturb and create fragmentation of nearby EWM. Advanced diver training involves other pulling methods including Bag Over (same as Wrap Method to pull out the roots but instead of pulling the plant down and wrapping it, opening the diver bag above it and the plant floats up into it once released from the soil), pulling in rocky areas which involves tweaking the roots out from between rocks, and pulling a patch that is done by skirting the outer edge after pulling all scattered plants around it first so the diver's body and flippers don't come into contact with any EWM. These methods reduce fragmentation, which is critical to milfoil control. We encourage divers to take their time and handle the plants gently and carefully, and that speed will come with experience (Figure 2).

Skimmers get training in identification as well so they pick up fragments of the invasives and can leave pieces of the native plants that come up. Polarized sunglasses are very helpful to see the fragments in the water column, as some fragments do not come up to the surface. Another useful tool is an underwater viewer, or bathyscope, both to find and mark locations of EWM, and also to look for fragments that stay under the surface. An ideal skimming boat is a small canoe that can be deftly managed by one person yet have plenty of room for a skimmer net, extra diver bags, a bathyscope, weed markers, a little bucket for fragments, the dive flag/float, an anchor in case of emergency, and taking in the full weed bags from the diver (after holding them over the side to de-water)



Figure 2. Pro-Diver Jo Smith on November 4, 2008 using the Wrap Method at the Big Rock patch that had been treated with diquat that year in June.

(Figure 3). Additional skimmer boats can be kayaks equipped with a skimmer net and small bucket.

We operated with volunteer divers until the fall of 2004 when we started paying our divers who had developed excellent hand-pulling skills and had subsequently been hired by other lakes.

These divers were professional in every way, most having dry suits as well as wet suits. We call them our Pro-Divers and can recommend them for hire at other lakes. For many years our funding was limited so that we were only able to hire them up until the end of May and again after October 15, and relied upon



Figure 3. The author, in the canoe, skims and collects harvested plant fragments.

volunteer divers from June 1<sup>st</sup> through mid-October. We still train new volunteer divers and rely upon them for the summer season in July and August. In the Pro-Diver early season we harvest EWM and curly-leaf pondweed (*Potamogeton crispus*) everywhere in the lake and go back again everywhere in the late season to harvest EWM and European naiad (*Najas minor*), another invasive that we found in the lake in 2011.

## Results

How we recorded the amount of EWM harvested has varied over the years, starting as the number of fills of a 32-gallon trash can. Since 2009 it has been consistently recorded as the number of fills of a diver bag (Figure 4), with curly-leaf pondweed and European naiad separated out. Since finding European naiad in 2011, that harvest has also been recorded as diver bag fills.

In 2009 we harvested 650.5 bags of EWM, in 2010 444.4 bags, with the lowest harvest to date in 2014, 22.5 bags. For the last three years we have been counting the number of curly-leaf pondweed plants harvested. In 2014 we found 58. Our experience with European naiad is more limited. In 2011 we harvested 21.5 bags and 6.7 bags in 2014 (Figure 5).

The total cost for our project in 2009 was \$11,648, our highest cost year. 2010 was \$8,282. The cost over the last four years has varied, averaging approximately \$5,000 per year, with 2013 and 2014 coming in under \$4,500. Since having the support of the lake association along with more significant funding, the general trend over these six years has been a reduction in the amount of EWM, and the management time and expense has been reduced correspondingly, but leveling off the last two years. Dives cover more territory than in the past, as divers are spending less time stopping to pull plants, so fewer dives are needed per area. However, there has been no reduction in the area that needs to be covered, and some harvesting is still required in all areas of the lake each spring and fall. Because the divers find many more plants and fragments on the bottom than we detect from the surface, to date we have had our Pro-divers swim through all areas. Further reduction in costs may involve



Figure 4. The EWM harvest de-watering prior to composting from a dive in June 2009 with one Pro-Diver and one Volunteer.

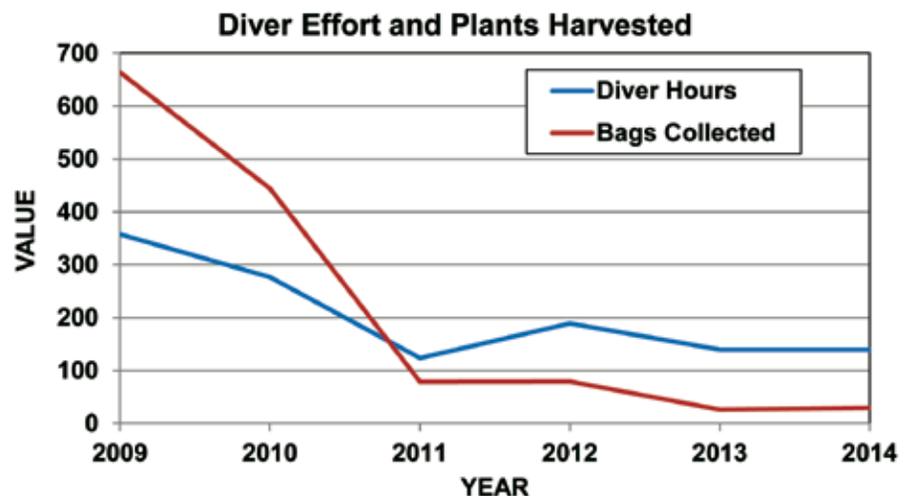


Figure 5. A comparison of total diver hours (paid and volunteer) and the number of bags harvested of all three invasive plant species.

trying new methods in certain sections that rely more on detection from the surface to save diver time. Another option may be to rely on volunteer divers in sections with sufficiently reduced EWM growth.

As director, I am a volunteer. Our biggest expense is to pay the Pro-Divers, who charge us less than at other lakes because this is where they learned their hand-pulling skills, they feel well supported here, and they love our lake. We pay them \$60 per dive, and also

give all our divers, seasoned volunteers included, \$10 each time they come as travel expense, an air refill, and lunch at the beach after the dive for both divers and skimmers. Back in the days when we had lots of divers and skimmers, the lunch at the beach was really important for our participants to share information, get to know each other, and feel a sense of community. For some years now most of our dives are with one diver and me in the canoe with them. They are hungry after a dive and still appreciate having a lunch

provided, and getting them something hot to eat or drink in the colder weather is important.

### The Future

Our challenges of late include finding EWM in the middle of the lake in up to 17-foot depths. These plants are hard to find until they are very mature and tall enough to be seen with a bathyscope. They appear to be lankier and may grow slower than the EWM in shallower water, but all have fragments ready to launch at the top of each stem. It is quite possible that they have been there for many years sending off fragments that re-populate areas that we commonly harvest between the shoreline and up to 12-foot depths. This has added new territory that we have been having divers swim through to find them. We are hoping to purchase an underwater scooter to assist with this. We have had weather-related issues, such as tropical storms possibly combined with fertilizers and septic systems, causing an increase in nutrients in the lake, with EWM growth seeming to increase following these events.

The year 2014 was our 12th year hand-pulling invasive plants from Center Pond. In 2010 after eight years of effort these invasives were reduced to such low numbers that Aquatic Control Technology (ACT) reported that their management was no longer needed and the lake association could let their permit for chemical controls lapse. After a year without any surveys, the lake association retained Water Resource Services (WRS) as their lake management consultant, and they have reported that the hand-harvesting program is providing effective invasive control to date. WRS has provided detailed surveys; including finding the EWM growing in the middle of the lake using their underwater video camera, as well as getting us started using GPS technology and recommending other improvements we can make to the efficiency of our invasive plant control.

My role as director of this project takes a huge amount of my time, but it is time I enjoy and find very fulfilling. Prior to this I spent time at the beach relaxing and swimming. Instead I am often out in a canoe and get a quick swim before going to work. My job working in the evening into the night allows me a good

part of the daytime to devote to the Center Pond Weed Project. Someone who is retired would be ideal for this, as would an arrangement for a number of people to split their lake into sections and manage the project for their area.

There are many other little pieces of the puzzle of controlling aquatic invasives that I have not addressed here: We developed foot-pulling where people remove EWM by the roots while standing in water as deep as up to their shoulders; hand-pulling any of these invasives from a canoe in shallow, mucky areas; and removing the seeds (turions) of curly-leaf, an annual, with a rake from a boat. It's important to be vigilant and always learning and trying new methods as you go. If you look and listen with all your senses to the plants and the lake ecosystem you can make sense of your observations and outsmart the invasives.

### Mercedes Gallagher was

on the board of directors and the Executive Director of Del-AWARE Unlimited in Bucks County, PA, in the 1980s and came to MA in 1990 to work as director of administration of the Kushi Institute in Becket. She joined the Becket Conservation Commission just months before the first diquat treatment of Center Pond was proposed and was the only member to vote against it. Her search for alternatives came to fruition when she learned about hand-pulling and two SCUBA divers offered their services in 2002. She works at the Red Lion Inn in Stockbridge, MA. You may reach Mercedes at: [centerpondweedproject@yahoo.com](mailto:centerpondweedproject@yahoo.com).



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**Gene Welch** is professor emeritus, University of Washington, where he taught and researched water quality problems in lakes and streams for 29 years. Since 2000, he is senior limnologist with Tetra Tech, Inc., in Seattle. He has served as NALMS president (1993) and twice as board member.



**Harry Gibbons** has 40 years of experience leading the management and restoration programs for over 250 lakes/reservoir and 35 stream and river systems, and has developed and implemented several in-lake activities for techniques like phosphorus inactivation (alum), dredging, hypolimnetic aeration, aeration and circulation, AIS management, and integrated aquatic plant management. Harry has served NALMS twice on the board of directors and NALMS president in 2009. Harry received NALMS Secchi Disk Award in 2012.



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