# Littorally Speaking

## Battling Invaders with Our Bare Hands: Manual Harvesting

By Roberta Hill, Laurie Callahan, and Jackey Bailey

*This article is the second in a four-part series focused on the challenge of controlling invasive aquatic plants in Maine. In the fall issue of the Water Column the topic was aquatic herbicides. For the remaining three installments, the focus will be on various "non-chemical" control methods (alternately referred to as "manual," "physical" or "mechanical" methods). Most groups currently involved in combating variable milfoil infestations in Maine are utilizing one (or more) of these non-chemical control methods. The first we will look at is manual harvesting.*

Jim Chandler, one of Maine's most experienced milfoil divers, arrives at the surface with a bag full of variable milfoil

Though many of the variable milfoil control efforts in Maine involve a combination of manual control methods, most involve some use of the method known as "manual harvesting." Manual harvesting is a useful technique for removing scattered individual plants and controlling small infested "patches." With manual harvesting, plants and their root systems are individually removed from the infested area, collected, and transported away from the waterbody for disposal. The means by which the plants are approached, handled, and even the way in which they are disposed of may vary, but the basic concept remains the same. Think "weeding the garden by hand, or with hand tools." Now think "weeding the garden under several feet of water." This should give you a pretty good sense of the work.

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The depth at which the invasive plants occur determines the approach (or combination of approaches) that are used. For invasive plants occurring along the shore in shallow water it may be possible to approach the task by simply wading from plant to plant. The major problem with this approach is that it is difficult for harvesters to "tread lightly" enough to avoid disturbing sediments and causing turbidity. Brown clouds of fine sediments obscure visibility and release excess nutrients back into the water column, neither of which is desirable.

When the plants to be removed are in very shallow water, one way to reduce disturbance and turbidity *somewhat* (remember you are removing plants by their roots; disturbance is pretty much unavoidable) is to approach plants using a shallow draft boat such as a canoe or kayak. The obvious drawback here is the inherent "tippiness" of these lightweight craft, but avoiding calamity is possible by working in two-person teams: one person (the harvester) bending over the gunnels to work the plant from the muck, and one person (plant collector, fragment scout, and counterbalance) carefully shifting his or her weight in the boat to keep things stable.

Another way to minimize disturbance when harvesting in very shallow areas is to use a snorkel, mask and --if conditions are suitable and care is taken--fins. (Fins keep the feet buoyant at the surface, reducing the disturbance of the bottom, but when they come in contact with the bottom they are even more destructive than feet.) As with the method above, it is helpful (and safer) to work in teams: one or two snorkelers in the water pulling plants, and one or two spotters in a boat, keeping an eye on the snorkelers, handling plants as they are removed, and retrieving stray fragments.

In deeper water--greater than 3 or 4 feet--the approach is made by way of SCUBA divers or divers using a "hookah," a system that allows multiple divers to breathe air from a compressor at the surface through long flexible air tubes. Most of the manual harvesting currently being done in Maine is being done by trained divers. Again teamwork is key--divers working in teams of two or three, attended by spotters in boats at the surface, skimming fragments, and handling plants that are pulled up by the divers. (Please contact the VLMP for more information on manual control training opportunities.)

There are a number of techniques for extracting invasive plants from the substrate. The factors at play include: composition of the substrate, number of plants to be removed, whether they occur in dense single-species patches or are scattered among native plants, time of year, the size of the plants, and the resources that can be brought to bear upon the project. The primary tools used for extracting plants are the hands. The harvester, wearing gloves, finds the base of the plant, reaches down into the substrate gingerly loosening the root hairs, then lifts the plant, roots intact, from the sediments. In some cases, small hand-tools, such as those used for weeding a garden, may be needed to gently prize plants loose. Whether the work is being done by hand or with hand tools, it is VERY IMPORTANT to remember that any small stem or root fragment left behind is capable of sprouting a new plant. *Great care must be taken to minimize fragmentation.*

Removing plants causes turbidity; so much of this hand work is done in conditions of poor visibility, compelling divers to learn to recognize the target invaders as much by feel as by sight. The visibility problem can be mitigated somewhat by working methodically in one direction, and striving to keep ahead of the leading edge of the sediment plume. Another solution is to work a defined area, or "plot," until the turbidity becomes

SCUBA divers, divers using a floating hookah system, and spotters in boats at a recent MCIAP training event.

unmanageable, then to leave that area to settle, (perhaps shifting to a second area away from the plume) then returning to the initial plot to "mop-up" the plants that were missed earlier.

Another area where variation in technique and equipment occurs is in transporting plants to the surface. If you are working in very shallow water (or, in deeper water, removing only one or two isolated plants) getting plants to the surface is not much of an issue. If you are removing dozens, hundreds, even thousands of plants in deeper water, the way in which the plants are transported to the surface has great bearing upon both the efficiency and efficacy of the project.

Volunteers wading into Dingley Brook, in Raymond, to remove variable milfoil.

For smaller deepwater projects, divers generally use dive bags to collect plants. Dive bags (the type used by urchin divers) are made of lightweight nylon mesh with a wide, aluminum-frame mouth that opens and snaps shut like a clam shell. Bag-size can vary depending on the number of plants that one is attempting to pull during the dive, and the personal preferences of those who will be handling the bags. (Some divers find that cutting down standard dive bags to ½ to ¾-size makes them more manageable, others prefer larger bags.)

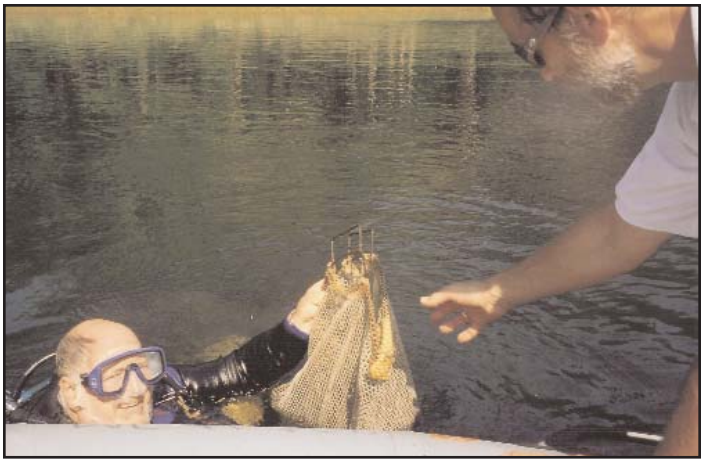
Getting the octopus-like variable milfoil weeds into the bags can be a challenge. The upper parts of plants may be coaxed into the bag prior to digging in after its roots, to keep the plant under control and to minimize fragmentation. Larger plants are sometimes wrapped around the diver's hand like a forkful of spaghetti prior to bagging. It may be necessary to remove some plants in sections--removing the upper part first, and then the lower part and roots.

Once bags are full, divers may swim them up to the "handlers" in boats at the surface or alternatively, bags may be transported to boats by more mechanical means. One fairly simple and inexpensive mechanical technique is to rig up a pulley system. Clips are attached at intervals along a loop of rope. (The rope should be long enough to extend from the surface to the bottom, then back again.) The loop-line is threaded through smaller loop anchored to the bottom and another smaller loop secured to the boat. Divers clip loaded dive bags to the line, yank on the line to signal helpers in the boat, who pull up the bag, empty the weeds into the hold of the boat, reattach the bag, signal the diver, and run the bag back to the bottom. Slick. (We have also seen a system of cables and ropes rigged up across an infested stream to transport 5-gallon buckets full of plants to trucks waiting on shore.)

A much more sophisticated method of transporting plants to the surface is used in a control method called "diver-assisted suction harvesting." In this method, there are no bags. Divers extract plants by hand as above, and then feed the plant material directly into a 4" diameter suction tube for instant transport to the work platform at the surface, generally a pontoon boat or barge. Diver-assisted suction harvesting will be the focus of a later article in this series. Also please see "A Day in the Life of a Milfoil Diver" in the Fall 2006 issue of the Water Column.

Quality control is extremely important. First, the emphasis should be on patience and diligence. Hand harvesting is hard work. If it is not done with great care and meticulous attention to detail, all your hard work may be in vain. Worse, the activity may result in more harm than good. It is, for example, essential that everyone involved in pulling up plants knows how to differentiate the target invasive species from any look-alike native plants in the area. Attending an Invasive Plant Patrol workshop is a good prerequisite.

Second, every fragment created during the course of the control project has the potential to cause another infestation, both within the infested lake or--if the proper vector comes along to some other *uninfested* waterbody. *After safety, fragment control should be the number-one consideration of everyone involved in the project.* Strategies for controlling fragments include: choosing the proper means to approach the plants, extracting plants with care to minimize breakage, having spotters and skimmers at the surface to gather up stray fragments, and installing fragment barriers



Teamwork is key -- Diver Scott Gregory hands a bag of harvested plants to Scott Williams.

around project sites. Fragment barriers can be nets, screens or plastic sheeting suspended from poles or floating booms to catch stray fragments.

Third, weather and light conditions can have a significant impact on the efficacy of the project. Work days and the specific hours of activity should be planned to optimize weather and light conditions. If conditions suddenly degrade, call it a day.

Last, despite your best efforts to maintain quality control, it cannot always be assumed that every single fragment or plant is removed, or even seen. Some plants may get covered over with sediments during the course of the disturbance. It may take time for some fragments to float to the surface and others will settle on the bottom, become entangled in nearby plants, or remain neutrally buoyant in the water.

For this reason, follow-up monitoring and ongoing control is essential. After harvesting, the site should be monitored on a monthly basis (more frequently if possible) during the growing season. It is preferable to use snorkelers or divers for this effort as they will be able to immediately remove any invasive plants that are spotted. If surveyors in boats are used for the follow-up monitoring, a system for directing divers to precise plant locations must be developed and employed. Whatever the particulars, the system must make it as easy as possible for divers to find the marked plants and remove them in a timely manner. Labeled buoy markers, corresponding to labeled marks on a map, is an example of a simple and effective plant marking system. As with the actual control work, all monitoring activities should be properly documented.

All plant material must be disposed of properly--dried and composted distant from any body of water (permanent or intermittent), buried, disposed of as solid waste, or burned. If harvested material is in large enough amounts it may be feasible to contract with a disposal service.

Mapping and marking control sites (recording GPS coordinates if possible) facilitates ongoing monitoring and control. It is important that records are kept for all control activities, including dates, times, people involved, hours spent, amount of plant material harvested, etc.

And of course the first consideration for any project of this kind should be SAFETY! All diving involving SCUBA equipment should be done by certified SCUBA divers *only*. (MCIAP has a list of certified SCUBA divers who have been trained in invasive milfoil removal.) Diving and snorkeling sites should be marked with flags or markers. The rule is that boaters must stay a minimum of 200 feet from marked diver areas, but boaters cannot be relied upon to know or follow the rules. Divers and snorkelers should always be attended by spotters at the surface. Spotters should be aware of the divers' position in the water at all times and keep a careful watch out for unwary boaters.

Like virtually all known methods of controlling invasive aquatic plants, manual harvesting has its drawbacks and limitations. But--especially when used in combination with other control methods--manual harvesting does have an important role to play in the ongoing struggle to control the spread of invasive aquatic plants in Maine.

One of the longest-running and most successful manual harvesting projects in the state is being carried out by a group of dedicated individuals on Cushman Pond in Lovell. For more information on the Cushman Pond project and other manual control projects in Maine, please see the new "Battling the Invaders" link on the MCIAP webpage.

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