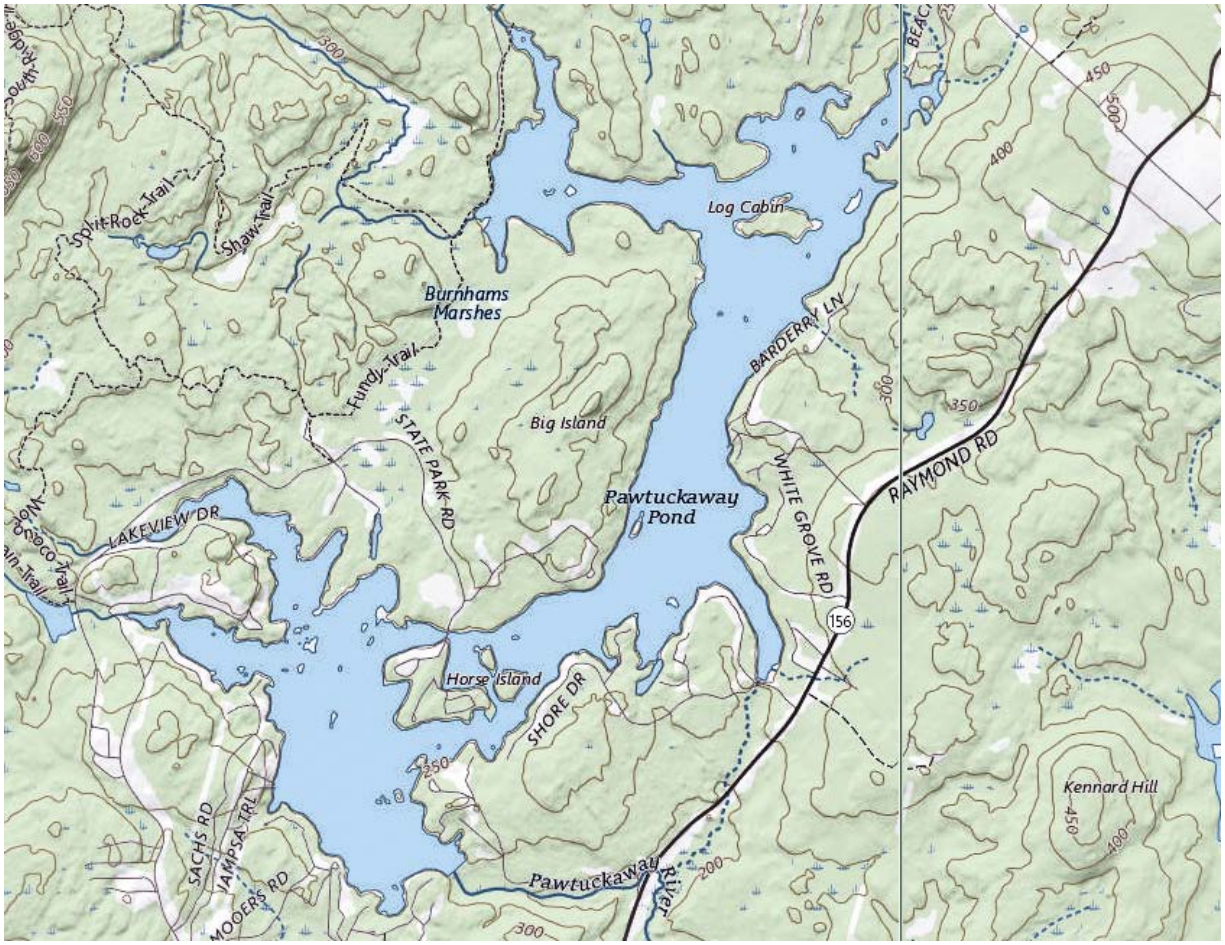
PAWTUCKAWAY LAKE INVASIVE AQUATIC PLANT SEARCH AND REMOVAL PROCEDURES



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INTRODUCTION

The purpose of this manual is to document the Pawtuckaway Lake procedures to search for and remove underwater invasive species from the lake. All members of the Milfoil Team and the Milfoil Support Team must become familiar with what is contained in this document. As of 2023, the only underwater invasive vegetation found so far in the lake is Variable Milfoil. However, the general processes and procedures contained in this document would likely apply to other underwater invasives should they ever infest the lake.

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DEFINITIONS

Divers – Unless otherwise specified, the term "divers" includes scuba divers, hookah divers, and snorkelers, or anyone else who is in the water during the course of any activity described in this procedures manual.

Hookah – A diving rig with a surface air compressor and an air hose which leads to a mouth regulator which is similar to a SCUBA second stage regulator. Hookah is one version of what is generally termed Surface Supplied Air (SSA).

Kayakers – Unless otherwise specified, the term "kayakers" includes all forms of watercraft in support of an activity described in this procedure guide. This would normally refer to kayakers but may from time to time include canoeists, stand-up paddleboarders or other watercraft.

Milfoil – There are many kinds of milfoil, both invasive and native. In this document, unless otherwise specified, "milfoil" refers to invasive variable milfoil (Myriophyllum heterophyllum). For more information than is contained in this document, a web search will show comprehensive examples.

NH DES – New Hampshire Department of Environmental Services https://www.des.nh.gov/

PLIA- Pawtuckaway Lake Improvement Association. A 501 (c)(3) organization that monitors and acts upon environmental and safety issues that affect Pawtuckaway Lake and educates the public on the conservation, protection, and improvement of water quality, natural shoreline, wildlife habitat, recreational resources, safety, and natural resources as they pertain to the welfare and interests of Pawtuckaway Lake. The Milfoil Team operates under the aegis of PLIA.

SCUBA Diver- For the purpose of this document, SCUBA diver means anyone certified by PADI as an Open Water Diver or the equivalent certification by other organizations such as NAUI or SSI.[1]

WCD (Weed Control Diver)- A certified SCUBA diver who has taken a New Hampshire certified course to remove milfoil and other underwater invasives. [2]

[1] PLIA has arranged to fill SCUBA tanks for milfoil work at no cost. Diver insurance costs will also be reimbursed by PLIA. For details, see the Milfoil Team Leader.

[2] PLIA will reimburse the costs for Weed Control Diver training for divers who have participated in Milfoil Team activities in Pawtuckaway Lake and who wish to become certified. The costs for milfoil specific supplies, such as collection bags, will also be reimbursed by PLIA.

HISTORY

Variable milfoil was first discovered in Pawtuckaway Lake in 2015 by Weed Watchers but it had probably been introduced in the lake a year or two earlier. The first plant was found near the red and black channel markers in the South Channel. Subsequent plants were found in that general area but nearer the Horse Island boat launch making it highly likely that it was introduced by a State Park visitor, either on a boat, trailer, or fishing gear.

Since then, milfoil has spread to many additional areas of the lake with most infestations concentrated in the South Channel, Gove's Cove, and the State Park canoe rental area.

From 2015-2018, about 10-20 gallons of milfoil had been removed by certified divers each year. In 2019, about 130 gallons were removed. In 2022, 416 gallons were removed, so the infestation continues to grow. A portion of this significant increase was undoubtedly due to the continued spread of milfoil, but was probably also due to the increased size and capability of the Milfoil Team in locating previously unknown areas of milfoil as well as the diligence of Weed Watchers and lake users in spotting new areas of milfoil growth.

Milfoil Areas as of 2022

Circled Areas new in 2022

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CHAPTER 1 : AQUATIC PLANT BASICS

VARIABLE MILFOIL

Variable Milfoil is an invasive underwater plant. It can grow rapidly in a variety of conditions. In warm sunny weather it has been known to grow as fast as an inch or two a day. It can survive freezing temperatures and can even grow underneath ice as long as sunlight can reach it. The roots can also survive in solidly frozen ground for several weeks.

Milfoil spreads through three mechanisms.

1. Through seed propagation. If milfoil reaches the surface it can produce small flowers and seeds. The seeds can then be spread and produce new plants. This method is insignificant compared to the other two means.
2. Through root runners. The root hairs that embed in the lake sediment can send off runners that can grow into new plants at least several feet away and, in limited circumstances, even further.
3. Through fragmentation. This is by far the most common method of propagation and spread. Pieces of the plant, as short as a couple of inches, can break off and will float freely, on or just under the surface for up to 14 days, while the fragment develops root hairs. The fragments then sink into the sediment, root, and give rise to a new cluster of plants. By this means, new infestations can start at a great distance from existing plants. Variable milfoil fragments easily, especially as the plant grows larger and also toward the end of the summer. Direct contact with milfoil is not required for fragmentation. It can easily be broken by turbulence from props, from paddles, fishing gear, and even from the feet of waterfowl.

Milfoil will grow to the surface and can even produce flowers slightly above the surface if left to grow long enough. Large plants can reach a diameter of 8-10’ or more and be many feet tall.

The following pictures give some idea of the visual characteristics of variable milfoil.

Mature Variable Milfoil Plant

Variable Milfoil Identifying Characteristics

Lake Area Filled with Variable Milfoil

While what we have currently in the lake is variable milfoil,, there is another form of invasive milfoil in some NH lakes called Eurasian Milfoil. There are also six varieties of native, non-invasive milfoil in NH. As far as we know, there is only one variety of native milfoil in Pawtuckaway Lake, Myriophyllum humile (low water-milfoil). This was discovered in the Fundy area and has since been found in a few other locations. This milfoil looks very much like variable milfoil but does not grow much bigger than 1- 1 ½ feet tall.

It should also be noted that, in some other lakes, variable milfoil has hybridized with native milfoil. This is still an invasive plant but may be difficult to distinguish from native milfoil. In some cases only DNA tests can verify the species with certainty.

LOOKALIKES

In addition to native milfoil, there are two native species that grow widely in the lake which can resemble variable milfoil; coontail and bladderwort.

COONTAIL

Coontail is widely found in the lake. In most areas it is only 6-12 inches tall but has grown up to several feet in a few places. It very much resembles a fir tree branch tip. While it looks similar to variable milfoil at first glance, it can be distinguished in two ways. First, it is much more evenly green than milfoil. Second, the growing tips are much firmer than milfoil. If milfoil is lightly pinched there will be no resistance, whereas coontail will resist and spring back. Similarly, if milfoil is taken out of the water, it is a limp string, whereas coontail will retain its shape. Since coontail in our lake is generally quite small, though, it can resemble small milfoil plants. Lastly, coontail lacks true roots although it can lightly anchor itself in bottom sediment.

Coontail

Coontail Identifying Characteristics

BLADDERWORT

Bladderwort is found extensively in the lake. Tape grass and bladderwort together comprise about 80-90 percent of the vegetation growth at the bottom of the lake. Large bladderwort is easily distinguished from milfoil but small bladderwort has a bright green growing tip that is easy to confuse with milfoil's bright green color. Also, in small plants, the distinctive "bladders" are hard to see, especially when they are not filled, i.e. clear. In some cases, it may take a very close inspection to see the bladders. Occasionally bladderwort plants can even be found without bladders. Like coontail, bladderwort does not have roots.

Bladderwort

Bladderwort Identifying Characteristics

Bladderwort growing in an aquarium

OTHER AQUATIC INVASIVES

As of 2021 we are not aware of any of the following invasives being in Lake Pawtuckaway, but most are present to varying degrees in lakes in NH so it is good to be aware of them in case something unfamiliar is encountered. In fact, if you see anything unfamiliar or suspicious it would be wise to take particular note of it and alert someone on the Milfoil Team who is more knowledgeable so it can be investigated further. Many of these plants are still being grown as aquarium plants and may have initially found their way into ponds and lakes by someone dumping aquarium contents into the water. From that origin they have been spread by fishing, boating, and in some cases, like water chestnut, by waterfowl.

EURASIAN MILFOIL

This is not too prevalent yet in NH but is present in several lakes. It looks a bit different than variable milfoil but grows just as aggressively and is far more prone to fragmentation than variable milfoil.

Eurasian Milfoil

Eurasian Milfoil

FANWORT

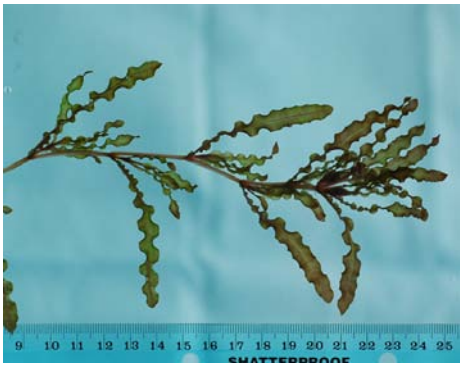
This is also not too prevalent yet in NH. It is also spread by fragmentation.

Fanwort

Fanwort

CURLY LEAF PONDWEED

This is found in only a few lakes in NH so far. It is one of the earliest aquatic plants to green up in the spring. It dies back in early summer after producing turions(growth tips), seeds, and fruits. All of these lie dormant in the summer, then start to germinate in the fall. After being dormant all winter, they start to grow early in the spring. It also spreads through rhizomes (root runners).



Curly Leaf Pondweed

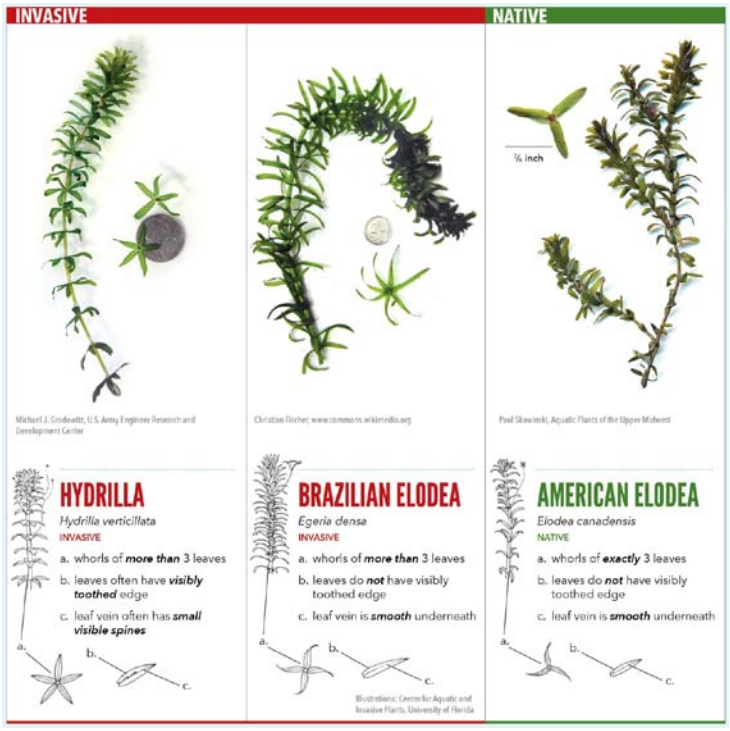
Curly Leaf Pondweed

HYDRILLA AND BRAZILIAN ELODEA

These two invasives are easily mistaken for native Elodea, which we normally have in the lake in small amounts. In 2020, however, there was a huge amount of large native elodea in the lake so apparently it has periodic significant growth years. Native elodea is generally smaller, a foot or less on average, and can be distinguished from hydrilla by the grouping of leaves, called whorls, which leave the stem at a single point. Native elodea has whorls of 3, hydrilla normally has whorls of 5, and Brazilian elodea has 4-6.

Hydrilla

Hydrilla



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PARROT FEATHER

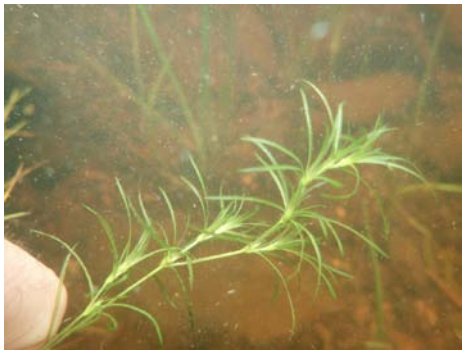
This is an aquatic plant but it can extend several feet above water. It has not been found, as of yet, in any NH lakes but has been found in other New England states.

Parrot Feather

Parrot Feather

EUROPEAN NAIAD

There is also a native version of Naiad, called Slender Naiad. Slender Naiad can be found in the lake; normally in very shallow water. As you can see from the pictures, the two look very similar. The distinguishing characteristic is leaf serration. The European naiad has visible serrations whereas the native naiad's serrations can only be seen with magnification.



European Naiad

European Naiad

Slender Naiad

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SUSPICIOUS AQUATIC PLANTS

If you encounter one of the above known invasives or some other unfamiliar plant, inform the Milfoil Team leader or take a sample and carefully note the plant's location. Take care to make sure that the plant does not get fragmented when taking a sample. If you have to keep the sample for a while, place it in a plastic bag with a damp paper towel and give it to the Milfoil Team Leader. If it can't be identified by local resources, the sample will be sent to NH DES for a definitive analysis.

CHAPTER 2 : MILFOIL TEAM BASICS

As a result of finding variable milfoil in the lake, a Milfoil Team was formed in 2015. It consists of three equally important but overlapping groups. First- Divers, who search underwater for the milfoil and mark it for removal. Second- Support Kayakers, who provide safety for the underwater team and other logistical support which will be described later in more detail. Third- Weed Control Divers who are trained and certified to remove milfoil.

Very important adjuncts to the Milfoil Team are the Lake Hosts and Weed Watchers.

Paid and volunteer Lake Hosts are posted at the State Park entrance and the Fundy boat launch to try to prevent additional invasives from getting into and out of the lake. They also perform a very important function in educating boaters about invasives, as well as proper practices to clean boating equipment.

Weed Watchers continually search their various territories around the lake to find any evidence of suspicious plants or animals, below and above water, and alert the Milfoil Team or the Weed Watch Captain so that they can investigate further. Steve Soreff (soreffs15@aol.com , tel 603 895-6120) is the Weed Watch Co-Captain.

SAFETY

Team safety is paramount. No one in any role should attempt to do things beyond their ability or things which may put themselves, anyone else on the team, or other lake users at risk. Specific safety procedures will be covered in more detail when outlining the responsibilities of various team members. Any safety issues or incidents/injuries must be reported to the Milfoil Team Leader.

In order to insure that the team members understand and follow the procedures detailed in this document, everyone on the team must sign a waiver indicating that they have read the document and accept the attendant risks in volunteering.

EQUIPMENT/QUALIFICATIONS

It is expected that all team members are capable swimmers with no health conditions which would endanger themselves or others. All team members should check with a medical professional if there is any concern about their capability to swim, snorkel, scuba dive, or kayak.

SNORKELERS

Snorkelers should be comfortable in snorkeling on the surface and surface diving down to about six feet.

Snorkelers should have a mask, snorkel, and fins. A full wetsuit, or at least a shorty wetsuit, is recommended but not required. Even in mid-summer, with water temperatures in the upper 70s to low 80s, a wetsuit can make a search session more comfortable. A weighted dive belt may also be useful in some cases to make surface diving easier.

HOOKAH DIVERS

Hookah divers use surface supplied air to remain underwater. PLIA owns two hookah rigs, each of which can support up to two divers. The hookah rigs consist of battery powered compressors installed in inflatable rafts with hoses leading to second stage regulators. In order to be a hookah diver on the milfoil team, one must be a certified SCUBA diver or be qualified by the Milfoil Team Leader based on in-water training by that leader. Any prospective hookah divers that are not SCUBA certified must be experienced snorkelers that are comfortable surface diving to at least six feet of depth. They should also have the same equipment as specified in the preceding snorkeler section. Note that hookah divers cannot be certified as Weed Control Divers i.e. they cannot remove milfoil.

SCUBA DIVERS

SCUBA Divers should have a full complement of their own scuba gear including mask, fins, BC, weights, tank, regulator, full or shorty wetsuit. A wrist compass may also prove helpful to guide search directions. Divers will almost never go deeper than 15 feet since it is unlikely that milfoil can grow at depths below 12-14 feet in our lake.

PLIA has arranged to fill SCUBA tanks for milfoil work at no cost. PLIA will also reimburse diver insurance premiums from DAN (Diver Alert Network) and for supplies uniquely required for milfoil work such as collection bags. If any divers are interested in becoming certified for removing milfoil, PLIA can help to arrange a WCD (Weed Control Diver) course and, if approved, reimburse the costs for such training. WCD course reimbursement must be authorized by the Milfoil Team Leader before enrolling in the course. Authorization will depend on the amount of participation the diver has performed with the Milfoil team and the expectation of future contribution. For more information on any of the above, contact the Milfoil Team Leader.

SUPPORT KAYAKERS

Kayakers should have normal kayak equipment including an approved PDF. Safety vests, dive flags, and whistles will be provided for use during search and extraction sessions.

MARKERS/FLOATS

We use weighted floats of various colors to mark plants of interest and to help guide our searches. They are made of PVC pipe filled with mortar and attached to sections of pool noodles.

The orange floats mark locations where milfoil has been found.

The green ones are used to delineate search areas and as visual markers to guide searches.

The purple floats are used by Weed Watchers to mark suspicious plants for further investigation.

CHAPTER 3 : MILFOIL SEARCHES

We utilize snorkelers, scuba divers, and hookah divers to perform underwater searches for milfoil. For each dive session, we choose an area to search based on specific sightings of milfoil or the probability of finding milfoil based on previous experience. In general, searches are conducted on weekends since that is when most people are available. Occasionally, searches are arranged on weekdays if enough people can volunteer. Searches are also contingent on weather and underwater visibility. The ideal time of day for searches is from 10am-2pm because the underwater visibility is greatest between those hours. For weekend searches an email will be sent on Thursday indicating the day and time of the proposed search, the meeting place, and the area to be searched. Plans are subject to change based on the availability of team members, weather conditions, and other water conditions affecting underwater visibility.

SAFETY RULES

1. For any search, there must be at least two snorkelers/divers, who must maintain a buddy watch.
2. All gear must be safety checked before each dive per the requirements outlined in the safety manuals for each discipline.
3. At least one diver down flag must be located near the dive team. Anyone in the water must keep within a 75 foot radius of a diver down flag. Diver down flags may be held by support kayakers, moored as floating indicators, or mounted on a hookah raft depending on individual circumstances.
4. There should be at least one support kayaker accompanying the divers. Ideally, there should be no more than two team members in the water for each support kayaker and preferably one kayaker for each diver.
5. Support kayakers should nominate one person to act as the “traffic cop” for the group. That person is responsible for determining if boat traffic through the area should be halted or let pass and determining the route that any passing boats should take. That decision should be announced to all other support kayakers.
6. Support kayakers are responsible for determining if it is safe for divers to continue diving when passing boats cross the search path and informing divers when to stop and when to continue their searches.
7. Depending on the area to be searched, it may be preferable to outline the search area with floats to guide boats around the dive area.
8. Dives should be suspended if the weather is threatening or if boat traffic is heavy.
9. Divers are encouraged to purchase diver’s insurance. PLIA will reimburse premiums.
10. Support kayakers are encouraged to wear orange or other safety colored vests and carry diver down flags to alert boaters to their presence and the presence of divers in the water.
11. Support kayakers should wear PFDs or have them at hand in case of emergency.
12. Before the search session starts all team members must be briefed by the search team leader about the specifics of the dive. This includes the area to be searched, how the search is to be conducted, known underwater specifics such as previous milfoil locations, underwater hazards, depth notices, assignments of divers to support kayakers, anticipated boat traffic, and any other special considerations for the search.
13. Team members should take care to check their gear before each dive to minimize the possibility of any entanglements.
14.

SEARCH PROCEDURES

Dive sessions are normally one to two hours in length. Unless otherwise arranged, searches are normally done in a grid fashion, with team members spaced appropriate to the water visibility, swimming back and forth in parallel lines across the search area to provide maximum coverage. Staying in parallel lines and crossing the search area evenly is very challenging underwater. Wrist compasses may be useful as is coming up to the surface every 100 feet or so to reorient. As much as possible, given the geometry of the search area, searches should be made in discrete sweeps. That means that all divers will start on one edge of the search area then proceed as uniformly as possible to the opposite edge of the search area. Divers should then wait until everyone has reached that side before starting a return pass. This is not always possible because of an area's geometry or because a diver may be delayed by searching for and marking suspicious growth or other eventualities. When uniform searches are not possible, it is important that a support kayaker remain with the diver who is not currently coordinated with the rest of the team.

For search purposes, large areas that have milfoil are broken up into regions of 3-4 acres each. This is a reasonable amount for a team to search in one session and helps to insure that all areas are explored over time. Our experience is that one diver can reasonably search about one acre per hour.

South Channel Search Areas

Gove's Cove Search Areas

In the case of other areas to be searched, delineation of the area will be made at the time of the search by the search leader. Depending on the boat traffic and the geometry of the area to be searched, it may be advisable to

mark the boundaries of the search area for safety and for efficiency. Green floats may be pre-positioned to help direct boat traffic and may provide a good way of ensuring visual marks to orient divers and snorkelers.

DIVER RESPONSIBILITIES

Each diver should carry one or more orange floats to mark any milfoil that is found. The weight at the end of the marker should be dropped near, but not on, the milfoil plant. As a general rule, the weight should be placed as many feet from the milfoil as the milfoil is tall. This is to prevent the line attached to the weight from tangling in the milfoil and fragmenting it. Divers should also take care to keep several feet away from plants to avoid accidently fragmenting them. It is especially important to keep flippers well away from the plant to avoid contact or even excessive turbulence which may cause fragmentation. Keeping flippers well away from the bottom also helps to minimize sediment disturbance. That is important so that visibility is not impaired, which would limit the possibility of finding more milfoil in the area or doing a verification check. To that end, if a diver is near a plant and needs to come to the surface immediately to hail someone or obtain a new marker, they should gently float upward or bend backward to keep flippers from raising silt or fragmenting the plant. Hookah divers need to be continuously aware of their air hose as well so it does not tangle in a plant or get hooked on a previously placed marker and drag it out of position.

In general, even if the search diver is a certified Weed Control Diver, that diver should just mark the milfoil and not try to remove it unless kayak support is in place and is prepared to support removal operations. There are two reasons for this. First, it allows the plant to be marked via GPS so that milfoil locations can be documented for further analysis. Second, there may not be a removal support kayaker in place to watch for floating fragments or handle any milfoil brought to the surface. The determination of immediate removal is subject to diver judgment. For example, if the plant is very small and likely to be visually lost when trying to obtain and place a marker, it is generally better to remove the plant rather than attempt marking as long as it is done by a certified Weed Control Diver.

SUPPORT KAYAKER RESPONSIBILITIES

1. Provide protection for the divers by warning boaters of their presence and keeping them well clear of the dive area if possible.
2. Stay in communication with divers when they surface to provide relevant information.
3. Warn boaters of any existing milfoil markers in the area and guide them appropriately.
4. Warn divers who inadvertently stray from the designated dive area.
5. Warn divers if weather or boating traffic appears threatening.
6. Carry extra orange float markers and be prepared to hand another to a diver when needed.
7. Carry small clear plastic bags in case suspicious plants are found and samples need to be collected.
8. In the non-typical case where milfoil is being extracted at the same time as marking is going on, ensure that all newly marked milfoil plants have had their GPS locations marked before the float is removed.
9. Educate boaters about the search activities and about invasive plants and animals as long as it doesn't distract from one's safety responsibilities.

CHAPTER 4 : MILFOIL REMOVAL

SAFETY RULES

In addition to the safety rules listed for search operations, the following must also be observed.

1. There must be at least two divers for any removal operation and they must maintain a buddy watch. At least one diver must be a certified Weed Control Diver.
2. There must be one removal support kayaker accompanying each diver or pair of divers removing milfoil.
3. Divers should wear protective gloves when removing milfoil to help prevent cuts from sharp rocks, glass, and other debris which may be in the sediment.

REMOVAL PROCEDURE

DIVER RESPONSIBILITIES

1. Milfoil team leader must be contacted before any removal efforts to insure DES notifications are completed.
2. Only certified Weed Control Divers can extract milfoil.
3. When extracting milfoil, a trained support kayaker must be present for each diver or diver pair removing milfoil to ensure that any fragments are captured. One kayaker per diver is recommended .
4. In general, a Weed Control Diver should not remove milfoil that has not been marked with GPS. This is a judgment call based on the size of the plant and its distance from other previously located milfoil. The intent of this rule is to ensure that the locations of all milfoil plants are recorded for future investigation and analysis.
5. If the Milfoil Team Leader is not present for the removal, the following information must be provided to the team leader.
    a. Location of dive
    b. Name(s) of certified divers
    c. Dive duration
    d. Name(s) of any non-certified divers who were present
    e. Name of support kayaker(s)
    f. Amount of milfoil removed
    g. Any other relevant dive details

SUPPORT KAYAKER RESPONSIBILITIES

1. Keep the diver(s) safe.
    a. Make sure a diver down flag is appropriately located/displayed.
    b. Warn the diver of any danger.
    c. Maintain position near the diver.
    d. Direct boat traffic away from the divers.
2. Be prepared to capture any loose milfoil fragments.
    a. Carry a fine mesh net to capture fragments.

    Note: Milfoil fragments may take several minutes to surface or appear just below the surface. They may also drift downwind from the immediate area if there is strong wind or current.

3. Be ready to empty any full collection bags into garbage bags or other containers.
    a. Carry empty garbage bags or extra mesh bags.
4. Pick up milfoil markers if diver believes that they have removed all milfoil and if the location has been recorded by GPS.
    a. Especially in the case of large plants, enough silt may be stirred up so not all stems can be seen by the diver. In these cases, the marker should be left for further checks when the silt has settled, either later in the same dive session or on another day.
5. Make sure that all extracted milfoil is dumped in a safe place well away from any water bodies.
6. Educate boaters about the removal activities and about invasive plants and animals as long as it doesn't distract from one's safety and monitoring responsibilities.

APPENDIX A: ADDITIONAL REFERENCE MATERIAL

For further information about native and invasive aquatic plants, the following resources may be useful.

1. Pamphlet showing examples of the fourteen most threatening invasive plants in NH.
https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/frightful_fourteen.pdf

2. Maine Field Guide to Invasive Aquatic Plants
https://lakestewardsofmaine.org/mciap/FieldGuide.pdf

3. Aquatic Plants and Algae of New Hampshire Lakes and Ponds
https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-05-30.pdf

4. Diving as a Technique to Control Exotic Aquatic Plants by NH DES

5. Weed Control Diver Course Manual – Available from the WCD Course Instructor

APPENDIX B: OTHER MILFOIL CONTROL MEASURES

While the increasing amount and spread of milfoil is discouraging, we still have far less milfoil than many other lakes and it has not yet started to materially impact the use of the lake.

SEARCH PRODUCTIVITY IMPROVEMENTS

Searching for infestations currently consumes about several times as much manpower as removal. Therefore, improving our ability to locate milfoil will pay the most dividends in reducing manpower needs. We are currently investigating the use of aerial drones, sonar, and underwater drones as search aids. Aerial drone were first tried in the spring of 2021. The aerial drone photographs were very effective just after ice out when the lake water levels are low. They proved ineffective after the lake rose to normal summer levels. Other lakes are exploring the use of underwater drones to locate milfoil and we are monitoring their results. For the past two years, we have used sonar equipment for searching large areas of the lake for new milfoil growth. Sonar is most effective in the spring and early summer when milfoil is the only large vegetation in the lake. Later in the summer, when native vegetation rises in the water column, the ability of the sonar to differentiate between milfoil and native vegetation becomes more difficult. In 2022 used powerful underwater lights mounted on a pontoon boat at dusk to locate milfoil. It proved very successful and will will be using more in the future.

REMOVAL PRODUCTIVITY IMPROVEMENTS

So far we have been able to remove milfoil soon after we locate it through hand-pulling by our volunteer certified divers. This is the preferred method of dealing with milfoil but the spread of milfoil is starting to overwhelm the feasibility of hand pulling.

If milfoil gets beyond this manual removal capability, the next step would be DASH (Diver Assisted Suction Harvesting). This still involves a diver hand-pulling the milfoil but uses a large suction hose connected to a pump on a barge or special pontoon boat to more efficiently get the plants to the surface. The milfoil gets caught on screens and bagged by a crew on the boat. This is faster than having the divers put milfoil in mesh bags underwater as we do now. Of course this requires a significant investment to equip such a boat or rental costs to borrow one from another lake.

If that is not sufficient, the next step would be the use of herbicides. There are several choices of chemicals but all are expensive and have varying side effects on native plants and the environment. They also do not do a 100% job in killing milfoil and usually need to be repeated every few years. Just like weed killer on a lawn they are a suppression vehicle not a cure. Depending on many factors, including the specific herbicide and the area to be covered, herbicide treatment costs between $1000 and $1500 per treated acre as of 2022 . For reference, treating the all the currently known locations of milfoil on Pawtuckaway Lake with herbicide would cost between $30,000 and $60,000. As of 2022, the preferred herbicide for variable milfoil is ProcellaCOR.

For comments, updates, and corrections contact the Milfoil Team Leader Neil Santos, neilsantos@comcast.net