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# GRANT REPORT-FINAL

## INVESTIGATION OF SIDE SCAN SONAR'S ABILITY TO LOCATE AREAS OF INVASIVE VARIABLE MILFOIL IN PAWTUCKAWAY LAKE

### PROJECT DESCRIPTION

#### PURPOSE

The purpose of this project was to purchase and utilize a side scan sonar unit to determine if it would have value in the early detection of invasive variable milfoil in a water body, specifically Pawtuckaway Lake.

#### REQUESTOR

Pawtuckaway Lake Improvement Association (PLIA)

Mike Coltin – President

Neil Santos – Milfoil Team Leader

#### AUDIENCE

The initial audience was the users of Pawtuckaway Lake, which includes lake residents, state park visitors, and day users of the lake. The greater audience was all stakeholders of the water bodies in the Lamprey River drainage as well as interested parties in other water bodies infested with submerged aquatic plants.

### BACKGROUND

In 2014 variable milfoil was discovered in Pawtuckaway Lake near the Horse Island boat launch. Since then a team of resident volunteers, using snorkels, hookah gear, and scuba equipment have been regularly searching the area around the Horse Island site to locate and remove any additional areas of infestation. Over the next two years, milfoil spread to adjacent areas in the South Channel. While that increased our concerns, we still felt that our search and removal efforts were containing the milfoil to a reasonable area.

Once milfoil is established in a water body, its main means of spread is through fragmentation of existing plants. Milfoil fragments can float for up to 14 days before sinking and rerooting. It is possible, as we have found, that new areas of milfoil can spring up at arbitrary and distant locations in a water body, far removed from known infestations.

As an example, in 2018 we found milfoil in Gove's Cove, a mile away from any previously found plants. In 2019, we found milfoil in a small cove outside the South Channel. In 2020 milfoil was discovered in Tuckaway Shores Cove, a mile from the South Channel. All of these initial finds were made by casual passersby or by the lake Weed Watchers. Since milfoil needs to get quite large before it can be noticed by surface observation, these new areas all had significantly large plants that could easily have been fragmented, with the fragments causing further infestation in those areas or other, more distant locations.

Once a milfoil location is found, our volunteer team has been successful in marking and removing every plant we have found. With over 50 percent of Pawtuckaway Lake shallow enough to support the growth of milfoil, it is impossible for our dive team to survey all potential areas to determine its presence.

We have researched several other means of locating new milfoil infestations such as the use of underwater cameras and drones, but believed that side scan sonar might hold promise in aiding in our searches. The goal is to quickly and efficiently search large areas to locate suspected milfoil plants, knowing that direct underwater observation would still be necessary to verify its presence.

## PURCHASE AND INSTALLATION

The equipment was ordered in mid May 2020 and delivered in late May. A “portable” case was built for the sonar and related equipment and an experimental mount was made for the transducers out of scrap material and mounted in such a way that the equipment could easily be moved to another boat when needed.



Sonar unit in its “carrying case”



Sonar unit showing display and 3D module



Transducer mounted on pontoon boat



Transducers  
Blue unit is normal down scan, 2d, and side scan.  
Other unit is side scan and 3D.

## METHODOLOGY

### USAGE

Some time was spent learning the basic features of the sonar unit and learning to interpret the sonar readings. After the initial learning period, the sonar was used several times in areas of known milfoil to learn how milfoil appears in the sonar display. While observing the display in real time to note areas of interest, it was found that it was more effective to record all sonar readings and upload them to a PC for additional analysis. The results of these test runs showed that the sonar could find areas of suspicious growth which should be further investigated. After using the sonar on each of those known areas one or more times, other areas of the lake not known to have milfoil, were searched. The sonar logs from these runs were analyzed and all suspicious areas were investigated. Fortunately, no new areas of infestation were found.



Areas of Pawtuckaway Lake searched by sonar

## FUTURE PLANS

We believe that the sonar has been sufficiently useful in finding milfoil that we intend to keep it in regular use in searching both known milfoil areas as well as in other areas of the lake that could potentially support milfoil growth. One of the features of the sonar that we intend to investigate further is the use of the 3D capability. We were unable to investigate that this year for several reasons. First, it requires two operators on the boat, one to drive and one to manipulate the display since 3D readings must be viewed in real time. Second, we were fully occupied using the 2D and side scan capability as well as doing underwater searches. Finally, the 3D unit increasingly malfunctioned as time went on and it finally failed completely. It was sent back to the factory in mid August and a replacement unit was not received until early October.

## EXPENSES

The expenses for this project were limited to the cost of the acquisition of the sonar equipment, related cables, and the PC software for viewing and analyzing the sonar logs on a PC. Expenses for the sonar unit case, miscellaneous hardware, fuel for doing sonar runs, etc were assumed by the PLIA volunteers. Volunteer time was used exclusively throughout this project.

Lowrance HDS 16 Live Sonar with 3 in 1 Transducer	\$5313.04
Lowrance 3D Structure Scan Module and Transducer	
Power Cables and Misc Electrical Fixtures	\$57.67
Reefmaster Sonar Viewer (PC Software)	\$49.00
On hand plywood and misc. hardware for case and transducer bracket	\$0.00
Total	\$5419.71

## COMMUNITY OUTREACH

Community outreach is an important adjunct to our use of side scan sonar. There are two primary facets to this outreach. The first is in assisting people in the Lamprey watershed in understanding what we have found and directly assisting them in using our sonar to detect milfoil in other waterbodies. We have not pursued any of this outreach this year because of the health concerns and restrictions surrounding the current pandemic. We intend to participate in such activities when health conditions permit.

The second is to inform a larger audience, both in New Hampshire and in other states and waterbodies, about our experience so they can benefit from what we have learned. For this purpose we will be pursuing any New Hampshire conferences and forums to disseminate our knowledge. We have already contacted the NH Lakes Association to determine where such information can be placed to inform the NH lakes communities who might have an interest.

We have also written a more detailed report of our findings in the associated paper entitled "Report on the Use of Side Scan Sonar to Locate Milfoil in Pawtuckaway Lake". This report offers a much more detailed analysis of our experience in using sonar and is a stand-alone document that can be distributed to interested parties as needed or requested.

## CONCLUSIONS

We have been effectively controlling milfoil in known areas of infestation on Pawtuckaway Lake through surface and diver observation and hand removal. As a result there have only been a few test cases that would allow us to verify that we can identify milfoil with the side scan sonar. However, in those cases, we have demonstrated that we can locate aquatic vegetation that rises above the surrounding vegetation which may indicate the presence of variable milfoil. We have found that there are a manageable number of such cases and that it is possible to investigate all such suspicious areas with visual observation. In those limited number of cases we have verified milfoil at approximately two thirds of the locations noted. The remaining third of suspicious locations turned out to be columns of native vegetation, mostly large leaf pond weed.

In searching areas not known to contain milfoil, we found a small number of suspicious sonar readings. Upon direct inspection, none of these locations contained milfoil.

Our conclusion is that side scan sonar has proven effective at locating potential locations of milfoil without producing an untenable number of false positives. With further use of the sonar we hope to be able to refine our analysis to try to be able to discriminate between milfoil and other tall aquatic vegetation, although that may never be possible.

## REFERENCE

For full detail on the use of sonar and our findings, refer to the document which is an adjunct to this summary report, entitled "Report on the Use of Side Scan Sonar to Locate Milfoil in Pawtuckaway Lake"

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