Paradox Lake Eurasian Watermilfoil Population Reduction Efforts 2008-2024

March 5, 2025

Executive Summary:

The Paradox Lake Association has been fighting Eurasian Watermilfoil (EWM) in Paradox Lake since 2008. For significant portions of this time, we had been figuring out our next steps as we went, with limited information available on tried-and-true strategies to win the battle. We were successful in slowing the spread of EWM through this approach but ultimately got to the point where we were losing control of the EWM population.

The PLA developed and executed a multi-year, focused effort to significantly reduce the EWM population in the lake and it appears we have been successful. It was an effort that integrated herbicide use with hand harvesting. The primary purposes of this report are to: 1) Document our EWM activities for future generations of PLA leadership, and 2) Provide a source of information for other lake associations that are in various stages of their own battle against EWM.

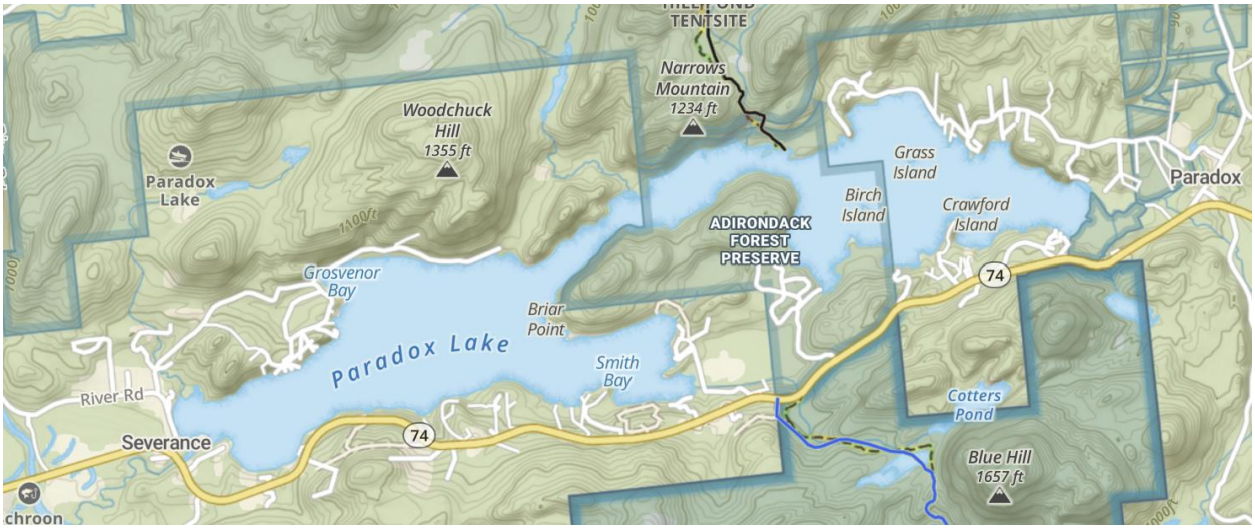
Key Learnings from our 16 year fight with EWM:

- Gain as much information as possible on techniques to fight EWM and be aggressive in the approach taken to controlling the EWM population in the lake. Err on the side of over resourcing the effort to avoid losing control of the fight.
- A core of active and well-trained volunteers is critical to success. Contract lake managers and/or hand harvesters, although important, are not sufficient to conduct the full scope of a comprehensive fight against EWM because they are expensive and are not efficient for much of the necessary work.
- A partnership relationship with the hand harvesting contractor yields significant advantages over a transactional relationship.
- An herbicide (ProcellaCOR EC) is an important tool to supplement hand harvesting efforts in areas where hand harvesting is not effective. Treatment is best prior to the point where dense growth is resulting in major fragmentation events.
- Collecting data and information, and frequent analysis of the data, should be a significant component in the development of action plans.

Table of Contents:

	Page
Paradox Lake facts and figures	2
Eurasian Watermilfoil history in Paradox Lake	3
Summary of efforts to limit the growth and spread of Eurasian Watermilfoil	6
Status of Eurasian Watermilfoil growth as of late 2024 and path forward	8
Comprehensive list of learnings from 16 years fighting Eurasian Watermilfoil	10
PLA contact information	15
Examples of PLA data	15

Paradox Lake Facts and Figures:



Paradox Lake is in the southeastern portion of the Adirondack Park. It covers ~900 acres, is ~4 miles long and ~3/4 mile wide at its widest point. It consists of two lake basins connected by a ½ mile long Narrows which contains a navigable channel, even at the lowest water levels. The lake has a mean depth of 25 feet with a maximum depth of ~30 feet for the eastern lake basin and ~50 feet for the western lake basin. In general, the lake bottom on longer, straight shorelines on the north and south sides of the lake slopes steeply to deeper water and there are extended shallow areas in most of the coves and on the east and west side of the islands. The Inlet bay on the east end of the lake and the Narrows are large shallow areas that border wetland areas.

The NYSDEC rates the water quality for Paradox Lake as AA and the lake is considered to be of low – moderate productivity.

The lake has a main inlet stream at the eastern end of the lake and several other tributaries. Inlet streams and tributaries originate, and flow through, 98% undeveloped forest lands. The lake outlet is near the western end of the lake and drains to the Schroon River. The lake contains a large volume of water relative to the average inflow. There is a minimal natural current flowing from east to west in the lakes but the prevailing wind direction creates more dominant wind driven surface currents from west to east.

The lake level fluctuates by several feet during the year. There is a shallow dam in the outflow creek which sets the minimum lake level during dry periods. The elevation of the lake is very close to that of the Schroon River and Schroon River backflows into the lake during periods of high river water levels (such as spring snow melt and storms), raising the level of the lake by several feet, sometimes quite rapidly.

The NYSDEC Paradox Lake Campground is located on the southwestern corner of the eastern lake basin. The campground is the location of a NYSDEC boat launch. The AWI lake steward data showed that 883 boats were inspected during launch and removal in 2023, with 46% being motor boats and 52% being canoes/kayaks/ SUPs. There are a limited number of additional boat launches that occur outside the AWI lake steward hours that are not recorded in the AWI data.

The NYSDEC Boat launch is located 18 miles from the closest boat launch on Lake Champlain which is home to >50 invasive species. There is a NYSDEC boat wash station available for boaters on Rt 74, ~4 miles west of the campground entrance.

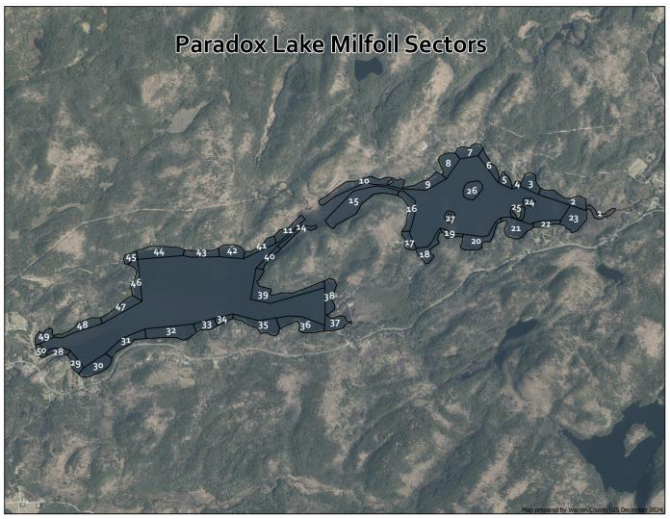
<u>Eurasian Watermilfoil History in Paradox Lake</u>:

Eurasian Watermilfoil (EWM) was first discovered in 2008 in the cove where the NYSDEC boat launch is located in the eastern lake basin. Two patches were discovered, one that was relatively recently established and one that appeared to be several years old. It was first encountered in the western lake basin in 2017 and the first hand harvesting in the western basin occurred in 2018. There is anecdotal information indicating that it was present in one isolated channel in the western basin for a number of years prior to 2017.

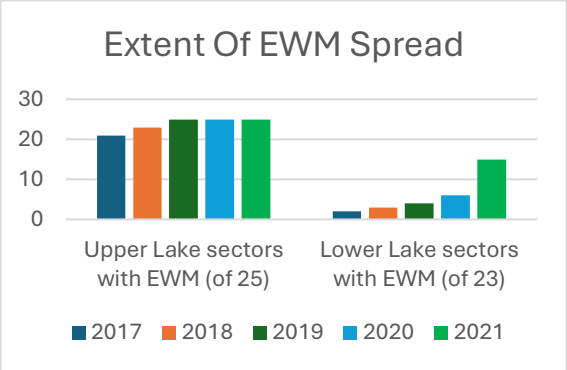
EWM has been shown to grow in depths of up to 15 feet in Paradox Lake, although at depths greater than 12 feet, the EWM struggles to grow and single plants are typically found rather than patches of plants. The EWM grows best between 3-12 foot depths, forming dense growth if left unharvested. The EWM grows in water shallower than 3 feet but is often located among native plants, such as whitewater lily (Nymphaea odorata)

The EWM grows best in the soft, muddy bottom frequently found in the coves. It will grow in rocky areas, although it is harder for it to become established there. When it does grow in rocky areas however, it can be very difficult to remove the roots when harvesting, leading to regrowth.

To help with the data tracking and harvesting work, the PLA broke the lakeshore into 25 sectors in the eastern basin and 23 sectors in the western basin. These sectors are shown on the lake map below and are referenced in much of the reporting by the PLA.



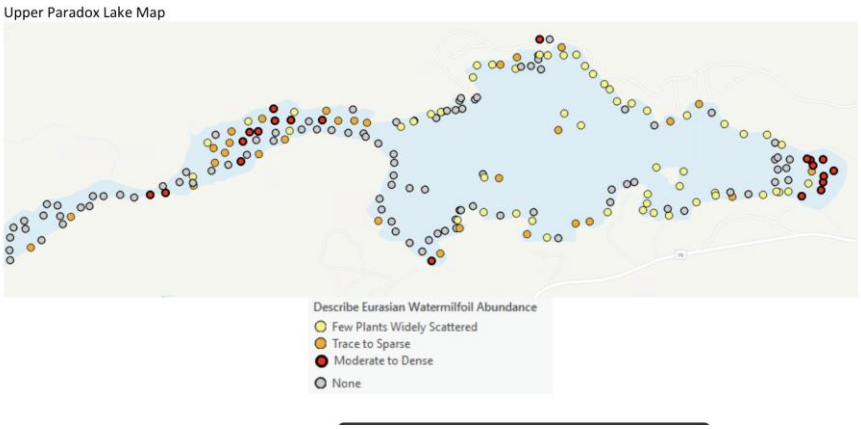
Scouting and hand harvesting by volunteers and contractors has occurred every year since 2008 and is responsible for slowing the spread of the EWM throughout the lake. The EWM has, however, spread despite these efforts. The spread of the EWM across the lake has followed the traditional S-shaped curve experienced with the introduction and spread of invasive aquatic species in a body of water. The initial spread is slow, as we experienced for the first 6-8 years. Then the rate of spread increases as more plants are present, becoming quite rapid. Finally, the rate of spread decreases as most of the suitable growing sites already have the invasive species present. By 2017, the EWM was found in 21 of the sectors in the eastern basin and 2 of the sectors in the western basin. The bar chart to the right shows the spread from 2017 – 2021. Paradox Lake was on the steeper part of the curve during this period.

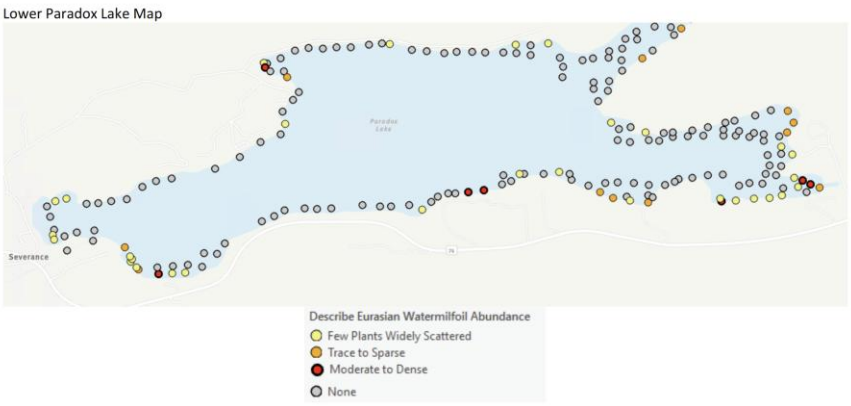


As of 2023, the EWM was present in all of the sectors in the eastern basin, including the main inlet creek. It was also present in 16 sectors in the western basin.

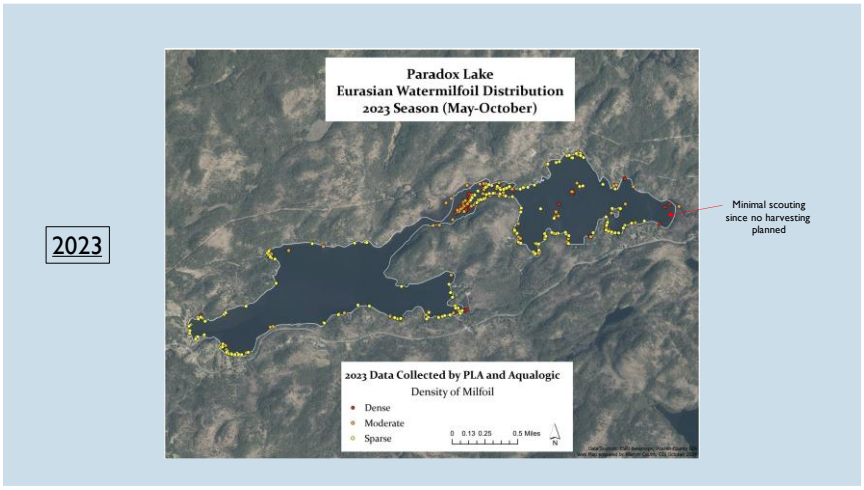
The distribution and density of the growth can be seen in the data collected as part of the APIPP Lake Management Tracker program and that collected in a bespoke EWM app developed and maintained for us by Warren County Soil and Water staff. The means of data collection differs between the two methods and therefore the data shown is not a direct overlay. Looking at both data sets gives a good understanding of the status of the EWM spread and density as of 2023.

APIPP Lake Management Tracker data for 2023:





PLA bespoke APP data for 2023:



By 2021 we were starting to see periods with high volumes of EWM fragments floating around the lake, originating in the areas of dense growth. These fragments drifted on wind driven currents and new growth was being found around the lake. In 2023, we experienced a period of very high fragmentation with many fragments, and many large fragments, immediately following an intense July storm. Lake levels were very high and the level of fragmentation was overwhelming. Fortunately, many of these fragments settled in the shallow areas that are dry or extremely shallow at normal lake levels.

The PLA initiated a focused multiyear effort to substantially reduce the breadth and density of the EWM in the lake in 2022. The effort included:

1. A dramatic increase in the number of days our commercial harvesting partner Aqualogic was on the lake
2. A treatment of the most difficult to hand harvest (and most dense EWM growth) areas with the aquatic herbicide ProcellaCOR EC
3. Implementation of an APP to aid in coordination of scouting and harvesting efforts and geolocate areas of EWM growth
4. An increase in communication within the PLA volunteer efforts and with our commercial partner.

The work was conducted as planned and the ProcellaCOR EC treatment occurred on June 5, 2024. The reduction in the EWM growth in the lake has been substantial. Scouting, and surveying the lake at depth, in 2025 will be required to fully understand the impact of the work.

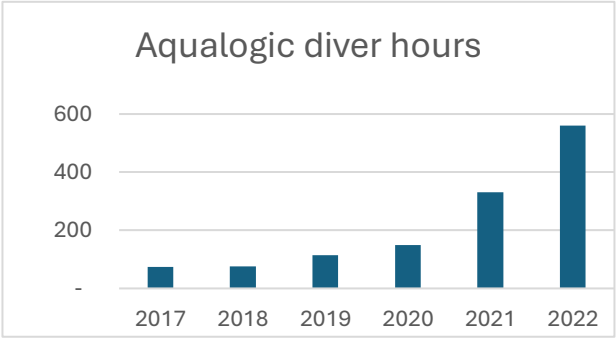
Summary of Efforts To Limit The Growth and Spread of EWM in Paradox Lake:

Shortly after the EWM was discovered in Paradox Lake, the PLA established a network of volunteer lake stewards to inspect boats being launched onto the lake to prevent further introduction of aquatic invasive species. The effort evolved into paid lake stewards supported by the Town of Schroon. For the past several years, the Paradox Lake stewards have been part of the AWI lake steward program. The total cost incurred by the PLA for lake stewards for 2017-2019 was $22,000.

Hand harvesting of EWM by trained scuba divers was started upon discovery in 2008 and has continued each year since. The harvesting work was initially done by the Adirondack Ecologists from 2008 through 2014. In 2016, Aqualogic was hired as the hand harvesting contractor. Diver Assisted Suction Harvesting (DASH) harvesting was used for 1 year, but the EWM density was not high enough to warrant the use of DASH.

Several Paradox Lake Association members who were certified scuba divers learned the proper techniques for hand harvesting and began harvesting in 2009. Several PLA members who were comfortable snorkeling were also trained to hand harvest the EWM and, while less efficient than scuba divers, have been able to successfully harvest EWM in waters up to ~10 feet deep starting in 2009. Many of the volunteer divers 'adopted' certain sections of the lake and would dive periodically to remove any EWM growth found in those areas. The volunteer divers have been critical to the effort to combat EWM as a supplement to the commercial efforts. They develop a deep knowledge of the EWM growth in the lake, and specific areas, survey areas at depth to improve understanding, harvest areas of sparse growth, and respond quickly to more urgent needs.

In 2016, the PLA initiated a relationship with Aqualogic as our hand harvesting contractor/partner which is still ongoing. From 2016 until 2021, Aqualogic focused their harvesting efforts on the areas with the densest growth, while the volunteers focused on the areas with less dense growth. In 2022 through 2024, Aqualogic was directed to areas where their contribution would be most effective as part of a broader hybrid approach that would ultimately include a treatment with the aquatic herbicide ProcellaCOR EC. These included many areas of less dense growth as we tried to eradicate the EWM in specific areas of the shoreline.



The contracted hours with Aqualogic mirrored the expansion in spread and density of the EWM growth as can be seen in the bar chart to the right. In 2017, Aqualogic was on the lake for 2 or 3 five day periods and by 2022, they were on the lake 5 days a week from late May until mid-August. The total costs incurred by the PLA for hand harvesting for the period of 2017-2024 are $245,000. This would have been about 20% higher if not for the support we received from Aqualogic. The PLA is planning to spend another $38,000 in 2025 to complete our focused efforts.

From about 2009 until 2020, we found that hand harvesting was most effective if scouts were able to mark individual EWM plants or patches with markers in advance of divers working in the area. This practice was particularly effective where plants were scattered about so the divers could move from plant to plant. As the growth became more dense, divers found they needed to cover whole areas and marking individual plants was not as useful.

The PLA partnership with Aqualogic became closer over time as our efforts increased, and this led to more effective EWM management. Aqualogic became highly committed to helping the PLA overcome the EWM problem. The level of communication increased, including off season planning on the most effective way to use the Aqualogic capabilities in the coming year, daily feedback on the results of the harvesting, and more real-time adjustments to the dive locations. Aqualogic also committed dedicated dive teams to Paradox Lake which ensured divers were familiar with the details of the lake's EWM population. In 2022 and 2023, the PLA utilized the Aqaulogic divers to scout areas of the shoreline at depth to ensure a complete understanding of the EWM growth across the entire lake. In 2024, Aqualogic assigned one of the divers to be a dedicated liaison with the PLA Invasives coordinator. The daily communication and insights gained from the liaison led to a more flexible use of the Aqualogic resources to conduct very targeted harvesting. Aqualogic also provided grants to the PLA in 2022, 2023 and 2024 to enable the PLA to harvest for the number of days necessary to complete our 3 year plan EWM reduction.

The scuba diving and snorkeling hand harvesters are effective in deeper water but it is very difficult for them to be effective in water shallower than 3 feet. Unfortunately, EWM does grow in these shallower waters, often mixed in with native plants. These plants don't appear to grow very robustly but they are susceptible to fragmenting and spreading to other areas in the lake. The PLA has a group of volunteers who harvest in these shallow waters by either wading in the mud, or by reaching down from kayaks. The harvester can just reach down in waters less than 15" deep, dig down into the soil under the plants with their hands, and remove the plants and roots. For water depths between 15" and 3' deep, we have found that a multi-tine long handled garden cultivator can be used to loosen the soil around the roots and allow the plant to be removed. This is most effective where the bottom is muddy or loose sand.

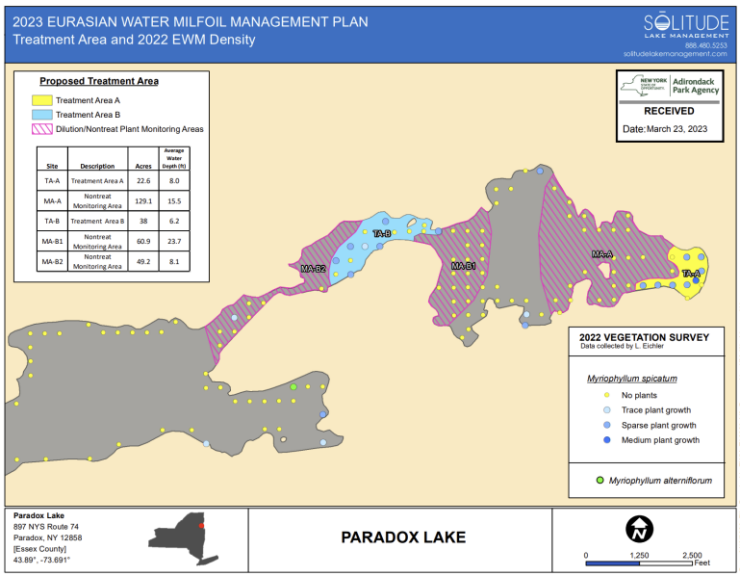
The PLA educated a group of volunteer scouts to look for EWM plants around the lake and mark their locations, starting in 2009. While individual scouts have joined and left the group over time, we have maintained a robust group of scouts each year. Some scouts work individually and others in groups during planned scouting outings. The effectiveness of the scouting is dependent on environmental conditions such as degree of sunshine, flatness of the water surface, proximity of the EWM plants to the surface of the water, and the height above the water of the scout (ability to see EWM plants improves substantially if the scout is able to stand in a motorboat versus sitting in a kayak). The scouts are an invaluable part of the EWM effort, dramatically increasing the efficiency of the harvesters and providing the bulk of the knowledge on the status of EWM growth around the lake.

Starting in 2023, we attempted to develop the capability to scout for EWM plants in deeper water using an underwater drone, believing that we might be able to free our divers from scouting work and allow them to focus on harvesting. We are able to purchase a drone utilizing a grant from the Adirondack Foundation - Community Fund for the Gore Mountain Region. After 2 years of dedicated work, we've concluded that the drone is not well suited for scouting.

In 2022, the PLA initiated work to obtain permits to treat the areas with the most dense EWM growth with the aquatic herbicide ProcellaCOR EC. Glenn Sullivan, initially with Solitude Lake Management, and later with Ready-Scout LLC, was invaluable in leading us through the intricacies of the permitting

and treatment process and navigating the permit process as the first lake seeking permits for ProcellaCOR EC use with NYS owned lake bottom. We will not document the details of the permitting processes as these are well documented by the regulatory bodies and may change over time. We do, however, document our important learnings and recommendations regarding the permitting activities further on in the report.

Permits were received in 2024 to treat two areas in the lake totaling 60 acres. One was located in the Inlet Bay at the east end of the eastern lake basin. The other was on the eastern end of the Narrows. These areas are shown in yellow and blue on the map below. The total costs incurred by the PLA from 2022 – 2024 for the required permitting and treatment with ProcellaCOR EC, as well as all other associated costs, was $110,000.



Status of EWM Growth as of Late 2024 and Path Forward:

The high level of hand harvesting by Aqualogic, and our volunteer divers, in 2022 – 2024 allowed for thorough harvesting of areas of sparse EWM growth and harvesting areas of more dense growth several times per year for several years. By early 2024, the reduction in the density of the EWM growth was evident to our divers across the lake.

The exception was in the areas targeted for treatment with ProcellaCOR EC. We limited harvesting these areas starting in 2022 with the expectation of the ProcellaCOR EC treatment in 2023. The treatment was delayed to 2024. The increase in growth while not harvesting certainly contributed to the high levels of fragmentation experienced in 2023 that was discussed earlier.

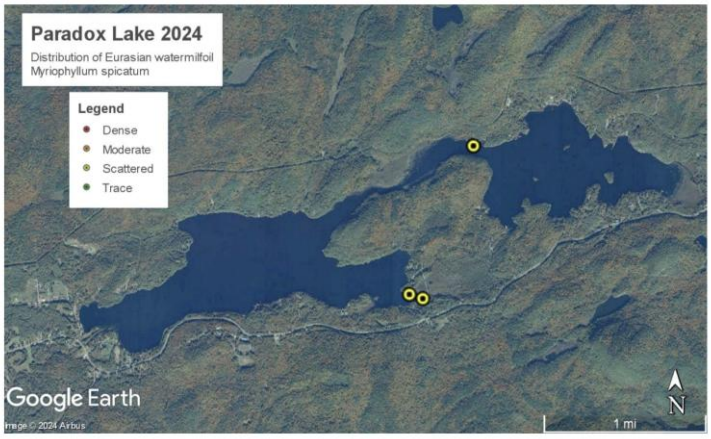
The ProcellaCOR EC treatment occurred on June 5, 2024. Within a few weeks, the impact on the EWM in the treatment areas was obvious with the EWM plants bending over. After 6 weeks it was difficult to find any EWM plants within the treatment zone. It also became difficult to find EWM plants outside of the treatment zone by either our volunteers or the Aqualogic divers. In the eastern basin. EWM plants in a number of areas had been GPS marked prior to the treatment and then could no longer be found. Impacts on the EWM plants outside of the treatment areas was expected due to dispersion of the ProcellaCOR EC active ingredient throughout the water column but the impact across the basin was surprising to us.

There had been limited EWM growth in the western lake basin prior to the ProcellaCOR EC treatment. However, after the treatment, it also became difficult to find EWM plants in the western basin as well. This continued to be the case through to the end of the 2024 season.

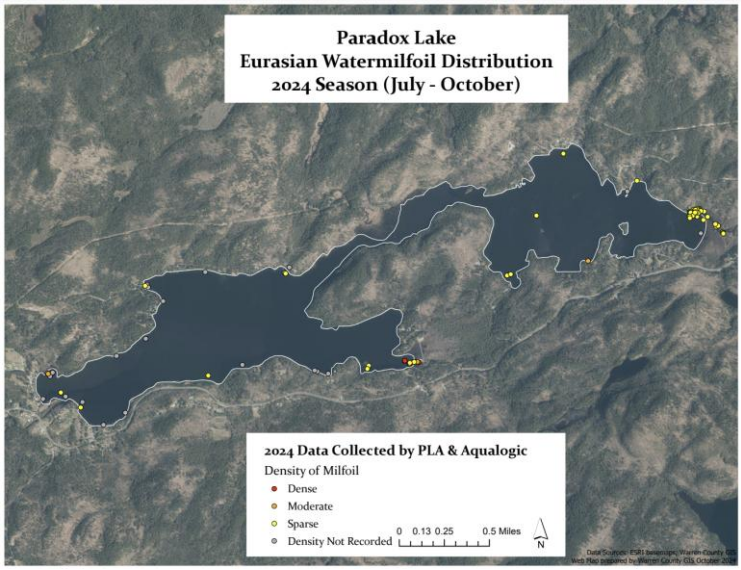
The 2024 post treatment plant survey data and the data from our App for July-Oct of 2024 are attached below showing the year end state of EWM growth.

Aug 2024 plant survey:

Figure 2. Eurasian watermilfoil distribution and relative abundance in Paradox Lake in 2024.



Aug-Oct 2024 PLA APP data:



At the end of the 2024 season, EWM was found in a few places in Paradox Lake.

- The Inlet Creek at the east end of the lake contains EWM plants. It is not permitted to treat a creek environment with ProcellaCOR EC so the Inlet Creek was not treated. It was harvested by Aqualogic several times during the year and was also scouted and harvested by the volunteers many times, through to October. Great progress was made but it is a difficult area to harvest.

- An area in the Inlet Bay immediately south of the Inlet Creek showed some single plant EWM regrowth in Sept/October. This is likely due to an incomplete killing of the EWM plants here due to dilution from the creek flow during treatment. These areas were harvested in Sept/October.
- The Nawita Inlet, in the southeast corner of the western basin, also continued to have EWM growth late in 2024. This is a shallow area with fairly dense growth. It has received intense harvesting focus during 2023/2024 and scouting and harvesting continued through September. The density of the growth in this areas has decreased from pre-2023 levels.

The definitive assessment of the impact of the multi-year focused effort will become clear in 2025. There is potential that some areas of the lake more remote from the ProcellaCOR EC treatment zones will not have experienced a complete killing of the EWM plants and we may see some regrowth. According to APIPP, a number of lakes have reported unusually low levels of EWM growth in 2024. We are not sure if this natural phenomena contributed to the reduction in EWM that we saw, especially in the western lake basin. We are also not sure what to expect for the intensity of regrowth after these periodic natural reduction cycles as little information is available. We will also see the impact of our intensive harvesting in the areas showing growth late in the year.

Comprehensive list of learnings from 16 years fighting Eurasian Watermilfoil:

The PLA has accumulated a significant amount of knowledge regarding the identification of EWM, and combating its spread in our lake. We have made lots of observations, have done things that worked well, and have done things that have not worked well.

We have attempted to organize what we have learned during our 16 year battle. The information is organized into a number of topics but it is not organized in any particular order of importance. Different learnings will be more or less important to other organizations depending on their particular situations.

Volunteers

1. It takes a significant number of volunteers to successfully fight EWM. Many different roles – scouting, harvesting, collecting/organization data and information, managing resources, determining work to be done.
2. Need to have a balance of skills and capabilities as well as volunteers with enough availability.
3. Need to have a few volunteers who are truly committed to the fight and are willing to persuade others to join the fight and to put in whatever effort is needed.
4. It takes work to organize the volunteers so their efforts can be as effective as possible.
5. Unless the lake association has vast resources, volunteers will need to be the core of the effort to fight EWM
6. The PLA has averaged ~1500 hours per year of volunteer effort to fight EWM

Scouting for, and marking location of, EWM plants

1. It is easy to spot EWM plants once you are trained but conditions have a huge impact on scouting – still water and sunny skies are best.

2. Kayaks and canoes are the most maneuverable for scouting but it is easier to see EWM plants if you are higher above the surface of the water standing in a powerboat. Must also be cautious in a powerboat to not create plant fragments with the propeller.
3. We have found that we tend to get more volunteer scouting hours when we organize scouting 'events' rather than relying on individual scout initiatives.
4. We have marked plants with small floating bottles and with GPS location via a smartphone app developed for us by Warren County Soil and Water staff. Each approach has pros and cons:
    a. Floating bottles
        i. Pros
            1. Easy to deploy by scouts
            2. Easy for harvesters to find plants
            3. Easy for harvesters out on their own to find places to harvest
        ii. Cons
            1. Effort to recover bottles after use and get back to scouts is significant
            2. Creating the number of bottles needed is a lot of work
            3. Not attractive to have bottles floating around the lake
    b. GPS marking via app
        i. Pros
            1. App allows navigation to marked locations
            2. Creates record of plant location with metadata for further analysis
            3. Creates locations that can be revisited later in the year or in subsequent years
            4. Easy to use app
            5. Data can create valuable imaging for communication with stakeholders and regulators
        ii. Cons
            1. GPS location only accurate to with 20-30 ft – some searching required to find plants once at the GPS point
            2. Phone damage or loss possible, especially in the harvesters' boat/kayak. It is difficult for a harvester in the water to use their phone to navigate to the next point without damaging their phone. Can be resolved with a scout to aid the diver but increases the resources needed per harvesting trip.
            3. Some scouts and harvesters will need to bring reading glasses into their boats to use the app
5. We obtained an underwater drone via a grant from the Adirondack Foundation - Community Fund for the Gore Mountain Region. We experimented for 2 years to see if the drone could be a useful tool to aid in scouting for EWM in deeper water, or before the EWM plants get near the water surface. We found a steep learning curve to use the drone for effective scouting work. We also realized that a dedicated drone operator and a support team are needed for significant periods of time to scout for, and then mark the location of, EWM plants. Finally we found that the drone was vulnerable to getting tangled with native plants during scouting work. Ultimately we concluded that a drone may work for some organizations/lakes but we did not find it to be a good addition to the PLA toolset.

Harvesting EWM

1. It is easy to pull EWM plants but, to correctly harvest, removing the entire root structure to prevent regrowth requires training and practice. The importance of removing the root structure must be clear to all harvesters.
2. There are times, however, when removing the complete root structure is not possible and partially removing the plant is an acceptable alternative. These times are limited though. The reduced effectiveness of these methods must be recognized and there may be procedural changes implemented in order to achieve the longer term goals
    a. Later in the season when fragmentation is likely, plants can be topped to remove the section of the plant where fragmentation is most likely.
    b. A long handled multi-tined garden cultivator can be used from a kayak to remove plants in shallow waters. However it takes extensive experience to be able to do this without leaving behind broken roots. To compensate, repeated visits to the area to remove the subsequent regrowth can eliminate the EWM over time.
3. We have found that not all EWM emerges at the same time in areas of growth. We have found that visiting the same area to harvest several times during the year generates the best long-term results.
4. EWM often grows among native plants making it difficult to harvest effectively. Our experience is that the EWM emerges before the native plants and there is a window of several weeks when EWM can be harvested fairly easily before the native plants emerge. This window is the last week or two in May and the first week or two of June. This has been particularly effective in shallow areas of white water lily beds.
5. Having volunteer harvesters who take ownership for a section of shoreline, scouting and harvesting the area periodically during the year, is very valuable in maintaining a minimum EWM population.
6. Commercial harvesters are most effective and cost efficient in areas of fairly dense growth. They can be valuable by harvesting lower density areas, especially those that pose difficulties for our volunteer divers (EWM plants among downed trees for example), but remove fewer plants.
7. We have found that a long-term partnership relationship with the commercial harvester is far more beneficial than a transactional relationship. The benefits we have realized include:
    a. Harvester understanding of the lake and nature of the EWM growth, lake association objectives and challenges; harvester input into the planning of work; improved communication during the season; and greater flexibility in adjusting the work to fit the fluid EWM growth situation during the year.
8. We were unable to find an effective way to hand harvest the EWM once the growth became very dense and in difficult to access areas. The root structures became extensive and intertwined and impossible to fully remove. Harvesting in these very dense areas also created a high level of fragmentation.
9. In our experience, scuba divers and snorkelers will hear a distinct ‘cracking’ sound if roots snap when removing an EWM plant. Sharing this information when it has happened can be important for determining where regrowth is likely, and subsequent scouting will be needed to verify the status.

Importance of data and deep understanding of EWM growth in the lake

1. Collecting and analyzing data on the location and harvesting of the EWM in the lake was critical in our efforts to:
    a. Understand the drivers to EWM spread
    b. Track progress of efforts and track expansion of EWM population
    c. Develop detailed plans on how to attack the EWM
    d. Communicate with PLA members for situational awareness and fund raising
    e. Communicate with regulatory authorities
2. Physical surveys of lake bottom to establish detailed understanding of depth and lake bottom material/consistency enabled understanding of where EWM is likely to thrive, or have difficulty growing, were critical.
3. It was important to understand the maximum depth where EWM grows in our lake and the depth where it thrives.
4. We divided the lake shoreline into small sectors to aid in communications, data collection and reporting. This move also helped us understand and communicate about the spread of EWM around the lake.
    a. We also generated a description of the nature of the lake bottom for each sector to facilitate a common understanding of the likelihood of growth in each sector.

EWM Spread and fragmentation

1. Plant fragmentation appears to be the primary mode for EWM to spread in our lake. Fragments can be caused by boat propellers or canoe/kayak paddles severing the plants or by a natural process. Fishermen frequently maneuver their boats among the shallow weed beds that contain EWM. The fragments float on currents, eventually sink and can take root at the new location.
2. We found little information on the drivers for the natural fragmentation. We have found it most often occurs later in the year but have also seen it happen as early as June in several years.
3. The fragmentation becomes a significant driver of EWM spread as areas of more dense growth form and more plants survive through the winter. There is a compounding effect of more plants driving more fragmentation, which drives more plants. This is when the EWM invasion is on the steep part of the spread curve.
4. The volume of inflow to the lake is very low compared to the volume of the lake itself, resulting in minor currents between lake inlet and outlet. Observations of fragment movement, and location of EWM growth, showed that wind driven currents were the primary driver of EWM fragment movement.
5. Scuba diving hand harvesting, both volunteer and contract, is a critical tool for fighting EWM. However, since the diver is usually on the lake bottom when harvesting, fragments can break off higher on the plant and not be seen by the diver. It is very important to have surface scouts supporting the divers to find and remove these fragments. Not all the fragments will be captured though.

Approach/philosophy for fighting EWM growth

1. It is important to actively fight the EWM every year, not skipping a year or two for funding or resource reasons, especially as the EWM becomes more widespread.
    a. The PLA did not take any years off. However in 2022, we did not harvest in the two areas of most dense EWM growth expecting to treat those areas with herbicide in

2023. We did not receive our permits for 2023 and saw extremely high levels of fragmentation from those areas in 2023 which spread fragments around the lake.
    b. There is anecdotal data from several other lakes where a year or two were skipped and much ground was lost in the EWM fight as a result of the break in activity.
2. While EWM has been a widespread invasive species for a long time, the PLA found it difficult to find guidance on best practices for fighting EWM. We learned year by year and adapted our efforts based on what we observed. However, looking at the current year's growth to learn what could have been done better the prior year always left us in a position of chasing unexpected spread or increases in density. We were successful in slowing the rate of spread of the EWM but never got ahead of the spread.
    a. There is much more info available today with more experience fighting EWM in Adirondack lakes. We encourage any lake association to reach out broadly to gather the experience of others as they develop their plans.
    b. Do not be afraid of overreacting/over resourcing. Applying too much resource in a year costs a little extra money. Under resourcing in a year will result in a significant increase in the number of resources required in subsequent years.
3. In the early stages, it is easy to set simple annual objectives such as 'remove all the EWM we can find'. However, we found that the objective setting needs to be more detailed as the EWM spreads and the fight becomes more complex. Planning needs to look ahead several years, including identification of the desired state in 2-3 years, and then an action plan developed that can deliver the desired state.
    a. Makes the total scope of work more clear
    b. Allows for organizing the necessary resources
    c. Clarifies fund raising requirements
    d. Allows consideration of potential impacts if target levels of funding or resourcing cannot be obtained
    e. Gives intermediate milestones for use in evaluating progress each year and communicating with lake association members

Herbicide treatment and permitting

1. The herbicide ProcellaCOR EC is a valuable tool for augmenting hand harvesting. We found it to be very effective in areas where hand harvesting is proven to be unsuccessful.
    a. Once an area is determined to be unsuitable for hand harvesting and the EWM growth is becoming more dense, it is important to treat with ProcellaCOR EC early enough to prevent periods of very high fragment generation. The high fragment generation rate from mature dense patches leads to the rapid spread of the EWM to other parts of the lake. Of course this is a subjective evaluation and needs to be balanced against an over reliance on the herbicide to control the EWM.
2. It is important to determine if NY State owns the lake bottom or lake shore adjacent to potential herbicide treatment areas. If so, additional permits will be required from NYDEC Lands and Forests.
3. The permit process to allow herbicide treatment will take 18-24 months. Several factors drive this long timeline:
    a. APA requires an on-site visit during the peak growing season to confirm the nature of the growth. This would be in August the year prior to treatment and requires prior work with the APA to get to that point.

    b. A plant survey is required during the peak growing season to identify potentially threatened species that could be affected by the treatment and to set a baseline for the post treatment surveys.
        i. This plant survey needs to be designed with the likely treatment areas in mind to ensure the survey generates the necessary info.
    c. Communication with lake users and landowners, as well as stakeholders, should occur over a prolonged period to allow for concerns to be addressed and avoid conflict as the treatment nears
4. Several years of data outlining harvesting efforts and EWM growth are beneficial for progressing the required permits.
5. We found that hiring a consultant to aid in the development and filing of our permit applications, and tracking the progress of our permits, was a critical step.
    a. They understand the permitting process
    b. They have relationships with many of the individuals involved directly, and indirectly, in the permitting process which aids in tracking the progress of the applications and working through any obstacles that arise.
    c. They understand the unique language present in many parts of the permit applications.

PLA Contact Information:

This technical report attempts to capture all the relevant information on the fight against EWM in Paradox Lake. However, it will not likely function well as a stand-alone document providing support to other lake associations fighting EWM.

Those looking to learn more about the PLA efforts, or to better understand the context of any aspect of our work, are encouraged to reach out to us at paradoxlakeassociation@gmail.com.

Examples of PLA data:

The PLA has been tracking EWM harvests by lake sector since 2014. This tracking has allowed us to analyze our efforts and to understand the multiyear impacts of concentrated harvesting work in certain areas.

The data collection can be problematic for several reasons:

- Different harvesters used different measurements. Some contract harvesters measure their output in gallons and some in pounds. Our volunteers initially reported the number of plants harvested. For those who harvested for more than 30 minutes, this became a rough estimate. We switched our volunteers to gallons with the development of our reporting APP.
- To put all of our historic and recent data on a consistent basis, we convert our contract harvester gallons to # of plants. Our reporting and analysis are all in # of plants. The conversion rate is somewhat arbitrary because a 15 foot tall bushy EWM plant has much more volume than one harvested in 2 feet of water. However, most of our analysis is year over year comparisons by sector, so we are comfortable in our conversion.

The table below shows some of the EWM harvest data for 2014 – 2023 by sector.

	A	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
2		Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
3	**Upper Lake ZONE**	**2014 EM**	**2015 EM**	**2016 EM**	**2017 EM**	**2018 EM**	**2019 EM**	**2020 EM**	**2021 EM**	**2022 EM**	**2023 EM**
4	**1**	6	13	123	50	25	25	30	1051	2380	480
5	**2**	710	490	2176	4036	5450	4400	3803	5938	2540	835
6	**3**	5	30	24	25	110	90	199	601	125	225
7	**4**	125	105	42	45	72	55	560	1619	72	250
8	**5**	27	2	11	16	2	25	60	24	75	80
9	**6**	43	84	24	27	44	15	99	550	60	200
10	**7**	110	154	28	59	110	35	113	150	500	1370
11	**8**	0	0	0	10	4	10	20	36	80	30
12	**9**	0	0	2	0	0	2	5	116	65	50
13	**10**	193	51	36	20	30	320	63	2425	880	2750
14	**11**	343	77	60	350	1980	985	2180	860	725	1755
15	**14**	51	78	234	930	1440	1163	415	2200	770	1830
16	**15**	10	26	52	40	10	20	17	695	145	3690
17	**16**	12	12	14	10	10	18	3	51	90	210
18	**17**	45	30	25	15	10	12	35	300	90	400
19	**18**	12	6	1	0	3	4	2	88	120	335
20	**19**	0	0	0	0	0	7	11	57	5	0
21	**20**	48	20	2	4	10	4	18	101	140	280
22	**21**	32	14	19	10	10	18	19	350	450	390
23	**22**	0	0	0	0	3	4	37	335	626	50
24	**23**	1657	1005	2089	1210	4637	4060	3770	8937	1980	100
25	**24**	16	8	42	37	20	12	25	8	30	100
26	**25**	0	50	297	20	17	340	34	700	80	100
27	**26**	514	333	1925	6926	4633	1285	1017	3487	740	4460
28	**27**	47	66	17	30	30	8	0	588	110	300
29	**Lower Lake Zone**				0	0	0	0	0	0	0
30	**28**				0	0	0	4	178	25	0
31	**29**				0	0	250	64	600	170	237.5
32	**30**				0	0	0	0	21	110	25

The PLA collated the information we gathered from all of our volunteer divers/snorkeler, as well as from our contract harvester, to generate descriptions of the lake bottom by sector. This information was valuable in understanding, and predicting, of the likelihood of EWM growth in a sector. A portion of the table is shown below to illustrate the nature of the descriptions.

Sector characterization

					EWM and Harvesting Info						Sector Characteristics		
Upper Lake ZONE		**Sector Name**	**Resource Needed**	**Historic nature of growth**	**Trend of EWM population (Worse/Better/Stable)**	**Difficulty to Harvest**	**Fragment Source or Receiver?**	**Level of Knowledge About Sector (Good/Need More)**	**Havesting intensity in past several years (High/Med/Low)**	**Resources Needed to Harvest**	**Underwater topography**	**Bottom material**	**Native vegetation to impede harvesting**
1		Inlet		In brook, single plants - some in channel, some in	Worse	Not that difficult.	Supplier	Good	Med in brook/High	Snorkeler	Shallow brook and outflow	Sand/gravel in brook, muck in	White water lily, pickerel
		dock)		Pond Weed.							pockets of more gradual depth increase	ledges	
3		Glen Reay Bay		Heavy infestation in shallows in NW/W part of the bay, growing among Lily pads. Few plants in the beach area. Nothing on Eastside. weedy area, continues into deeper water	Worse	Difficult in the dense area, Rest is not difficult	Receiver	Good Have to evaluate if this can be successfully hand harvested	Medium	Wader Cultivator Snorkeler/Diver	Rapid depth increase on east end, gradual increase on north side then drops abruptly, gradual to deep drop on west side	East and West side cliffs and rock ledge, rocky, shallow bay is soft except beach area Sandy firm, drops off fast	Yellow pond Lily, Eel grass, Pond Weed
4		Caldwell Cove		Dense in shallows, individual plants as move into deeper water. Among sticks in the shallows. Lots of harvesting in here. Some curly leaf	Better	Easy	Receiver	Good	Med/High	Cultivator Snorkeler	Very gradual depth increase. Large area of relative shallows	Soft near shore then firms up with short grasses	Mostly Eeel grass and other grasses near shore, scattered pickerel weed, pond weed in deeper
5		Sunderland cove		Single plants scattered along the shore but not too much growth. Some curly leaf	Stable	Easy	Receiver	Good	Med/High	Cultivator Snorkeler Diver	Rocky along east and west end, sany with some vegatation in bay, drops off fairly quickly	Rock, compact dirt, softer in bay	Some Pickel weed and Lily Pads
6		LeGoys Bay East		Individual plants, but more small patches in 2021. Deep along the point and tehn gets shallower as move into the cove. Light growth.	Slight increase	Not difficult	Receiver	Good	Low	Cultivator Diver	Shoreline drops off fairly quick	some rocks, mostly firm	Pond weed at depth
7		Maxwells		Plants in most dock areas, individual out deeper, small patches at east end of zone. Not that many plants. Some curly leaf pondweed.	Stable	Not difficult	Receiver	Good	High	Cultivator Snorkeler	Mostly gradual depth increase	Soft near shore, firms up at 3-4 ft. depth	A mix of Yellow pond Lily, Eel grass, Pond Weed
8		Emery		Some scattered plants in Lily Pads near small creek inlet, deeper ones near Emery's. Not many plants.	Stable	Not difficult	Receiver	Good	High	Cultivator Snorkeler Diver	Gradual increase in depth along north side of zone as it turns toward the south it becomes rocky and drops off quicker	Soft at east end of zone, firmer ground heading north, then rocky along shore with pockets of soft areas and plant growth	white lily pads near and Eel grass across intersection of zone 7&8, then pond weed as depth increases and heading further north.
9		Biscuit Rock Bay		Individual plants along shoreline in deeper water. Not many plants. New patch near Wrigley's dock in deep water	Stable	Not difficult	Receiver	Good	Low	Snorkeler Diver	Within the bay it gets shallow with a rock ledge and the west corner vegetation, The rest drops off quickly	Soft in West Corner, rock elsewhere	Yellow Pond Lily in the shallow west end
10		Trail		Individual plants on east and west end of bay in lily pads, plants found in deeper water as well - shoreline turns to rock heading west. Has been substantial amount of harvesting here	Worse	Not difficult	Receiver	Good	Low/Med	Cultivators Snorkeler Diver	Mostly gradual depth increase, except West end of zone drops off faster	Soft to firm	Yellow Pond Lily, Pickerel weed, white pond lily.
11		UL Narrows North		Lots of plants. Mixed in with the lily pads on the north side, single plants extend well into the channel	Stable (but bad)	Difficult in the lily pads because so wide spread and some of the lily pads are in deeper water. May not be able to successfully hand harvest	Supplier	Good	High by Aqualogic but low in shallows and lily pads	Cultivators Snorkeler Diver	Mostly gradual depth increase	Soft with lots of undergrowth	lots of Bladderwort, pond weed outside of of Lily Pad growth

The PLA developed detailed plans to create alignment among the team and to determine if the resources available were aligned with our objectives. A portion of the start-of-year plan for 2022 is below:

2022 Plan

	Intense activity
	Moderate activity
	Light activity
	No activity (beyond scoutin)

Upper Lake ZONE		Sector Name	2022 Desired End State	2022 Action Plan
				2022 Plan Details
1		Inlet (Inlet brook to Kuttler's dock & south to shallows)	Low/no growth observed at end of season	Harvest east of dock to brook early and mid season Harvest brook throughout season
2		Inlet Bay North + cliffs (west of Kuttler's dock)	Scattered single plants present	Scout only
3		Glen Reay Bay	Depends on ProcellaCOR decision	Decided if ProcellaCOR needed Qaulity control squares monitor growth Deep water harvested Remaining harvest plan dependent on assessment
4		Caldwell Cove	Low/no growth observed at end of season	Test systematic harvesting to clear all plants, deep water and shallows Multiple harvests Harvest curly leaf early
5		Sunderland cove	Scattered single plants present	Scouting Harvest curly leaf early
6		LeGoys Bay East	Scattered single plants present	Scouting
7		Maxwells	Scattered plants	Volunteer harvesting in shallows & around docks
8		Emery	Scattered plants	Harvest early where lily pads will grow
9		Biscuit Rock Bay	Scattered single plants present	Harvest patch identified in 2021
10		Trail	Depends on outcome of assessment for ProcellaCOR	Fully evaluate to decide if ProcellaCOR is needed APA/DEC assessment Harvest as needed to minimze fragmentation Expensive harvesting if ProcellCOR is ruled out
11		UL Narrows North	Plants among lily pads Plants in shallow open water	Full harvest of center channel - early and mid season