

Aquatic Invasive Plants

Early Detection Standard Operating Procedure for Chautauqua Lake

Chautauqua County, New York



Acknowledgements

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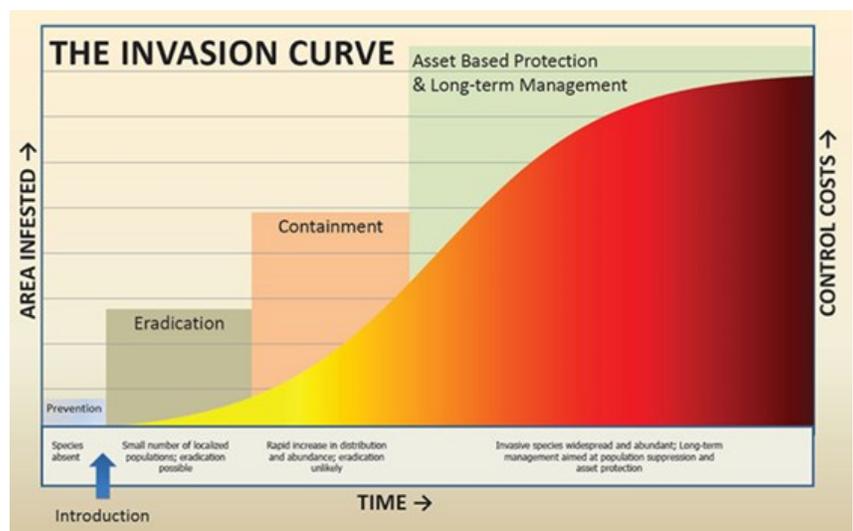
Introduction

In general, the introduction and establishment of aquatic invasive plants in a system creates a cascade of impacts including but not limited to: loss of beneficial native plant diversity, alteration of wildlife communities, degradation of water quality, restrictions on recreation and tourism and the creation of significant monetary costs to control in order to restore some essential functions to the ecosystem. However, local context and history are critical when assessing macrophyte communities in a lake, including the degree of negative impacts posed by invasive, or non-native, plant species and their associated eradication, containment, or long-term management options.

For instance, in Chautauqua Lake, Eurasian Water-Milfoil (*Myriophyllum spicatum*) and Curly-leaf Pondweed (*Potamogeton crispus*) have been present for decades and are among the most abundant macrophytes in the lake (Johnson, 2017). While they are, by definition, aquatic invasive plants, they are considered 'naturalized' to Chautauqua Lake (Chautauqua Lake Macrophyte Management Strategy, 2017). As such, they represent a major component of the overall lake ecosystem with respect to fish, native macrophytes, and other organisms, despite their classification as invasive plants. Based on their long-established and widespread presence in the lake and entwinement in the complex lake ecosystem, their eradication is no longer feasible based on the associated monetary costs and negative environmental ramifications (e.g., fishery disruption, widespread areal extent of macrophyte disruption). These long-established non-native plants are instead managed with more of a focus on asset protection and population suppression to combat nuisance growth in areas with human-use conflicts. Therefore, the primary focus of this Early Detection Standard Operating Procedure (SOP) is on newly emerging or nearby aquatic invasive species that threaten the existing Chautauqua Lake system, rather than these long-established non-native species.

While the long-term negative impacts of these well-established invasive species have been noted and continue to pose challenges, there are several other invasive plant species within the area that have the potential to become established in Chautauqua Lake and have similar, or in several instances even greater, negative impacts. Isolated occurrences of Brittle Naiad (*Najas minor*), Starry Stonewort (*Nitellopsis obtusa*) and Water Chestnut (*Trapa natans*) have been reported in Chautauqua Lake since 2000 (Johnson, 2017). Water Chestnut and Brittle Naiad have also been documented in other waterbodies within Chautauqua County along with European Frogbit (*Hydrocharis morsus-ranae*) and Watercress (*Nasturtium officinale*). Aggressive invasive plants such as Hydrilla (*Hydrilla verticillata*), Water Lettuce (*Pistia stratiotes*) and Water Hyacinth (*Eichhornia crassipes*) have been found within the Western New York region and could potentially be introduced into Chautauqua Lake as well (WNY PRISM, 2018).

As evidenced by the ongoing challenges posed by Chautauqua Lake's 'naturalized' aquatic invasive plants, the management of established populations is complex and costly. Prevention and Early Detection of invasive aquatic plants, before they



Invasion Curve
Photo © LeRoy Rodgers, South Florida Water Management District

Introduction

become established, is the most effective way to protect Chautauqua Lake from new aggressive species such as hydrilla and water chestnut. The costs associated with invasive species control and the sizes of infestation typically increase very rapidly with time (see 'Invasion Curve' figure on previous page). Prevention programs alone are unable to stop all invasive species introductions. Therefore, Early Detection programs seek to identify and address these invasions early in the process when control costs, environmental service loss, and environmental risks associated with treatment options tend to be lower. Knowledge of the location and infestation level of a newly threatening invasive species, and a consistent method of data collection and record-keeping, can provide critical information needed for effective and efficient, science-based actions to be taken (New York State Department of Environmental Conservation [NYS DEC], 2016; NYS DEC and New York State Department of Agriculture and Markets [NYS DAM], 2018).

Currently, a statewide database called iMapInvasives is used to report new occurrences of invasive species, including aquatic invasive plants. Volunteers and professionals alike can report findings into this system. The database and reporting protocol are accessible using a mobile application or PC-based platform, and both are available at: <https://www.nyimapinvasives.org/>. While many local reports have been entered into iMapInvasives documenting the presence of various aquatic invasive plants in Chautauqua Lake, there remains a need for increased annual monitoring throughout the growing season to capture newly emerging species. As a result, the need for a local volunteer network has been identified to assist natural resource managers in this endeavor.

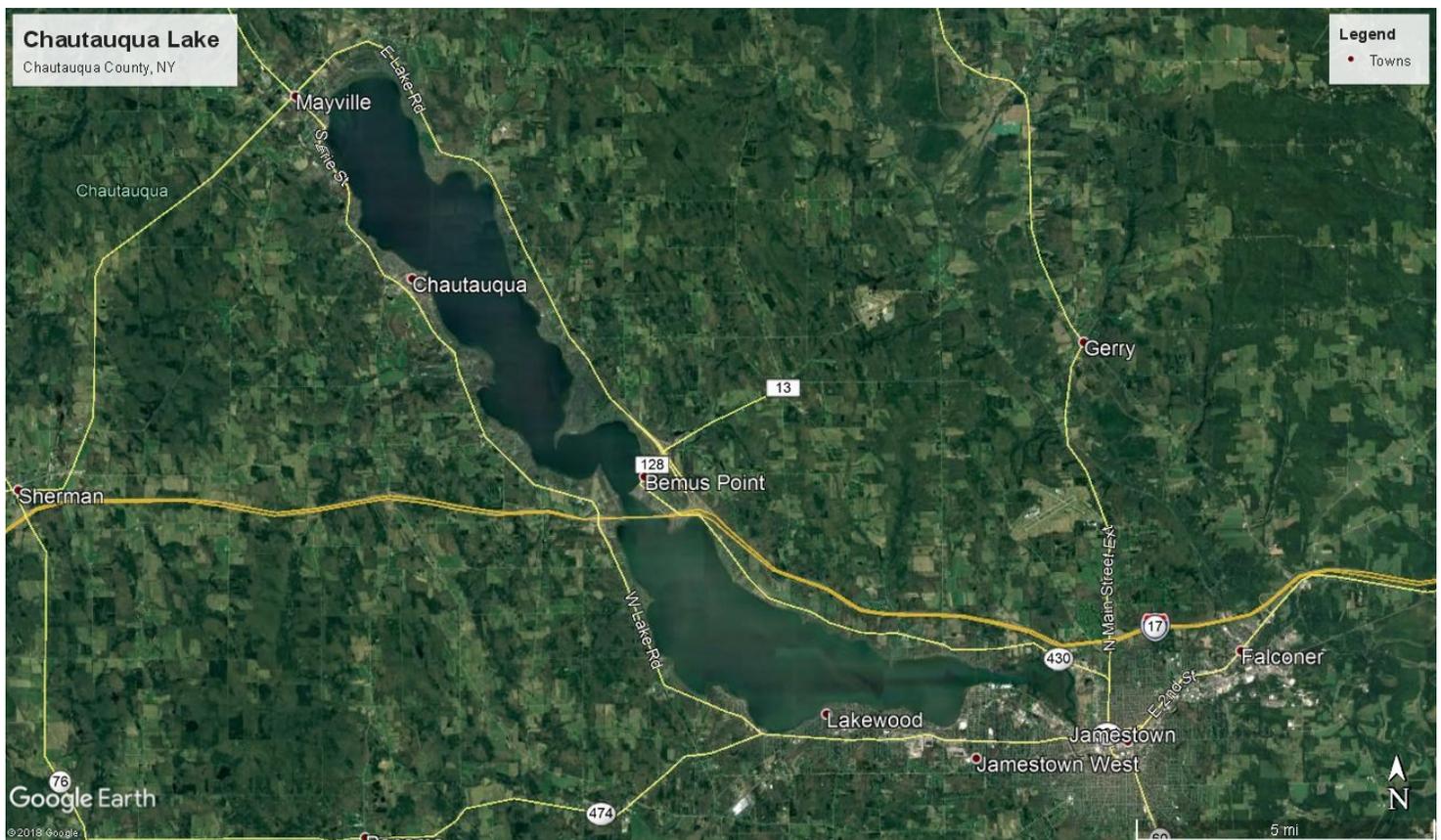
This SOP is meant to serve as a tool for outdoor recreationalists, citizen scientists, lakeshore landowners and professionals to report invasive plants that are new to the lake while standardizing the data collected for management use. It presents an initial framework for the formation and implementation of the Chautauqua Lake Aquatic Invasive Species Early Detection Volunteer Network. If you are interested in learning more or participating in the network, please contact the Roger Tory Peterson Institute at (716) 665-2473 or invasives@rtpi.org.

Furthermore, this SOP is not intended to be an exhaustive description of the lake, its macrophyte community, or its watershed. In addition, while this SOP has been prepared specifically for Chautauqua Lake, the principles are broadly applicable to other systems. Key reference documents that may also be of interest on these topics and other matters are listed below. Many of these documents are freely available online or can be accessed by contacting the Chautauqua Lake & Watershed Management Alliance (<http://www.chautauquaalliance.org/>).

- 2000 *Chautauqua Lake – Entering the 21st Century: State of the Lake Report*, County of Chautauqua, NY
- 2010 *Chautauqua Lake Watershed Management Plan*, County of Chautauqua, NY
- 2016 *Rapid Response for Invasive Species: Framework for Response*, NYSDEC Program Policy DLF-16-1
- 2017 *Chautauqua Lake Macrophyte Management Strategy*, County of Chautauqua, NY
- 2018 *Harmful Algal Bloom Action Plan for Chautauqua Lake*, New York State
- 2018, *Draft New York State Invasive Species Comprehensive Management Plan*, New York State

Study Area

The study area includes all of Chautauqua Lake and its outlet that extends to the Warner Dam in Jamestown, NY. Chautauqua Lake is situated entirely within Chautauqua County, NY and is unique in that it is a 13,422 acre glacier-formed lake that sits at an elevation of 1,308 feet above sea level, making it one of the highest navigable lakes in the country (Chautauqua Lake Association [CLA], 2018) and NYS DEC, 2018). Chautauqua Lake is ecologically rich, hosting a large variety of fish, including many species of sport fish, and diverse aquatic and semi-aquatic plant-life (Johnson, 2017; NYS DEC, 2018). It has 11 streams that input water, sediment and nutrients into the system and has two hydrologically different basins, North and South, partially separated by glacial deposits (CLA, 2018; NYS DEC, 2018). Chautauqua Lake's two basins are very productive and sensitive to changes in phosphorous and nitrogen levels. Due to the extensive development around Chautauqua Lake's shorelines and its water sources, excessive nutrients flow into the lake, creating ideal conditions for plant growth. Invasive species that have become established within Chautauqua Lake also benefit from the increased nutrient load and make the lake susceptible to increased colonization of current and future invasive aquatic plants (CLA, 2018; NYS DEC, 2018).



The map above depicts Chautauqua Lake, surrounding towns, roadways and terrain.

For the Novice Observer

Who Can Survey? This protocol is for new aquatic invasive plant observers. It is recommended that a novice observer attends an aquatic invasive plant training session prior to taking part in survey activities. Training opportunities are available at no cost through the Chautauqua Lake Volunteer Network, coordinated by the Chautauqua Lake & Watershed Management Alliance (Alliance) and the Roger Tory Peterson Institute of Natural History (RTPI).

When Can I Survey? While some invasive species begin growing early in the season and extend into late summer, the recommended survey period is from June 1st to September 1st. It is also recommended that surveys take place during the morning or evening when waters are calm and motorized boat traffic is low.

How Do I Survey? Aquatic invasive plant surveys are easy and can be done from the shoreline, a dock or from a non-motorized boat. Using the equipment listed below and protocol on the next page, a newly detected aquatic invasive plant can be reported.

What Do I Need to Survey?

The essentials:

- Detailed map of Chautauqua Lake
- A Guide to Chautauqua Lake's Aquatic Invasive Plants and Their Native Look-alikes
- Observation Form
- Pencil or marker
- Clipboard
- White Tray (for viewing and photographing)
- Hand Lens
- Camera (phone cameras are sufficient)
- A friend-surveys are best done with another person

The following items are not essential, but may be very helpful:

- Small, shallow-draft boat such as a canoe or kayak
- Personal Floatation Device
- Polarized sunglasses
- Underwater viewing scope-these can be easily and inexpensively constructed
- Aquatic rake-this can be easily and inexpensively constructed
- GPS Unit



Elyse Henshaw | rtpi.org

Novice Observer Reporting Protocol

Prior to Your Survey

- Be aware of potential safety concerns or other limitations such as docks, marinas, popular fishing areas, etc.
- If going out onto the water, familiarize yourself with the various buoys and their meanings as well as rules regarding encounters with power boats, fishing boats and fishermen, etc.
- Always respect private property. If you are entering or exiting the water through private property, acquire permission before your planned survey.

Choosing Your Survey Location

Your survey should take place in an area that is easily accessible via shoreline, dock or small watercraft and your observations should be focused in the littoral zone of the lake. This area includes where the sunlight can reach the lake bottom and provide light to submerged plants rooted below.

If an Aquatic Invasive Plant is Present:

- First determine the identification of the species. The Aquatic Plants Guide is in the Appendix of this standard operating procedure for reference.
- Document the infestation using the Observation Form found on the next page.
- Mark on your map the area(s) that you surveyed and where invasive plant species were present.
- Please submit all documentation to the Roger Tory Peterson Institute of Natural History for confirmation:
 - Send to: 311 Curtis Street, Jamestown NY 14701
 - OR email all documents, photos and maps to invasives@rtpi.org with the subject line "Early Detection Report."
- If you have an iMapInvasives account, we also encourage you to log the plant individual or infestation into iMapInvasives by going to www.nyimapinvasives.org.

Attach Photos
and Maps Here

Chautauqua Lake Aquatic Invasive Plant Observation Form-Novice

Date of Report::	Date of Observation:
Observer Name:	
Address:	Phone:
Email:	
Observer's Organization (if applicable):	
Species Observed:	Are you confident in your identification? Y/N
Town:	County:
Location Name/Local Name:	
Landmarks/description of location where species was observed:	
GPS Coordinates (if taken):	Source of Coordinates (circle one): Google Maps/ GPS/Map/Other:
Location Map Included with this form? Y/N	Photos taken? Y/N (if yes, please attach photo to top of this form)
Do you use iMapInvasives? Y/N	Have you submitted this data to iMapInvasives? Y/N

For the Expert Observer

Who Can Survey? This protocol is for seasoned aquatic invasive plant observers that have attended past training sessions and are conducting their own research or monitoring. It is recommended that an expert observer provides some oversight to novice observers to ensure that standard procedures are followed.

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- Hand Lens
- Camera (phone cameras are sufficient)
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- Personal Floatation Device
- Polarized sunglasses
- Underwater viewing scope-these can be easily and inexpensively constructed
- Aquatic rake-this can be easily and inexpensively constructed
- GPS Unit
- Thermometer
- Water sampling equipment (measuring pH, dissolved oxygen, turbidity, nutrients, water speed, etc.)
- Kestrel or similar equipment (measuring ambient air temperature, wind speed, humidity, dew point, etc.)
- Depth finder or weighted measuring tape
- Underwater video camera



Expert Observer Reporting Protocol

Prior to Your Survey

- Be aware of potential safety concerns or other limitations such as docks, marinas, popular fishing areas, etc.
- If going out onto the water, familiarize yourself with the various buoys and their meanings as well as rules regarding encounters with power boats, fishing boats and fishermen, etc.
- Always respect private property. If you are entering or exiting the water through private property, acquire permission before your planned survey.

Choosing Your Survey Location

Your survey should take place in an area that is easily accessible via shoreline, dock or small watercraft and your observations should be focused in the littoral zone of the lake. This area includes where the sunlight can reach the lake bottom and provide light to submerged plants rooted below.

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Attach Photos
and Maps Here

Chautauqua Lake Aquatic Invasive Plant Observation Form-Expert

Date of Report::	Date of Observation:
Observer Name:	
Address:	Phone:
Email:	
Observer's Organization (if applicable):	
Species Observed:	Area Occupied:
Town:	County:
Location Name/Local Name:	
Landmarks/description of location where species was observed:	
GPS Coordinates (if taken):	Source of Coordinates (circle one): Google Maps/ GPS/Map/Other:
Location Map Included with this form? Y/N	Photos taken? Y/N if yes, please attach photo to top of this form)
Do you use iMapInvasives? Y/N	Have you submitted this data to iMapInvasives? Y/N

Chautauqua Lake Aquatic Invasive Plant Observation Form-Expert

Additional Information

Air Temperature:	Air Temperature Units? °F/°C
Wind Speed:	Wind Speed Units? mph/kmph
Wind Direction: N/S/E/W	Cloud % Cover: 0-20/21-40/41-60/61-80/81-100
Water Temperature:	Water Temperature Units? F°/°C
Water Depth:	Water Depth Units? m/ft/yds
Dissolved Oxygen:	Dissolved Oxygen Units? mg/L/ppm
Turbidity:	Turbidity Units? NTU/FNU
pH:	Other water tests?

Notes:

References

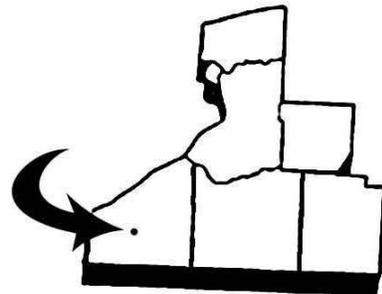
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- Chautauqua Lake Macrophyte Management Strategy. (2017). Retrieved from: http://www.planningchautauqua.com/_pdfs/Watershed/170308%20MMS%20Reduced.pdf
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- New York State Department of Environmental Conservation & New York State Department of Agriculture and Markets. (2018). New York State Invasive Species Comprehensive Management Plan [Draft]. Retrieved from: https://www.dec.ny.gov/docs/lands_forests_pdf/iscmpdraft.pdf
- Western New York PRISM. (2018). Aquatic Invasive Species. Retrieved from: <http://www.wnyprism.org/get-involved/early-detection/>

Appendix A: DEC Depth Map-North Basin

New York State Department of Environmental Conservation
Division of Fish, Wildlife and Marine Resources
Lake Map Series



Region 9 Chautauqua Lake (North)



Not For Use in Navigation

Chautauqua Lake

County: Chautauqua

Town: North Harmony,
Chautauqua, Ellery

Surface Area: 13,156 Acres

Fish Species Present: Muskellunge, Walleye, Smallmouth Bass,
Largemouth Bass, Black Crappie, Yellow Perch, White Perch, Bluegill,
Pumpkinseed, Brown Bullhead

Scale: 0 4,450 ft



Appendix B: Photography Protocol

Taking a Photograph of an Aquatic Invasive Plant

- Gently Clean off any debris from your plant specimen.
- Float the plant in a tray of clean water, stretching the plant specimen out as much as possible. A white bottomed tray or clear bottomed tray with a white piece of paper underneath it can be used.
- Place something to use as scale into the tray with the plant specimen, i.e. ruler or coin to show scale.
- Using a point-and-shoot camera, cell phone camera or DSLR camera, photograph the plant specimen as best as possible.
- Be sure that your photos are in focus, show detail of the plant and there is minimal glare on the water's surface.
- If possible, take a series of photos showcasing the entire plant specimen as well as close-ups depicting distinguishing details such as flowers, fruiting bodies, leaf edges or other identifying structures.



Submitting Your Photographs

- Print and attach images to your observation form and send to the Roger Tory Peterson Institute of Natural History: 311 Curtis Street, Jamestown, NY 14701.
- OR send a digital copy with your observation form to invasives@rtpi.org with the subject line "Early Detection Report."



Photo © Maine Volunteer Lake Monitoring Program

Appendix C: Garmin Montana 680t User Guide

Using this step-by-step guide you will be able to mark a waypoint, navigate to a stored waypoint, record tracks, take georeferenced photographs and download your data.

Getting Familiar with the Device



Turning On the Device

Hold 

Charging the Device

1. Pull up weather cap covering the USB connector
2. Plug the small end of the USB cable into the USB
3. Plug the USB end of the cable into the AC adapter (comes with device) or a computer USB port
4. Plug AC adapter into a standard wall outlet. Device will turn on once connected to the power source
5. Charge the batteries completely

Marking a Waypoint

Waypoints are locations you record and store in the device

1. Select **Mark Waypoint** on **Main Menu** screen
2. Select Edit to change the name or other waypoint data, if desired
3. Select **Save**

Recording Tracks

Tracks are a recording of your path and points along the path include data such as time, location and elevation

1. Select the > on the **Main Menu** and select **Current Track**
2. Choose to start or pause the track (device automatically will log tracks when turned on and receiving GPS signal)
3. Choose to save the current track by selecting the  button
4. Choose to delete the current track by selecting the  button

Navigating to a Point

1. Select **Where To?** on **Main Menu**
2. Select Category (in this case Waypoint)
3. Select a destination, such as a specific point you previously marked
4. Select Go (the map opens with your route marked with a magenta line)
5. Navigate using the map

Taking a Photo

1. Select > on the **Main Menu** and select **Camera**
2. Turn the device horizontally or vertically to change the photo's orientation
3. Zoom in or out using the – or +
4. Hold and release the  button to capture a photo
5. Select the **x** to exit the camera

Downloading Data

1. Connect the device to your computer using the USB cable provided with the unit
2. Once connected the GPS will appear as a removable device on Windows computers and a mounted volume on Mac computers
3. Open file browser and select the drive or volume, then select **Edit > Copy**
4. Within the file browser, select a new folder to paste the files to
5. Once the file is selected, select **Edit > Paste**
6. The file(s) will appear within the folder

Appendix D

A Guide to Chautauqua Lake's Aquatic Invasive Plants and Their Native Look-alikes



ROGER TORY PETERSON INSTITUTE
OF NATURAL HISTORY



Eurasian Water Milfoil-*Myriophyllum spicatum*

Origin: Europe and Asia

Habitat: Capable of growing in a wide range of habitats of varying depths, sediment types and flow conditions.

Threat: This plant fragments easily and can be transported from water-body to water-body-**an introduced fragment can begin a new population.**

Ecological Significance: Waterfowl graze on the fruit and foliage to a limited extent. Beds provide invertebrate habitat but studies have shown mixed stands of pondweeds and other aquatic native plants have higher diversity and numbers of invertebrates. Thick canopies of water milfoil chokes light and dissolved oxygen as it dies back at the end of the season, impacting water quality, navigability for fish and other wildlife, boats and so forth.

Management: Once established, this plant is difficult to remove

- A combination of physical, mechanical, biological and chemical techniques are recommended.
- Prevention is most effective control

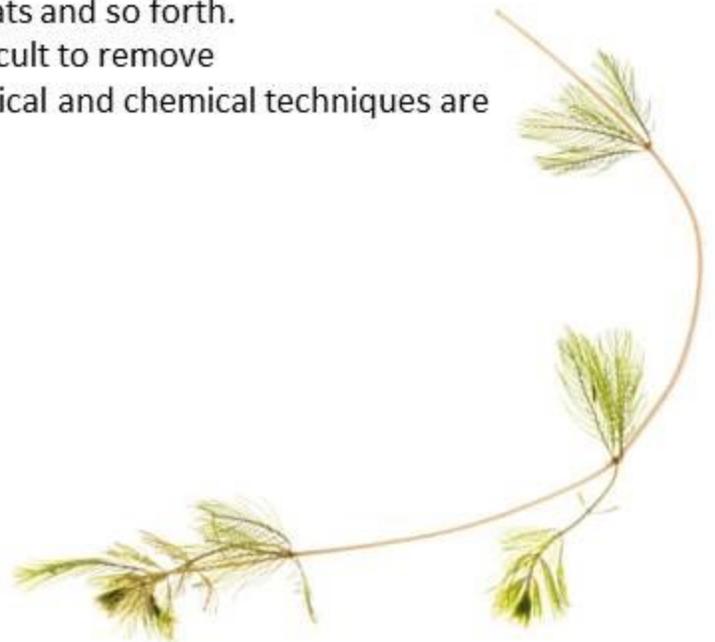
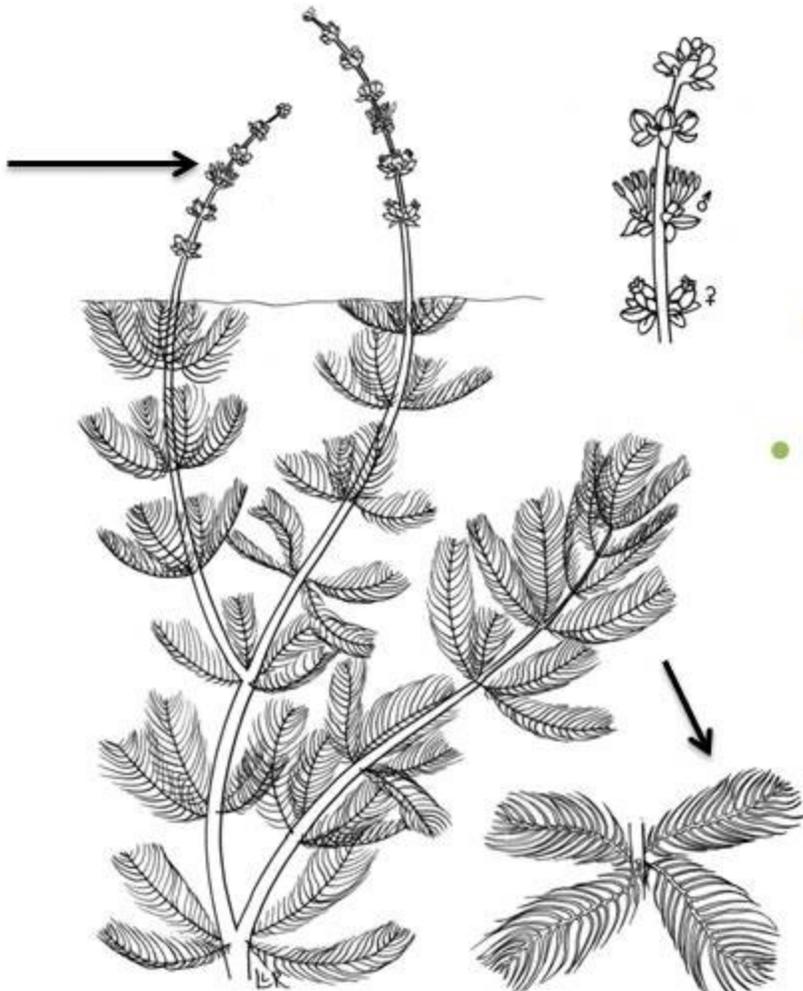
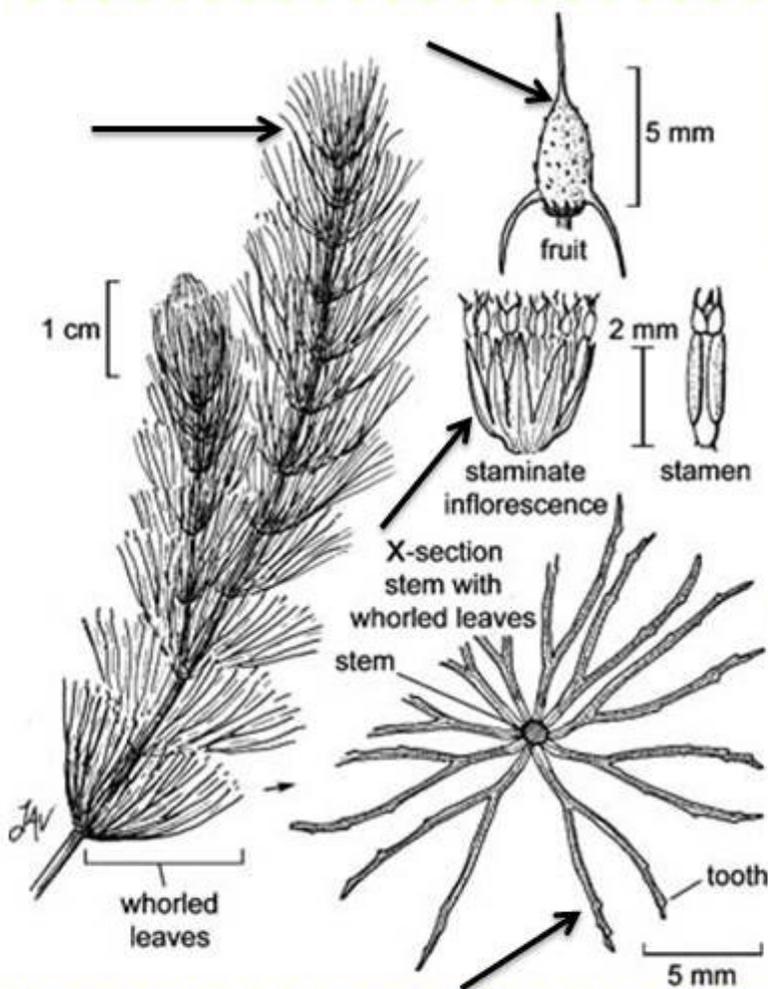


Photo © Twan Leenders RTPI

Quick ID:

- **Flowers:** tiny, pink and whorled in axils of short bracts, occur in late summer
- **Fruit:** 2-3mm long, four parted w/smooth-slightly rough surface
- **Leaves:** 14-20 pairs of leaflets per leaf, flat tipped
- **Winter Buds:** None
- **Entire Plant Length:** 20 feet

Coontail-*Ceratophyllum demersum*



Ecological Significance: The stiff whorls of the leaves support a number of invertebrate species and provide feeding opportunities for fish. The foliage and fruit serve as a food source for waterfowl.

Quick ID:

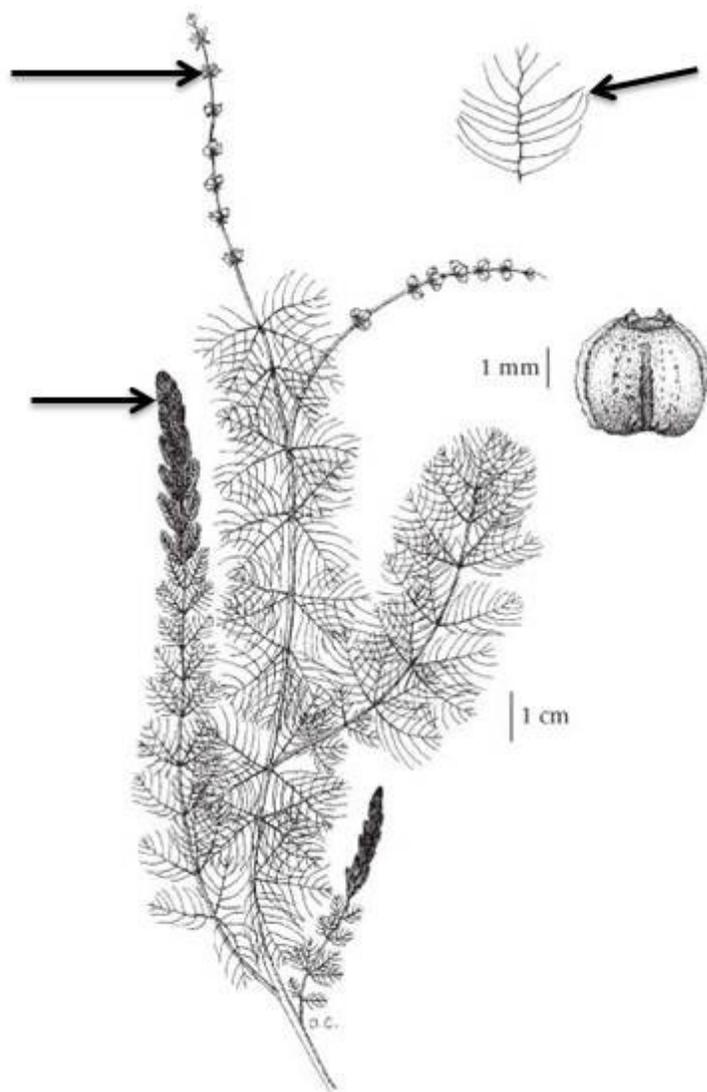
- **Flowers:** tiny, hidden in leaf axils
- **Fruit:** 5mm long, nut-like achene with two spines
- **Leaves:** 5-12 stiff leaves are arranged in whorls, leaves are once or twice forked and toothed

Northern Water Milfoil-*Myriophyllum sibiricum*

Ecological Significance: Beds offer shade, shelter and foraging for fish. The foliage and fruit serve as a food source for waterfowl.

Quick ID:

- **Flowers:** tiny, red and whorled in axils of short bracts, occur in late summer
- **Fruit:** ~2mm long, four parted w/smooth-slightly rough surface
- **Leaves:** 5-12 pairs of leaflets per leaf
- **Winter Buds:** Yes



Curly Leaf Pondweed-*Potamogeton crispus*

Origin: Europe, Africa and Australia

Habitat: Capable of growing in low light conditions, varying water temperatures and water depths.

Threat: Curly-leaf pondweed is one of the first emerging plants in early summer and will begin growing under the ice during late winter. By mid-summer dieback of the plant can cause a critical loss of oxygen.

Ecological Significance: Provides habitat for fish and invertebrates in winter and spring. However, mid-summer die-back results in loss of habitat and subsequent release of nutrients that can trigger algal blooms and turbid waters.

Management: This plant is sometimes difficult to identify. Once the ID is confirmed, physical, mechanical or chemical techniques can be used to manage this plant.

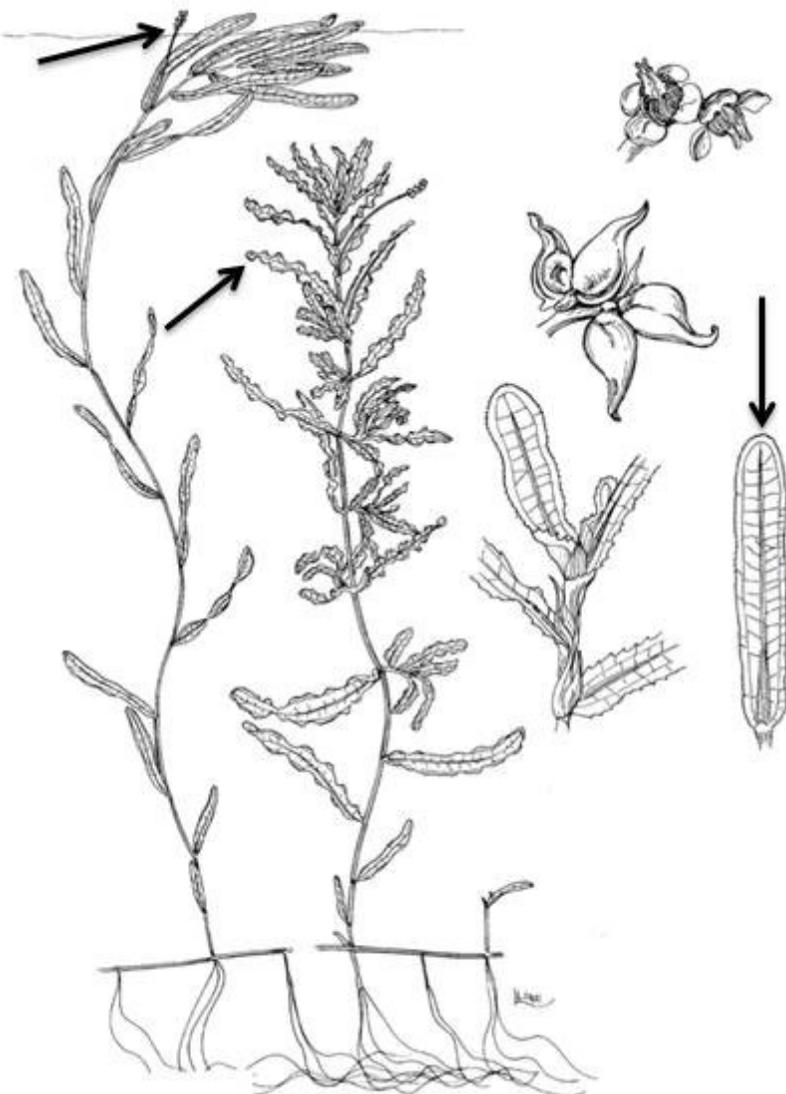


Photo © Twan Leenders RTPi

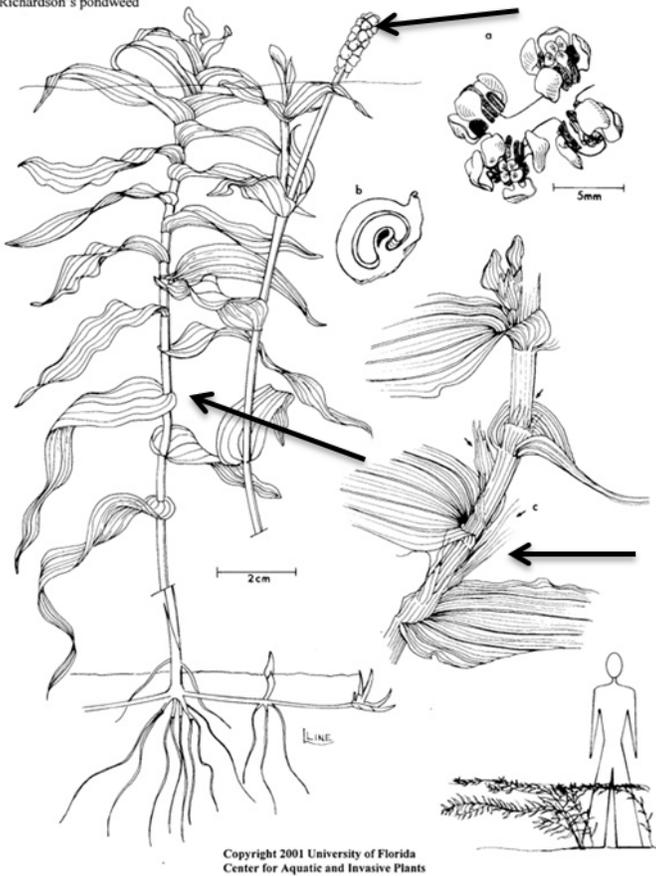
Quick ID:

- **Flowers:** Small, form tight clusters
- **Fruit:** 2-3mm long, four parted w/smooth-slightly rough surface
- **Leaves:** Rigid, reddish-green, oblong, finely-toothed and wavy edged
- **Winter Buds:** Yes (turions)
- **Entire Plant Length:** 1-16 feet

Source: UFL/Center for Aquatic and Invasive Plants, Gainesville, Flo

Clasping-Leaf Pondweed-*Potamogeton perfoliatus*

Potamogeton richardsonii
Richardson's pondweed



Copyright 2001 University of Florida
Center for Aquatic and Invasive Plants

Ecological Significance: Fruits are grazed by ducks and geese as well as muskrat, deer, beaver and moose. The leaves and stems support invertebrates and offer cover for fish.

Quick ID:

- **Flowers:** Greenish-brown and arranged in whorls around the spike.
- **Fruit:** 2-4mm olive-green fruits with a prominent beak
- **Leaves:** Wavy leaves lack finely toothed margins and are heart shaped where they clasp the stem. White fibers exist at the leaf node.



Photo © Twan Leenders RTPi

White-stem Pondweed-*Potamogeton praelongus*

Ecological Significance: Fruits are grazed by ducks and geese as well as muskrat, deer, beaver and moose. The leaves and stems support invertebrates and offer cover for fish.

Quick ID:

- **Flowers:** Four pedaled, occurring at the end of the spike.
- **Fruit:** Fruit exists on either continuous or interrupted spike. Fruits are egg shaped with plump, short beak and sharp dorsal ridge.
- **Leaves:** Wavy leaves exist on zig-zag stem. White, fibrous stipules exist at the leaf axils.

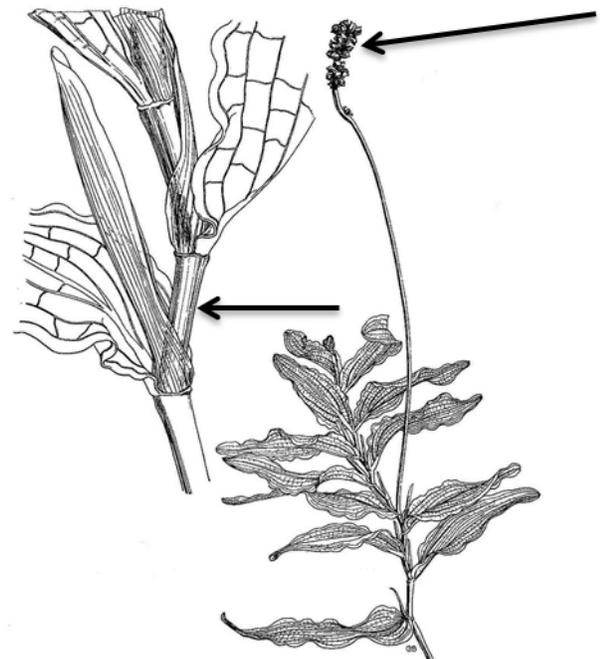


Photo © University of Florida Center for Aquatic and Invasive Plants

Brittle Naiad-*Najas minor*

Origin: Europe, Africa and Asia

Habitat: Found in ponds, lakes, reservoirs and slow moving streams in waters between 2-15ft deep.

Threat: This plant will grow into thick mats, inhibiting the growth of native plants as well as fishing and boating. Similar to Eurasian water milfoil, **this plant fragments readily and can be easily spread by boats, water currents or waterfowl.** Waterfowl eat this plant and move it from water-body to water-body.

Ecological Significance: Provides habitat for fish and invertebrates until it reaches large densities and impedes wildlife movement.

Management: Prevention is the most effective control as little information on successful treatment regimes exist.



Quick ID:

- **Flowers:** Tiny, form in leaf axils
- **Fruit:** Recurved seeds with pits that are wider than they are long.
- **Leaves:** are long, serrated and oppositely arranged on highly branched stems
- **Winter Buds:** None
- **Entire Plant Length:** 4 feet

Photo © 2018 Hippolyte Coste

Slender Naiad-*Najas flexilis*

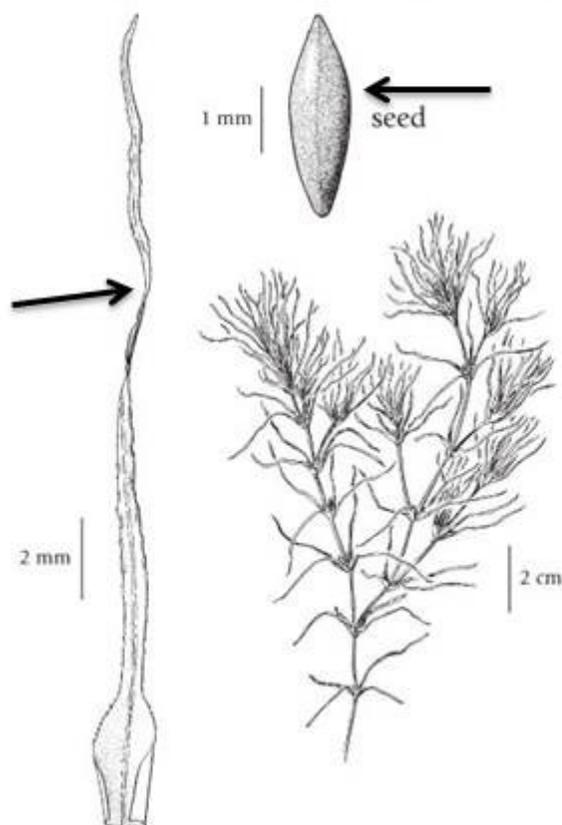


Photo © Electronic Atlas of the Flora of British Columbia

Southern Naiad-*Najas guadalupensis*

Ecological Significance: The leaves and fruit provide an important food resource for waterfowl, marsh birds, turtles and muskrats. Also provide shelter for fish.

Quick ID:

- **Flowers:** Tiny flowers develop in leaf axils.
- **Fruit:** Seed is dull and deeply engraved with 20-40 rows of angled pits.
- **Leaves:** Leaves are wider and less pointed when compared to *Najas flexilis*. Oppositely arranged but whorls of three occur throughout the plant.

Ecological Significance: The leaves and fruit provide an important food resource for waterfowl, marsh birds, turtles and muskrats. Also provide shelter for fish.

Quick ID:

- **Flowers:** Tiny flowers develop in leaf axils.
- **Fruit:** 2-4mm fruit with paper-thin walls. The seed is glossy with 30-50 rows of faint pits.
- **Leaves:** Long, narrow and finely toothed along leaf margins. Oppositely arranged except near the tip where it occurs in whorls.



Illustration provided by:
IFAS, Center for Aquatic Plants
University of Florida, Gainesville, 1990

Starry Stonewort-*Nitellopsis obtusa*

Origin: Eurasia

Habitat: Can sometimes found in deep, slow moving waters near docks or marinas for example. It can also maintain populations brackish waters with a salinity of up to 5%.

Threat: This algae can form dense mats along the lake bottom as well as near the water's surface, impeding movement of fish, other animals, boats and overall water flow. This species will also reduce diversity of other aquatic plants and may impact spawning of fish.

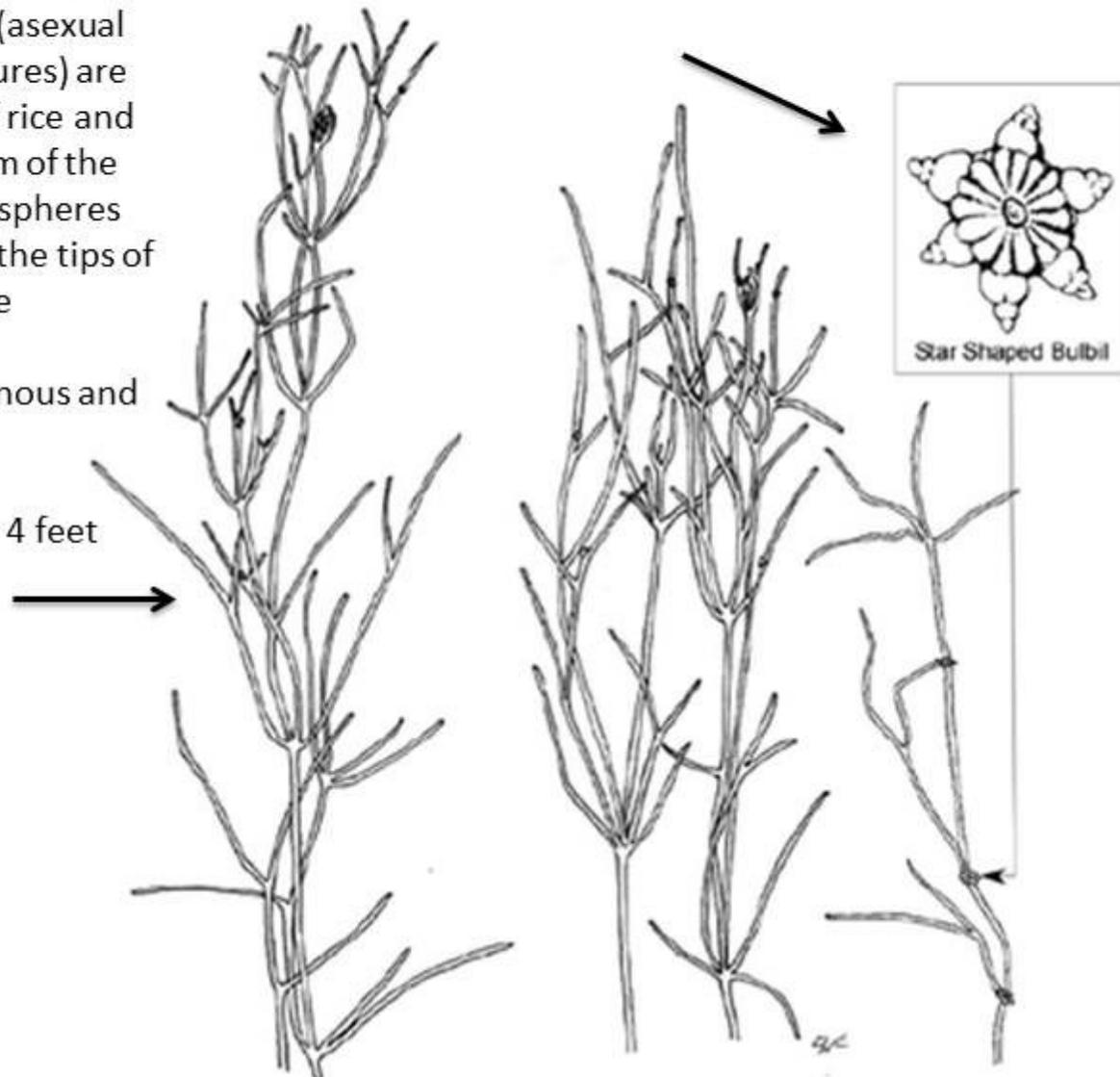
Ecological Significance: Provides some habitat for fish and invertebrates.

Management: Manual removal is possible with small populations, but must be sure to remove bulbils as well as they can sprout new individuals. Herbicides or algaecides have been effective.

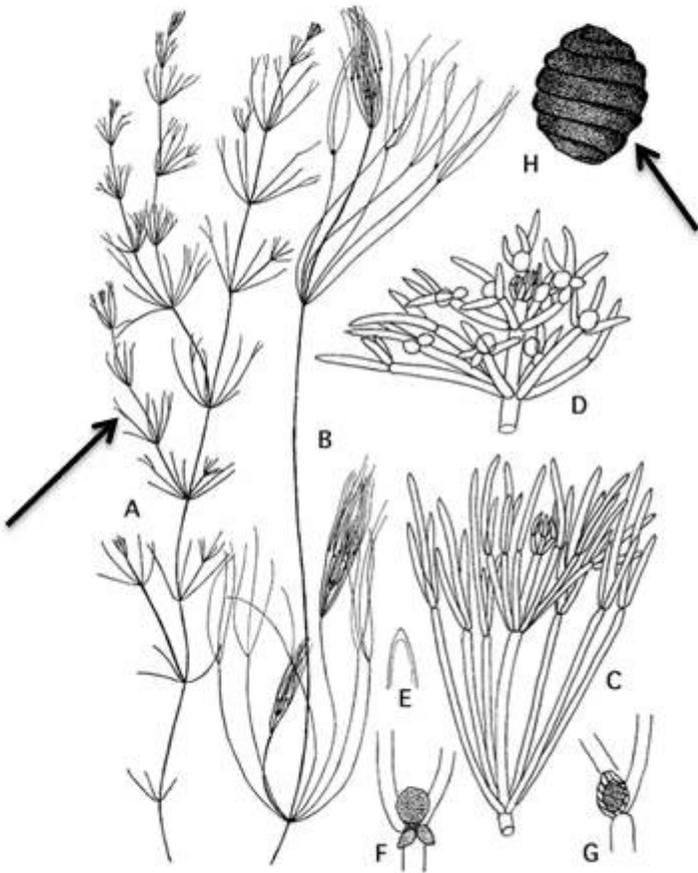
Other: Technically an algae, looks like a rooted plant

Quick ID:

- **Reproductive Structures:** Star-shaped bulbils (asexual reproductive structures) are the size of a grain of rice and develop near bottom of the algae. Small orange spheres may be visible near the tips of the branchlets (male structures)
- **Leaves:** Long, gelatinous and branched
- **Winter Buds:** None
- **Entire Plant Length:** 4 feet



Nitella-Nitella flexilis



Ecological Significance: Provides habitat to many invertebrate species and are sometimes grazed by waterfowl. Invertebrates provide food resources for fish.

Quick ID:

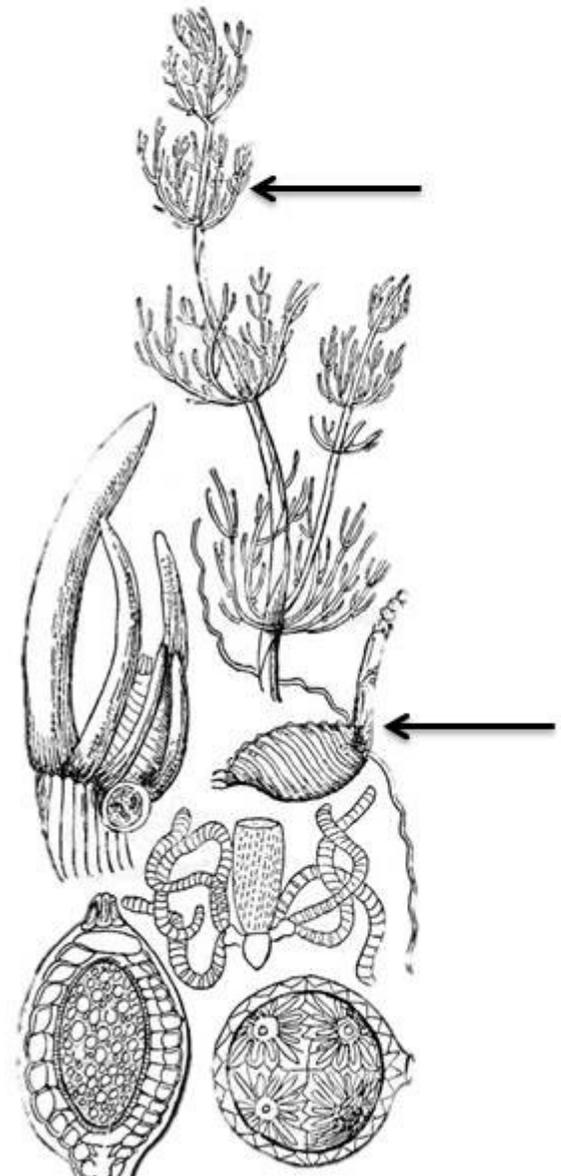
- **Reproductive Structures:** Oogonia (bulb) have a cap with 10 cells.
- **Leaves:** Branches are smooth and gelatinous. Side branches are arranged in whorls.

Muskgrass-Chara vulgaris

Ecological Significance: Provides ample food resources to waterfowl. One study found more than 300,000 oogonia in the stomach of a single duck! Also provides valuable fish habitat for young trout and bass. Due to its rigidity, this species is a good lake bottom stabilizer and slows the movement and suspension of sediments, improving water quality.

Quick ID:

- **Reproductive Structures:** Oogonia (bulb) has a cap of 5 cells.
- **Leaves:** Branches are harsh and rigid, encrusted in calcium carbonate. Side branches are arranged in whorls.
- **Other:** Has a skunky odor.



Water Chestnut-*Trapa natans*

Origin: Eurasia

Habitat: Typical in slow-moving or still waters and grow well in high nutrient waters with soft substrate.

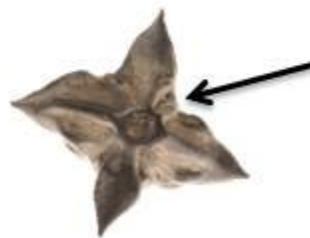
Threat: Forms thick mats that can cover large areas, altering water quality and clarity, deterring native plant growth and making fishing, boating and swimming hazardous.

Ecological Significance: Has little nutritional or habitat value to fish or waterfowl.

Management: Small populations can be pulled whereas larger infestations can be controlled by mechanical harvesters and the application of aquatic herbicides.

Quick ID:

- **Flowers:** Four pedaled white flowers.
- **Fruit:** Develop thorny nutlets that remain viable for up to 12 years.
- **Leaves:** Glossy, triangular, toothed floating leaves form rosettes at the water's surface. Also form feathery leaves that are submersed.
- **Winter Buds:** None
- **Entire Plant Length:** 16 feet



European Frog-bit-*Hydrocharis morsus-ranae*

Origin: Europe

Habitat: This plant grows well in slow moving or still open water, including marshes, ditches, swamps or coves.

Threat: Quickly forms dense mats, crowding out native plants and limiting light penetration. Thick mats may impede recreational activities.

Ecological Significance: Has little nutritional or habitat value to fish or waterfowl.

Management: Hand pulling may be suitable for small infestations but little information exists on how to best manage larger infestations.

Quick ID:

- **Flowers:** Three pedaled white flowers with yellow centers.
- **Fruit:** Berry with 1-1.3mm length seeds
- **Leaves:** Leathery and round with purplish undersides.
- **Winter Buds:** None
- **Entire Plant Length:** Interlocking plants can form lengthy mats.



American Frog bit- *Limnobium spongia*

Ecological Significance: Provides cover for fish and invertebrates as well as food resources for turtles.

Quick ID:

- **Flowers:** Several long, thin petals make up the flower.
- **Fruit:** Sphere shaped with spiny seeds that are released in a gelatinous mass.
- **Leaves:** Midline grooves exist on the leaf stem, this characteristic is lacking in European Frog-bit.

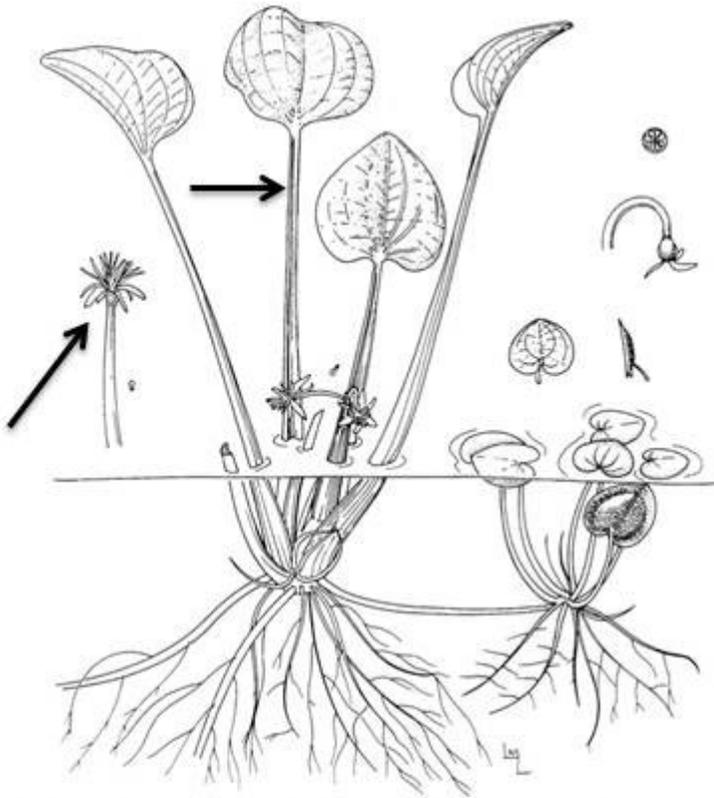


Photo © Center for Aquatic Plants, University of Florida

Duckweed-*Lemna* sp.

Ecological Significance: Dense populations of duckweed provide important food resources for waterfowl and fish. Duckweed grows quickly, providing ample resources.

Quick ID:

- **Flowers:** The flowers of duckweed is microscopic and form an inflorescence in a pouch-like sac.
- **Fruit:** Microscopic, oval-shaped seeds.
- **Leaves:** Individual plants consist of a single, flat oval-shaped leaf no larger than ¼ inch.



Photo © Twan Leenders RTPi

Watercress-*Nasturtium officinale*

Origin: Eurasia

Habitat: Tends to grow in shallow sections of lakes and reservoirs or slow-moving streams and rivers. Intolerant of low light.

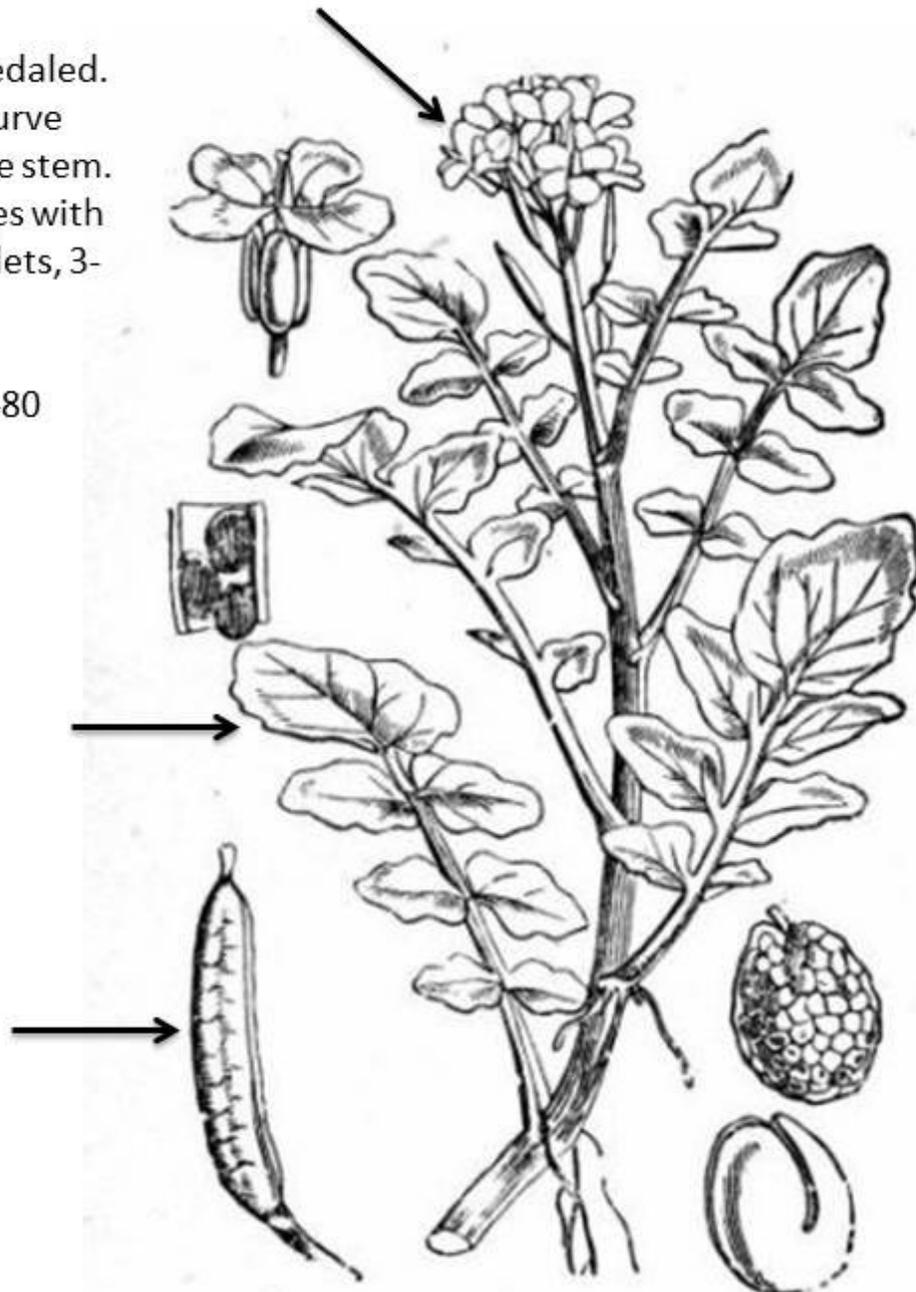
Threat: Fast growing, fragments easily transported by wind, water and animals

Ecological Significance: Provides food resource to waterfowl, muskrat and deer. Humans can also consume watercress (once cleaned).

Management: Small infestations can be pulled by hand. Larger infestations are harder to control. Some success has been seen with herbicide treatments.

Quick ID:

- **Flowers:** White, four-petaled.
- **Fruit:** Long seed pods curve slightly upward from the stem.
- **Leaves:** Pinnately divides with oval to egg-shaped leaflets, 3-7 occurring.
- **Winter Buds:** None
- **Entire Plant Length:** 20-80 inches in height.



Hydrilla-Hydrilla verticillata

Origin: Asia

Habitat: Can tolerate a variety of water conditions and grows in lakes, ponds, reservoirs, rivers, canals and ditches.

Threat: Spreads rapidly and clogs waterways, restricting water flow, recreational activities and movement of wildlife.

Ecological Significance: Provides some food resources for waterfowl.

Management: Mechanical removal, herbicide and biological control treatments have been seen effective as well as physical habitat manipulation. Prevention and early detection is the best control method for this particular plant

Quick ID:

- **Flowers:** Produces tiny white flowers on long stalks.
- **Fruit:** Berry with 1-1.3mm length seeds
- **Leaves:** Are visibly toothed and grow in whorls of 3-8. The undersides have one or more spines and the mid-rib of each leaf is reddish in color.
- **Winter Buds:** Yes (turions)
- **Entire Plant Length:** Up to 25 feet

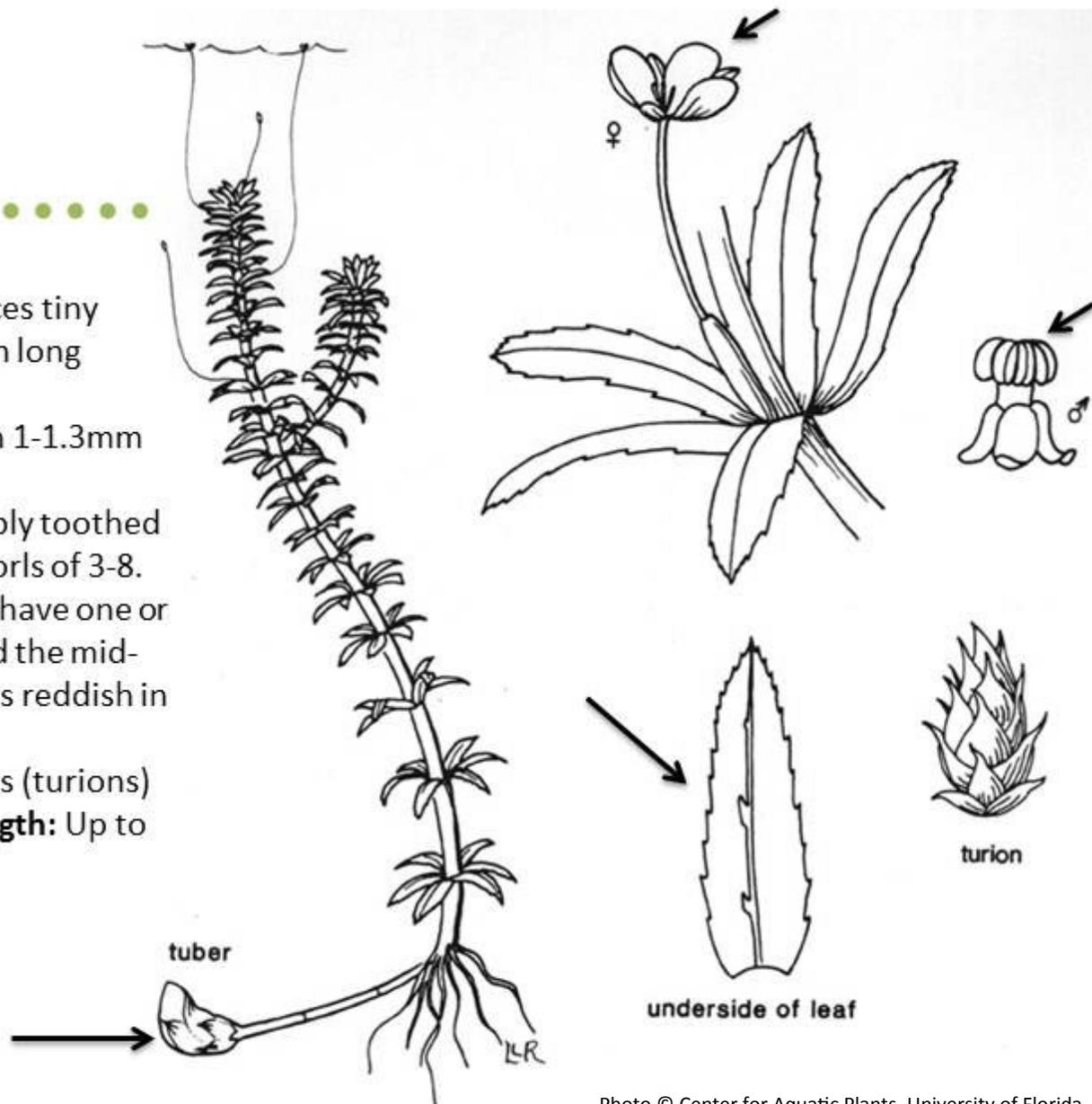


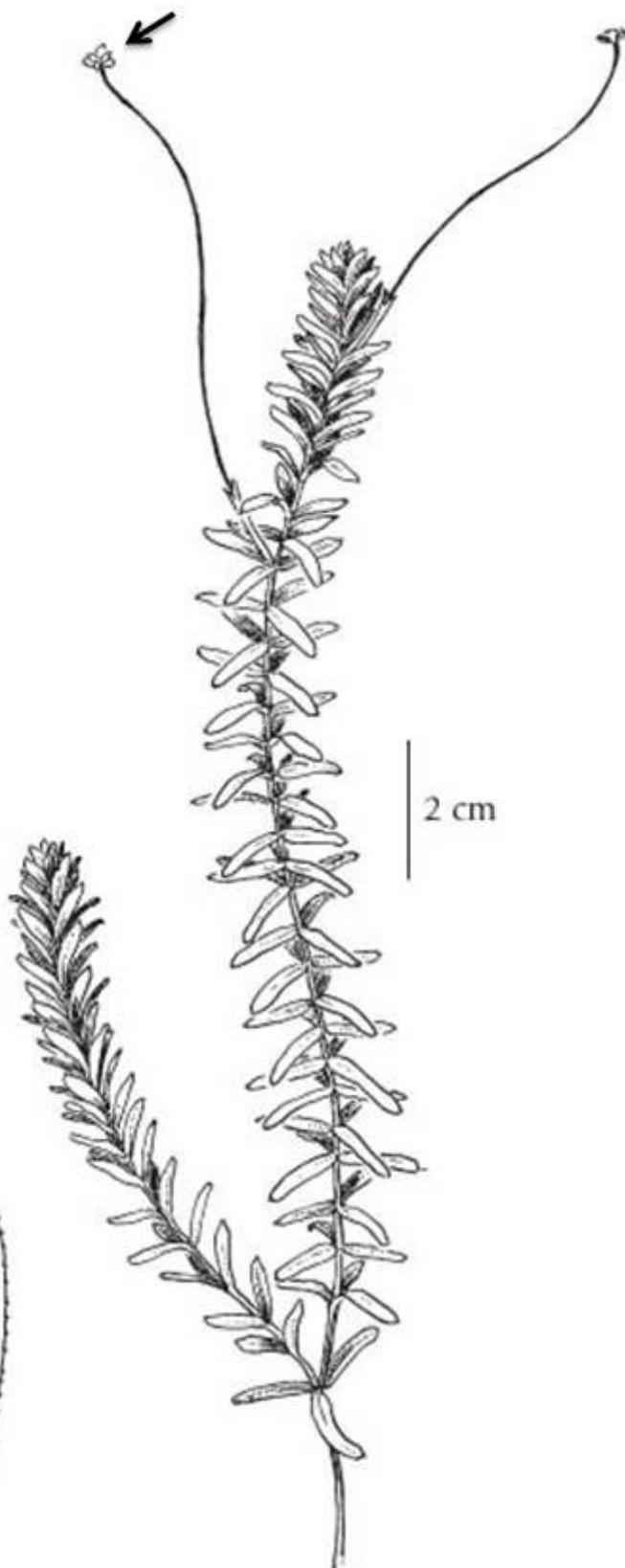
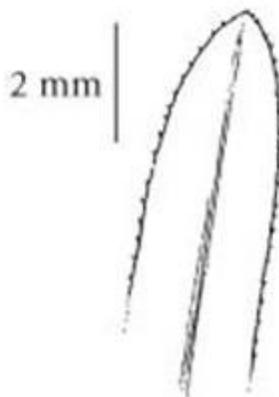
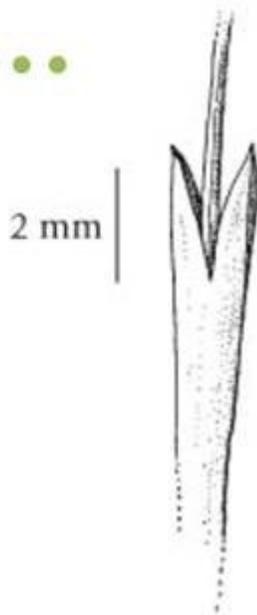
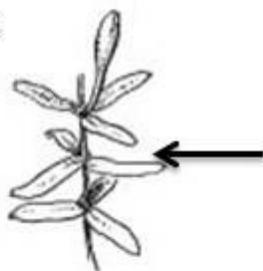
Photo © Center for Aquatic Plants, University of Florida

Common Waterweed-*Elodea canadensis*

Ecological Significance: Provides cover for fish, invertebrates and amphibians as well as food resources for waterfowl, beaver and muskrat.

Quick ID:

- **Flowers:** Produces tiny white to pale purple flowers on long stalks.
- **Fruit:** Tiny capsule
- **Leaves:** Finely toothed, oblong and linear and are arranged in whorls of three around the main stem.



Water Lettuce-*Pistia stratiotes*

Origin: Africa and South America

Habitat: Tolerates slow moving or still waters within lakes, ponds, rivers or streams. Somewhat limited by colder winter temperatures.

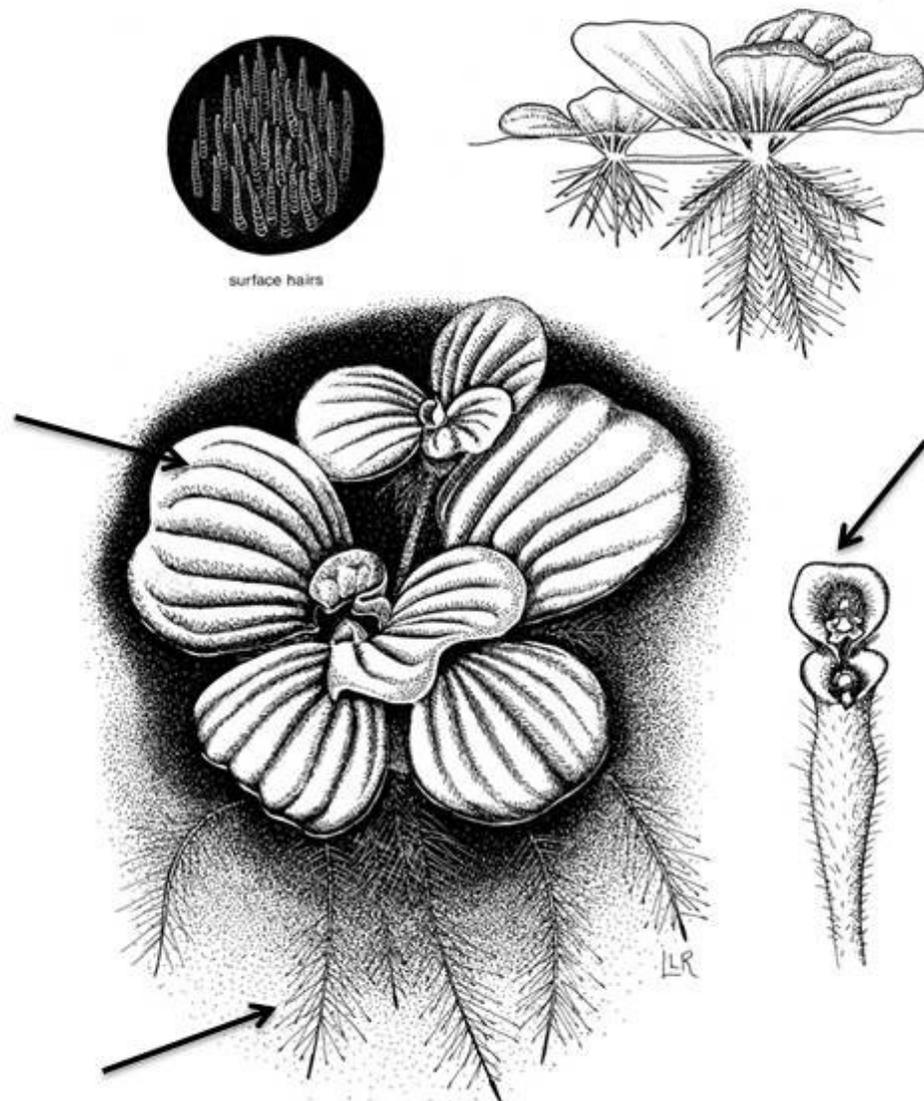
Threat: Water lettuce forms thick mats that block sunlight and prevents recreational use. As the plant dies back, it lowers oxygen in the water impacting fish and other aquatic species.

Ecological Significance: Has little nutritional or habitat value to fish or waterfowl.

Management: Small infestations can be controlled by hand pulling whereas larger infestations can be mechanically harvested or treated with herbicide to reduce the population and finish it off by hand pulling.

Quick ID:

- **Flowers:** Inconspicuous green flower
- **Fruit:** Produces a small green berry that turns brown as it matures.
- **Leaves:** Looks like a floating head of lettuce. Leaves are thick, hairy, scallop edged and parallel veined.
- **Winter Buds:** None
- **Entire Plant Length:** 5-6 inches



Water Hyacinth-*Eichhornia crassipes*

Origin: South America

Habitat: This plant is capable of invading any freshwater system

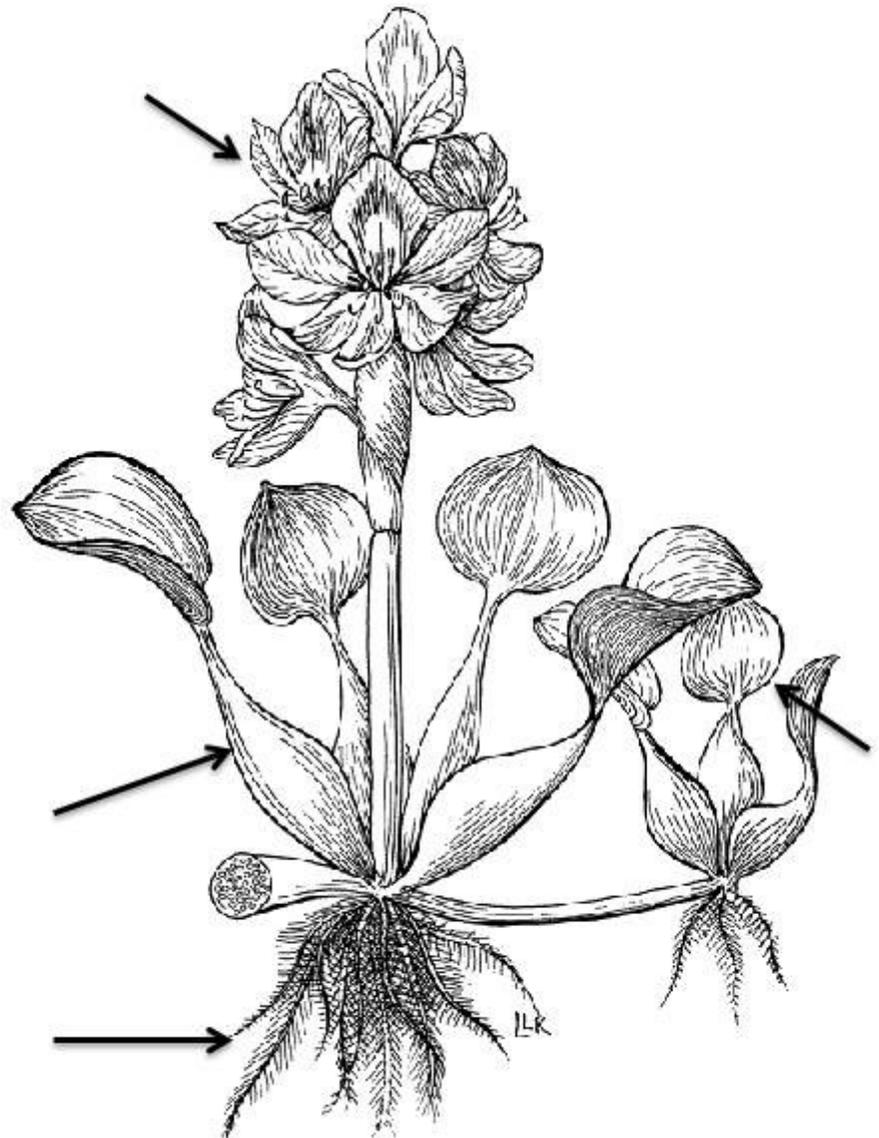
Threat: Water hyacinth reproduces rapidly and can double its population within a week's time. It forms dense mats so thick that boating, fishing and swimming are impossible. These mats will block light, lower oxygen levels, and reduce open water impacting aquatic life and waterfowl.

Ecological Significance: These mats also provides prime habitat for mosquitoes to reproduce.

Management: Plants can be hand pulled while larger infestations can be mechanically harvested, treated with herbicides or treated with biocontrols.

Quick ID:

- **Flowers:** Showy purple flowers arranged in a group at the tip of a long stalk
- **Fruit:** 3 celled capsule with many ribbed seeds.
- **Leaves:** Glossy, bright green leaves float above the water's surface. Additionally, leaves are round, curved, and are attached to bulbous stalks.
- **Winter Buds:** None
- **Entire Plant Length:** 3 feet



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Appendix E: How to Guide: Constructing an Aquatic Rake

An aquatic rake can be purchased or inexpensively built using the following items:

- 1 roll of Paracord or other sturdy rope (100ft)
- 1 roll of Duct Tape
- 1 small box of wood screws
- 2 metal rakes with wooden handles
- 2 zip ties



To assemble a double-sided aquatic rake, use the following steps:

1. Cut the wooden handle 2 inches above the metal rake attachment point of both rakes.
2. Placing the rakes back to back, drive a screw into the wood to screw the two rakes together.
3. Take one end of the rope and make a loop around the handle of the rake.
4. Next, wrap duct tape around the handles of the two rakes, covering the rope and screw(s).
5. Add zip ties to the metal rakes for added security
6. Your rake is now ready to be tested!
7. Before taking your rake into deep waters, test it in shallow waters to ensure the rope is secured to the rake.

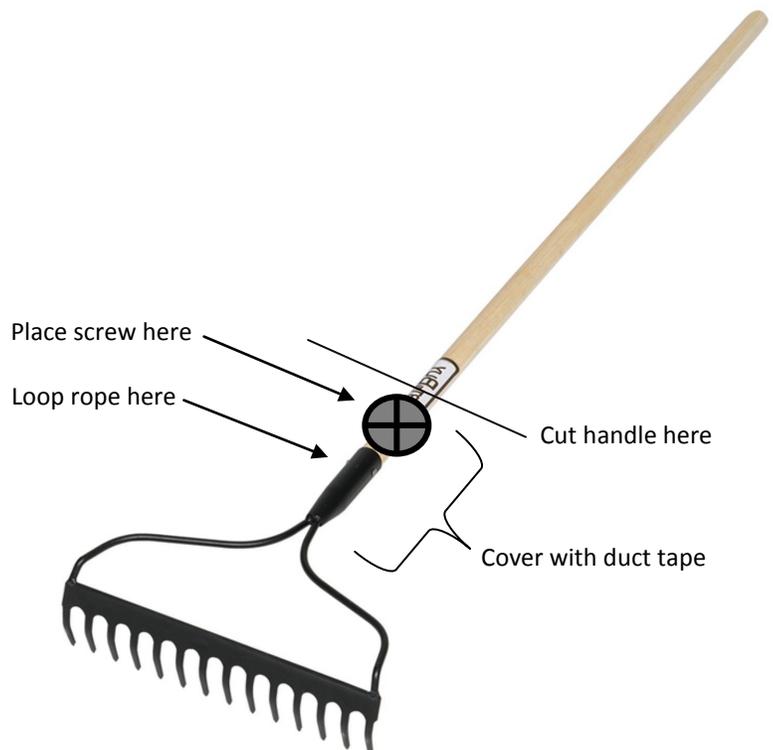


Photo © Elyse Henshaw

Appendix F: How to Guide: Constructing an Aquatic Viewing Scope

An aquatic viewing scope can be purchased online or inexpensively built. Depending on tools available to you, the scope can be built very simply or more complex. Below is a list of items that can be used to make an aquatic viewing scope.

- 1 plastic container with a lid
- 1 role of clear plastic wrap

OR

- 1 PVC pipe, 3" or 6" diameter
- 1 piece of Plexi-glass
- 1 tube of clear silicone sealant

OR

- 1 opaque plastic storage tote or bucket
- 1 piece of Plexi-glass
- 1 tube of clear silicone sealant



If using a plastic container with lid and plastic wrap, use the following steps:

1. Cut out the bottom of your container
2. Remove the lid and cut a circle or square out of the lid (depending on the shape of the container)
3. Place plastic wrap over top of container and place lid overtop to keep the wrap in place
4. The scope is complete! Test by placing the lid-side of the container into the water and make sure it is water tight. Glue can be placed around lid edges to further waterproof.

If using a PVC pipe, use the following steps:

1. Cut PVC pipe to desired length (2-2.5ft)
2. Cut Plexi-glass to fit one end of the pipe
3. Adhere using silicone sealant and allow to dry
4. The scope is complete! Test by placing the plexi-glass end into the water and make sure it is water tight.



Photo © Elyse Henshaw

If using a bucket or plastic tote

1. Cut out the bottom of the bucket or tote
2. Cut the plexi-glass to fit over the opening in the bucket or tote
3. Adhere using silicone sealant and allow to dry
4. If using a lid on either container, a hole can be cut and foam padding can be placed around it to create a padded viewing hole and lessen the light coming into the container.
5. The scope is complete! Test by placing the plexi-glass end into the water and make sure it is water tight.

Appendix G: Chautauqua Lake Early Detection Volunteer Network Action Plan

2018

The Chautauqua Lake & Watershed Management Alliance (Alliance) partnered with the Roger Tory Peterson Institute (RTPI) to raise awareness of the threats aquatic invasive plants pose to Chautauqua Lake while promoting increased stewardship of the invaluable aquatic ecosystem that exists. To do this, an 11-event series of free-to-the-public training sessions were developed and hosted in different locations around Chautauqua Lake. Of the events, eight were one-hour informational sessions developed to provide basic aquatic invasive plant information while serving as an opportunity to recruit interested attendees in participating in one of the three, six-hour mixed classroom style trainings. These mixed classroom style workshops provided attendees the opportunity to participate in a hands-on “floating classroom” experience in which they utilized GPS units, iMapInvasives Mobile App and field techniques discussed during the classroom training. Over the course of the summer, 55 people attended the programs in total. Of the total number of program attendees, 15 individuals participated in the on-the-water training and expressed interest in joining a future volunteer network.

To supplement the knowledge disseminated during training sessions, RTPI and the Alliance prepared and distributed a series of informational rack cards and posters related to invasive species awareness, reporting, and management on and around Chautauqua Lake. A Chautauqua Lake-specific Standard Operating Procedure (SOP) for Early Detection Monitoring of Aquatic Invasive Species was developed and will be implemented moving forward. Additionally, recordings of the presentations given during training sessions were created and all materials have been made accessible through RTPI’s website (<https://rtpi.org/conservation/chautauqua-lake-what-are-these-weeds/>).

Equipment List

The following items were purchased for participant use during training sessions held throughout the 2018 season and will remain available to training attendees in future years:

- 6 kayaks and life jackets
- 1 inflatable work boat with life jackets and motor
- 1 Waterproof cameras
- 3 GPS Units
- 3 Secchi Discs
- 3 Aquatic Rakes
- 3 Aqua scopes
- 1 Depth Finder

2019

Our project team will host a series of events in 2019 focused on the early detection of new aquatic invasive species on Chautauqua Lake (i.e., hydrilla and water chestnut). The events, which will be offered free of charge to the public, are planned to consist of four short informational sessions to attract interested members of the public and encourage them to take part in field activities; one mixed classroom-field ‘floating classroom’ training event to equip interested members of the public with skills needed to take part in future ‘Early Detection’ volunteer paddles and observe and report suspicious plants on their own using iMapInvasives; and, three ‘Aquatic Invasive Species Early Detection Volunteer Taskforce’ paddles that will search for priority invasive species (e.g., hydrilla and water chestnut) that are not yet established in Chautauqua Lake but represent an imminent threat to the ecological, environmental, and economic health of the lake. These outcomes are both short-term and long-term because while the programs will be delivered in 2019 and likely repeated in future years, once volunteers are trained and engaged, these members of the public will be able to apply these newly acquired (or in many cases, enhanced) skills over multiple years.

Chautauqua Lake Early Detection Volunteer Network Action Plan

2019-2021+ Broad Goals

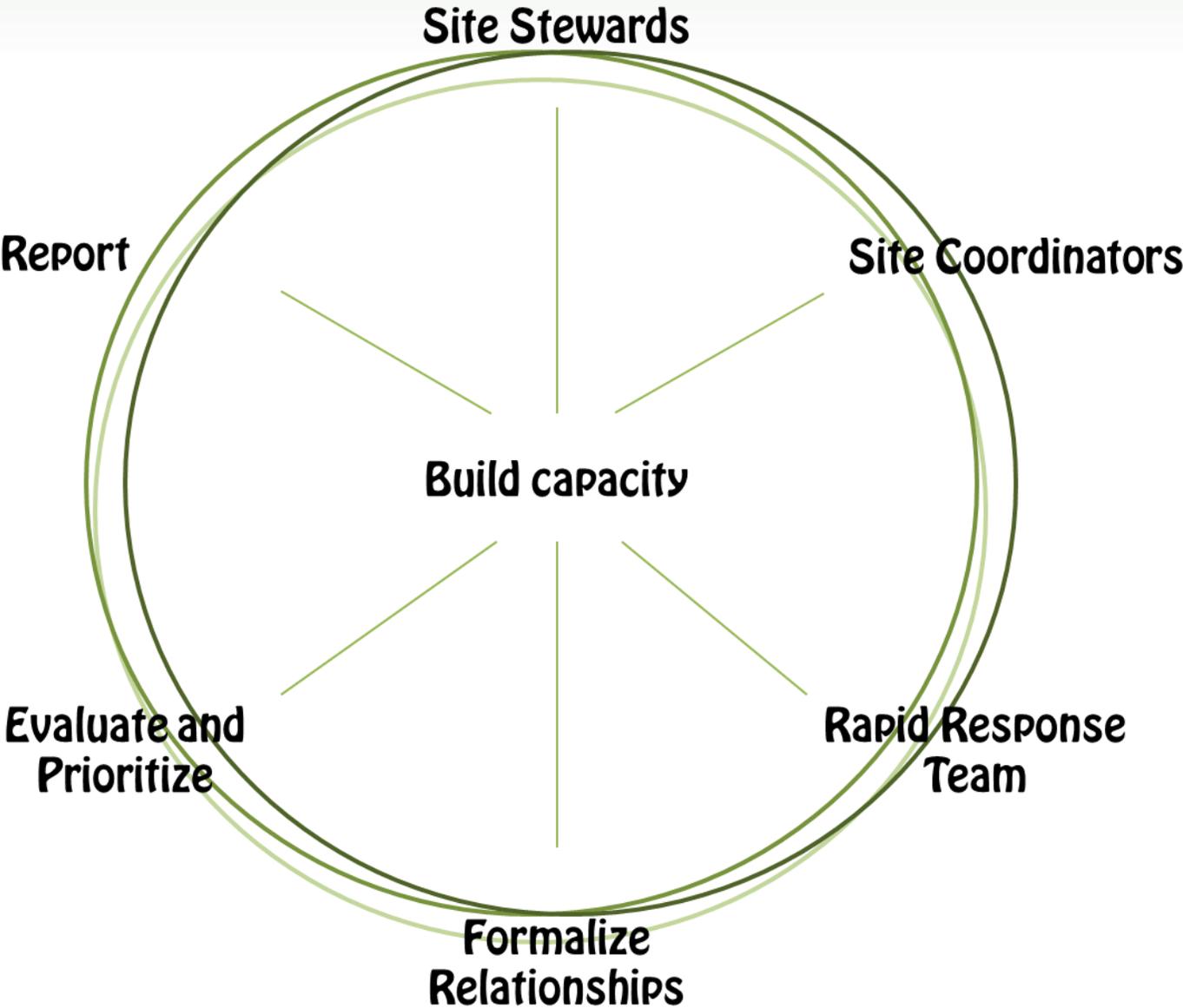


Figure depicts action plan for establishing the Chautauqua Lake Early Detection Volunteer Network using capacity building and multiple layers of open communication.

Chautauqua Lake Early Detection Volunteer Network Action Plan

Build Capacity: Build capacity of Chautauqua Lake Early Detection Volunteer Network by hosting annual in-person trainings and volunteer paddles.

Site Stewards: Develop Site Stewardship Program allowing trained volunteers to ‘adopt’ sites to monitor 3x per year (during growing season) and report their findings through iMapInvasives.

Site Coordinators: Develop Site Coordinator Program allowing trained and experienced volunteers to coordinate volunteer efforts within a section of the lake, covering multiple sites. These coordinators will be equipped to train volunteers and compile data.

Rapid Response Team: Develop Rapid Response Team allowing trained volunteers and professionals to verify sightings of detected priority aquatic invasive plants (reporting back to iMapInvasives) and begin course of action for removal.

Formalize Relationships: Formalize relationships with other organizations such as Western New York Partnership for Regional Invasive Species Management, Chautauqua Lake Association and others in order to establish open lines of communication regarding new reports of priority aquatic invasive plants.

Evaluate and Prioritize: Monitored sites, early detection reports, response actions and management decisions will be evaluated and prioritized regularly.

Report: Create and share an annual report of volunteer monitoring efforts, rapid response efforts and positive impacts made to the lake. This information as well as training materials, training dates, and volunteer events will be made publically available.

 **Outer Rings:** Representation of multiple open loops of communication between stakeholders, volunteers, responders and the general public: 1) Communication between volunteers, site coordinators, rapid response team and formal project partners; 2) Communication between formal partners to rapid response team then to site coordinators and site stewards for monitoring; 3) Communication between formal partners, volunteers, site coordinators, rapid response team and the general public.