Session 2

Plant CAMP
Northeast Aquatic Plant Management Society

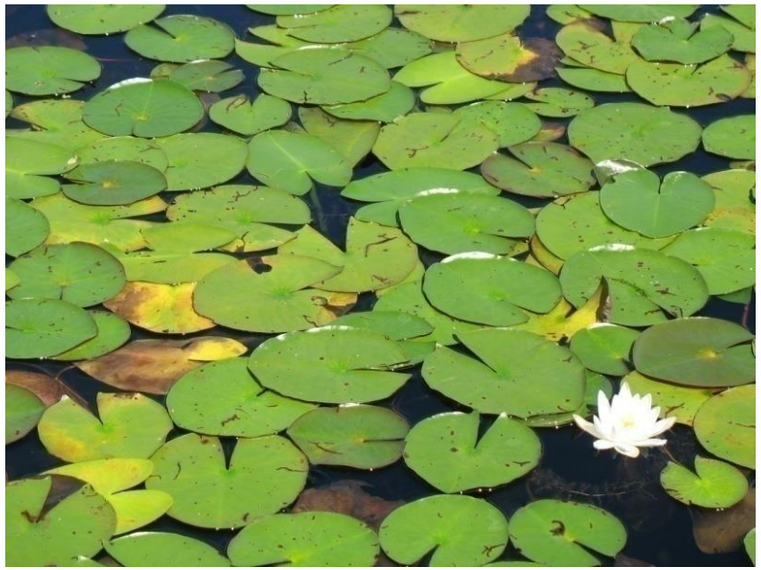
- Emily Mayer, MS
- Floating Leaf and Free Floating Aquatic Plants
  - Plus the Isle of Misfit Aquatic Plants

Floating Leaf Plants

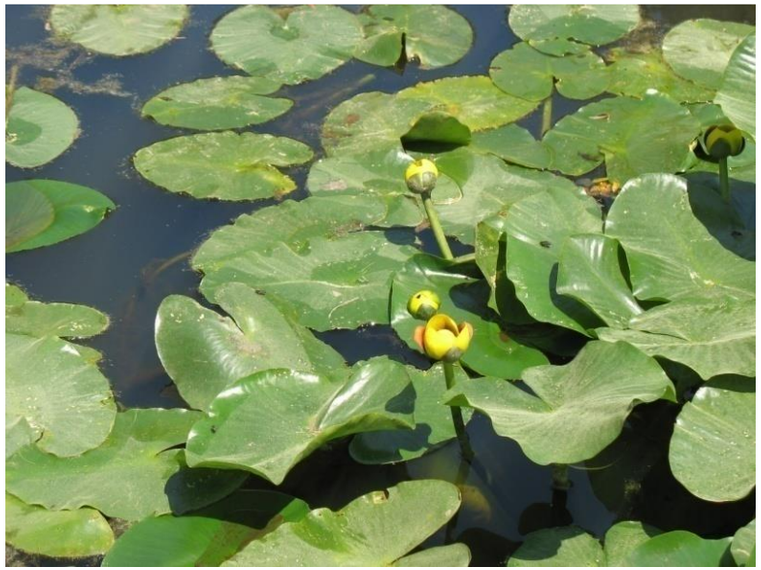
- Inhabit shallow water zones
- Long-lived (100+ years) rhizome systems
  - Stabilize bottom sediments
  - Over time: decrease water depth
- Leaves float on surface
  - Durable and smooth margins resist damage from wind and wave action
- Provide habitat/shade for fish
  - But also shade out other submersed plants
- If too abundant…
  - Restricts water movement and mixing
  - Restricts Recreation
  - Negative Water Quality Changes

Floating Leaf Plants: Water Lilies

- White Flower
- 10-30 cm Pad
- Red-Purple Underneath

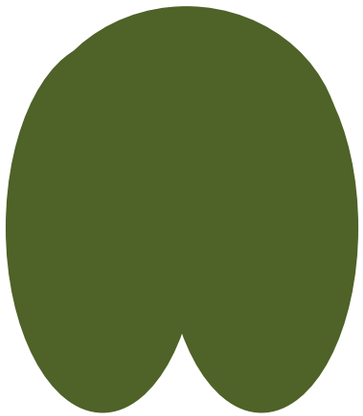


White Water Lily
Nymphaea odorata



Spatterdock (Yellow Water Lily)
Nuphar variegata

- Yellow Flower
- 10-25 cm long Pad
- Winged leaf stalk margin
- Can have erect pads



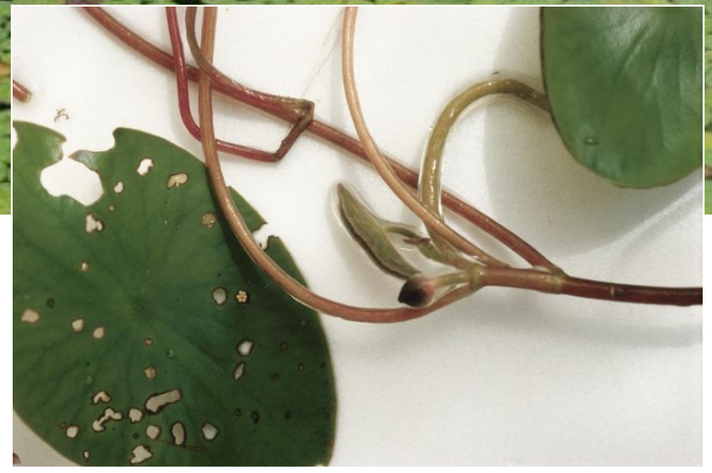
Not Shown: *Nuphar advena*
- 20-40 cm pads
- Round leaf stalk

Floating Leaf Plants: Watershield

Watershield

Brasenia schreberi

- "Snot-stem Lily"
- Prefers lower pH Water
- Common; Occurs with other lilies
- **Distinguishing Characteristics:**
- Floating Leaf
  - Smaller, oval; 4-12 cm long
  - Leaf stalk attached to center of pad
  - AKA water target
  - Green on surface, purple underneath
- **Stems and lower pad covered with thick gelatinous coating**
- **Small purple flower**
  - > 3 cm



Floating Leaf Plants: American Lotus

American Lotus

Nelumbo lutea

- Floating Leaf
  - Large 30-70 cm (2-feet+ !)
  - Often elevated
  - Waxy surface
  - Blue-green color
- Hairy Petiole
  - Attached to center of pad
- Yellow showy flowers
- Seeds in woody receptacle
  - Shower-head shape
- Sacred Lotus
  - *N. nucifera*

Inset Pics: https://plants.usda.gov

Floating Leaf Plants: Little Floating Heart

Little Floating Heart

Nymphoides cordata

- **Distinguishing Characteristics:**
- Small leaf (>5 cm)
- Heart-shaped
- **Each stem = one leaf**
  - unbranching
- **Delicate white flowers**
  - 5 petals, tiny
- **Banana-like tuberous roots**
  - Near the water's surface
- Yellow Floating Heart
  - *N. peltata*

Inset Source: A. Zinojev

Floating Leaf Plants: Water Smartweed

Water Smartweed

Polygonum amphibium

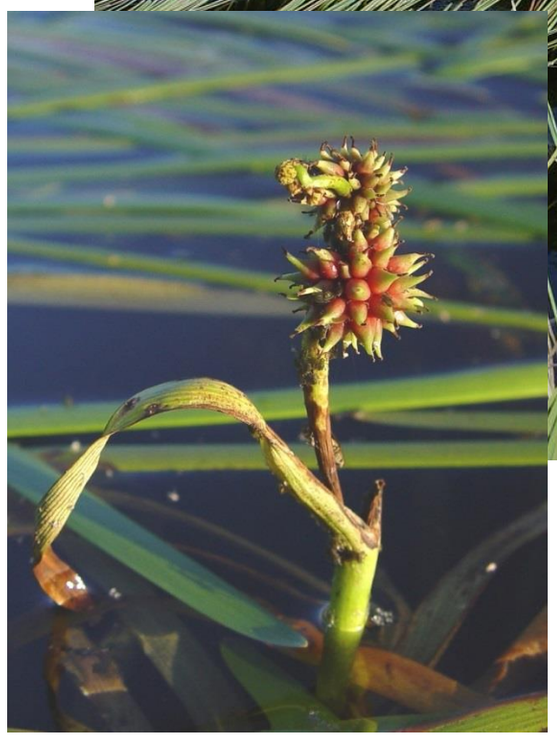
- True aquatic and terrestrial forms
  - Variable appearance
- Alternate, smooth floating leaves
  - Blunt tips
  - Fish-bone-like veins
- No submersed leaves
- Thick stems, with swollen nodes
- Bright pink flowers
  - Emergent on spike

Floating Leaf Plants: Floating-leaf Bur-reed

Floating-leaf Bur-reed

Sparganium fluctuans

- Several Bur-reeds in region
  - Most are emergent
- **Distinguishing Characteristics:**
- Flat wide leaves
  - 3-10 mm wide; **no keel**
  - Up to 1 m long
  - Flaccid; **Lay flat on water's surface**
- Nutlets reddish brown
  - **Curved beak**



Photos:: D Cameron

Floating-leaf Plant: Water Chestnut

- Native to Europe, Asia and Africa
- Hardy, robust stems, with floating leaves
- Can reproduce via fragmentation
- **Characteristics:**
- Triangular floating leaves
  - Saw-tooth margins
- Feathery submersed leaves
- Air-filled petioles (buoyancy)
- Tiny White Flowers
- Produces hard woody spiked fruit
  - Up to 20 per rosette!
  - Can lie dormant for 10-12 years

Trapa natans

Water Chestnut Control Options:
- Hand Pulling (very effective)
- Herbicides
- Mechanical Removal

Free Floating Plants

- Small size, flat leaves
- Unattached to substrate
- Distribution based on:
    - Water movement
    - Wind action
    - Presence of other surface plants
- Roots are absent, or hair-like
- Excellent waterfowl food
- Can become a nuisance
- Can pull nutrients from the water column
- Examples: duckweeds, watermeal

Free Floating Plants: Slender Riccia

Slender Riccia

Riccia fluitans

- A free ranging liverwort
- Often intermixed with duckweeds
- **Distinguishing Characteristics:**
- Forked stems
  - Called the thallus
  - Tangled mess of an aquatic jigsaw puzzle
  - Stems are flat, ribbon-like divisions
  - Like "deer antlers"
- Non-flowering
  - Reproduces via spores

Free Floating Plants: Mosquito fern

Mosquito Fern

Azolla caroliniana

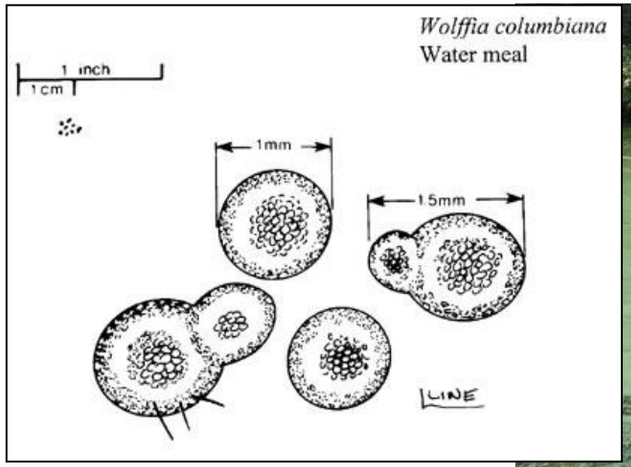
- Native to N. America
  - But not common in NE
- Often used in Wastewater Plants
  - Nutrient and metal uptake
- Often intermixed with duckweeds
- **Distinguishing Characteristics:**
- Free Floating Leaves (up to 0.5 mm)
  - Branched stems
  - Scale-like leaves in 2 rows
  - Green to purple hue
  - Velvety appearance

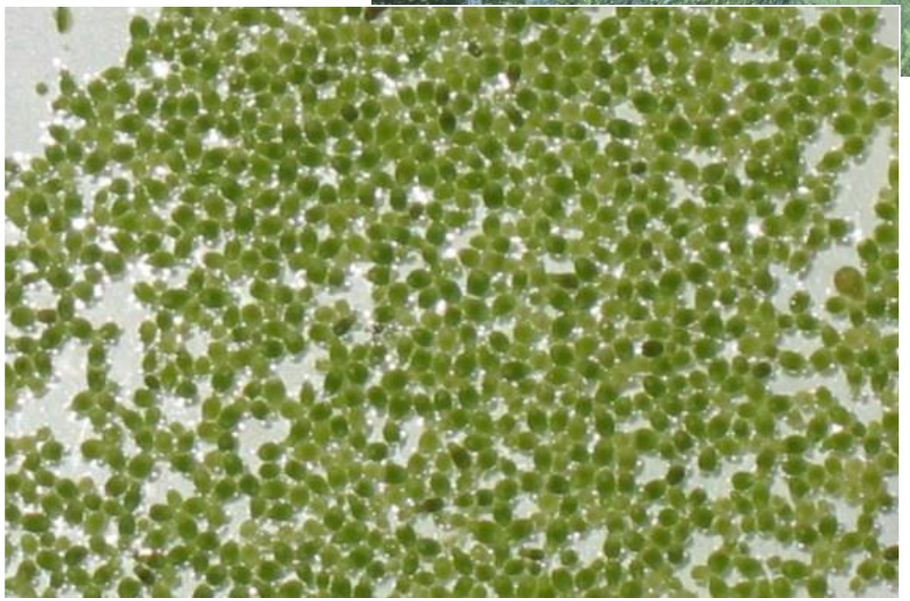
Floating Plants: Common Watermeal

Common Watermeal

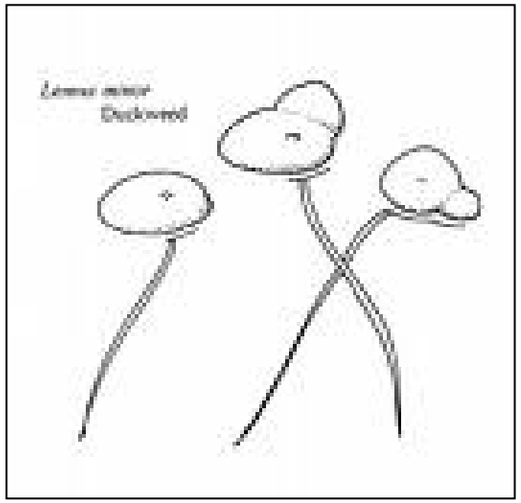
Wolffia columbiana

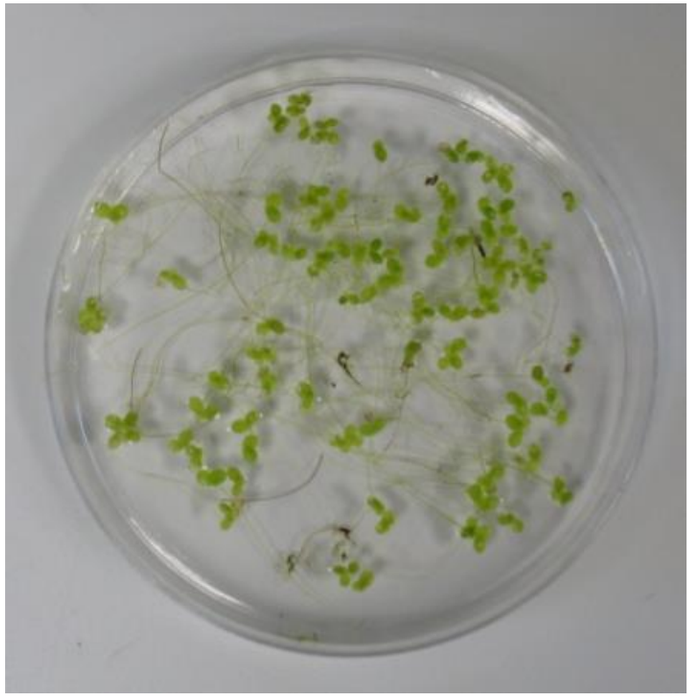
- One of world's smallest flowering plants
- Often intermixed with other duckweeds
- Can become a nuisance
- Waterfowl food source
- **Distinguishing Characteristics:**
- Tiny; up to 1.4 mm
- Pale green
- Asymmetrical globes
  - Lack roots, stems or true leaves
- Flowers require magnification
- Reproduces via budding

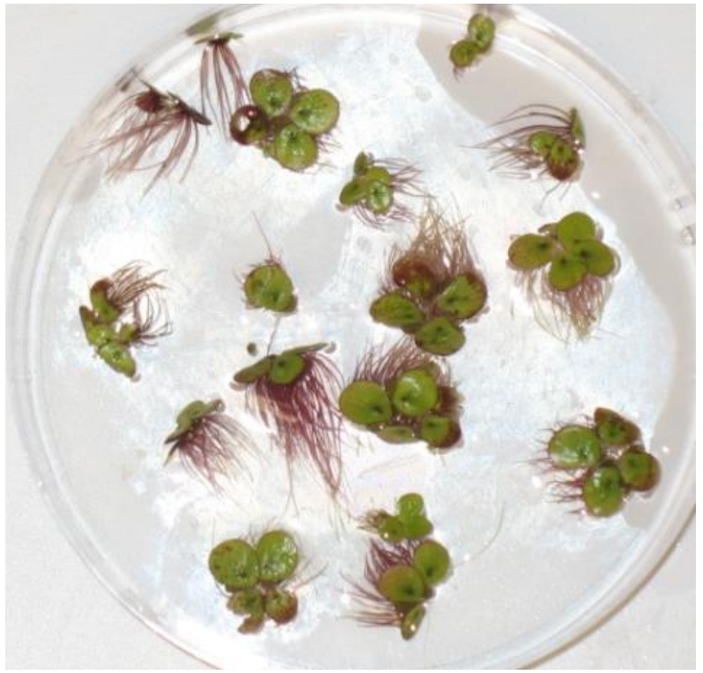


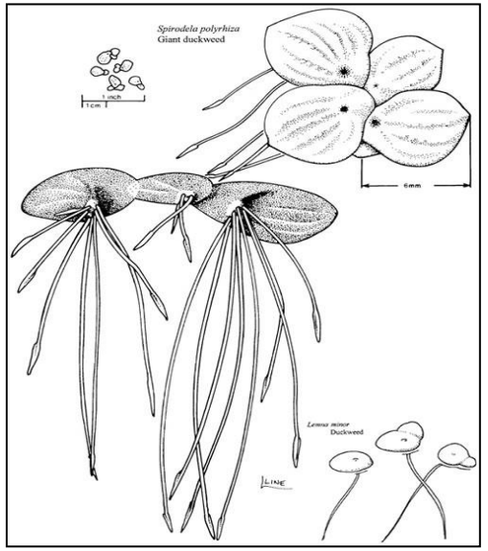


Floating Plants: Duckweeds









Duckweeds typically reproduce via budding

Small Duckweed
Lemna minor
- Round to oval leaves
  - Called fronds
- 2-6 mm long
- 1.5-4 mm wide
- One root

Great Duckweed
Spirodela polyrhiza
- Irregular oval leaves
- 3-10 mm long
- 2.5-8 mm wide
- Green surface
- Purple underneath
- Cluster of 5-12 roots

Floating Plants: Duckweeds

Pale Duckweed
Lemna valdiviana

- Pale-green fronds
- Almost translucent
- Lance-shaped
- Prominent midvein
- One root
- Not common

Forked Duckweed
Lemna trisulca

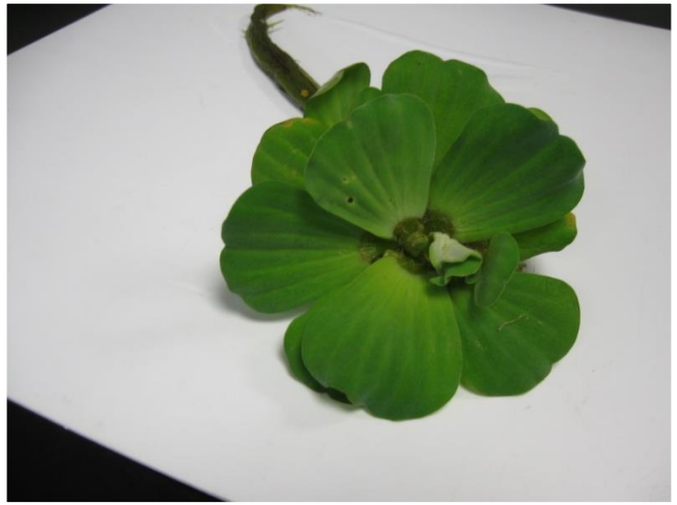
Photo: Susan Knight

- Olive-green fronds
- Flat and long; 4-16 mm
- Lateral fronds often attached
  - 4-10 mm
  - Interlocked
  - "Rowboat and oars"
- Often occurs beneath surface

Floating Leaf Plants: Invasive

- All three are free-floating
- Similar to "giant duckweeds"
- Root mass dangles below
- Create nuisance stands in quiet waters

European Frogbit
(Hydrocharis morus-ranae)

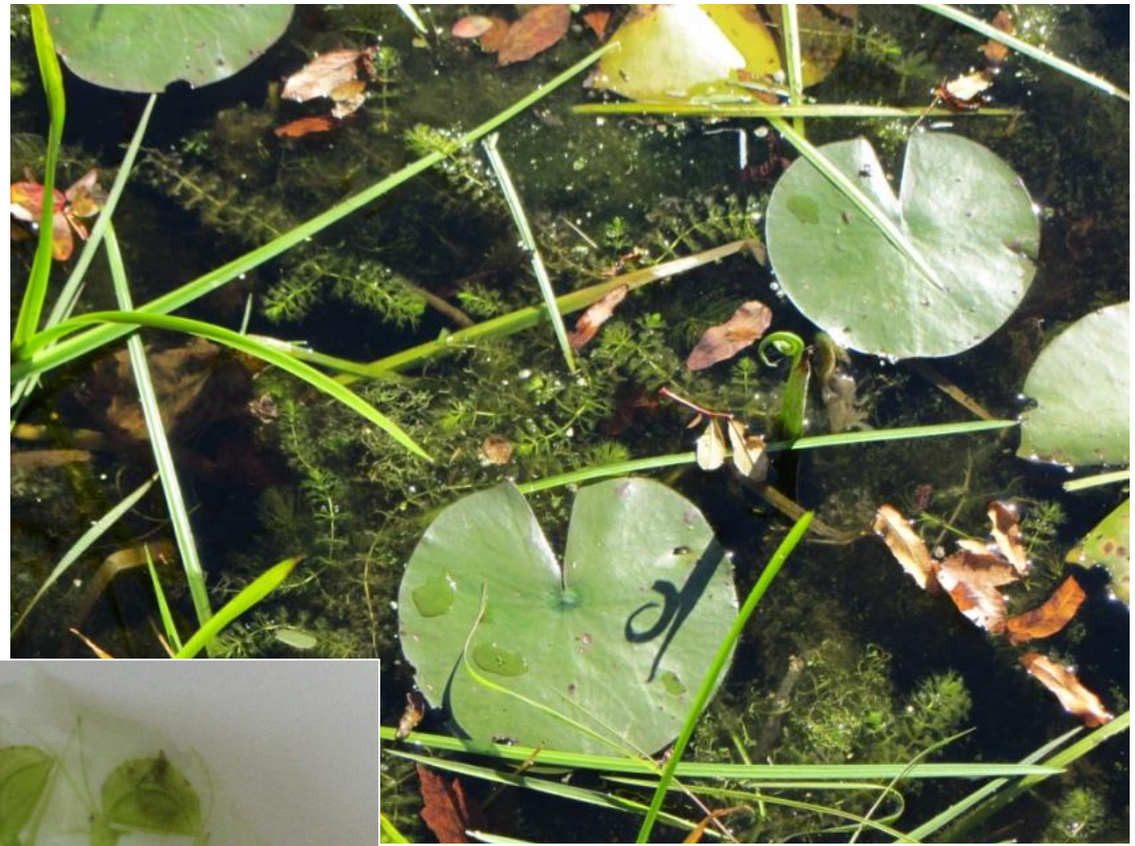


Water Lettuce (*Pistia stratiotes*)

Water Hyacinth (*Eichhornia crassipes*)

Floating Plant: Waterwheel

- Carnivorous
  - Insect larvae, zooplankton
- Free-floating, rootless
- Popular Aquarium Plant
- Reproduction via fragmentation and turion production
- Requires Specific Habitat
  - Low pH, high CO_2, organic content in water
- **Characteristics:**
- Stems up to 20 cm
  - New growth at apex
  - Degeneration at base
- Whorls of 6 to 8 leaves
- Trap ("Lamina") at each leaf tip
  - Trigger hairs
  - Closes in 0.01 second!

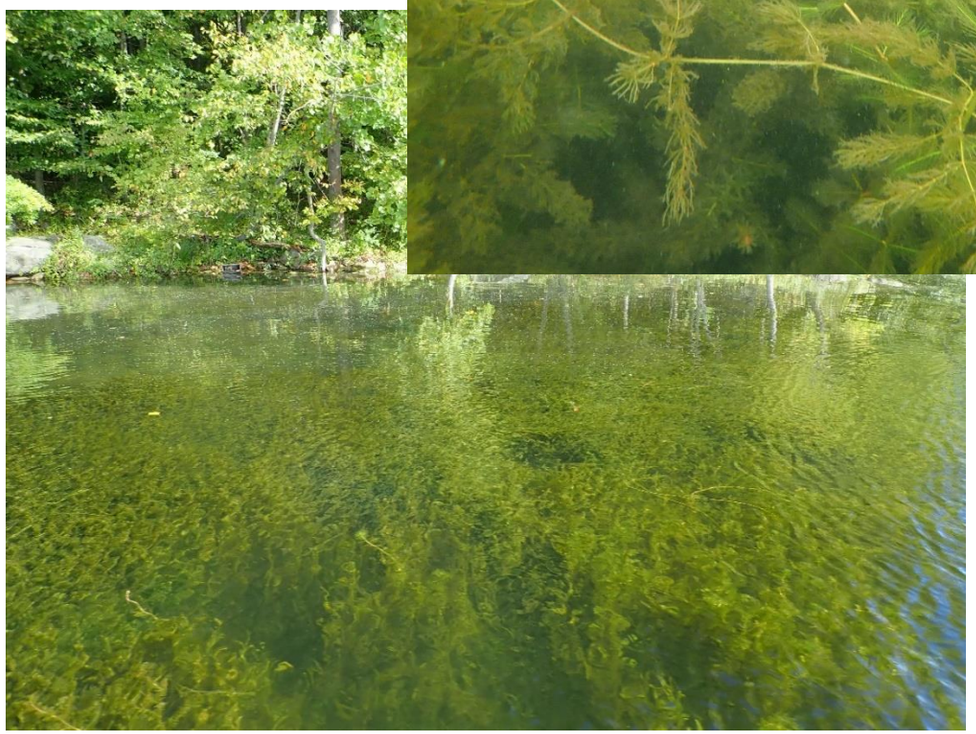


Waterwheel Look Alikes:
- Bladderworts

Waterwheel Control Options:
- None (at this time)

Isle of Misfit Plants: Submersed Plants

- Rooted in the substrate
- Might have some emergent structures
  - Flower or fruit spikes, leaves
- A true variety of shape, structure and growth forms
- Underwater Landscape diversity
  - Similar to the canopies of a rain forest
- **Submersed Adaptations**
  - Flexible leaves
  - Lack cuticle
  - Need buoyancy
  - Tolerant of water clarity (or not)
  - Root system diversity
  - Variety of Reproductive strategies



Submersed Plants: Waterweeds

Common Waterweed
Elodea canadensis

- Leaves in whorls of three
- Leaves somewhat **blunt tip**
- Leaves are firm
- **Leaves 1-5 mm wide**
- Leaves crowded at tip

Source: D Cameron

Slender Waterweed
Elodea nuttallii

- Leaves in whorls of three
- More delicate structures
- **Narrow leaves (>2 mm)**
- Leaves have pointed tip
- Leaves less crowded at tip

Submersed Plants: Invasive Waterweeds

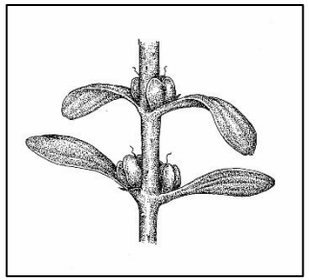
Hydrilla
Hydrilla verticillata

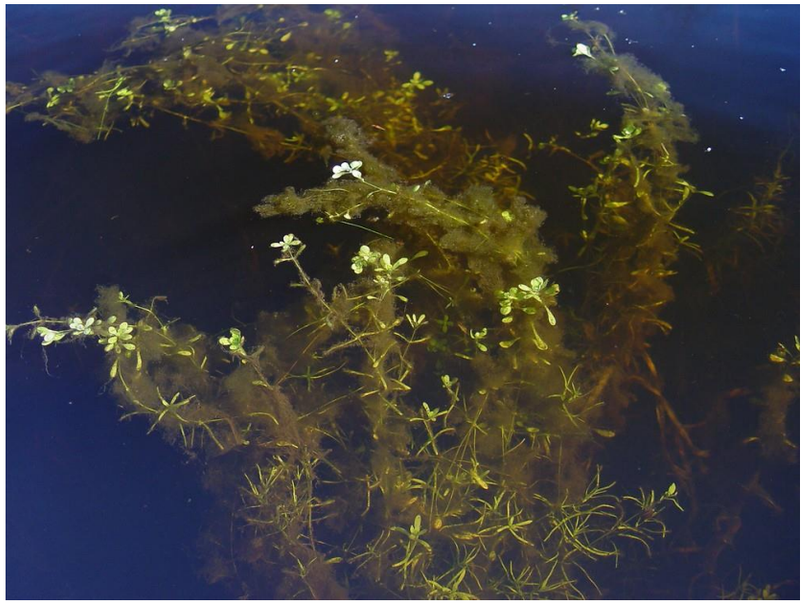
- Two Biotypes
- Leaves in whorls of 4 to 8
- Smaller leaves, heavily serrated
- Produces tubers and turions
- Not limited by habitat

Brazilian Elodea
Egeria densa

- Leaves in whorls of 4 to 6 (up to 8)
- Much more robust
- Leaves finely serrated
- Does not produce tubers/turions
- Origin: South America
- Popular aquarium plant ("Anacharis")

Submersed Plants: Water Starworts

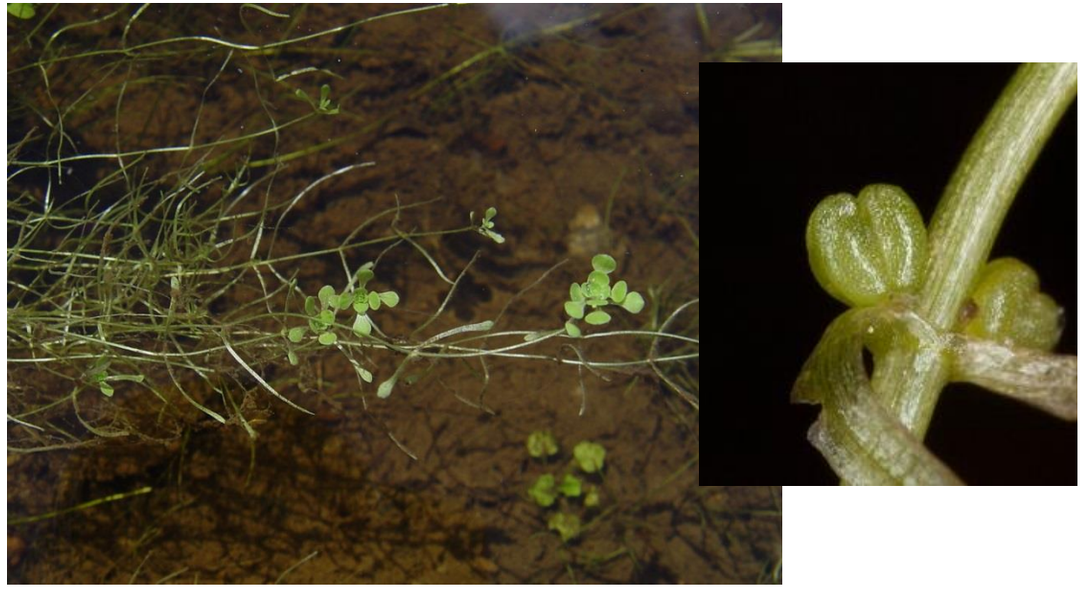




Source: D Cameron

Common Water Starwort
Callitriche palustris

- Leaves are opposite (maybe 3)
- Submersed leaves are linear
  - No serration or lobes
- Upper leaves oblong, crowded
- **Fruit in axil; winged, vertical pits**



Source: D Cameron

Large Water Starwort
Callitriche heterophylla

- Leaves are opposite
- Submersed leaves thin
- Floating Leaves rounded
- **Fruit not winged, pits not vertically arranged**

Other Submersed Plants: Horned Pondweed

Horned Pondweed

Zannichellia palustris

- Not a true pondweed
- Prolific seed producer
  - **Distinguishing Characteristics:**
- **Fine, stringy stems** (fish line-like)
- Leaves opposite or whorled
  - 3-10 cm long; one vein
- Distinct fruit producer
  - 2,000,000 fruit/plant in 6 months
  - **Located in axils, arranged in clusters**
  - **Wavy dorsal ridge; prominent beak**

Other Submersed Plants: Water Marigold

Water Marigold

Bidens (=Megalodonta) beckii

- Stem is usually unbranched
- Up to 2 m tall
- Bottle-brush appearance
- **Distinguishing Characteristics:**
- Submersed leaves in whorl
  - Delicate, heavily branched
- May produce emergent leaves
- Modified, serrated edges
- Solitary yellow daisy-like flower
  - Rarely produced

Source: D Cameron

Other Submersed Plants: Wild Celery

Wild Celery

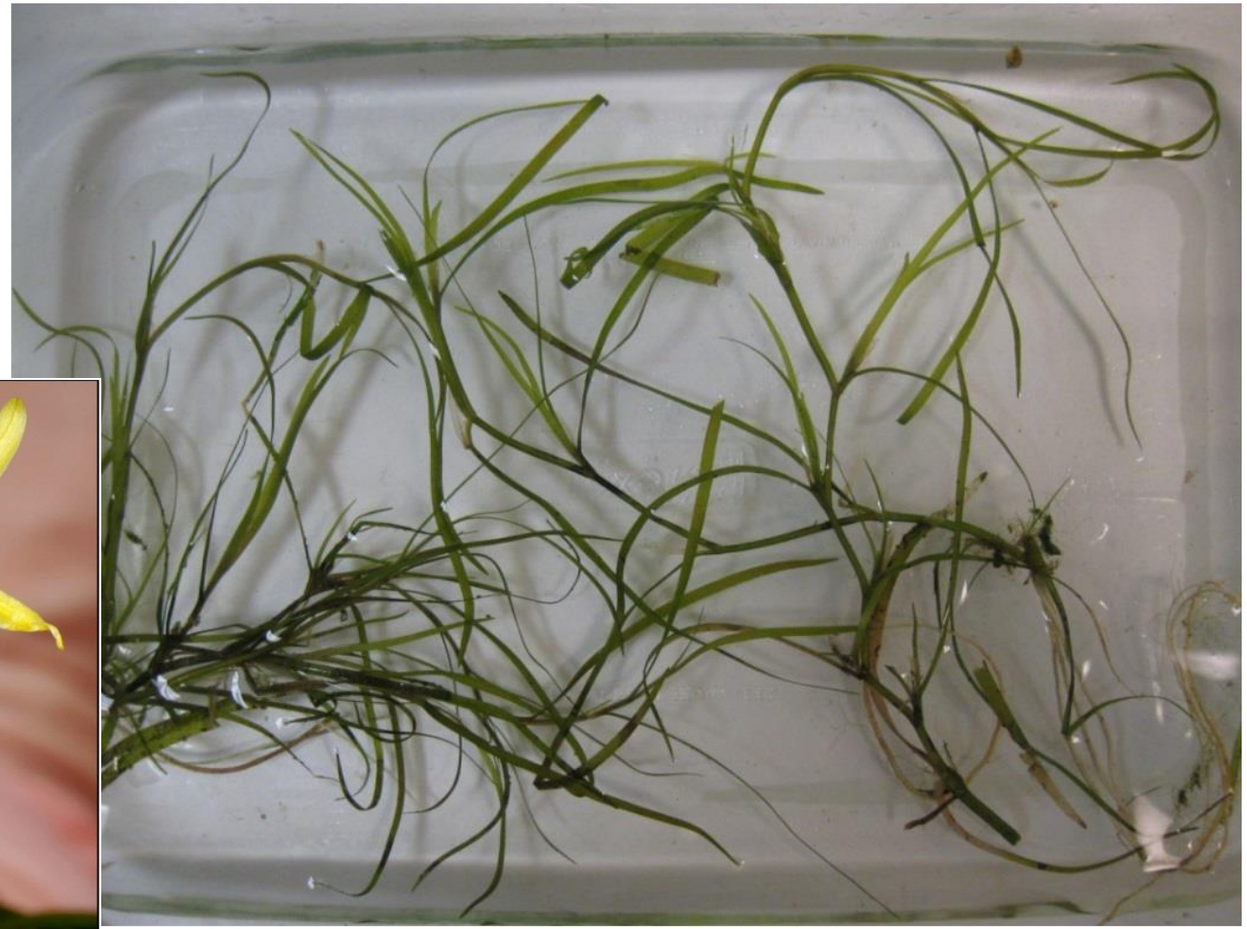
Vallisneria americana

- AKA eel-grass or tape grass
- Prefers firm substrates
- Tolerates turbidity
- Thrives in a variety of WQ
- Highly desirable habitat
    - Commercially grown and planted
- **Distinguishing Characteristics:**
- Stems 2+ m long
    - Basal rosette arrangement
    - Ribbon-like, wavy edges
    - Wide stripe hollow cells
- Female Flowers on a spiraled white stalk
- Prolific tuber producer
    - Important waterfowl food

Other Submersed Plants: Water Stargrass

Water Stargrass
Zosterella dubia
(= Heteranthera dubia)

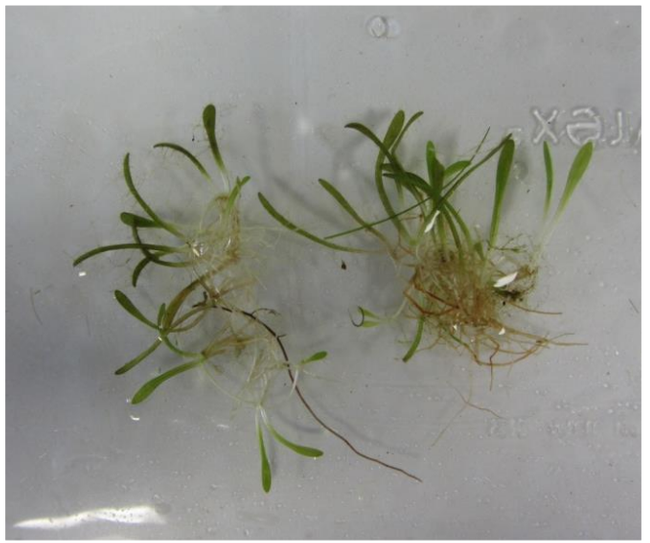
- Appears to be a pondweed
  - Pickerelweed family
- **Distinguishing Characteristics:**
- Stems can be slightly flat
- Slightly branched
- Leaves narrow and alternate; to 15 cm
  - Lack stalk or stipules
  - Leaves lack a mid-vein
- Distinct yellow star-shaped flower
  - Emergent



Submersed Plant: Mud Mat

- Native to Australia and New Zealand
- First identified in CT in 1992
- Since confirmed in CT, NJ, RI, and PA
- Prefers shallow sandy lake areas
- **Characteristics:**
- Diminutive stems
  - 1 to 4 cm leaves, **in pairs**
  - "Rabbit Ears"
- Tiny white flowers
- Can form dense mats
  - 10,000 to 25,000 plants/m^2
- Exotic, but low potential to become a nuisance to recreational lake uses

Glossostigma cleistanthum



Mud Mat Control Options:
- Unknown
- Hand Pulling ?

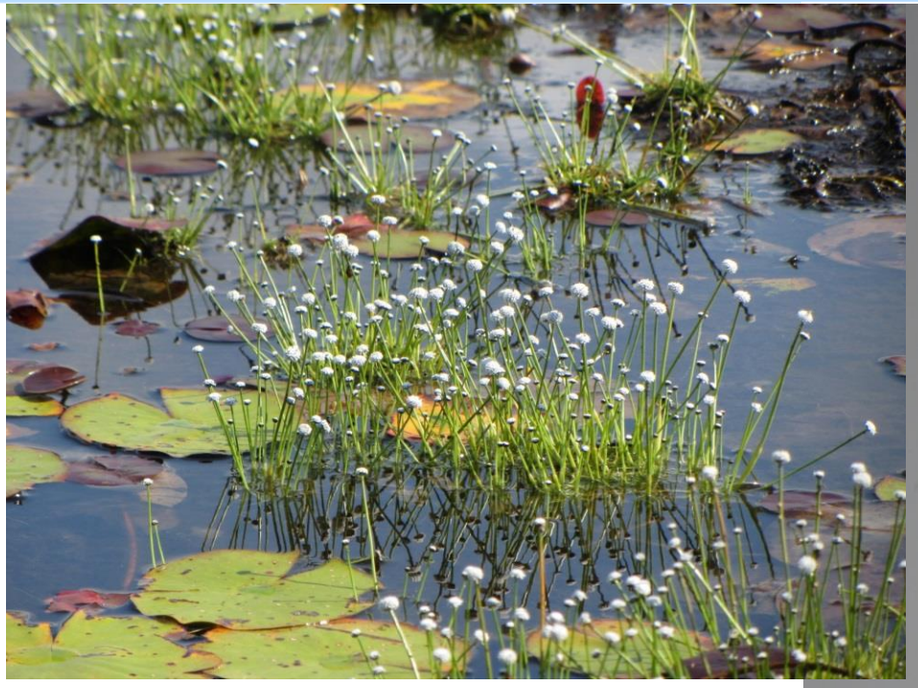
Submersed Plants: Rosette Species

Arrowhead

Sagittaria sp.

- Many emergent arrowheads produce submersed rosettes
- Common in shallow water
- **Distinguishing Characteristics:**
- Stiff leaves in basal rosette
  - Typically straight with pointed tip
  - Tend to be wide
  - Large cells in leaves
    - Resemble layers of bricks

Rosette Plants: Pipewort



Pipewort

Eriocaulon aquaticum

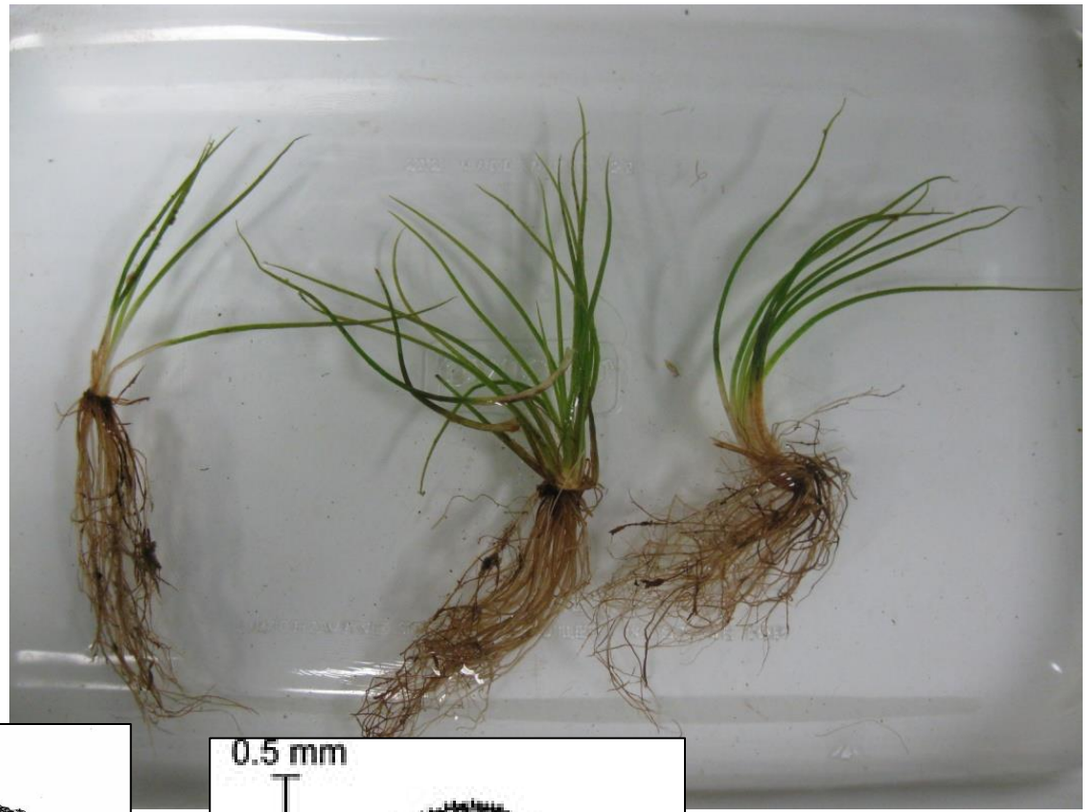
- Prefer soft water
- **Distinguishing Characteristics:**
- Small basal rosette of leaves
  - >10 cm tall
- **Each rosette produces one flower stalk**
  - Emergent
  - Water depth determines length
  - Few cm long to 3+ meters
- Round head packed with white flowers
  - **Button-like**
- **Checkerboard segmented roots**
  - **Unbranched**

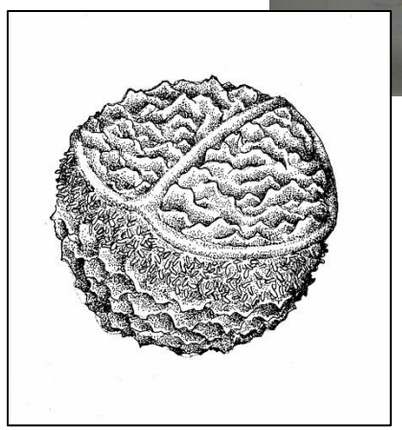
Submersed Plants: Quillworts

Quillworts

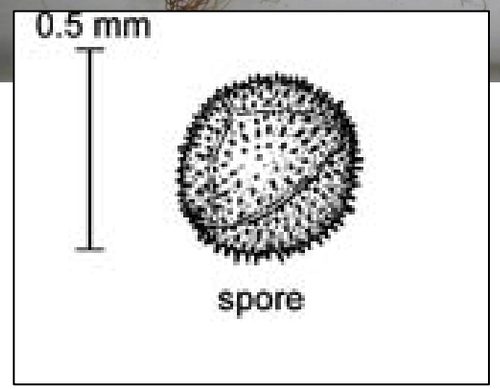
Isoetes sp.

- Can hybridize
- **Distinguishing Characteristics:**
- Fleshy stems in basal rosette
- **Roots are forked**
- **Leaves have 4 air chambers in cross section**
- **Megaspores needed to identify**
    - Spore sacks at base of leaves
- *I. lacustris*
    - Leaves dark green, firm, twisted
    - Spores: network of ridges on surface
- *I. echinospora*
    - Leaves pale green and soft
    - Spores: covered with short spines





I. lacustris spore



I. echinospora spora

Rossette Plants: Waterwort

Waterwort

Elatine minima

- Prefers sandy substrates
- Can be exposed on mud/sand flats
- **Distinguishing Characteristics:**
- Tiny stems
  - >5 cm tall
- Tiny, oblong/oval leaves
  - 3-8 mm
  - No stalk
  - **Shallow notch at leaf tip (usually)**
- Flowers in leaf axil
  - Barely visible
  - Seeds needed for identification to sp.

Photo: Susan Knight

Emergent/Submersed Plant: Water Soldier

- Native to Europe and NW Asia
- Appearance: aloe or pineapple top
- **Only North America Population**
  - **Trent River, Ontario (2008)**
- Submersed Growth
  - Winter
- Emergent Growth
  - Summer
- Reproduces via offshoots
  - Ave. 4.7 per plant
- **Characteristics:**
- Rosettes
- Leaves: up to 3 feet long!
  - Sword-like
  - Heavily Serrated margins
- White 3-part flowers

Stratiotes aloides

Water Soldier Control Options:
- Herbicides
- Hand Pulling

Water Soldier Look Alikes:
- None

Macroscopic Algae

Stonewort
Nitella spp.

- No true roots: Rhizoids
- Branches are whorled
- Stems are smooth and pale green
- Up to 0.5 m tall
- **Pear-shaped oogonium capped with <u>10 cells</u>**

Muskgrass
Chara spp.

- No true roots: Rhizoids
- Branches are ridged; side branches whorled; often calcified
- **Pear-shaped oogonium capped with <u>5 cells</u>**
- **Often musky or skunky stench**

Macroscopic Algae: Starry Stonewort

- Native to Europe and Asia
- Occurs in Northern-Tier USA Lakes
- Tall, dense growth pattern
- Likely spreads via fragmentation
- 2017: APMS and Partners
  - $60,000 Research Grant
  - Awarded to Clemson Univ.
- **Characteristics**
- More robust than natives
- Whorls of branchlets
  - 4-6 off main shoot
- **White star-shaped bulbils**
  - Reproductive structure

Nitelliposis obtusa

Starry Stonewort Control Options:
- Herbicides

Starry Stonewort Look Alikes:
- Muskgrass
- Stonewort

THANK YOU!

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