

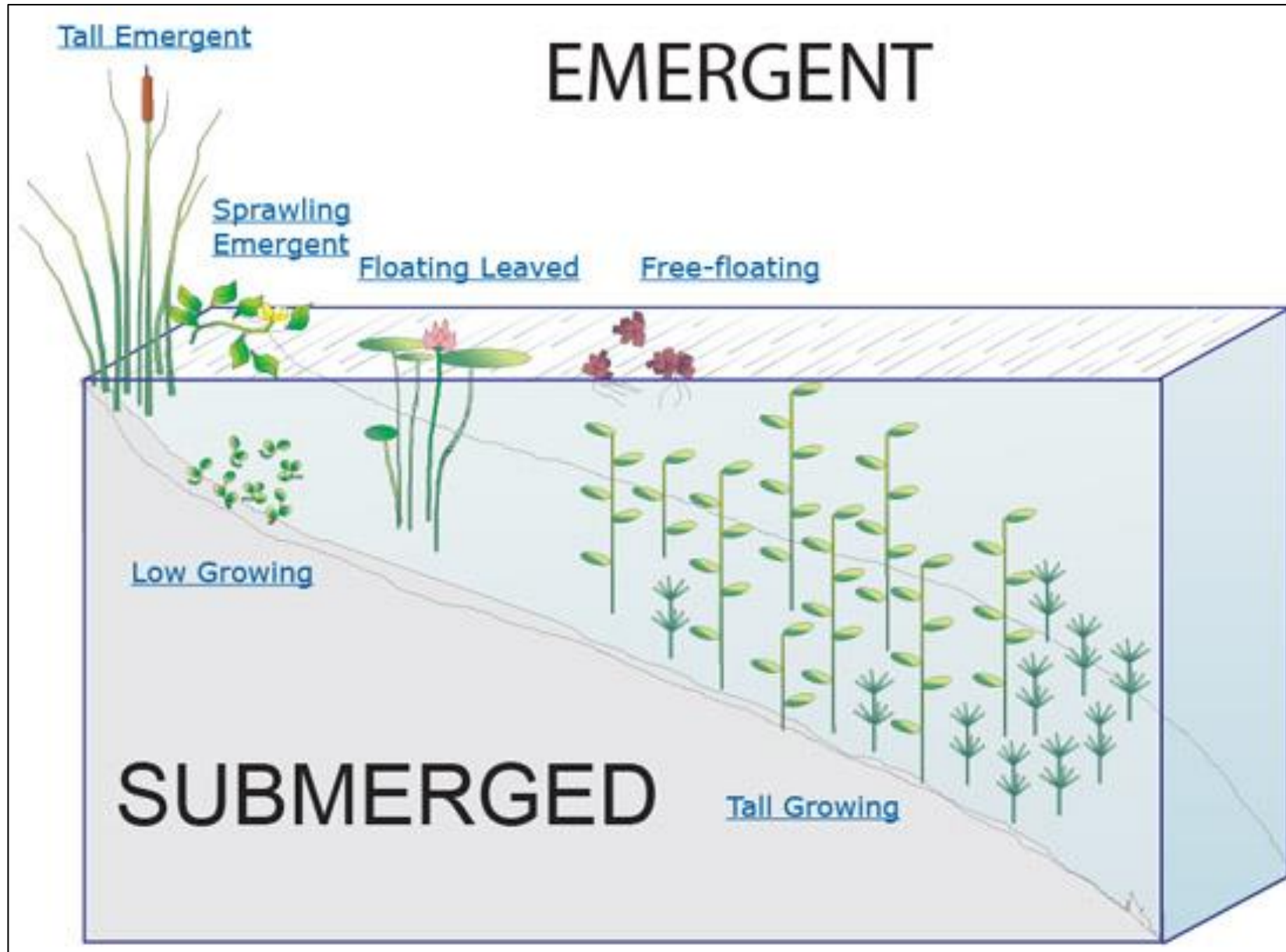
Session 1

Chris Doyle, CLM

Invasive Aquatic Plants



Aquatic Plant Communities



Benefits of Aquatic Plants

Aquatic Biota Habitat

- Fish
- Aquatic Invertebrates
- Zooplankton (Refuge)

Wildlife Habitat and Food

- Waterfowl, muskrats, otters, mink, beavers, deer

Nutrient Sink

- Competes with Algae

Shoreline and Benthic Stabilization

- Reduction of Nutrients

Aesthetics



But at Nuisance Densities...

Restrict Recreation

- Boat Movement
- Fishing Frustration
- Aesthetics

Ecological Imbalances

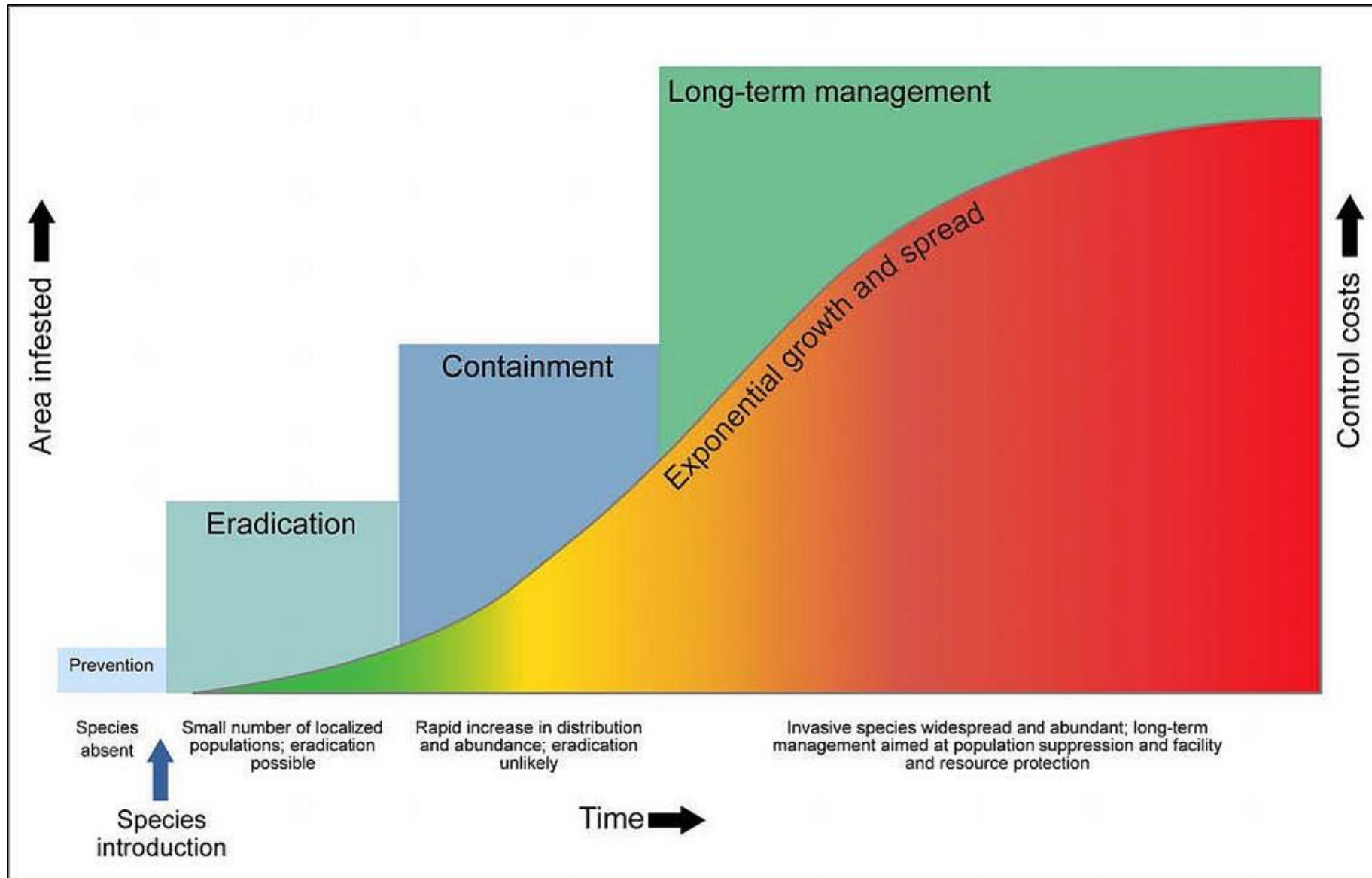
- Fish Community Shifts
- Negative WQ Impacts

Decreased Property Values

Invasive Species



Invasive Species Curve



Sources: National Invasive Species Council; U.S. Department of Agriculture; National Park Service; U.S. Fish and Wildlife Service; Rodgers, L, South Florida Water Management District; Department of Primary Industries, State of Victoria, Australia; and GAO. | GAO-16-49



Submersed Plant: **Curly-leaf Pondweed**

- The Only Invasive Pondweed
- Native to Europe and Asia
- Established in most US States
- Early Grower (winter)
- Natural die-off in June/July in NE
- **Distinguishing Characteristics:**
- Stems can reach 3 to 4 m long!
- **Serrated, wavy leaves (stiff/crunchy)**
- Pinecone-like turions

Control Options:

- Herbicides (many)
- Hand Pulling

Curly-leaf Pondweed Look Alikes

- Other pondweeds



Submersed Plant: Eurasian Water Milfoil

- Native in Europe and Asia
- Most common exotic invasive aquatic plant in the USA
- Millions of dollars spent annually to control
- **Competitive Advantages:**
 - Fast growth
 - Thrives in cool water
 - Thrives in a variety of habitats
 - Produces seeds, but usually only reproduces via fragmentation
 - Canopy formation



Myriophyllum spicatum



Eurasian Water Milfoil Control Options:

- Herbicides (many)
- Hand Pulling
- Benthic Barriers
- Herbivorous Insects



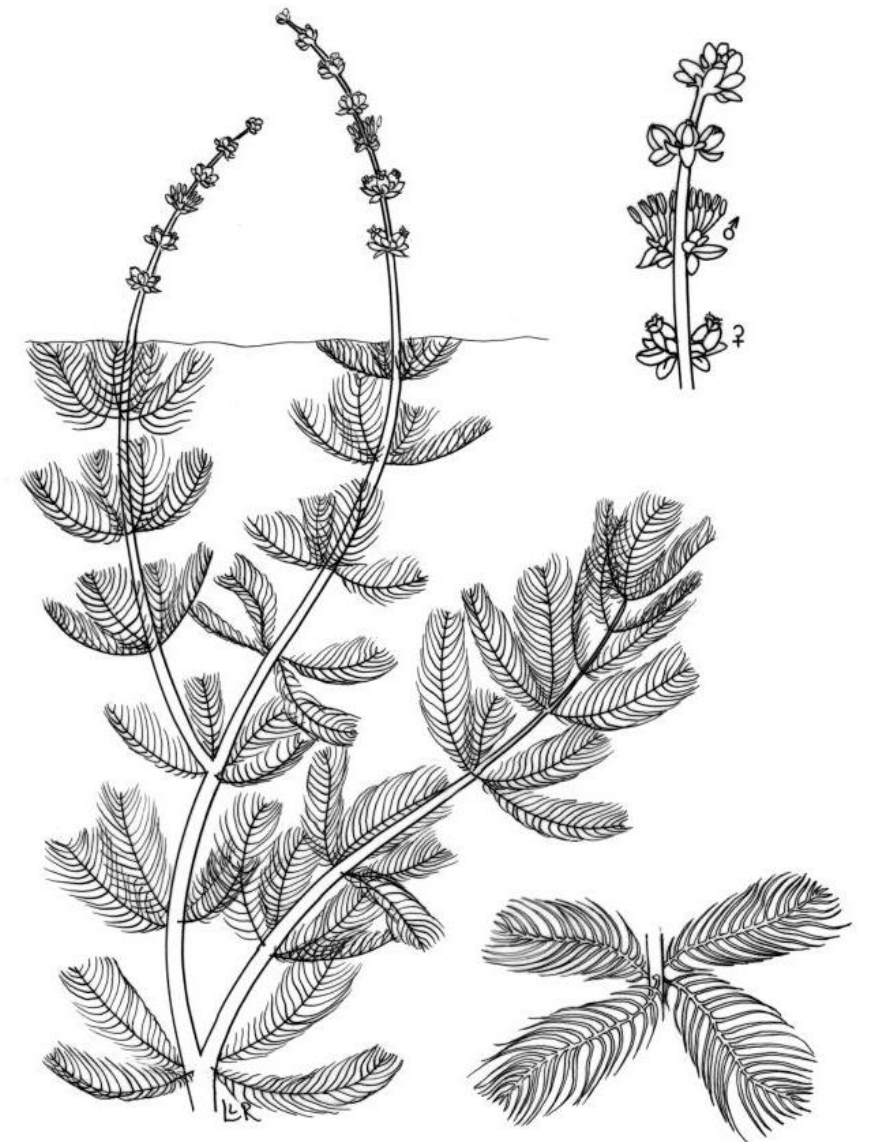
Submersed Plant: Eurasian Water Milfoil

Eurasian Water Milfoil Characteristics:

- Spaghetti-like stems
 - White to reddish
 - Can reach 20 feet long!
- Leaves in a whorl
 - 3-6 (Typically 4) leaves per whorl
 - **12 to 21 leaflet pairs per leaf**
 - **Gap between whorls > 1 cm**
- Flowers
 - Tiny, yellow
 - Produced on pink spike

Eurasian Water Milfoil Look Alikes:

- Other Native Milfoils
- Coontail



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Center for Aquatic and Invasive Plants

Myriophyllum spicatum
Eurasian watermilfoil



Submersed Plant: **Variable-leaf Water Milfoil**

- Native to North America, but not the Northeast
- Highly invasive in New England, but...
- Can reproduce via fragmentation
- Thrives in a variety of habitats
- **Distinguishing Characteristics:**
- **Whorls closely spaced** (<10 mm)
 - “Bottle brush” appearance
 - 4-6 leaves per whorl
 - 5-14 pairs of leaflets
 - Submersed leaves limp/feather-like
- **Distinct swollen toothed bracts**
 - Emergent, often red
 - Flower spikes emerge up to 12 cm

Variable-leaf Water Milfoil

Control Options:

- Herbicides (higher dose)
- Hand Pulling
- Benthic Barriers

Myriophyllum heterophyllum



Submersed/Emergent Plant: **Parrot Feather**

- Native to South America
- Can survive stranded on the shore
- Can survive in salt-intruded waters
- Reproduces via roots and fragmentation
- **Distinguishing Characteristics:**
- **Submersed Leaves**
 - **Limp, often degraded**
 - 4-6 leaves in whorls
 - Finely divided, flat midrib
- **Emergent leaves**
 - Up to 30 cm above surface
 - Emergent leaves are **vibrant and waxy**
 - **10 to 18 pairs leaflets per leaf**

Parrot Feather Control Options:

- Herbicides (higher dose)
- Hand Pulling
- Benthic Barriers

Myriophyllum aquaticum



Parrot Feather Look Alikes:

- Other milfoils
- Coontail
- Water Marigold



Submersed Plant: Fanwort

- Native to South America and SE USA (?)
 - Not native in the Northeast
- Very popular in aquarium trade
- Reproduces by fragmentation
- Forms extensive surface mats
- Prefers low pH water
- *Cabomba caroliniana*
- **Distinguishing Characteristics:**
 - Opposite Submersed Leaves
 - “Fan Shaped”
 - Tiny, alternate floating leaves
 - Flowers: Tiny, white

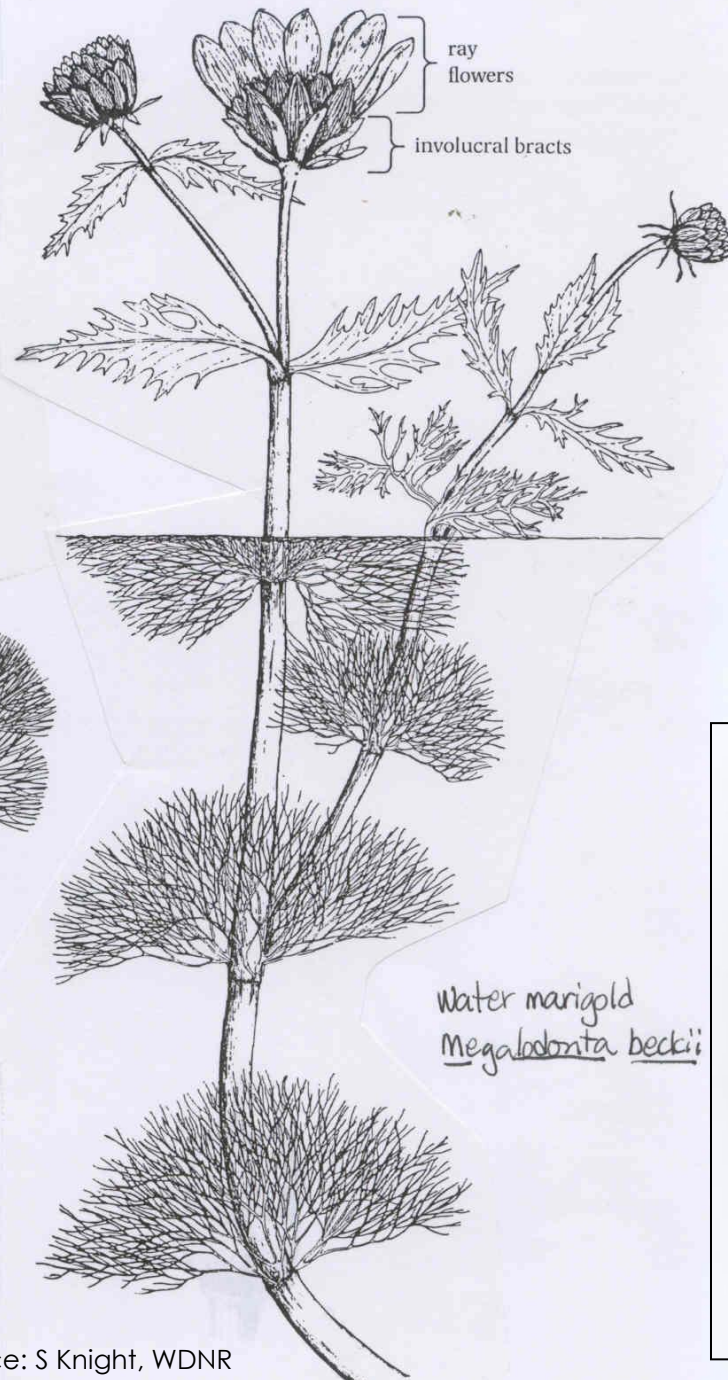


Fanwort Control Options:

- Herbicides
- Grass Carp
- Hand Pulling
- Benthic Barriers



Fanwort Look Alike



Photos: S. Knight



Other Look Alikes:

- Milfoils
- Water Marigold
- Bladderworts
- Water Crowfoot

Source: S Knight, WDNR



Submersed Plant: **Hydrilla**

- Native to Asia/India
 - Two Biotypes in USA (more?)
- Introduced to USA in 1960's
- Widespread in the SE USA
- Tolerates a Wide Variety of Habitats
 - Flowing and non-flowing, bottom substrates, salinity, water chemistries
- Can grow in 1% light
- **Distinguishing Characteristics:**
 - Sinewy stems; up to 25 feet long
 - Tremendous growth potential/day
 - Profuse branching
 - Leaves in Whorls
 - **4 to 8** (but sometimes 3)
 - Leaf margins are strap-like, pointed
 - **Saw toothed** (Visible)
 - Produces **tubers** and turions

Hydrilla Control Options:

- Herbicides
 - Biological (Grass Carp)
- Need to manage tuber bank*



Hydrilla verticillata



Submersed Plant: **Hydrilla**

Often Called the “Perfect Weed”



Submersed Plant: **Brazilian Elodea**

- Native to South America
- Introduced to USA in late 1800's
- Popular aquarium plant (Oxygenator)
 - "Anacharis"
- Reproduces via Fragmentation
- Growth actually slows in mid-summer
 - Fall growth flush
- **Distinguishing Characteristics:**
 - **Robust stems**
 - Leaves in whorl
 - 4 to 8 typical
 - **Margins Very finely serrated**
 - Variable spacing of whorls



Egeria densa

Brazilian Elodea Control Options:

- Herbicides
- Grass Carp
- Hand Pulling
- Benthic Barriers



Waterweed Look-Alikes



Hydrilla

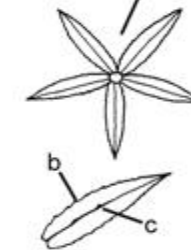


Common Waterweed



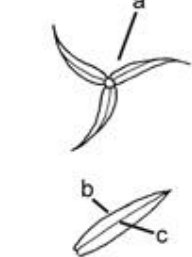
Egeria

HYDRILLA



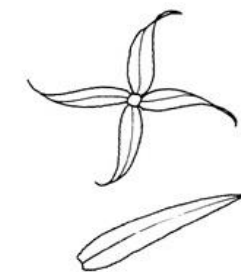
4-8 whorls
heavy serration

ELODEA



3 whorls (rarely 4)
fine serration

EGERIA



4-6 whorls
very fine
serration



Submersed Plant: **Brittle Naiad**

- Native to Europe
- Occurs in most US states
- Sometimes called European naiad
- Stems generally do not reach surface
 - Typically doesn't require control
- Bushy Appearance
- **Distinguishing Characteristics:**
- **Toothy Leaf Margins**
 - **Visible to naked eye**
 - **6-20 spines per leaf**
- Prolific seed producer
 - Slightly recurved
 - **Longitudinal rectangular pits**
 - Leaf axils
 - One-acre plot can produce 10,000,000 viable seeds/season

Najas minor

Brittle Naiad Control Options:

- Herbicides
- Hand Pulling ?
- Benthic Barriers

Brittle Naiad Look Alikes:

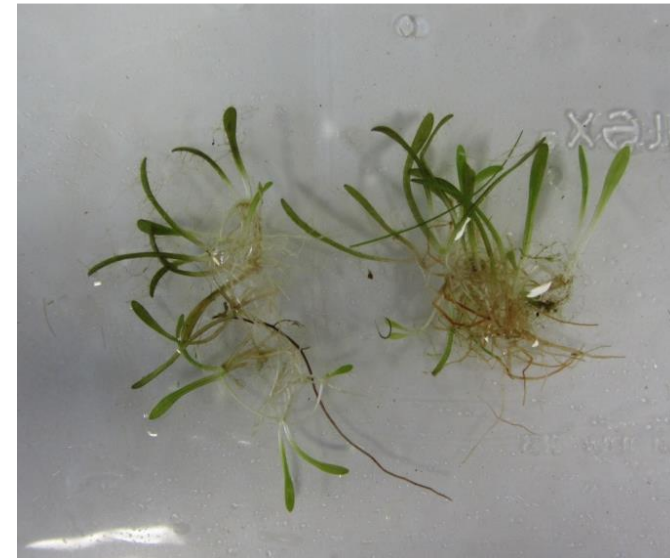
- Native naiads
- Common waterweed



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
- **Distinguishing 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/m²
- Exotic, but low potential to become a nuisance to recreational lake uses

Glossostigma cleistanthum



Mud Mat Control Options:

- Unknown
- Hand Pulling ?



Floating-leaf Plant: **Water Chestnut**

- Native to Europe, Asia and Africa
- Hardy, robust stems, with floating leaves
- Can reproduce via fragmentation
- **Distinguishing 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



Water Chestnut Control Options:

- Hand Pulling (very effective)
- Herbicides
- Mechanical Removal

Trapa natans



Floating-leaf Plant: **Water Chestnut**



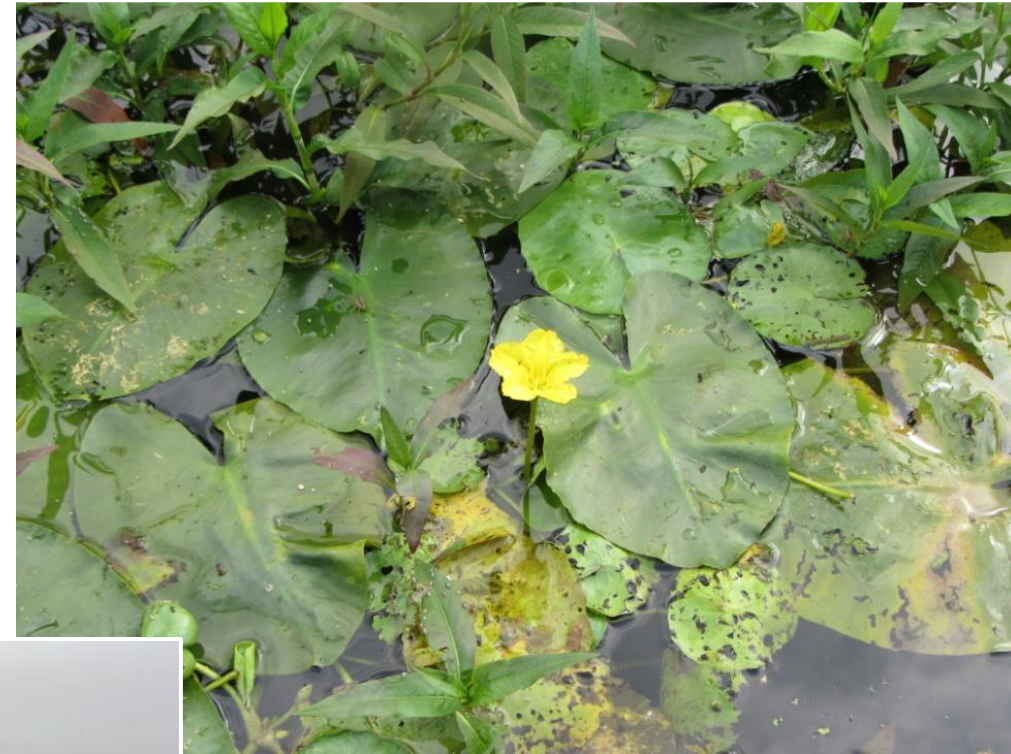
Water Chestnut Look Alikes:

- Other Water Lilies (?)



Floating Plant: **Yellow Floating Heart**

- Native to Europe and Asia
- Introduced to the USA as an ornamental
- Occurs throughout Northeast (not ME)
- **Distinguishing Characteristics:**
- Round to heart-shaped leaves
 - Smaller than native lilies
 - **Shallow scalloped edges (wavy)**
 - **Stem supports several leaves**
 - No banana-like tubers on stem (*N. cordata*)
- Bright yellow, showy flowers
 - Five petals



Nymphoides peltata

Yellow Floating Heart Control Options:

- Topical Herbicides
- Hand Pulling
- Mechanical?



Yellow Floating Heart Look Alikes:

- Native floating heart
- Watershield



Floating Plants: **European Frogbit**

- Native in Europe and Northern Asia
- Similar to a “giant duckweed”
- **Distinguishing Characteristics:**
- Small, **heart-shaped** leaves
 - Typically < 6 cm diameter
 - Leathery texture
- Well-defined root system
 - **But rarely anchored to substrate**
 - Spreads via runners
 - Tangled mess of roots/runners
- Tiny white flower
 - **Three petals**

European Frogbit Control Options:

- Topical Herbicides
- Hand Pulling
- Mechanical?

European Frogbit Look Alikes:

- Floating hearts
- Watershield
- Mud Plantain



Hydrocharis morus-ranae



Floating Plants: **Water Hyacinth**

- Native to Brazil (7 species)
- Common in SE USA (Florida-100 years)
- Can't overwinter north (Climate Change...)
- Tremendous Reproductive Capacity
 - Double in size in 6-18 days
 - 1 acre weighs 200 tons!
- Free-floating
- **Distinguishing Characteristics:**
 - Black to purple hanging roots
 - Leaves, **thick, glossy, water resistant**
 - Rosette
 - Ovate to round;
 - up to 6 inches diameter
 - **Air-filled petiole-buoyancy**



Eichhornia crassipes

Water Hyacinth Control Options:

- Topical Herbicides
- Mechanical Harvesting and chopping
- Bio control: insects

Water Hyacinth Look Alikes:

- None



Floating Plants: **Water Lettuce**

- Similar to a “giant duckweed”
 - Free Floating
- Creates nuisance stands in quiet waters
- Can't overwinter in NE (Climate Change...)
- **Distinguishing Characteristics:**
- **Leaves, thick soft, velvety, light green**
 - **Covered with tiny hairs**
 - Occur in rosettes
 - **Margins wavy**
 - Top margins scalloped
- Roots; prolific, hanging, feathery, light tint

Water Lettuce Control Options:

- Topical Herbicides
- Mechanical Harvesting and chopping
- Insect Bio-control



Pistia stratiotes

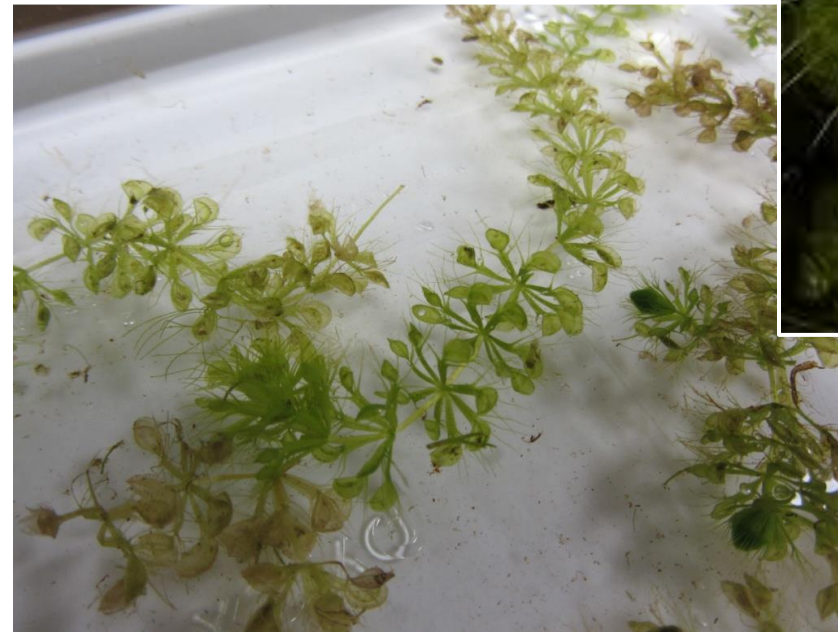
Water Lettuce Look Alikes:

- None

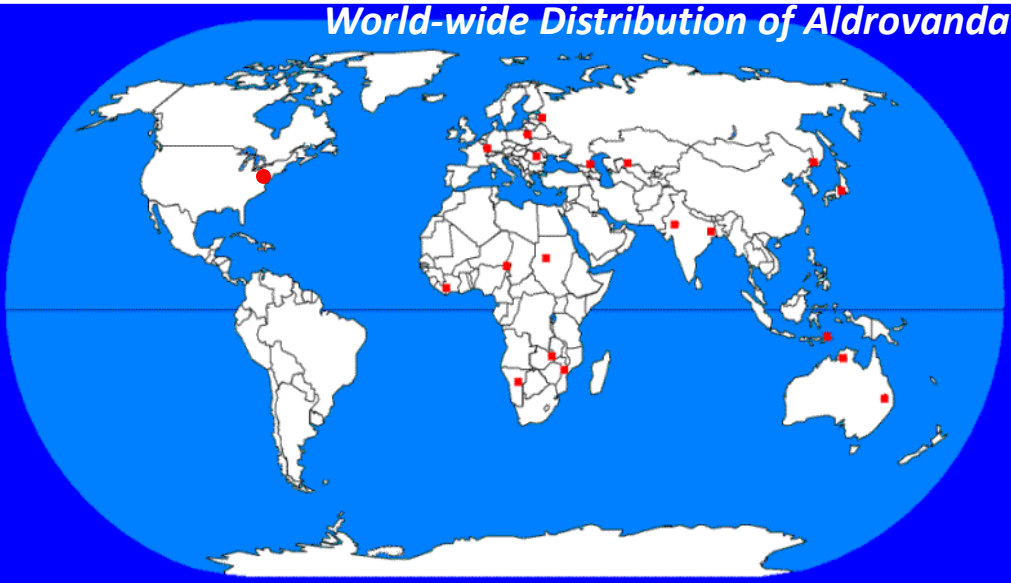


Floating Plant: **Waterwheel**

- Family: Droseraceae (sundews)
 - Most common: Venus Flytrap (*Dionaea muscipula*)
 - Carnivorous plant
- Native to Europe, Africa, Asia and Australia
 - Scattered distribution and dwindling
 - Less than 50 sites left throughout its range
- Never Officially Documented in North America!
 - Hellquist and Les (personal communication, 2012)



World-wide Distribution of Aldrovanda



Aldrovanda vesiculosa



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 CO₂, organic content in water
- **Distinguishing 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 Control Options:

- None (at this time)



Waterwheel Look Alikes:

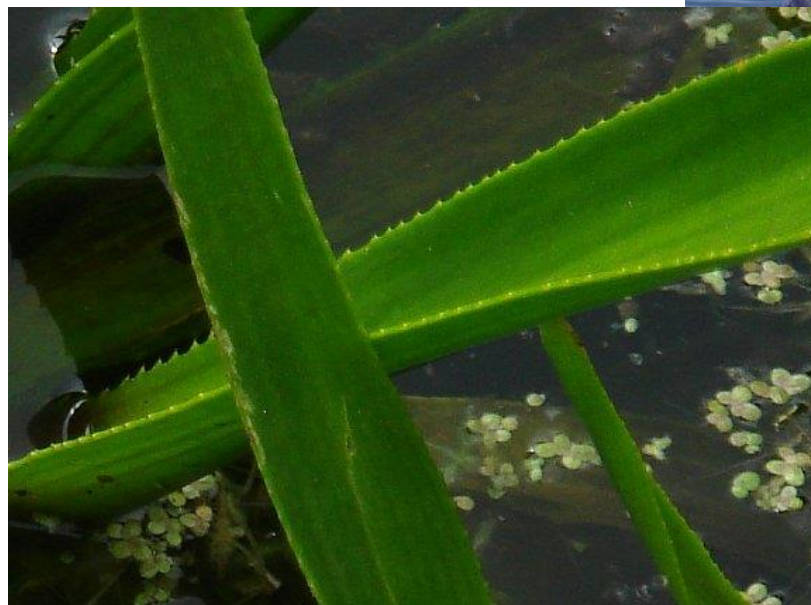
- Bladderworts



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
- **Distinguishing 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



Macro-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.
- **Distinguishing Characteristics:**
- More robust than natives
- Whorls of branchlets
 - 4-6 off main shoot
- **White star-shaped bulbils**
 - Reproductive structure

Starry Stonewort Control Options:

- Herbicides

Nitelliposis obtusa



Starry Stonewort Look Alikes:

- Muskgrass
- Stonewort



Thank You!

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