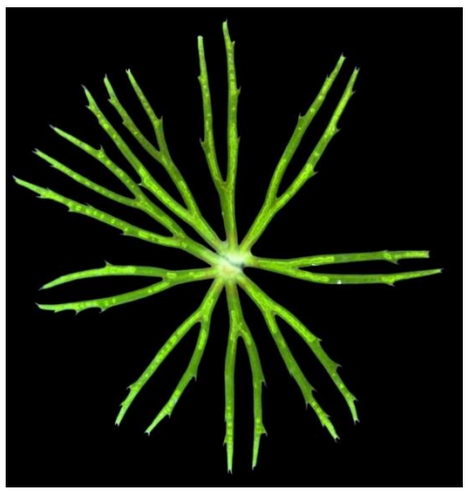
Session 4

- Emily Mayer, MS
- Water Milfoils and Friends (Bladderworts, Hornworts and Naiads)



Submersed Plants: Milfoil sp.

- Finely divided leaves, usually whorled
- Several species in Northeast
- Several species are invasive exotics
- Can hybridize
- Provide important opportunities for fish and invertebrates
  - Shade
  - Shelter
  - Forage Opportunities

Yet, studies have shown that invertebrate diversity decreases in monoculture stands of invasive aquatic plants

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 Plants: Northern Water Milfoil

Northern Water Milfoil
Myriophyllum sibiricum
(formerly *M. exalbescens*)

- Native in the Northeast
- Sensitive to turbidity
- Outcompeted by EWM
  - Likely was more common in NE
- **Distinguishing Characteristics:**
- Leaves in whorls (4-5)
  - Whorls up to 1 cm apart
  - Stiff, hold shape out of water
  - 5-12 pairs of leaflets
    - Lower leaflets longer
- Fruit produced on emergent spikes
  - Emergent leaves: bracts
- Produces Winter buds

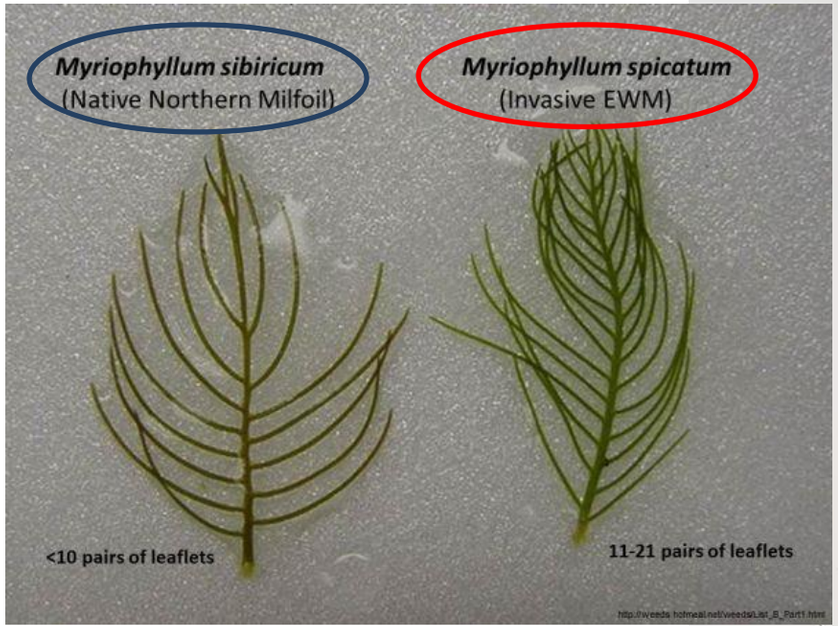


Photo: Susan Knight

Photo: Donald Cameron

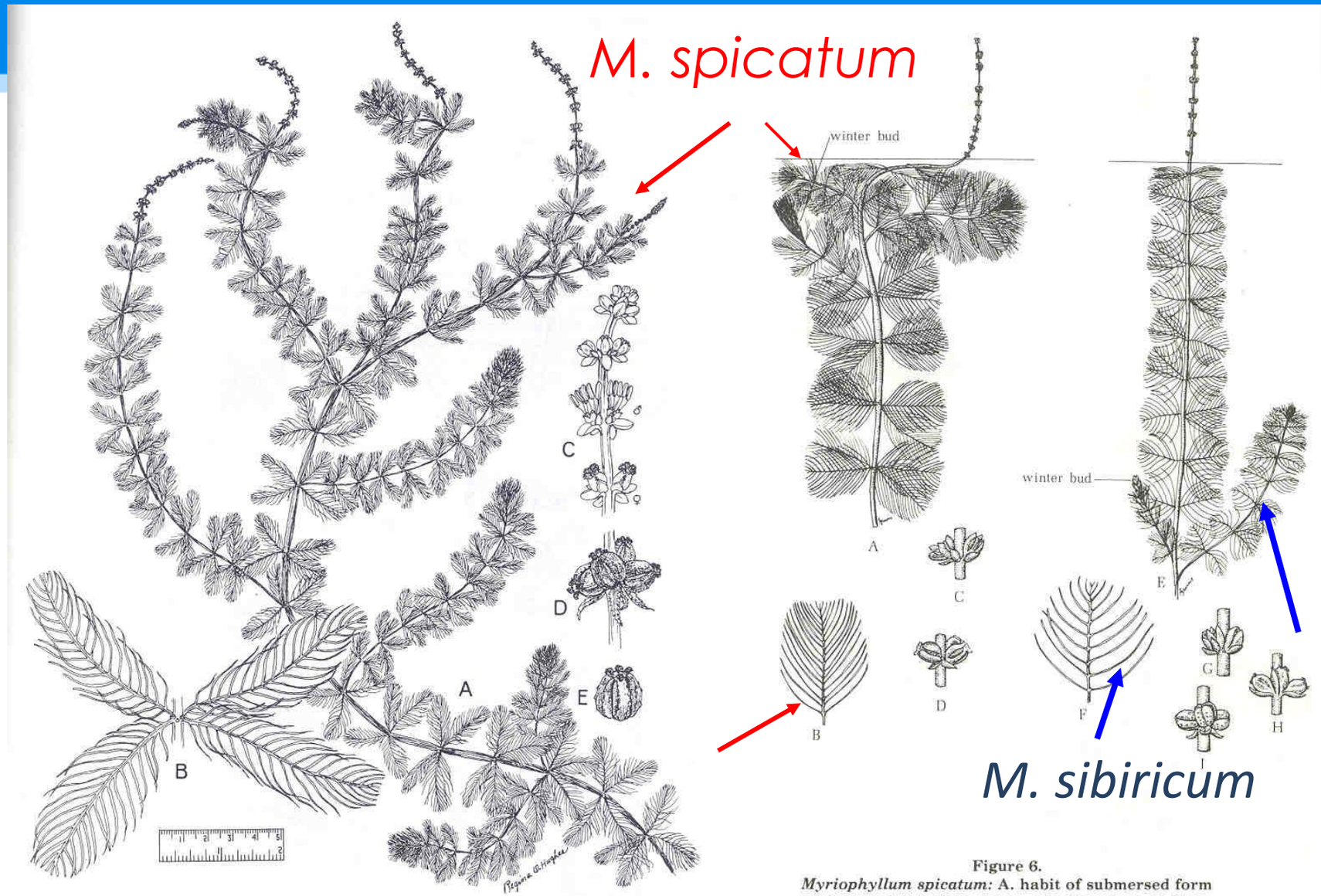


Fig. 200. **Myriophyllum spicatum:** A, habit; B, whorl of leaves; C, part of flower spike, with pistillate flowers below, staminate above; D, immature fruits; E, mature fruit. (From Reed, *Selected Weeds of the United States* (1970) Fig. 136)

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Figure 6.
Myriophyllum spicatum: **A. habit of submersed form with emergent inflorescence, × ½. B. leaf, × 1. C. flowers, × 2. D. fruits, × 2.**
Myriophyllum exalbescens: **E. habit of submersed form with emergent inflorescence, × ½. F. leaf, × 1. G. flowers, × 2. H. immature fruit, × 2. I. mature fruit, × 2.**

Source: S. Knight, WDNR

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
- **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 6 inches

Myriophyllum heterophyllum

Variable-leaf Water Milfoil Control Options:

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

Submersed/Emergent Plant: Parrot Feather

Parrot Feather Control Options:
- Herbicides (higher dose)
- Hand Pulling
- Benthic Barriers

Myriophyllum aquaticum

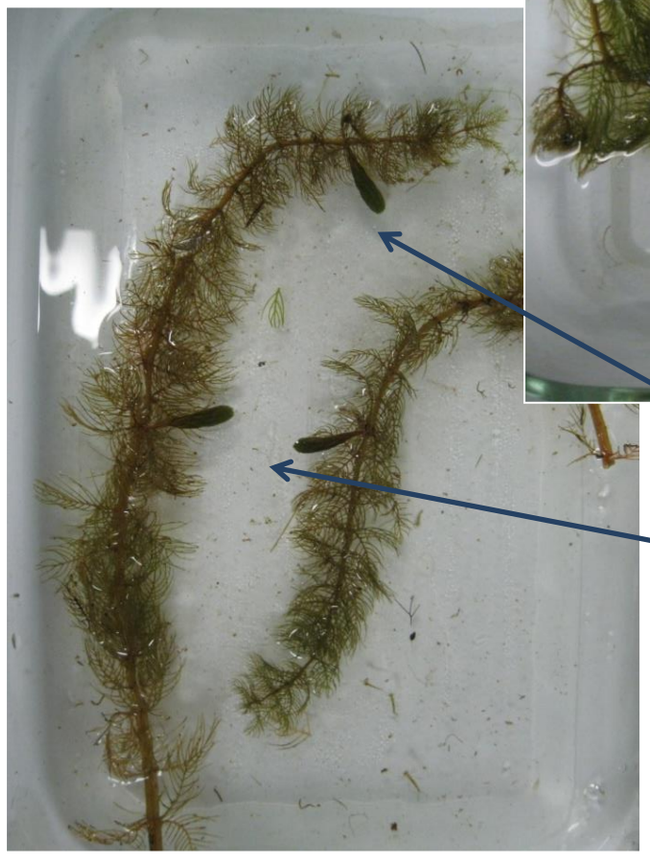
- Native to South America
- Can survive stranded on the shore
- Can survive in salt-intruded waters
- Reproduces via roots and fragmentation
- **Characteristics:**
- **Submersed Leaves**
  - Limp, often degraded
  - 4-6 leaves in whorls
  - Finely divided, flat midrib
- **Emergent leaves**
  - Up to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

Parrot Feather Look Alikes:
- Other milfoils
- Coontail
- Water Marigold

Submersed Plants: Whorled Water Milfoil

Whorled Water Milfoil
Myriophyllum verticillatum

- **Distinguishing Characteristics:**
- Submersed Leaves
  - Whorls (4-5)
  - **Spaced up to 1 cm apart**
  - 5-14 leaflets per whorl
  - Most leaves lack stalk
- Emergent Leaves (bracts)
  - Double-sided comb
  - Tiny flowers and fruit
    - < bract length
- **Produces club-shaped winter buds**
  - In submersed stems
  - Stiff modified leaves



Club-shaped winter buds

Submersed Plants: Alternate Flower Water Milfoil

Alternate Flower Water Milfoil
Myriophyllum alterniflrum

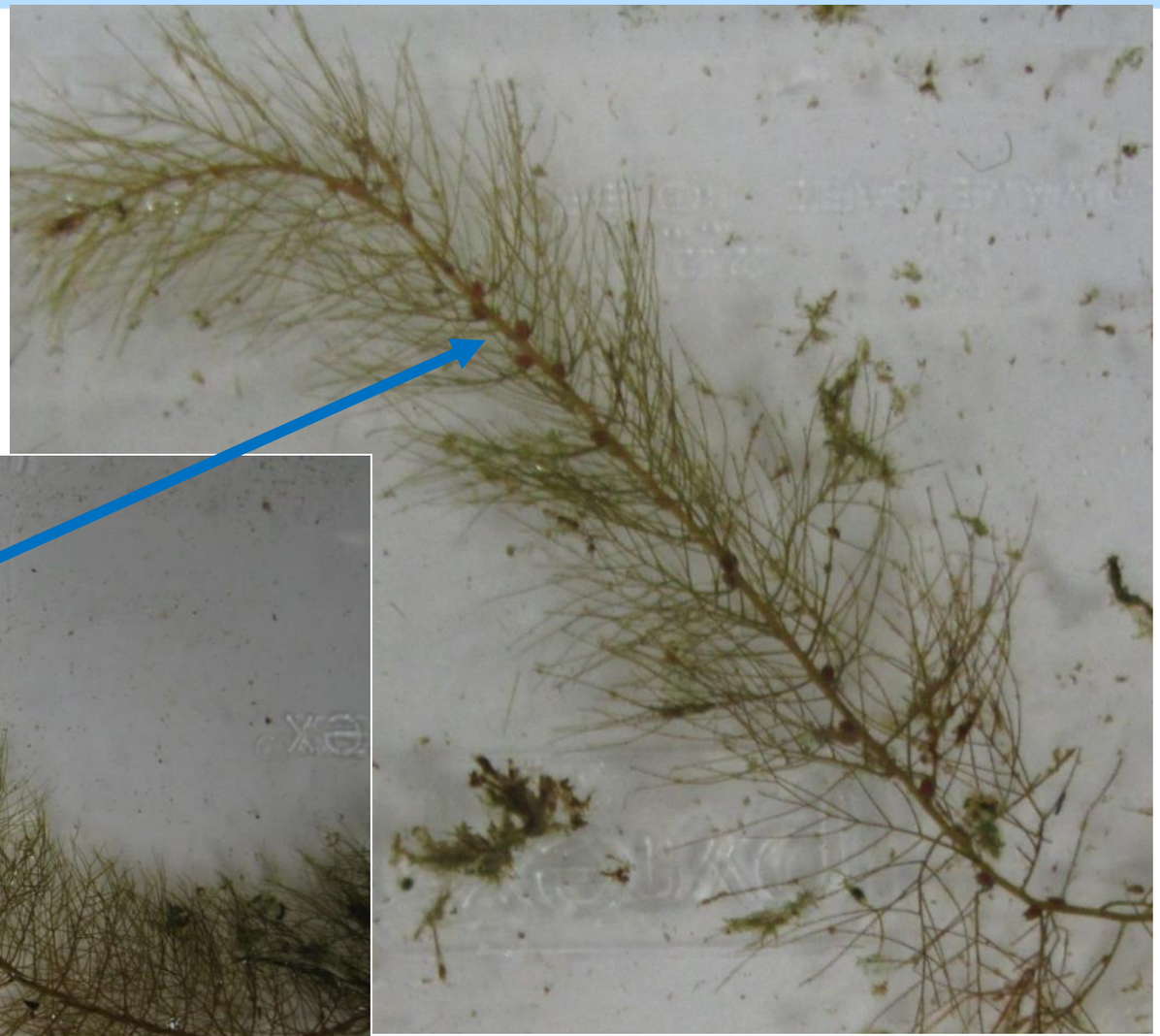
- Not Common
- **Distinguishing Characteristics:**
- Delicate Submersed Leaves
  - Less than 1 cm long; cupped up
  - Whorls (3-5)
  - 3-7 leaflets per whorl
  - Often heavily branched
- Emergent Leaves (bracts)
  - Toothed
  - **Tiny flowers in alternate pattern**
  - In axils of bracts
- Produces winter buds

Submersed Plants: Low Water Milfoil

Low Water Milfoil

Myriophyllum humile

- Prefers low pH, soft water
- **Distinguishing Characteristics:**
- **Leaves are <u>opposite</u>**, delicate
- 5-12 leaflets
- Spaced >5 mm apart
- **Fruit positioned in leaf axils**
  - **Four parts, <u>smooth</u>**



Submersed Plants: Farwell's Water Milfoil

Farwell's Water Milfoil

Myriophyllum farwelli

- Less Common than *M. humile* in NE
- **Distinguishing Characteristics:**
- **Leaves are radial or in whorls**
  - Delicate, thread-like
  - 5-12 leaflets
  - Spaced >5 mm apart
- **Fruit positioned in leaf axils**
  - **Four parts, <u>has ridges</u>**

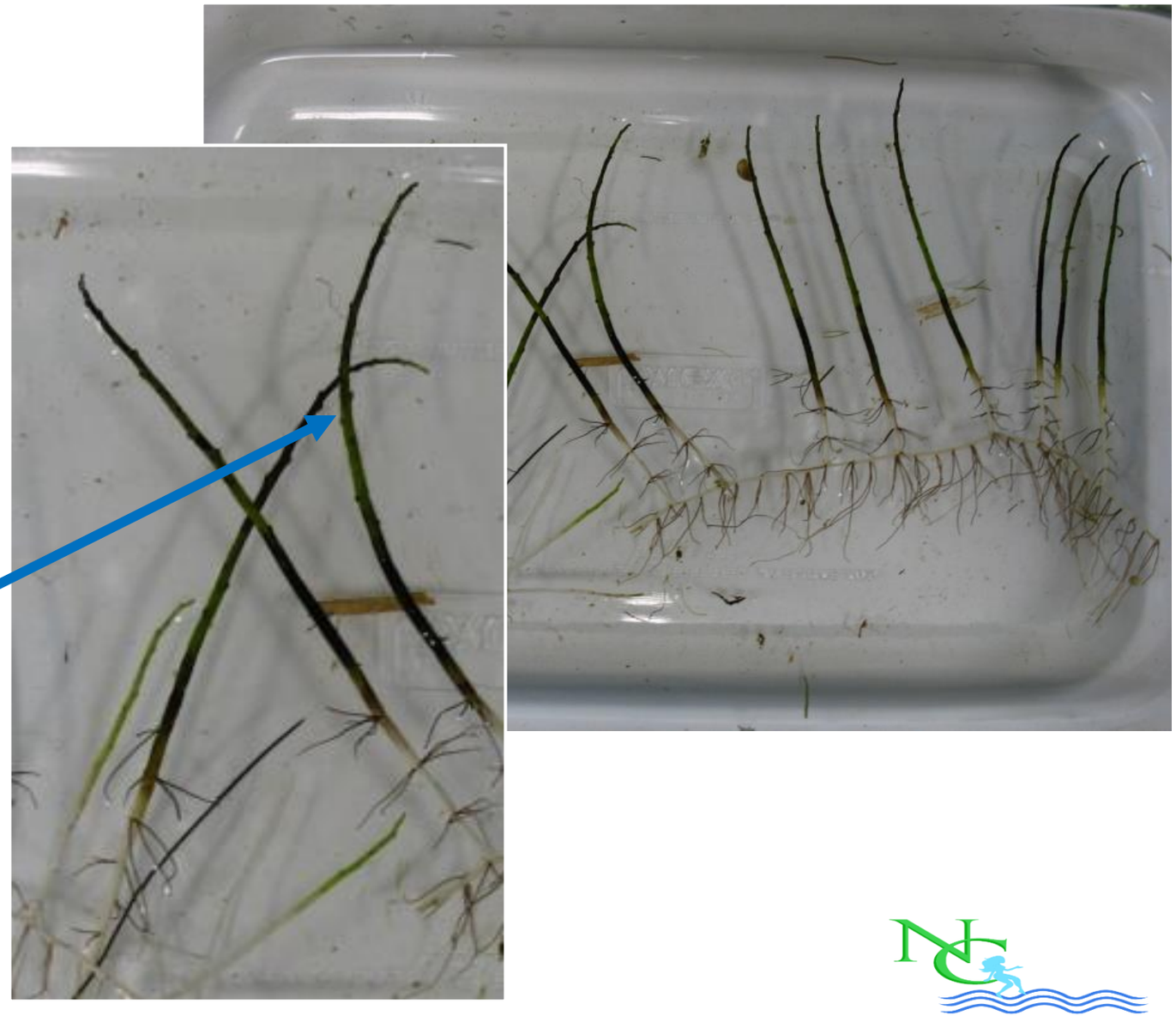
Photo: Donald Cameron

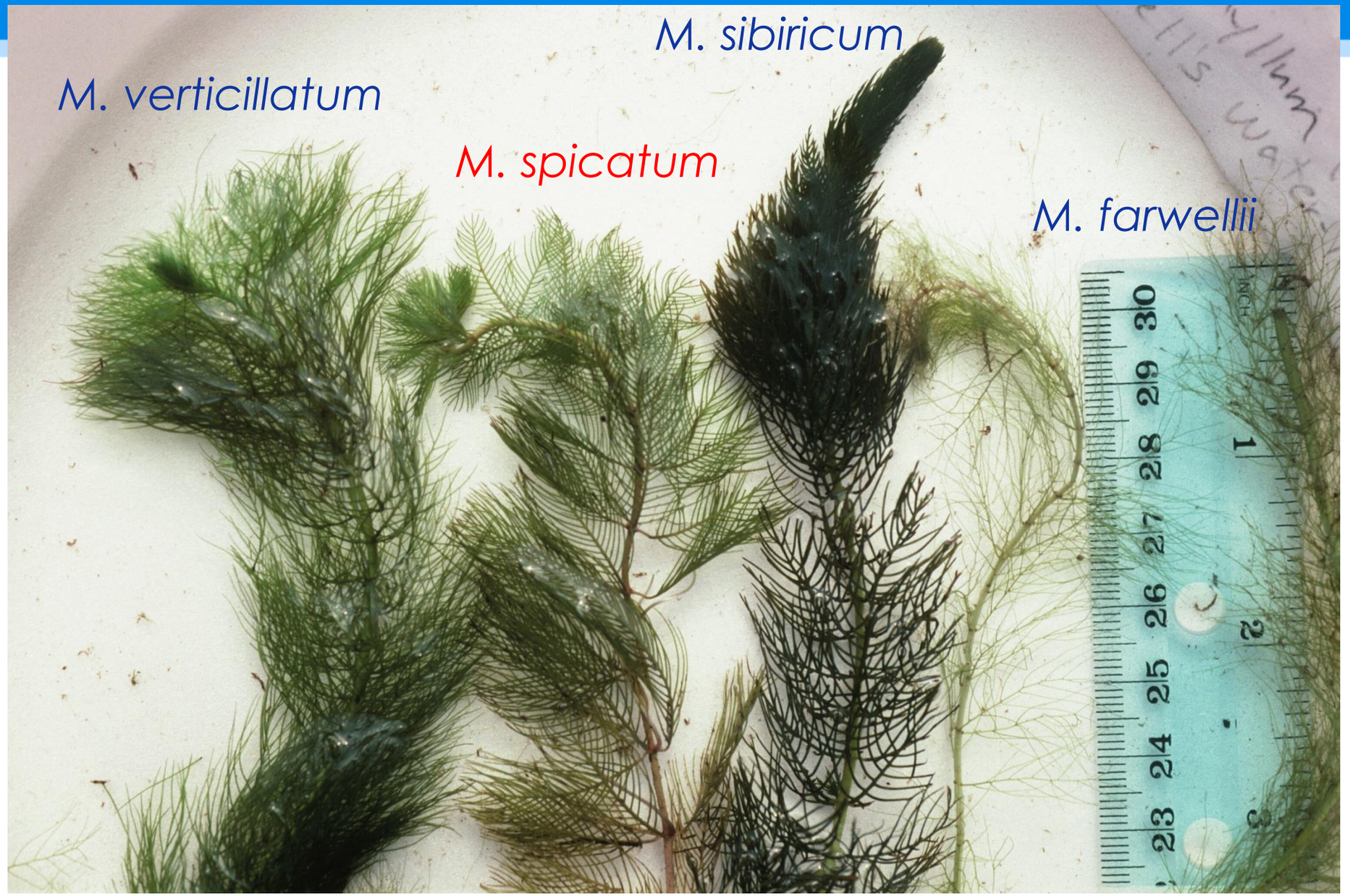
Submersed Plants: Dwarf Water Milfoil

Dwarf Water Milfoil

Myriophyllum tenellum

- Very different than other milfoils
- Prefers sandy substrate
- Creates dense tufts
- **Distinguishing Characteristics:**
- Slender, unbranched stems
  - 2-15 cm tall
  - Leaves reduced to scales or bumps
- If tips emerge (drought?)
  - Can produce tiny flowers





Source: S. Knight, WDNR

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
- **Characteristics:**
  - Opposite Submersed Leaves
  - "Fan Shaped"
  - Tiny, alternate floating leaves
  - Flowers: Tiny, white

Cabomba caroliniana

Fanwort Control Options:
- Herbicides
- Grass Carp
- Hand Pulling
- Benthic Barriers

Aggressive Fanwort infestation in NJ

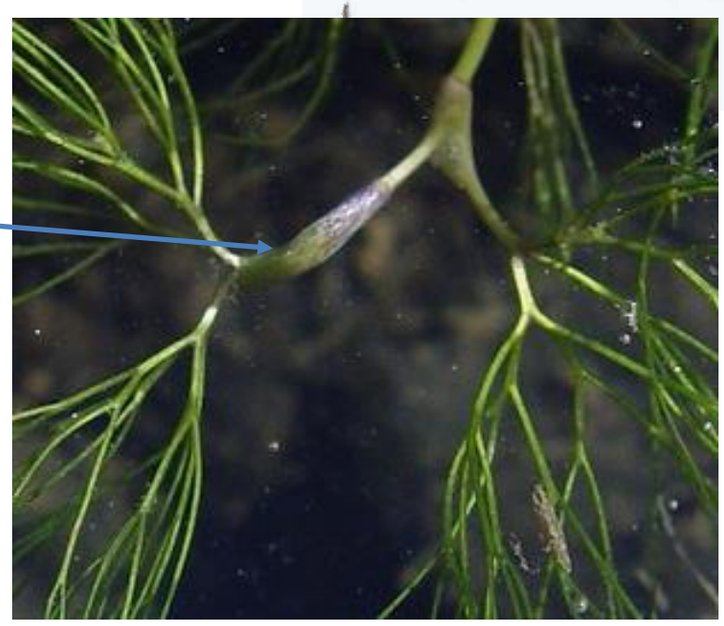
Submersed Plants: Water Crowfoot

Water Crowfoot
Ranunculus sp.

- **Distinguishing Characteristics:**
- Long, branching stems; pale
- Small (1-2 cm) branch-divided leaves
  - **Alternate arrangement on stem**
  - **Clasping sheath at base of stem**
- Produce small buttercup flowers
  - White or yellow, depending on sp.

Source: D. Cameron

Source: S Knight, WDNR



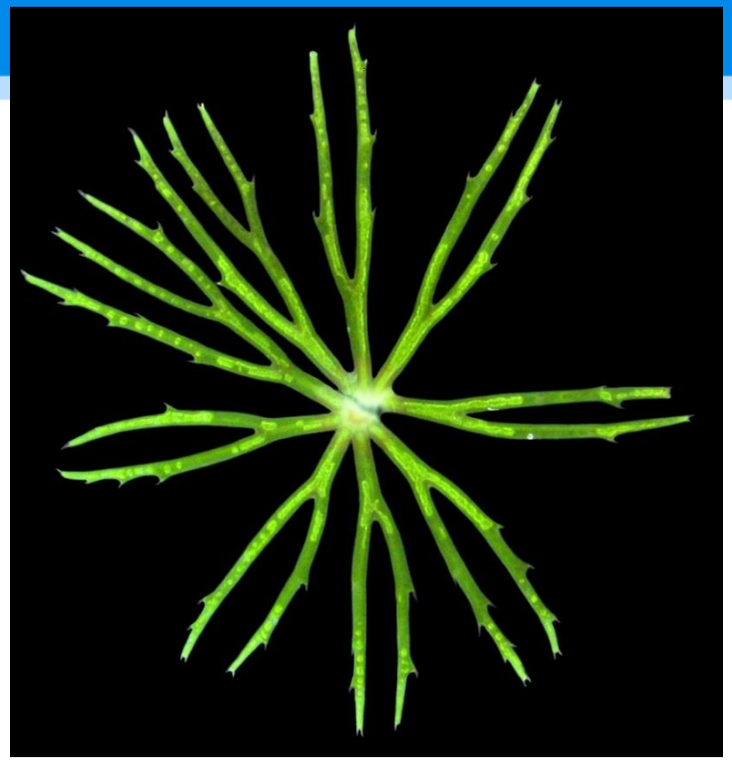
Submersed Plants: Hornworts

Coontail
Ceratophyllum demersum

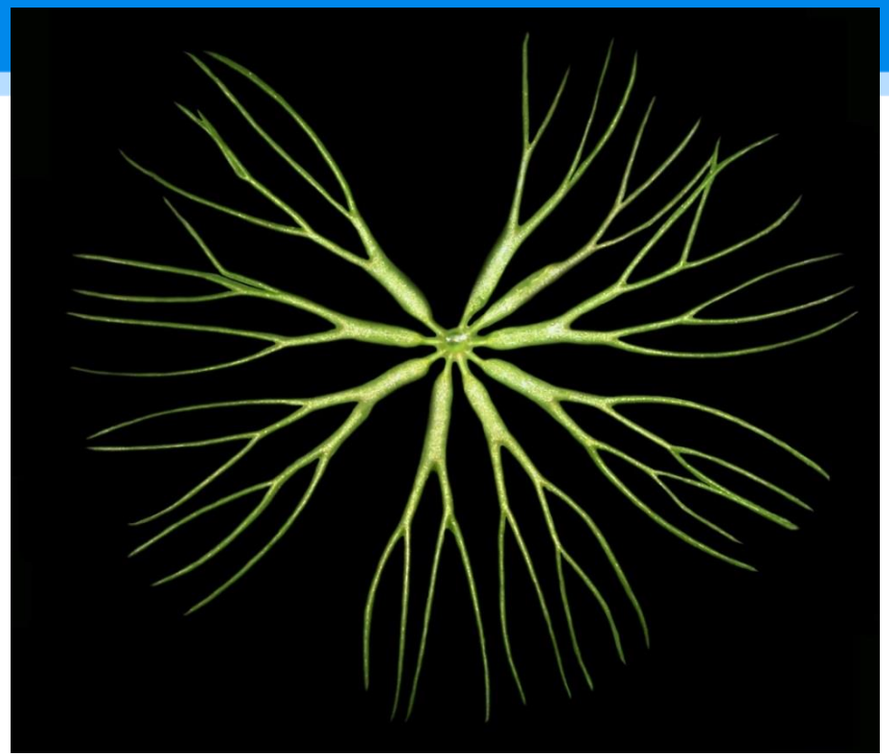
- More common
- No true roots
- **Leaves forked 1-2 times, stiff**
- **Fruit has 3 spines**
- Usually reproduces via fragmentation
- Often reaches nuisance densities

Spiny Hornwort
Ceratophyllum echinatum

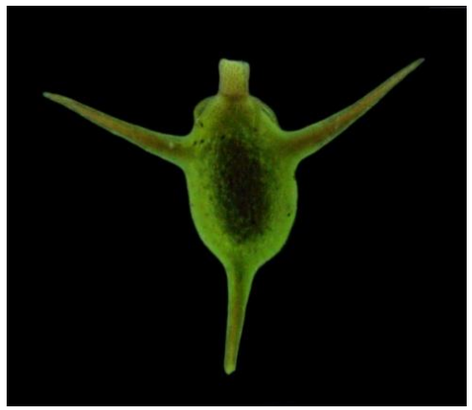
- Prefers low pH, soft water
- No true roots
- Leaves **forked 3-4** times, limp
- **Fruit has numerous spines** (~9)

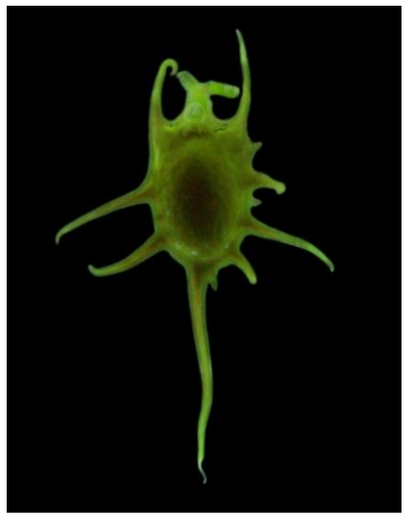


C. demersum



C. echinatum



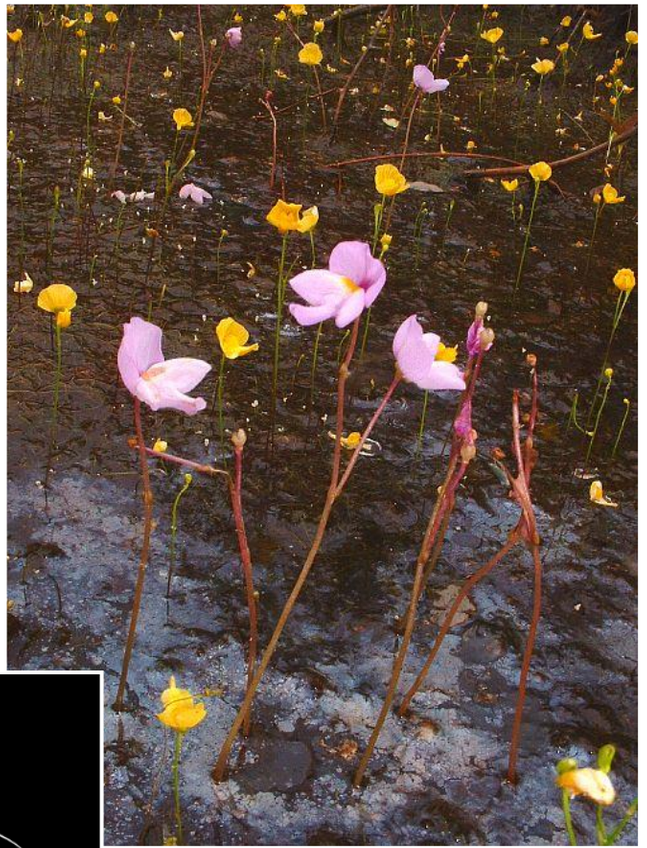


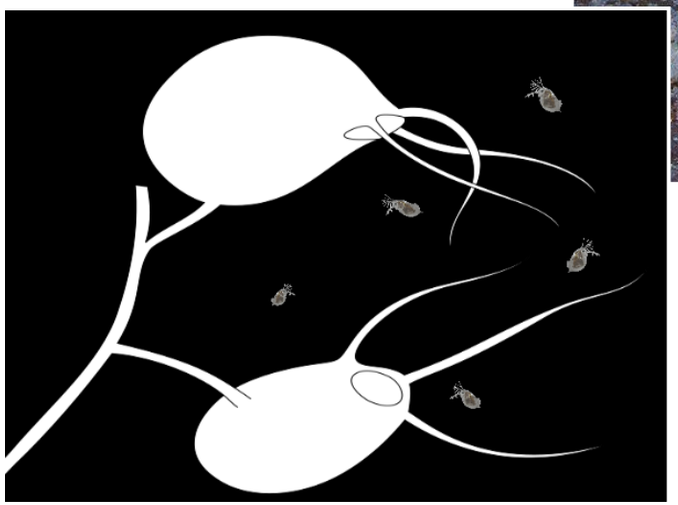
Source: S Knight, WDNR

Submersed Plants: Bladderworts

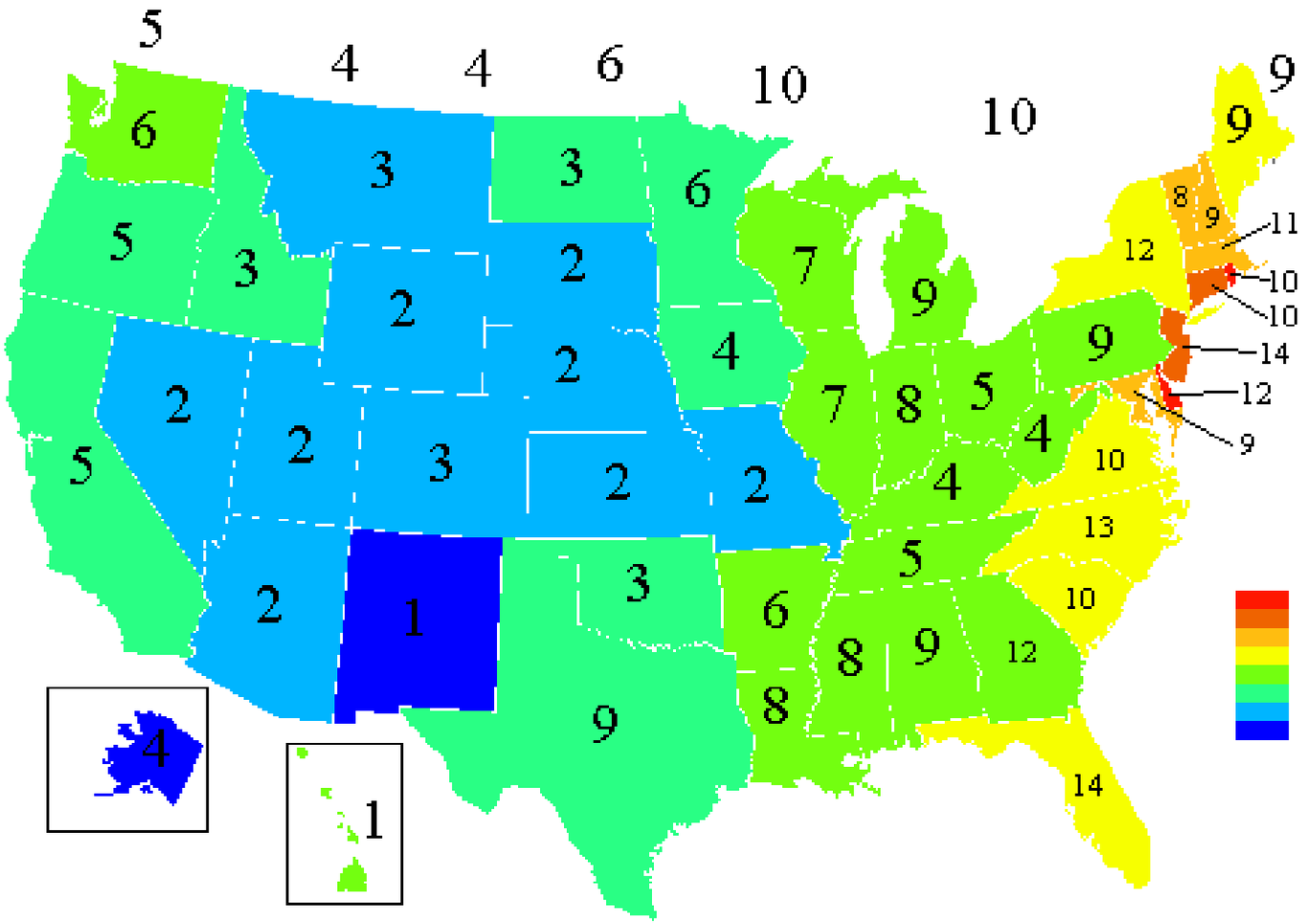
Utricularia spp.

- Numerous species present in Northeast
- Prefer low pH water
- Carnivorous plants
  - Bladders: trigger hairs used to trap prey
  - Source of nutrients
  - Prey: protozoa to mosquito larvae
- Root-like structures; largely free floating
  - Challenge to control due to movement
- Over winter via stem fragments and buds
- Produce snap-dragon-like flowers





Bladderwort Index in the USA



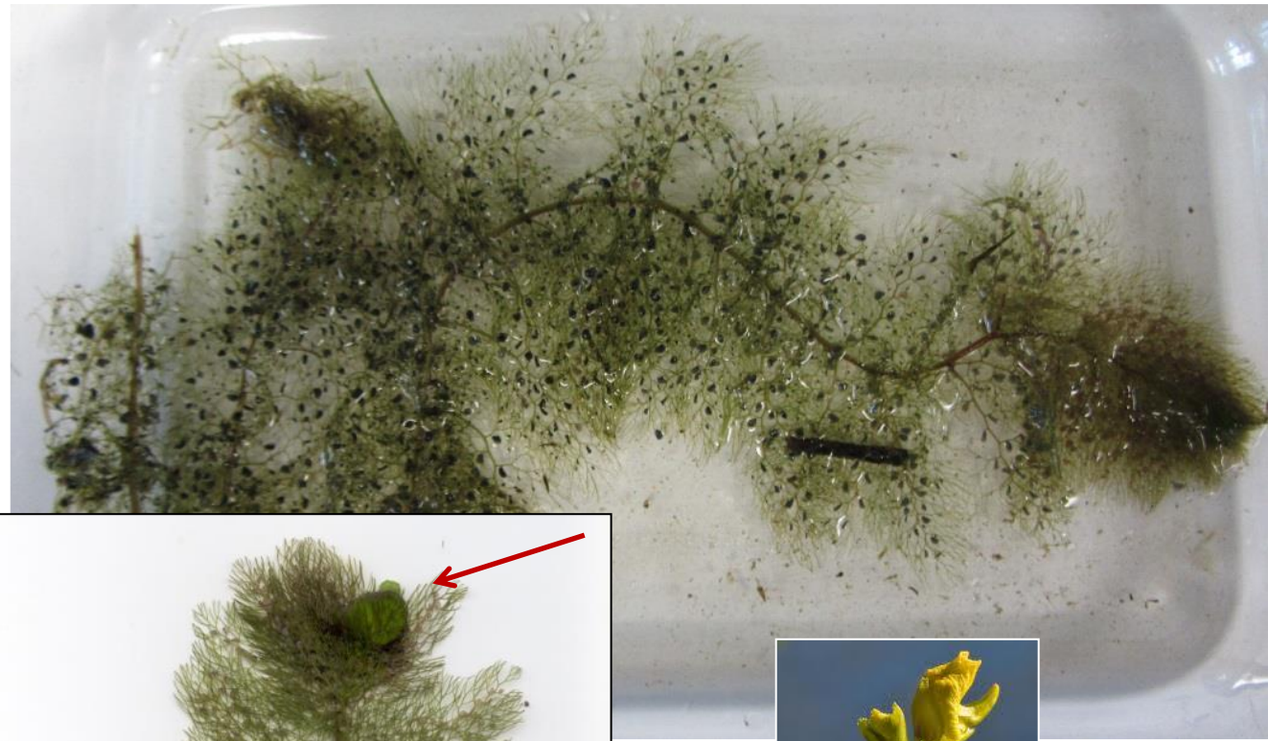
This index is based on Area of the State and Bladderwort Diversity

Source: www.sarracenia.com

Bladderwort: Common Bladderwort

Common bladderwort
U. macrorhiza (=*U. vulgaris*)

- Large size; stem length to **3 meters**
- Can become a nuisance
- **Distinguishing Characteristics:**
- Leaves alternate
  - Finely divided
  - Fork 3-7 times
  - But may appear opposite or whorls
- Bladders scattered on branches
  - **Occur on edges of divided leaves**
  - Bladders often black when mature
  - Snap shut when removed from water
- Produces yellow flowers
- Produces large winter buds



Bladderwort: Purple Bladderworts

Large Purple Bladderwort
U. purpurea

- Medium size; stem length to 1 m
- **Distinguishing Characteristics:**
- **Leaves in strict whorls**
- Bladders located **on tips only**
  - Transparent or pale green
- Distinct purple flowers

Small Purple Bladderwort
U. resupinata

- Fine stems under substrate
- Narrow grass-like unbranched blades
  - Up to 3 cm tall
- **Bladders on subterranean stems**

Utricularia respinata

Photo: Donald Cameron

Photo: Susan Knight

Bladderworts: Inflated Bladderwort

Inflated Bladderwort

U. inflata

- Medium Size; Stems up to 1 m
- Alternate leaves
- But may appear opposite or whorled
- Leaves are fine and delicate
- Thread-like, divided
- Bladders attached along edge of leaves
- Transparent or pale green
- Produces yellow flowers
- **Supported by a swollen raft of whorled modified leaves**
    - **Swollen branches 30-80 mm long**
    - **Peduncle 10 to 30 cm long**

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Bladderworts: Floating Bladderwort

Floating Bladderwort

U. radiata

- Medium Size; Stems up to 1 m
- Alternate leaves
- But may appear opposite or whorled
- Leaves are fine and delicate
- Thread-like, divided
- Bladders attached along edge of leaves
- Transparent or pale green
- Produces yellow flowers
- **Supported by a swollen raft of whorled modified leaves**
    - **Swollen branches 10-40 mm long**
    - **Peduncle 3 to 10 cm long**

Bladderworts: Flat-leaf Bladderwort

Flat-leaf Bladderwort

U. intermedia

- AKA Northern Bladderwort
- Small Size; stems to 0.5 m long
- **Distinguishing Characteristics:**
- Leaves finely divided, **flattened, serrated**
  - Bottlebrush appearance
  - Alternate arrangement
    - But tight radiating pattern
- **Bladders occur on <u>separate leafless</u> stems**
- Produces yellow flowers

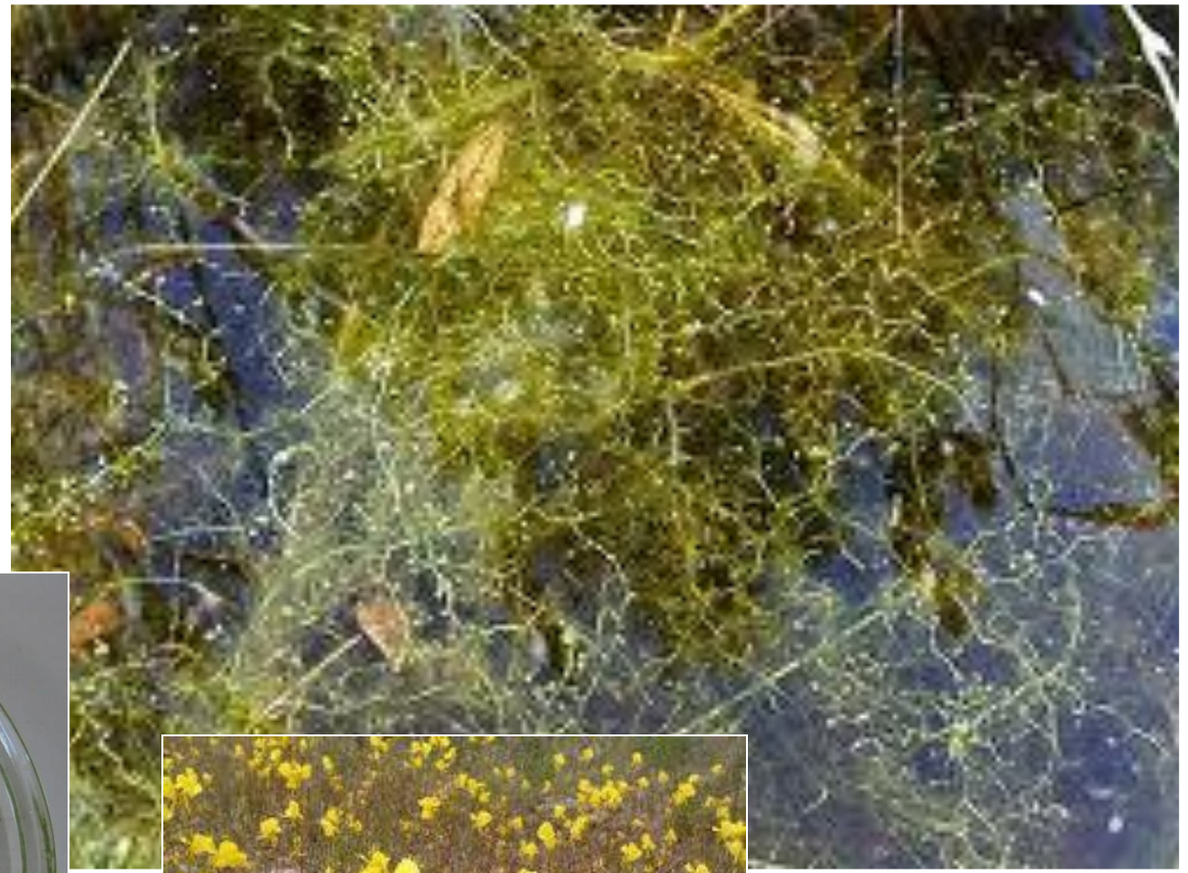
Photo: Donald Cameron

Bladderworts: Creeping Bladderwort

Creeping Bladderwort

U. gibba

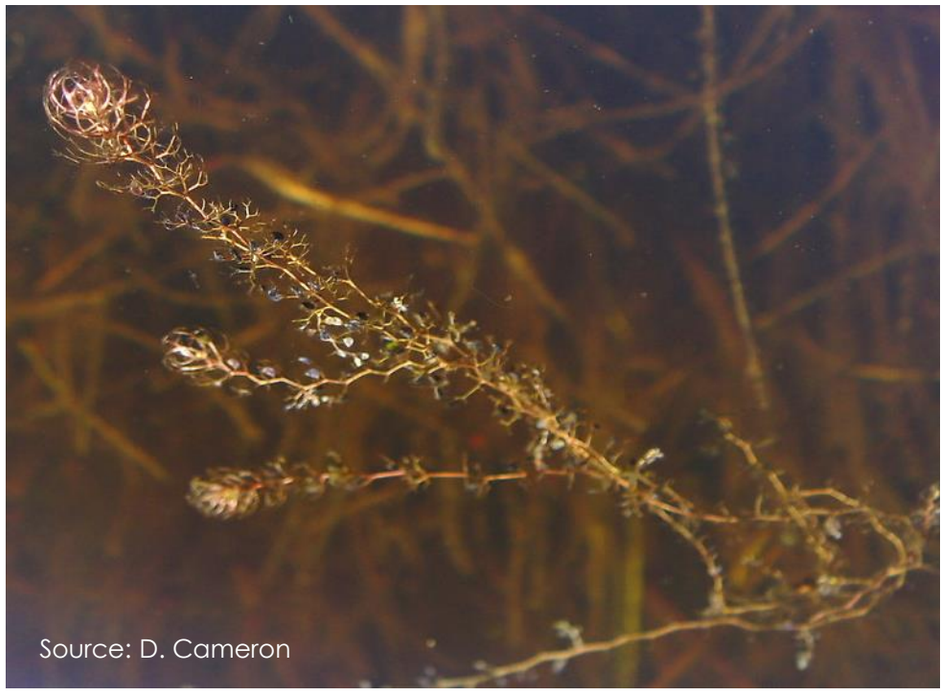
- Small size; stems up to 0.2 m long
- Tangled mats at surface
- **Distinguishing Characteristics:**
- Delicate structures
- Side Branches fork 1-2 times only
- Very few tiny bladders
- Produces yellow flowers
    - Lower lip has a spout



Bladderworts: Delicate Bladderworts

Twin-stemmed Bladderwort
U. geminiscapa

- Delicate structures
- Small size; > 0.5 m
- **Non-opening flowers**
  - **Cleistogamous**
- Spines only on leaf tips



Small Bladderwort
U. minor

- Delicate structures
- Small size; > 0.5 meter
- **Flattened leaves with midrib**
- Spines only on leaf tips
- Bladders scattered on upper branch

Submersed Plants: Naiads

Najas spp.

- Named after the immortal water nymphs of Greek literature
- Typically low growing (> 1 meter)
  - But can be a nuisance in shallow water
- True annuals (seed producer)
- Late season grower
- **Identification Tips:**
  - **Examine Seeds**
  - **Examine leaf base and lobes**
- 4 Species in Northeast
  - 2 Native
  - 1 Invasive
  - 1 "Maybe" Invasive"

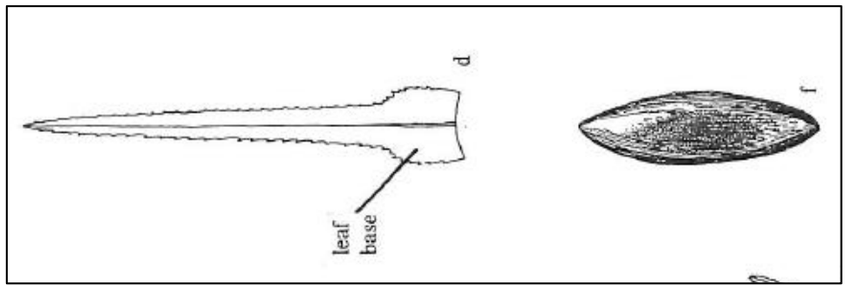
Naiads: Slender Naiad

Slender Naiad

Najas flexilis

- **Distinguishing Characteristics:**
- Leaves tapering to slender tip
  - 2-6 mm long
  - Leaf base: tapered lobes
  - Leaves have 20-60 spines
    - Need hand lens
- Seeds shiny
- Most similar to:
  N. guadalupensis
  N. gracillima

Other Common Names: nodding waternymph, bushy naiad, busy pondweed or wavy waternymph



Naiads: Northern Naiad

Northern Naiad

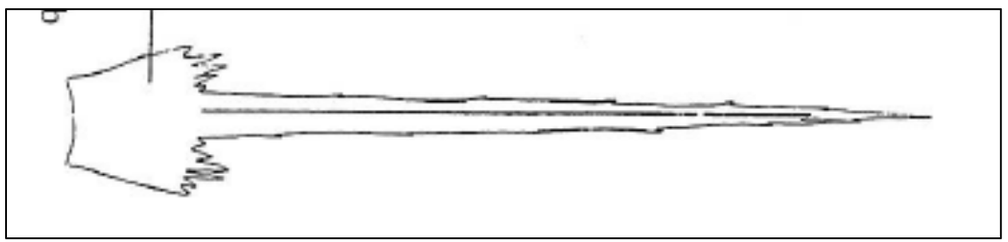
Najas gracillima

- **Distinguishing Characteristics:**
- Leaves fine
  - 6-28 mm long
  - Leaf base: square with jagged lobes
  - Leaves have 6-20 spines
    - Minute, even with hand lens
- Seeds covered with aerolae
- Most similar to:

  N. flexilis

  N. minor

Other Common Names: thread naiad, slender waternymph



Naiads: Southern Naiad

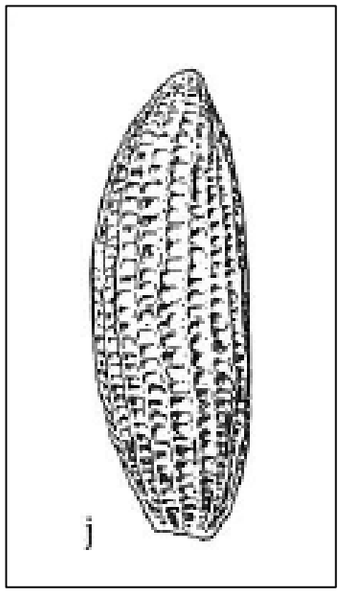
Southern Naiad

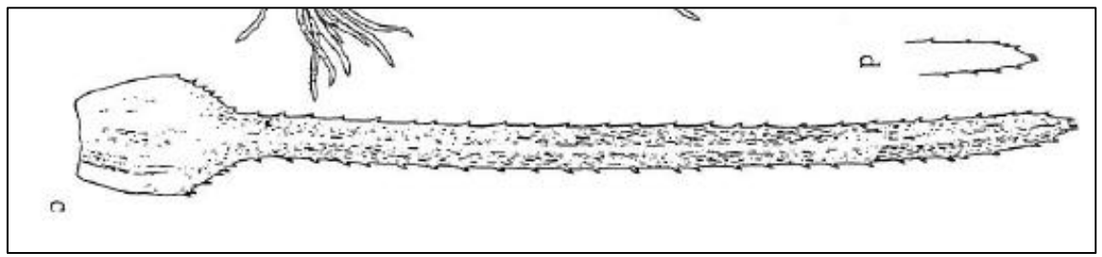
Najas guadalupensis

- Non-native?
- **Distinguishing Characteristics:**
- Leaves fine
  - 2-33 mm long
  - Leaf base: tapered lobes
  - Leaves have 20-60 spines
    - Need a hand lens
- Seeds dull, even rows
- Can tolerate some salinity
- Most similar to:

  N. flexilis

Other Common Names: Guadalupe waternymph, bushy naiad





Naiads: Brittle Naiad

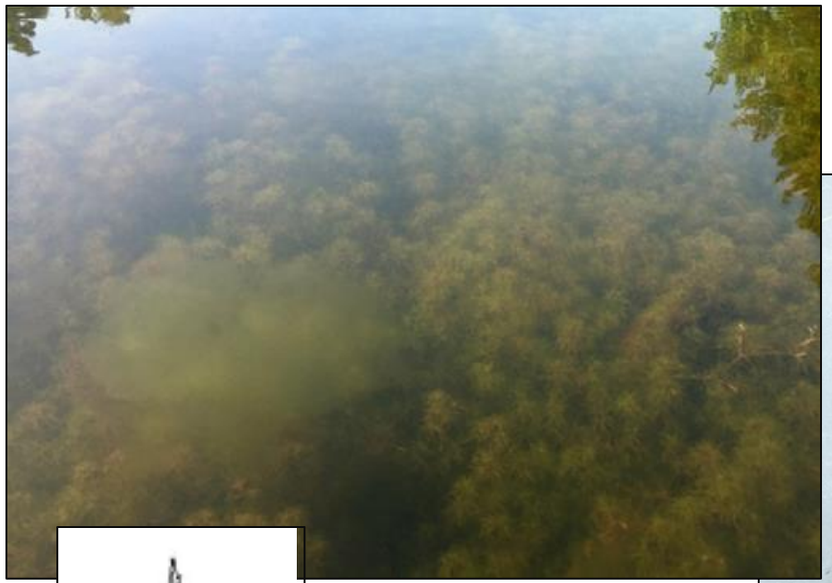
Brittle Naiad

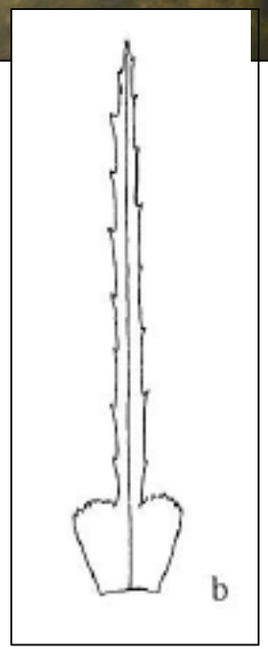
Najas minor

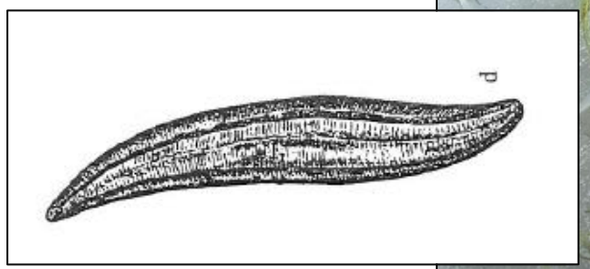
- **Distinguishing Characteristics:**
- Leaves stiff, recurved
  - Leaf base: fan-shaped toothed lobes
  - Leaves have 6-20 spines
    - Visible with naked eye
- Seeds curved both ends; striated
- Most similar to:

  N. gracillima

Other Common Names:
European naiad, spiny naiad







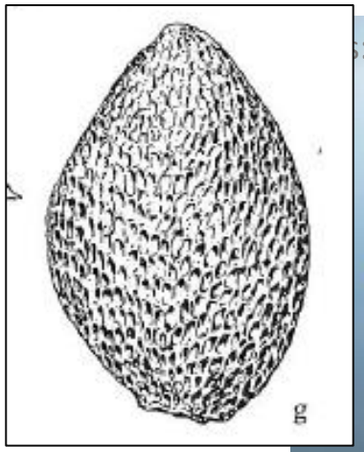
Naiads: Holly-leaf Naiad

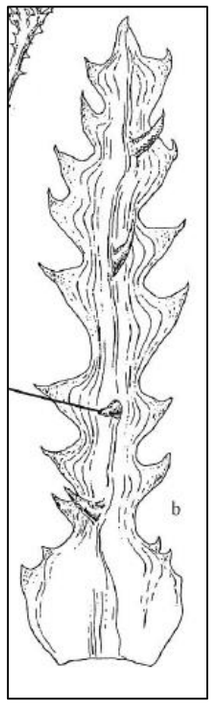
Holly-leaf Naiad

Najas marina

- Only found in Great Lakes region in Northeast
- Also established in AZ, CA, FL, ND, NV, SD, TX, UT
- Fresh-brackish water
- **Distinguishing Characteristics:**
- Leaves wide, flat and serrate
  - Leaf midribs (middle vein) hairy
  - Leaf base: rounded lobes
  - 8-13 triangular "teeth"
    - Visible with naked eye
- Seeds plump, randomly pitted
- Most similar to:

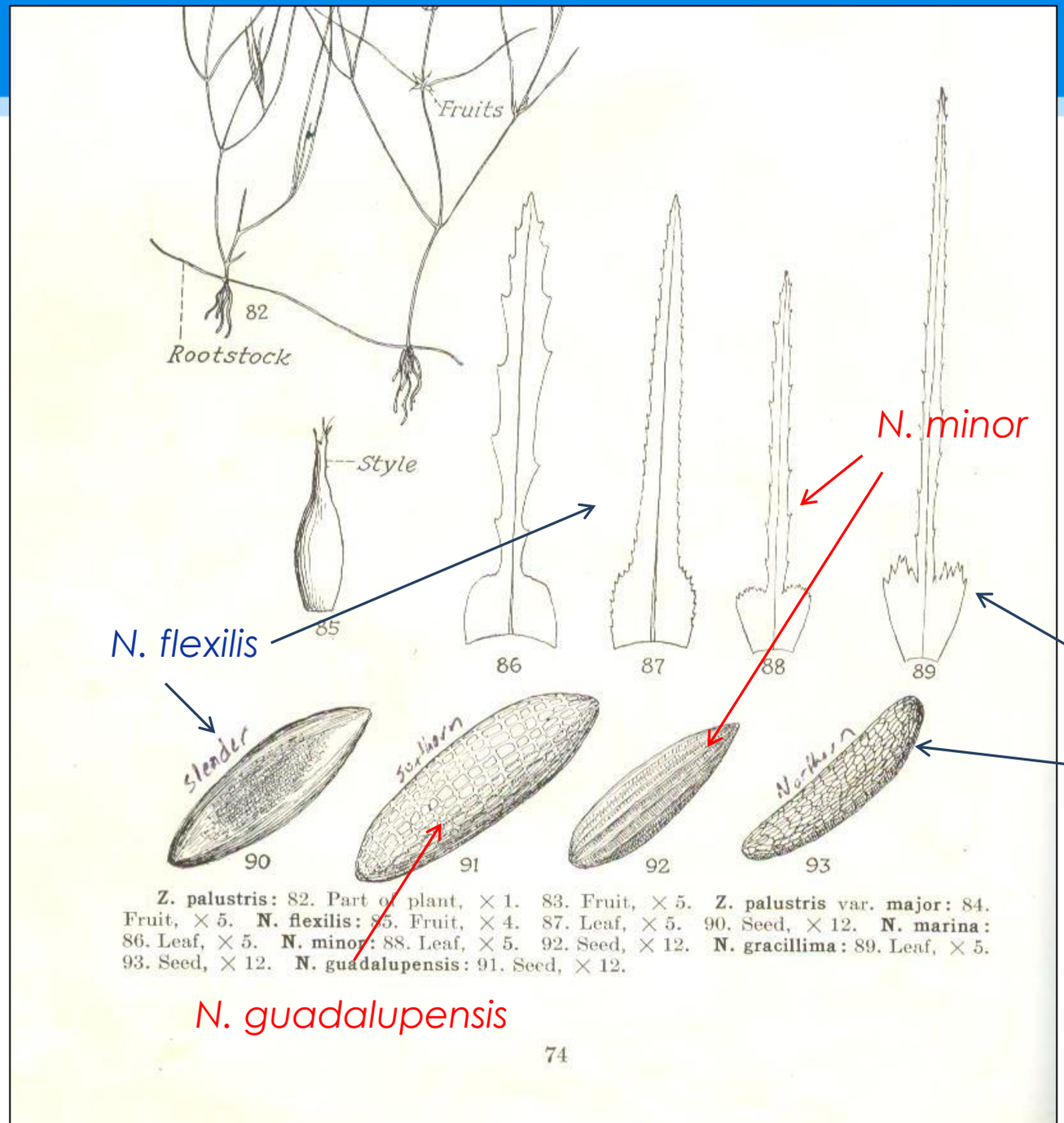
  None





Other Common Names: spiny-leaf naiad, saw-tooth naiad, marine naiad

Naiad Comparisons



N. minor

N. flexilis

N. gracillima

N. guadalupensis

THANK YOU!

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