



Aquatic Plant Identification

Erick Elgin and Jo Latimore

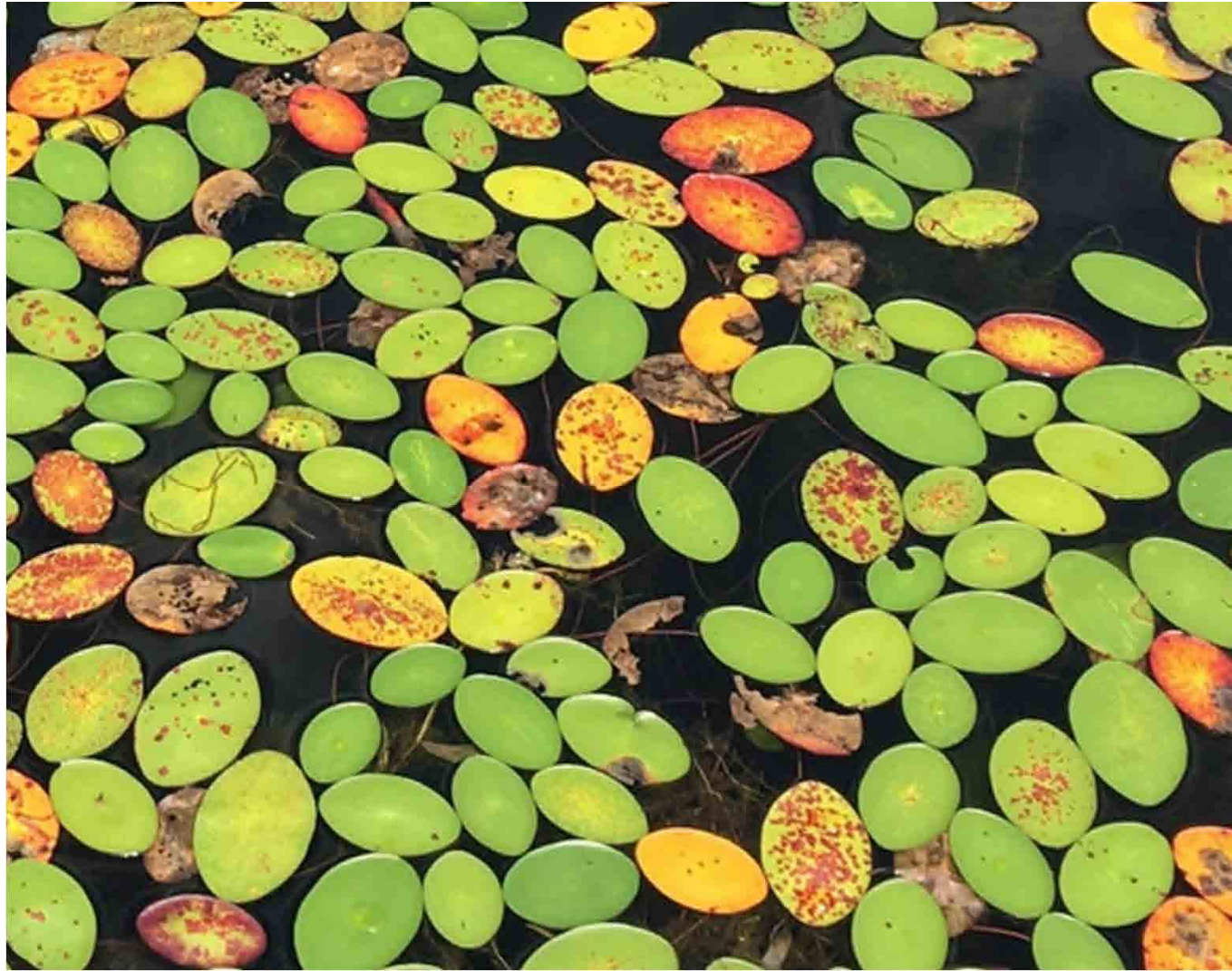
About Us

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- elgineri@msu.edu



Outline for Today

- 9:00 – 11:00
 - Introduction to Aquatic Plants
 - Plant Identification
- 11:30 – 12:30
 - Aquatic Plant Mapping protocol



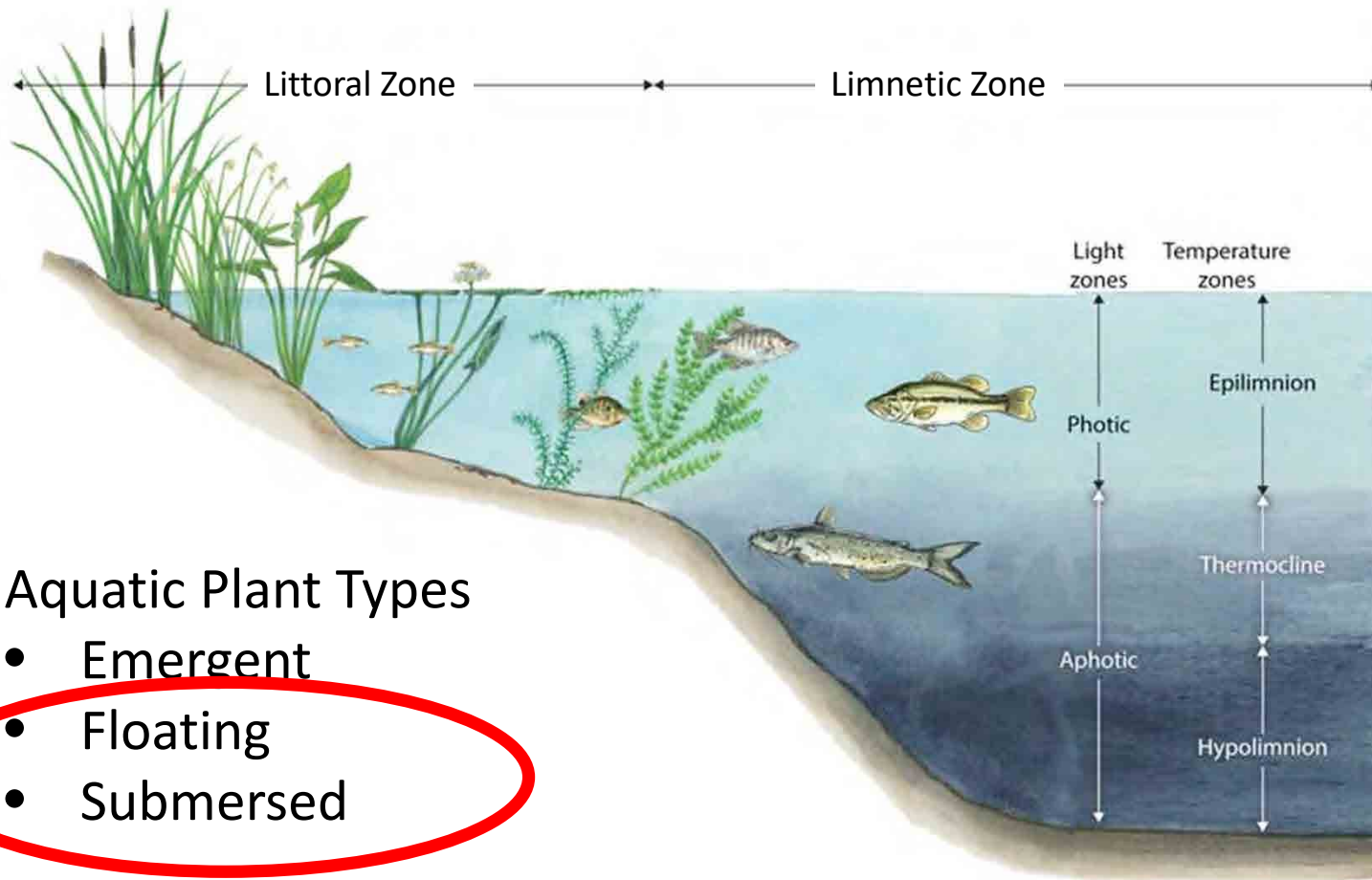


An Underwater Forest

High diversity
Improves water quality
Valuable fish and wildlife habitat

AQUATIC PLANT COMMUNITIES

A TRANSITION FROM LAND TO WATER

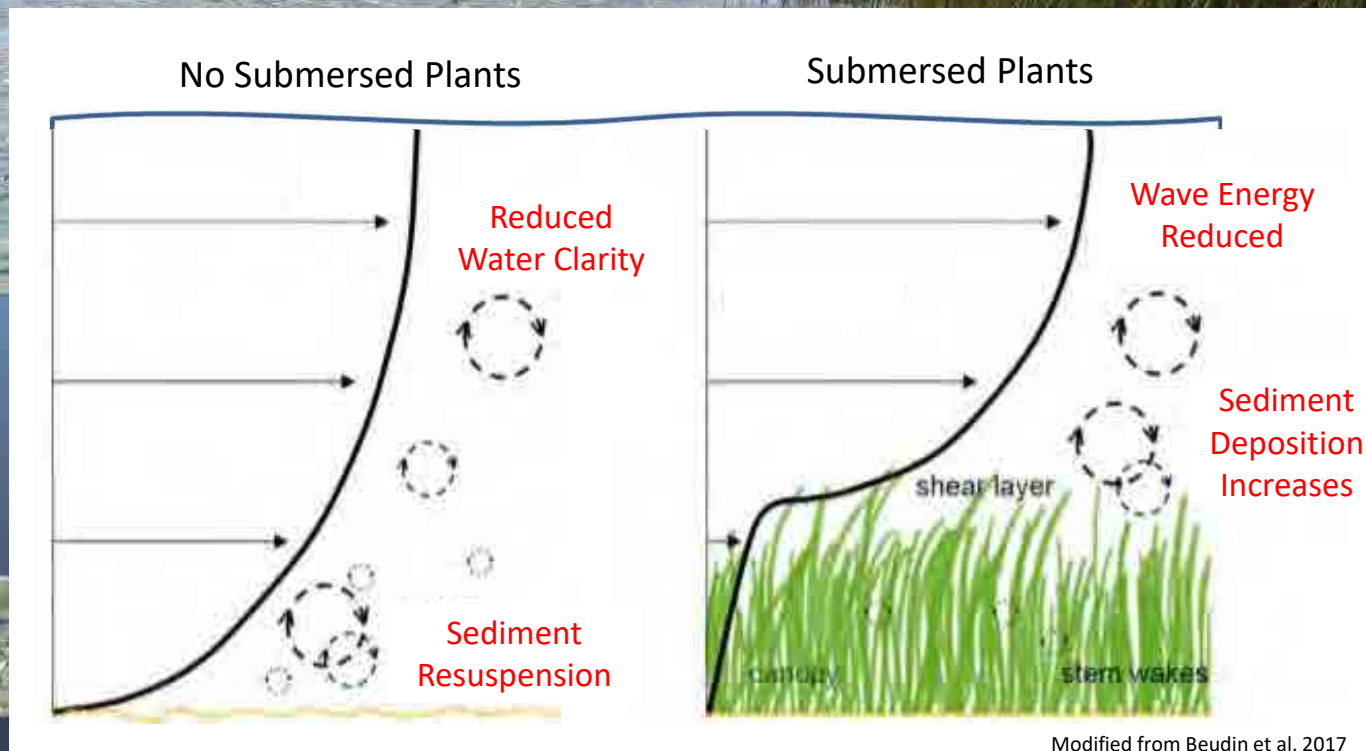


Aquatic Plant Types

- Emergent
- Floating
- Submersed

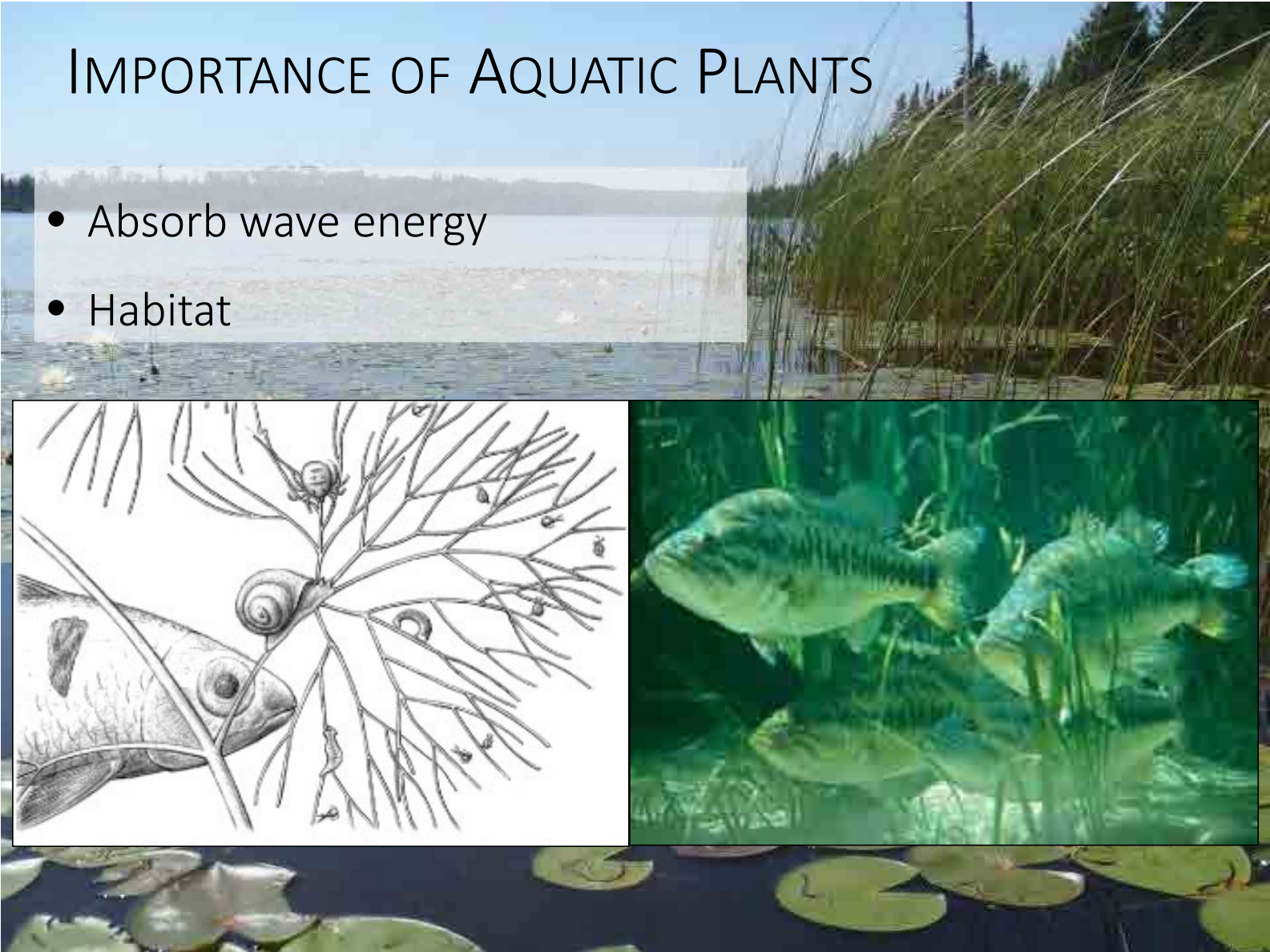
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy



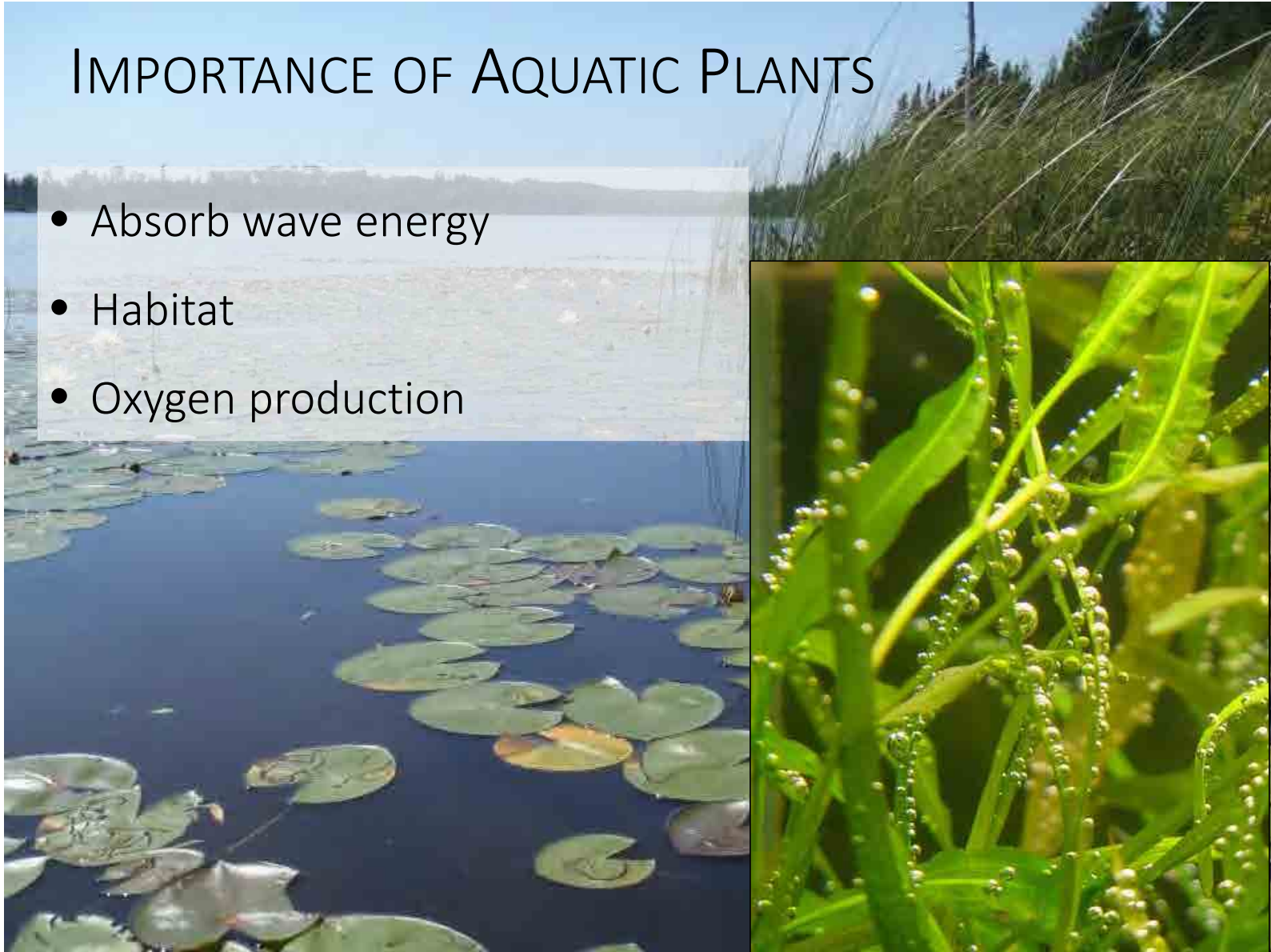
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat



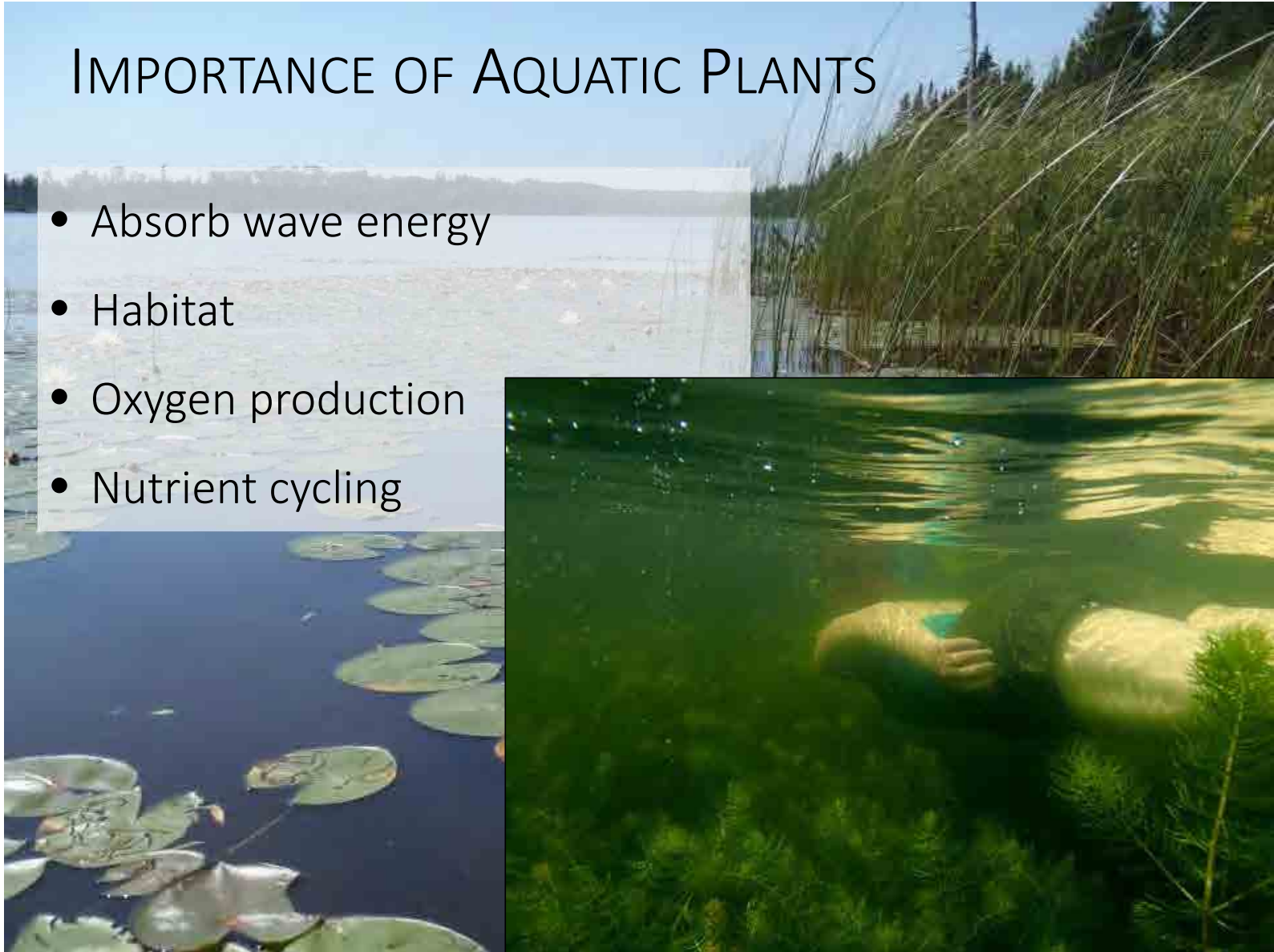
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat
- Oxygen production



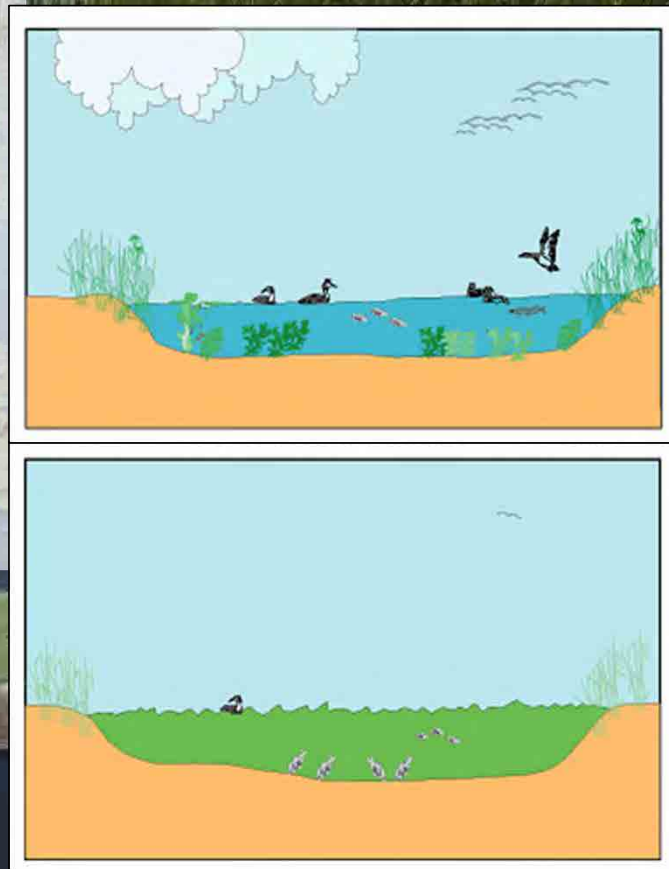
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat
- Oxygen production
- Nutrient cycling



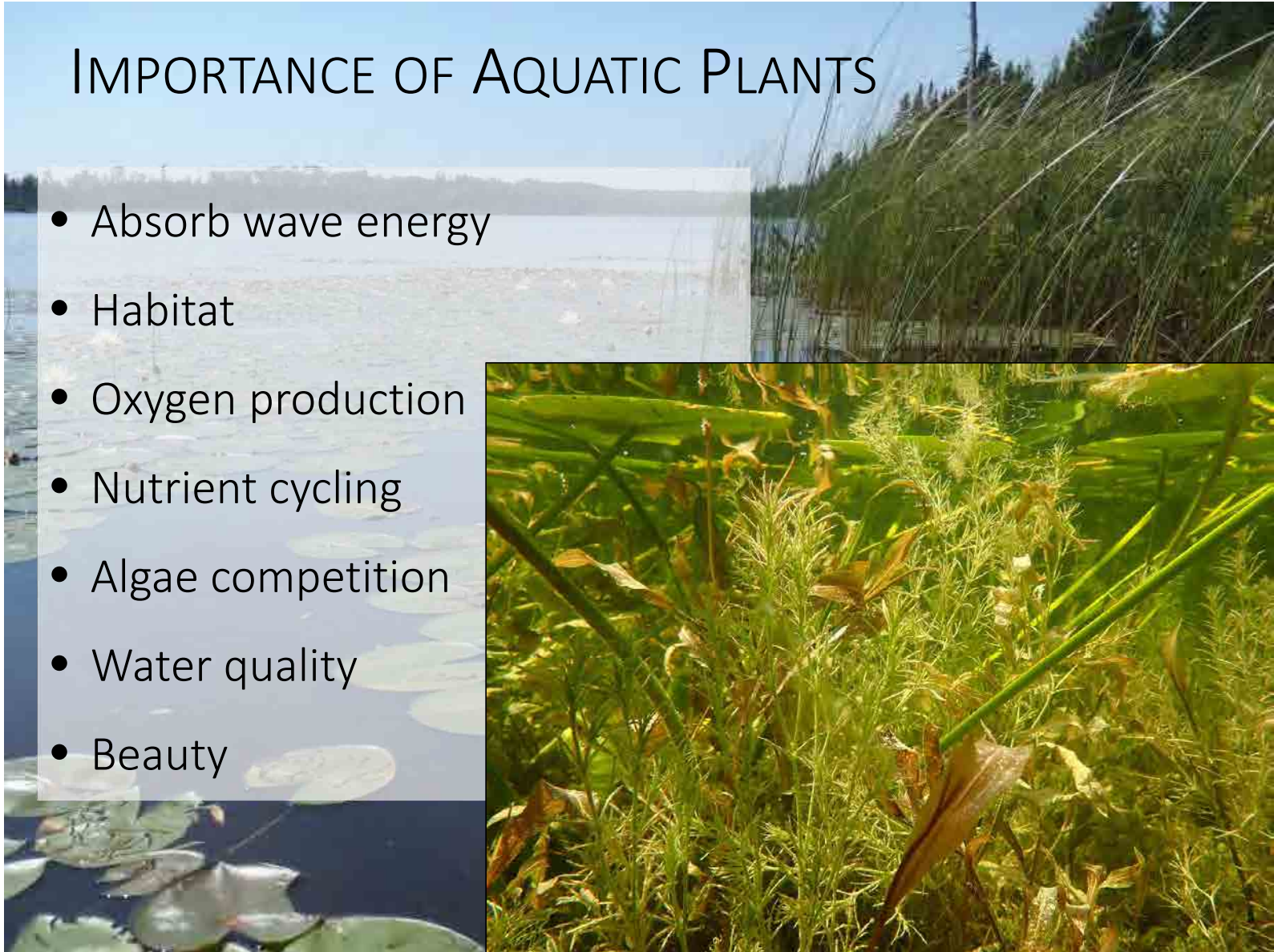
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat
- Oxygen production
- Nutrient cycling
- Algae competition
- Water quality



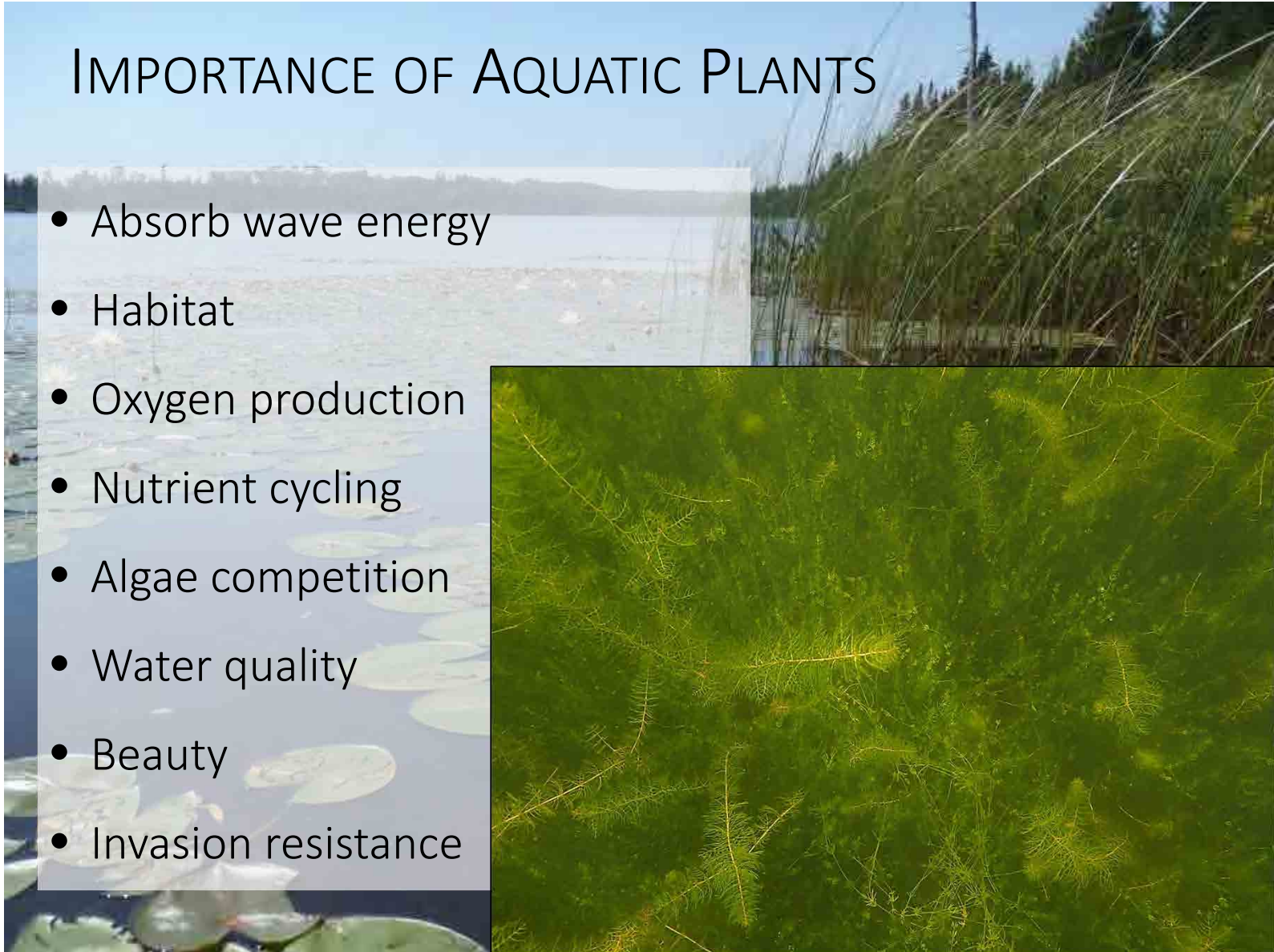
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat
- Oxygen production
- Nutrient cycling
- Algae competition
- Water quality
- Beauty



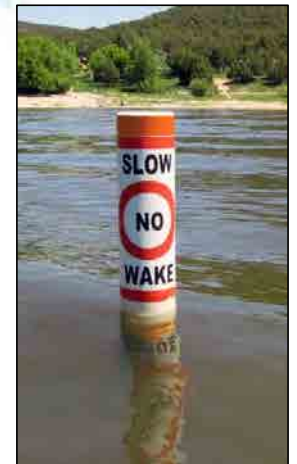
IMPORTANCE OF AQUATIC PLANTS

- Absorb wave energy
- Habitat
- Oxygen production
- Nutrient cycling
- Algae competition
- Water quality
- Beauty
- Invasion resistance



Lake Stewardship

- Protect native plants
 - Reduce disturbance & removal
- Enjoy them!
 - Snorkeling
 - Fishing
 - Observing



Available Resources



Water Quality Series: WQ-55

A Citizen's Guide
for the Identification, Mapping and
Management of the Common Rooted
Aquatic Plants of Michigan Lakes

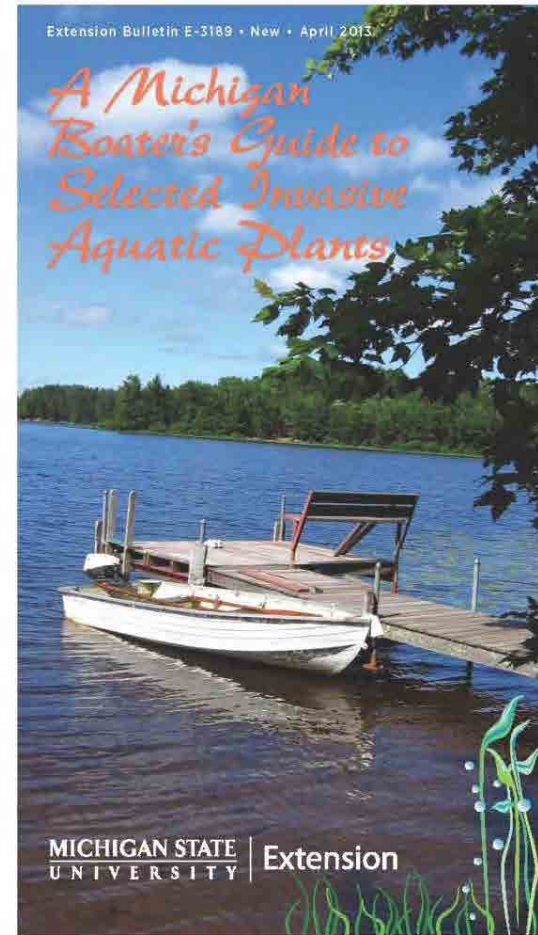
MICHIGAN STATE
UNIVERSITY
EXTENSION

MSU Extension WQ-55

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<http://shop.msu.edu>

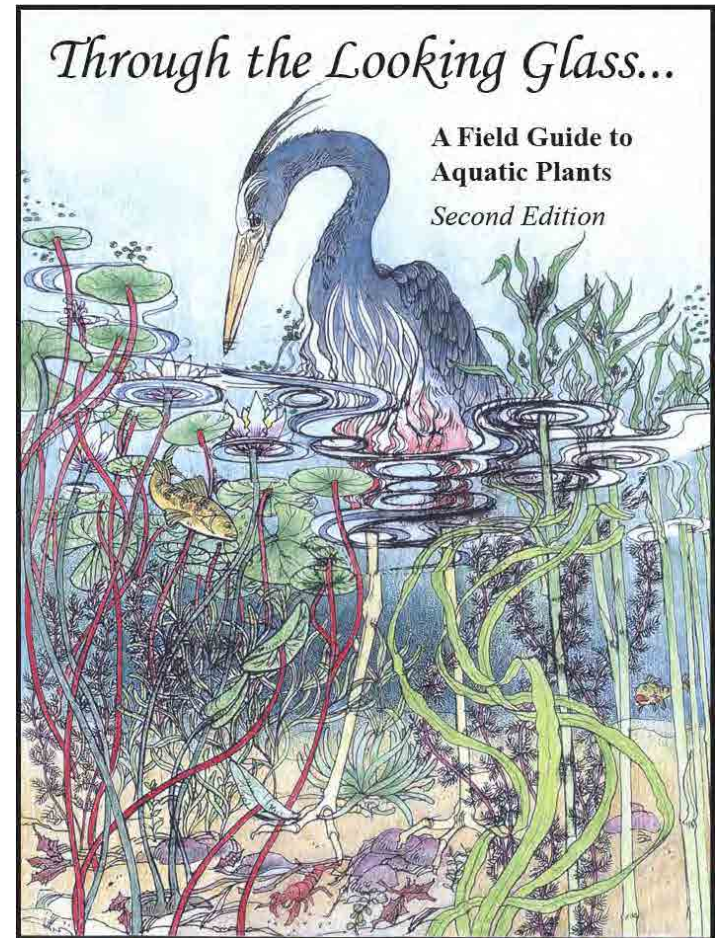
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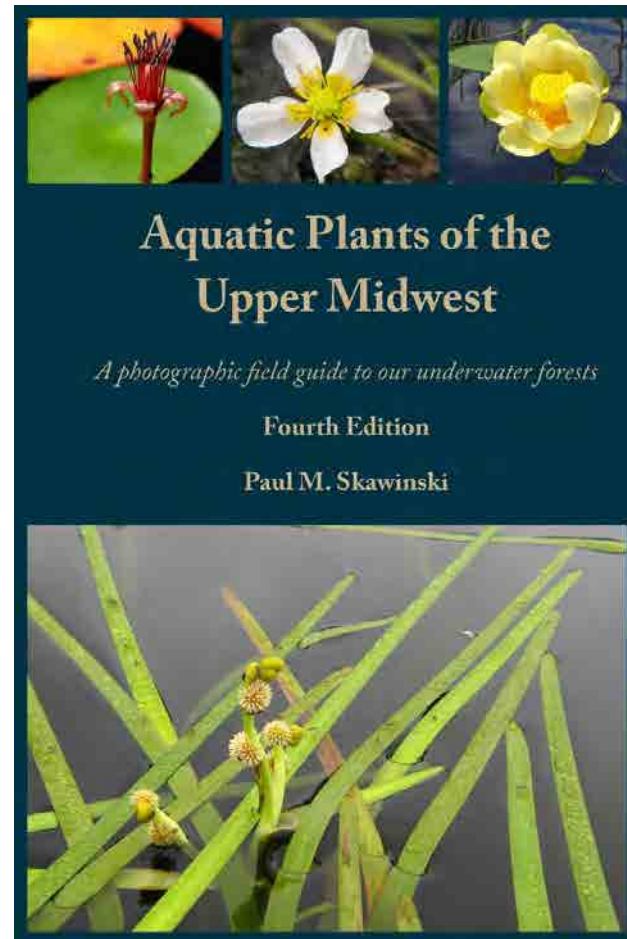
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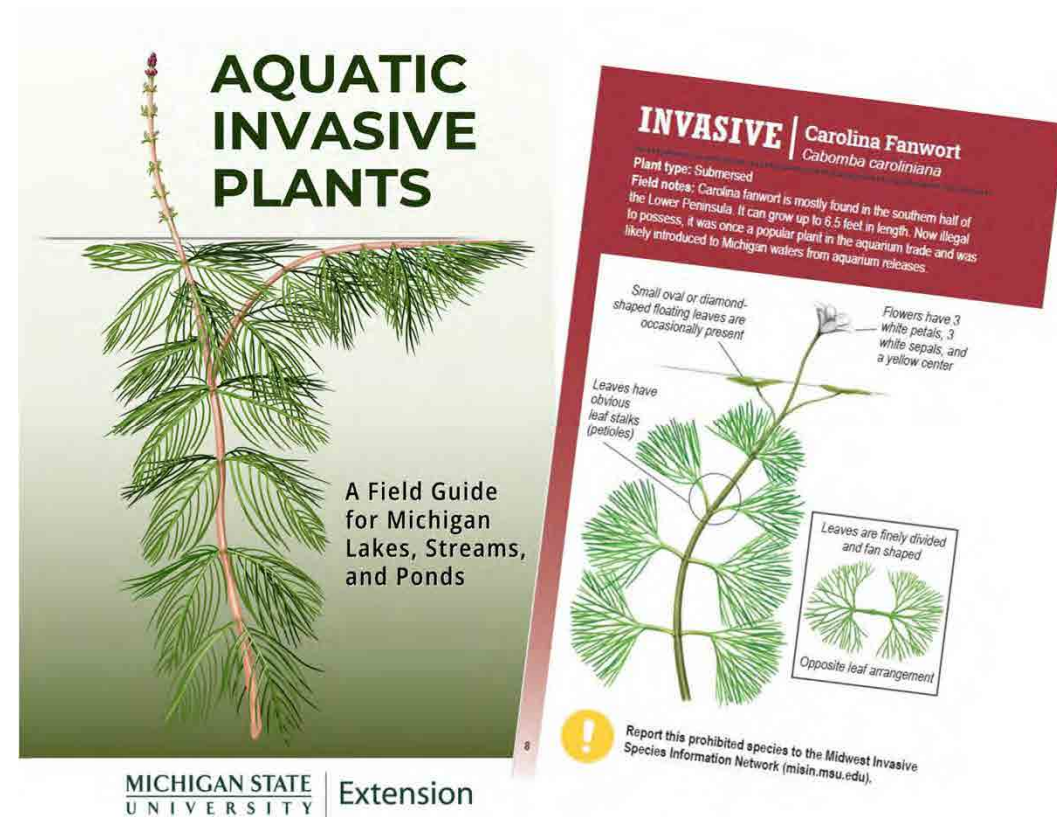
New identification cards

- Pick them up for free today
- Large quantities available for organizations



Coming soon...

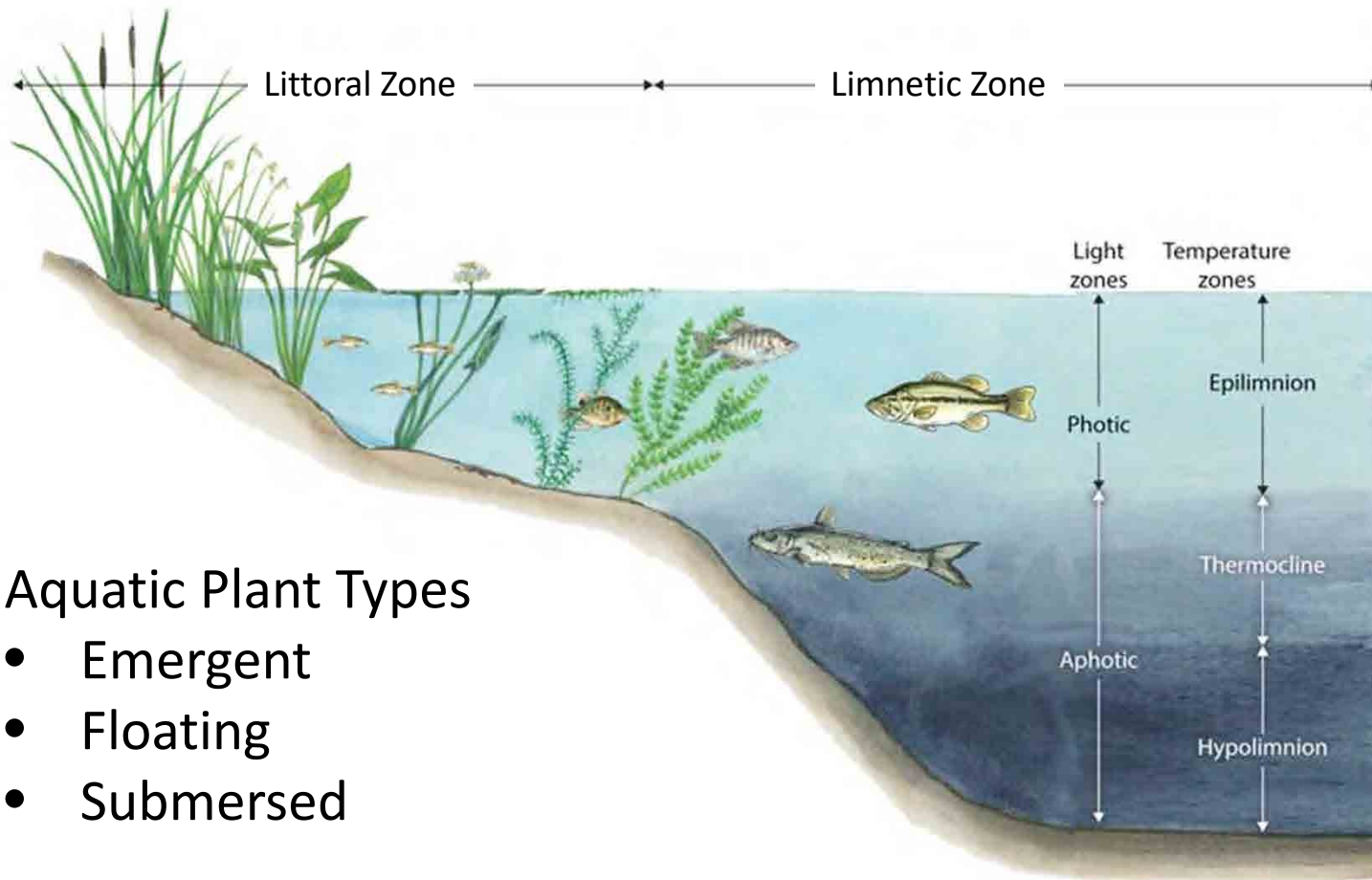
- “Aquatic Invasive Plants: A Field Guide for Michigan Lakes, Streams, and Ponds” from MSU Extension
- Available now for free download
- In print later this year



Aquatic Plant Identification

Aquatic Plant Communities

A transition from land to water

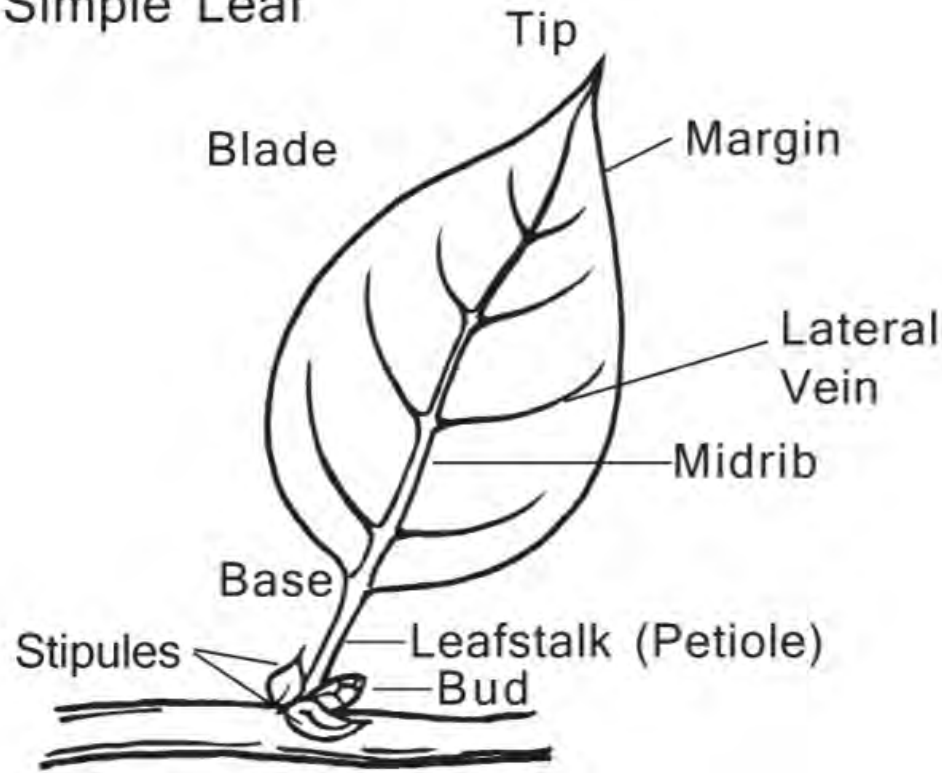


Aquatic Plant Types

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- Floating
- Submersed

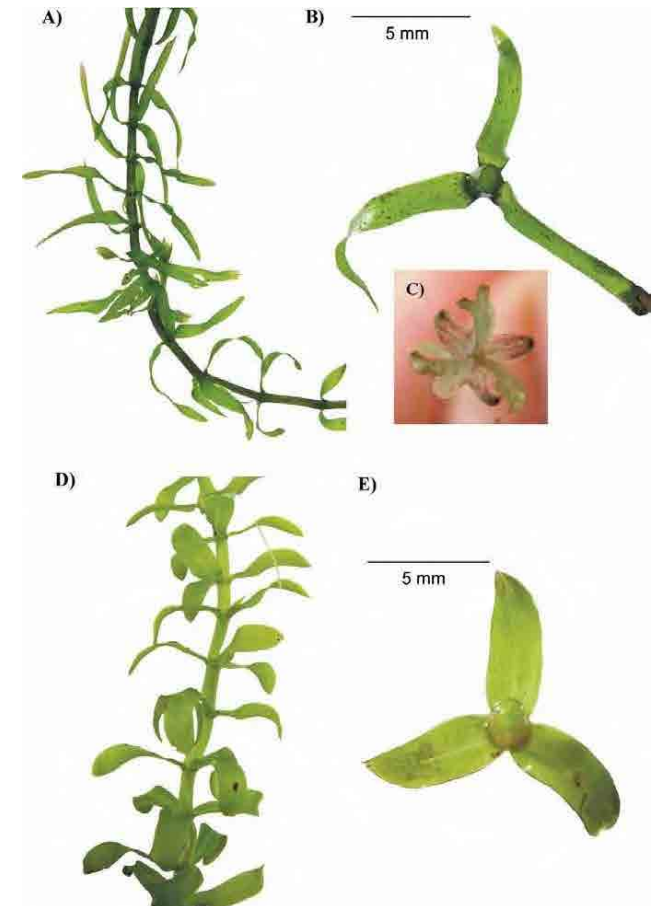
General Plant Identification

Simple Leaf



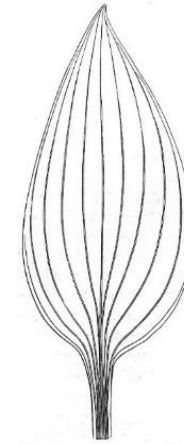
University of Minnesota Extension

Flowers are rarely used

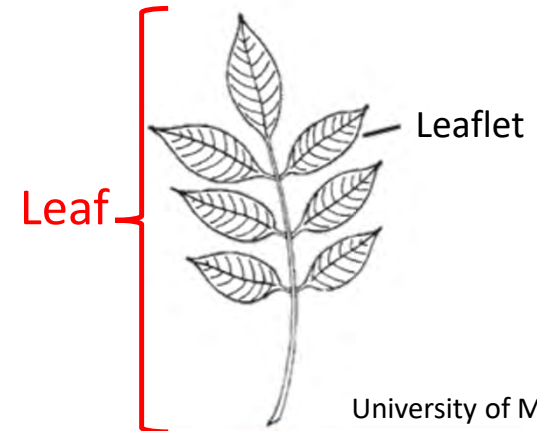


Aquatic Plant Anatomy – Leaf Type

- Simple



- Finely Divided (compound)



University of Minnesota Extension

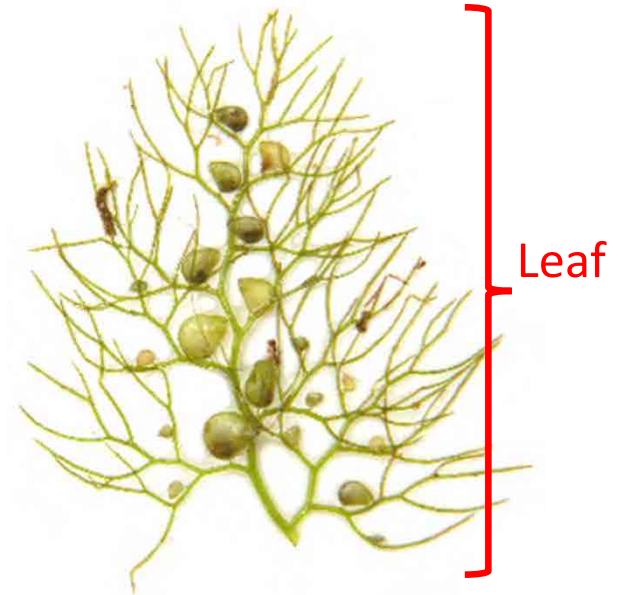
Finely Divided Leaves



Feather-like
or
Christmas Tree like
(Milfoils)



Forked or
wishbone
(Coontail)

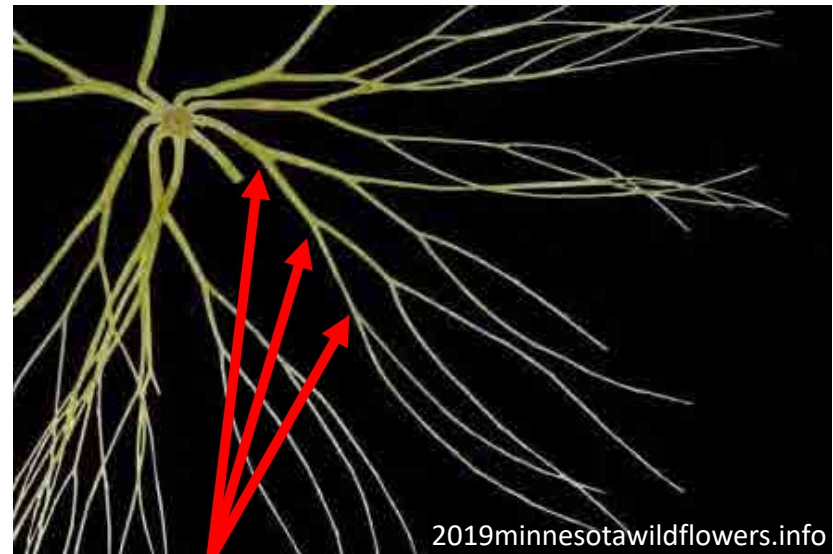
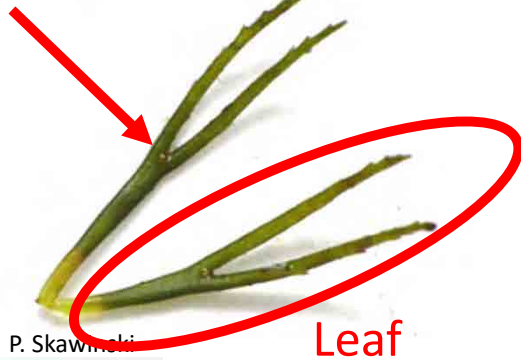


Branched (forked multiple times)
(Forked w/ bladders = Bladderworts)

P. Skawinski

Finely Divided Leaves Counting branches/forks

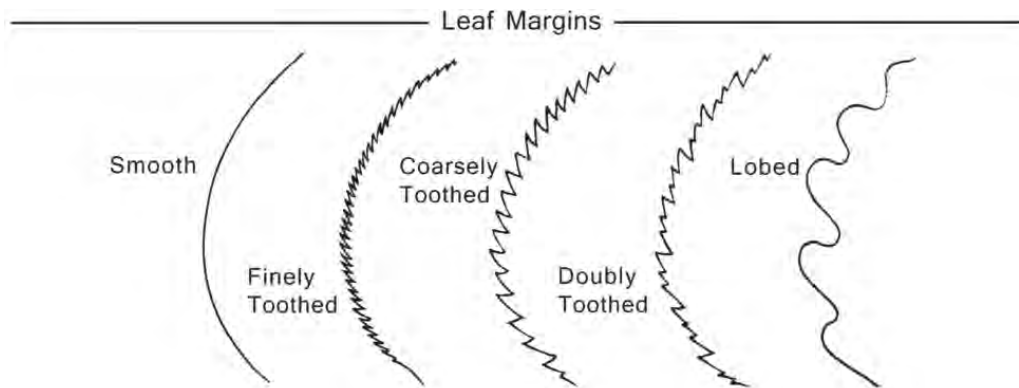
Forks once



Forking three times

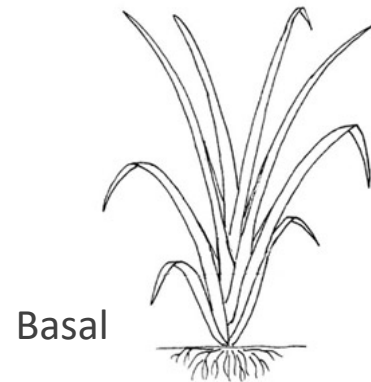
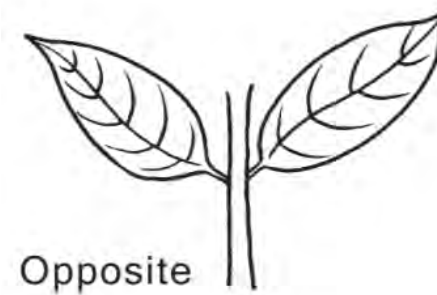
Coontails:
Ceratophyllum demersum
Ceratophyllum echinatum

Aquatic Plant Anatomy – Leaf Margin



Aquatic Plant Anatomy

Leaf Arrangement



Leaf arrangement examples



Alternate



Whorled



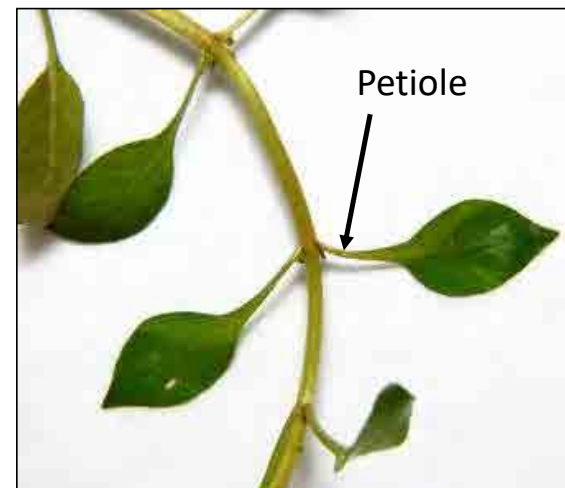
Basal

Aquatic Plant Anatomy – Leaf Attachment

Clasping



Stalked (petiolate)

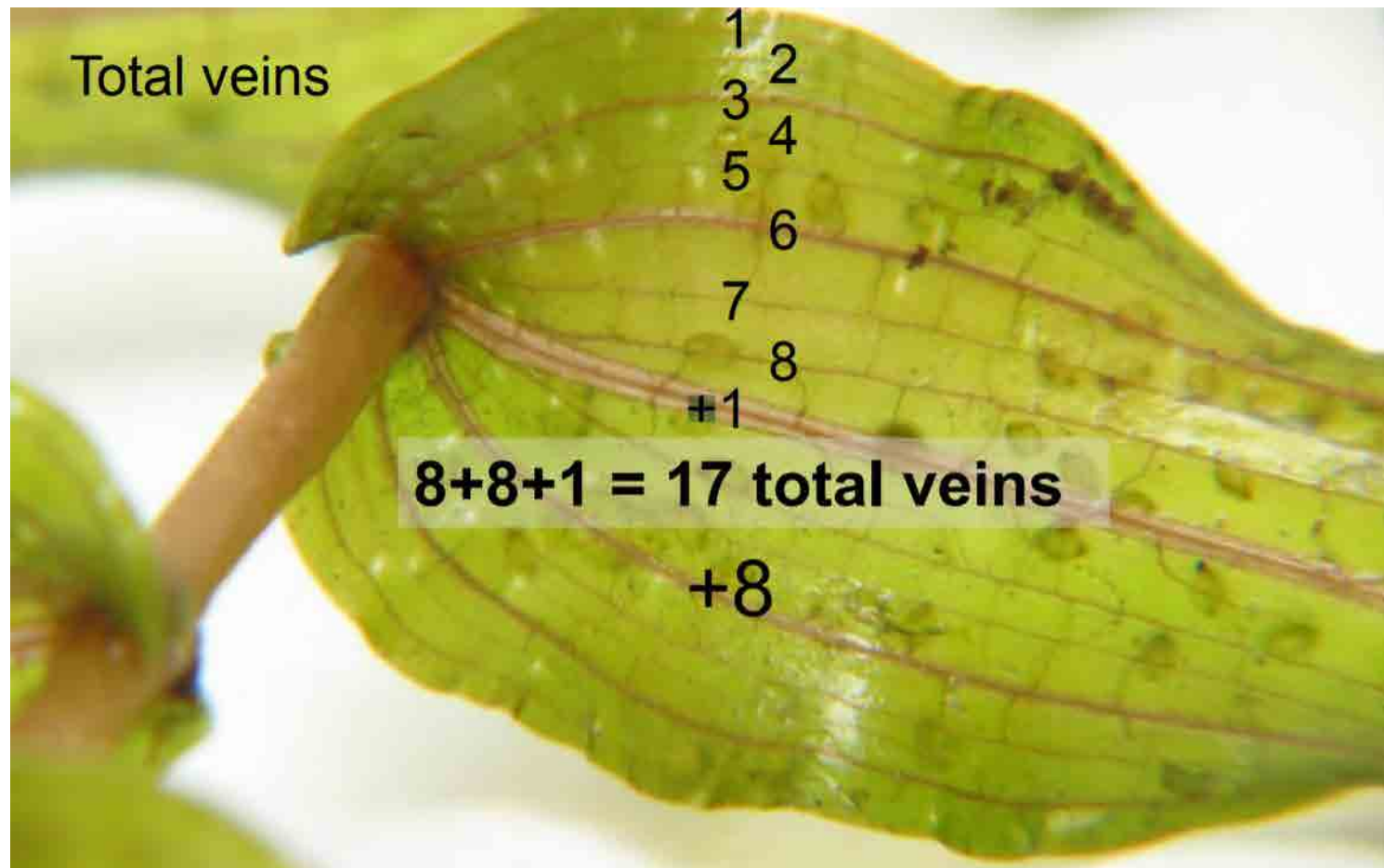


P. Skawinski



Sessile

Counting Veins

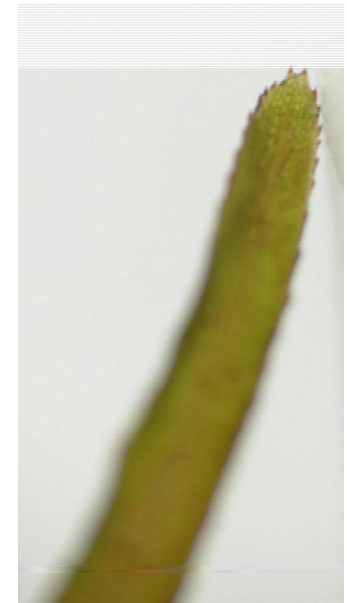


Other Features

Midvein



Apex



P. Skawinski

**Flat-stem
Pondweed**
(*Potamogeton
zosteriformis*)



**Water Stargrass
(= Mud Plantain)**
(*Heteranthera dubia* =
Zosterella dubia)



Water Celery
(*Vallisneria
americana*)



Arrowhead
(*Sagittaria* sp.)



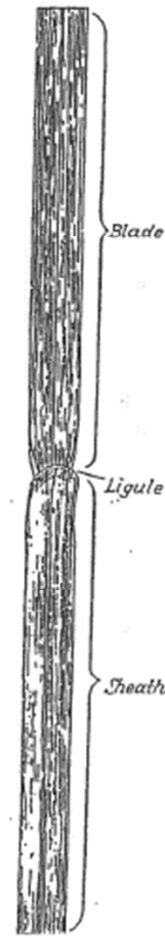
Burreed
(*Sparganium* sp.)



Pickerelweed
(*Pontederia cordata*)



Grass
(ex. Wild Rice)



Leaf Blades

Perleberg, 2000
adapted from Fossett

Leaf Blades

→
Vein Highway

- Center strip

- Empty shoulder →

Water Celery - *Vallisneria*



Other Features

Rhizomes and Roots



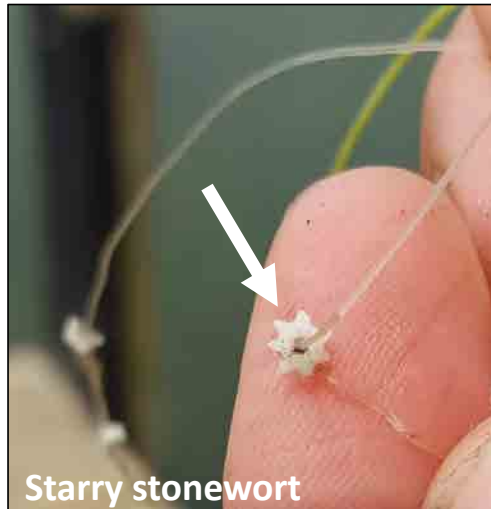


Other Features

Turions and Winterbuds



Other Structures



- Bulbil
- Bract
- Tuber



Helpful tools and tips

- Use fresh plants
- 10x hand lens (\$5-20)
- Use dichotomous keys
- Shallow white pan
- Zip-top bags
- Ruler/scale
- Camera
- Plant press



Questions or comments?



Using an identification key

Page 13

Plants that float on or grow above the water surface.		
Part One	(See page 14.)	Free-floating Plants — Plant floats free in the water; not attached to the lake bottom in any way. Plants small, less than ½ inch in size. (See figures on page 15.)
Part Two	(See page 16.)	Plants with Leaves that Extend Above the Water — Plant with leaves that extend out of the water. (See figures on pages 17 and 18.)
Part Three	(See page 19.)	Plants with Floating Leaves — Plant with a small or large leaf that floats on the surface of the water. (See figures on page 20.)
Plants growing entirely below the surface of the water. Possible exception is a small flower/seed stem that extends a short distance out of the water.		
Part Four	(See page 21.)	Plants with Leaves Thread- or Needle-like — Submerged leaves thread- or needle-like. (See figures on page 22.)
Part Five	(See page 23.)	Plants with Long, Ribbon-like Leaves — Submerged leaves long and ribbon-like — about 10 times longer than wide. (See figures on page 24.)
Part Six	(See page 25.)	Plants with Complex and Finely Divided Leaves — Submerged leaves complex and finely divided. (See figures on pages 26 and 27.)
Part Seven	(See page 28.)	Plants with Oval, Oblong or Lanceolate Leaves — Submerged leaves oval, oblong or lanceolate, as small as ½ inch or as long as 8 inches. (See figures on pages 30 and 31.)



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Part Five

Plants with Long, Ribbon-like Leaves

#1	<p>Choose one of the following:</p> <p>All leaves arising from base of plant (Fig. 3.31 and Plate 2), <i>Vallisneria americana</i> (wild celery).....see Portrait 34</p> <p>Leaves arising from a stem (Figs. 3.32, 3.34 and 3.35).....go to #2</p>
#2	<p>Choose one of the following:</p> <p>Stem flat (Figs. 3.32 and 3.33 and Plate 2). <i>Potamogeton zosteriformis</i> (flats-stemmed pondweed).....see Portrait 33</p> <p>Stem round.....go to #3</p>
#3	<p>Choose one of the following:</p> <p>Leaves extending in nearly opposite directions in a single plane so that the entire plant appears somewhat flat, forming the shape of a hand fan or fern plant, particularly as seen in the water (Fig. 3.34 and Plate 2). <i>Potamogeton robbinsii</i> (fern pondweed).....see Portrait 22</p> <p>Leaves of plant not arranged in a pattern to form the shape of a hand fan or fern plant but scattered along the stem (Fig. 3.35 and Figs. 3.52 and 3.53 in Part Seven of the key, "Plants with Oval, Oblong or Lanceolate Leaves").....go to #4</p>
#4	<p>Choose one of the following:</p> <p>Leaves short, less than 4 inches long, and leaf margins finely toothed (see Figs. 3.52 and 3.53 and Plate 3). <i>Potamogeton crispus</i> (curly-leaf pondweed)....see Portrait 51</p> <p>Leaves long and flexible and leaf margins not finely toothed (Fig. 3.35 and Plate 2). <i>Heteranthera dubia</i> (water star grass) (also known as <i>Zosterella dubia</i>)see Portrait 35</p>



Plants with Long, Ribbon-like Leaves

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Quick Aquatic Plant ID

- **Emergent** (e.g. Cattail)
- **Free-floating** (e.g. Star Duckweed)
- **Floating leaf** plants (e.g. Water Shield)
- **Submersed** (e.g. Whitestem Pondweed)





Emergent Species

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Free Floating

- Is it smaller than my hand?
 - Free-floating plants bigger than your hand likely indicate it is an invasive species (somewhat rare)
- Does it have roots?
 - Knowing if there are roots and how many will help distinguish among native species



Free Floating Duckweeds (*Lemna* and *Spirodela*)



Smaller than your hand



One root per leaf = *Lemna*



Multiple roots per leaf = *Spirodela polyrhiza*, Large duckweed

Free Floating – No Roots Watermeal (*Wolffia*)



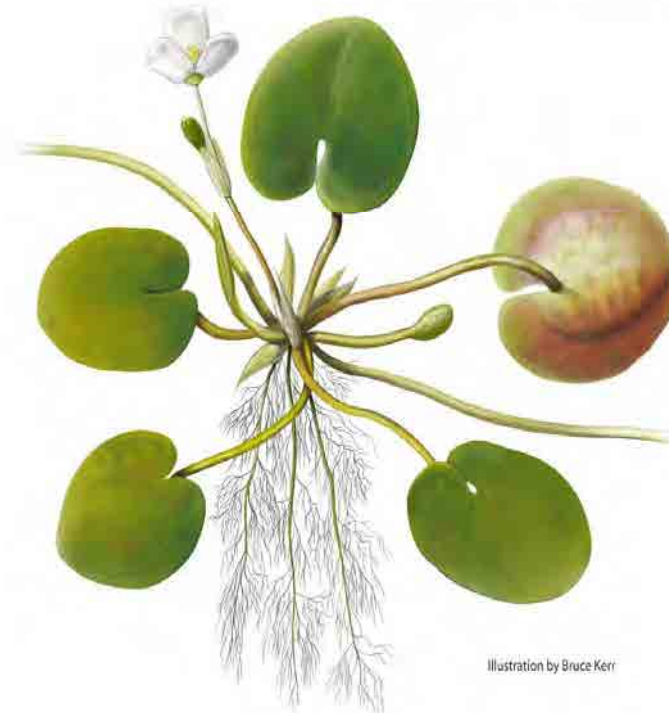
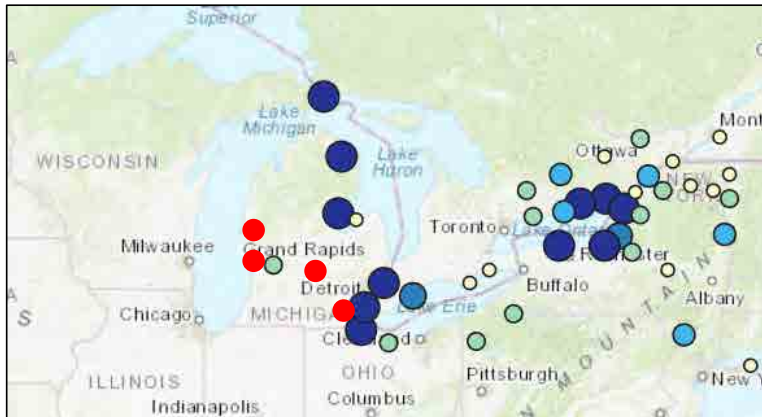
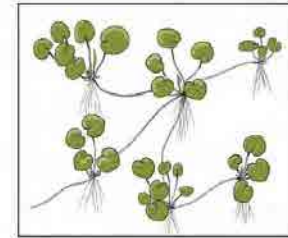
- Very tiny, no root, and feels like cornmeal
- Smallest flowering plant in the world - 3 species in MI

Invasive Species



Free Floating European frog-bit

- **Bigger than your hand**
- **Free-floating rosette**, roots hang below
- Small, heart-shaped leaves (**2-3"**)
- Small, white flower, 3 petals



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Rooted floating

Rooted:

- Water lilies
 - White and Yellow
- Water shield
- Floating-leaf pondweed
- Water smartweed
- Lotus



Rooted Floating Yellow lily pad, White waterlily

Yellow (Bull) Lily (*Nuphar variegata*)



White Water Lily (*Nymphaea odorata*)



Note: Shape of leaf and rounded versus sharp lobes



A dead octopus!
aka *Nuphar variegata* rhizome



Rooted Floating Watershield aka Snot Bonnet (*Brasenia schreberi*)

- Shaped like a football or shield
- Petiole attaches in center of leaf
- Leaf does not have a sinus
- Leaf underside and petiole covered in snot



Rooted Floating Pondweeds (*Potamogeton*)



Potamogeton natans – Floating-leaf pondweed
Many *Potamogeton* species have floating leaves, but not all the time

Practice with Plants!

Emergent, free-floating, and floating-leaf plants

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Submersed Species - Diverse

Submersed Plants

- Plants with **simple** leaves
 - **Opposite, whorled, or alternate** leaf arrangement
- Plants with **simple** leaves
 - **Basal** leaf arrangement
- Plants with **finely divided** leaves



Simple Leaves - Alternate with Midvein

28 Species in Michigan!

Pondweeds (*Potamogeton* spp.)



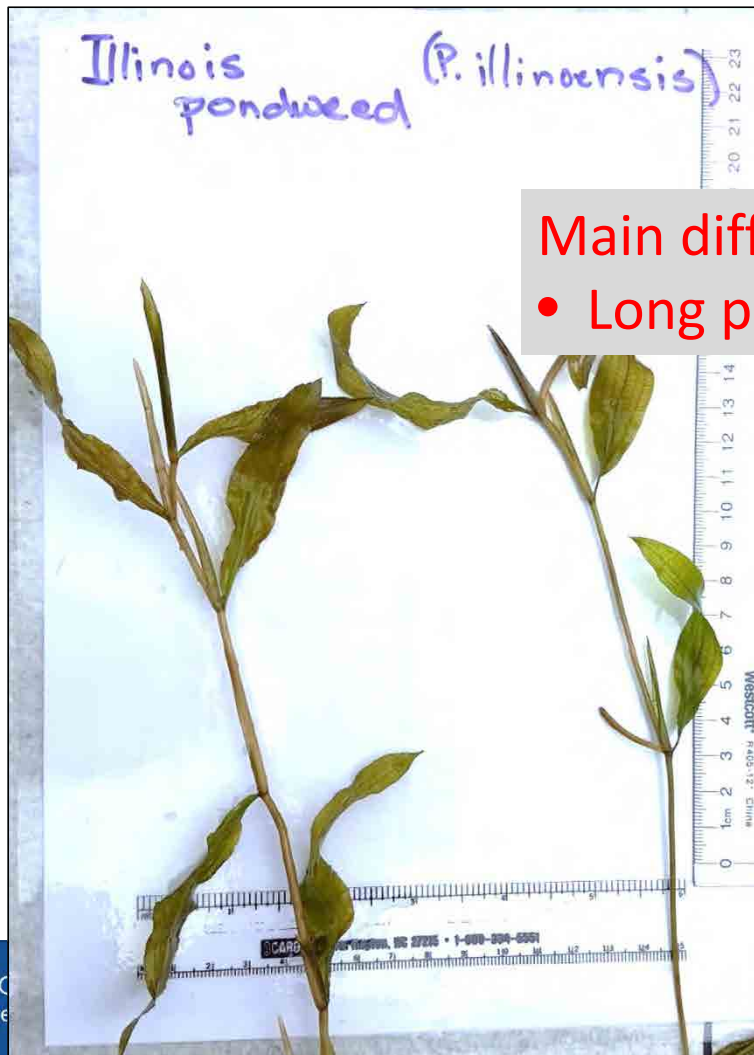
Broad leaf
(Illinois Pondweed)



Narrow leaf/ thread-like
(Small Pondweed)

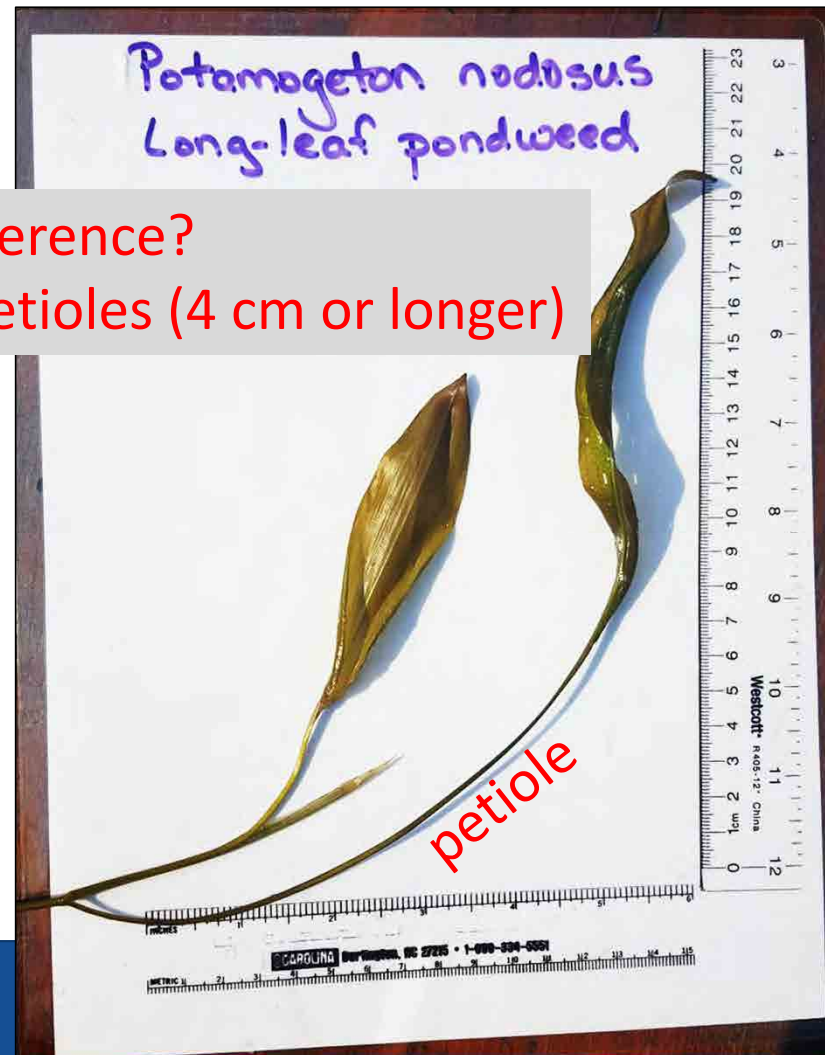


Broad-leaf w/ Petiole



Main difference?

- Long petioles (4 cm or longer)



Other Pondweed Features

Nodal Glands



Veins

1 2 3 4 5 6 7



Seeds



Stipule



Example: Large-leaf Pondweed

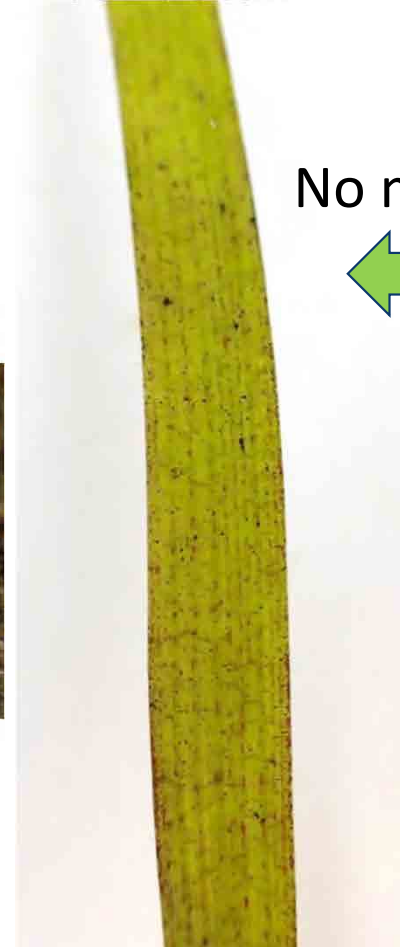


Simple leaves, alternate, without midvein

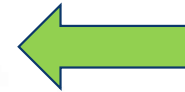


Water star-grass
(*Heteranthera dubia*)

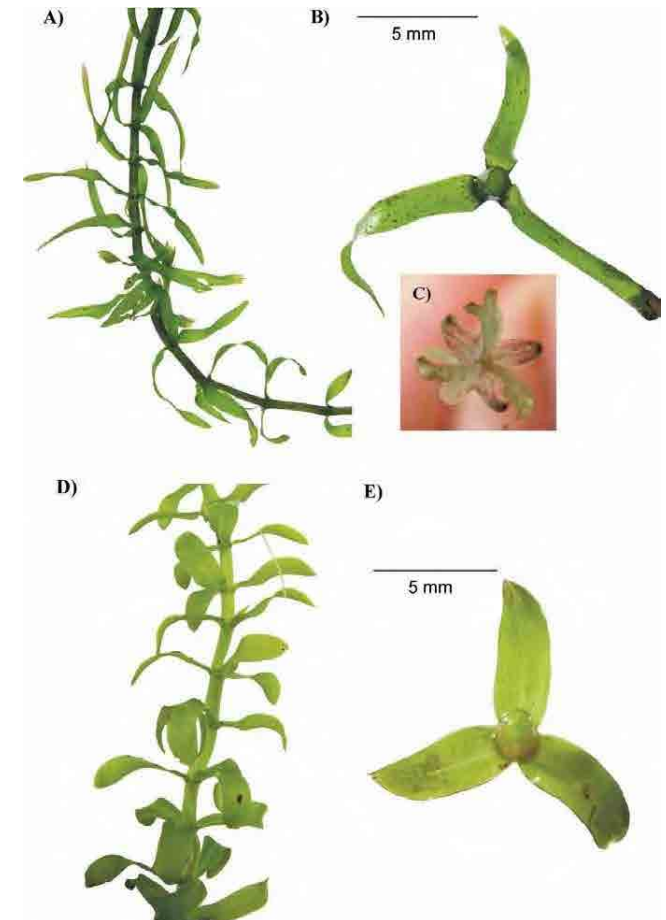
Leaf detail



No midvein



Simple leaves, whorled Waterweed (*Elodea*)



Simple “Leaves”, whorled Stoneworts (Characeae)

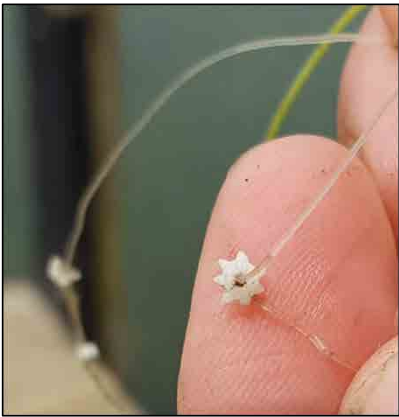
- Macroalgae
- Simple (*Chara*) or divided branchlets (*Nitella*)
- One prominent invasive – Starry Stonewort
- “It was grayish-green, coated with lime, and smelled like a skunk.”



Simple “Leaves”- Whorled

Stoneworts: Characeae

Starry Stonewort



Chara



Submersed Plants

- Plants with **simple** leaves
 - **Opposite, whorled, or alternate** leaf arrangement
- Plants with **simple** leaves
 - **Basal** leaf arrangement
- Plants with **finely divided** leaves



Simple Leaves- Basal (aka rosette)

Water Celery
(*Vallisneria americana*)

Tight parallel cells along midvein



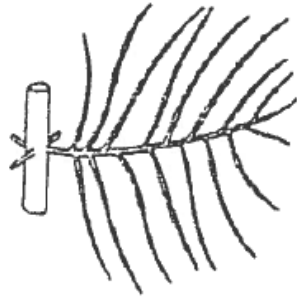
Quillwort (*Isoetes* spp.)
Pipewort (*Eriocaulon* spp.)



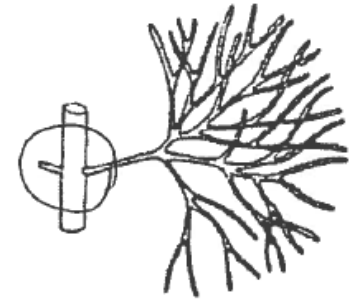
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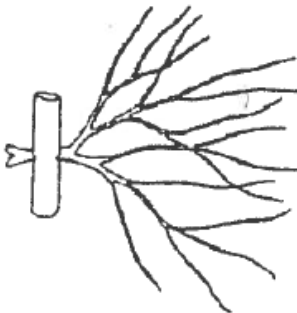
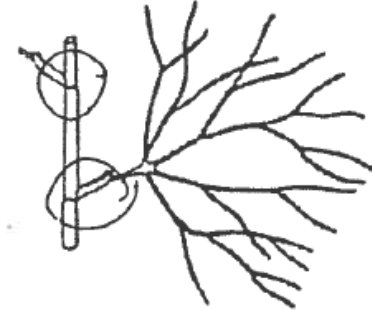


Finely Divided Leaves



Key Characters

- Feathery or branched leaves
- Leaf arrangement
- Bladders present?



Finely Divided- Forked Leaves



Coontail
(*Ceratophyllum demersum*)



****Super common****

Finely Divided- Feathered Leaves

Water-milfoil
(*Myriophyllum* spp.)



8 Species in Michigan!

- *M. alterniflorum*
- *M. aquaticum*
- *M. farwellii*
- *M. heterophyllum*
- *M. sibiricum*
- *M. spicatum*
- *M. tenellum*
- *M. verticillatum*

Eurasian watermilfoil
Myriophyllum spicatum



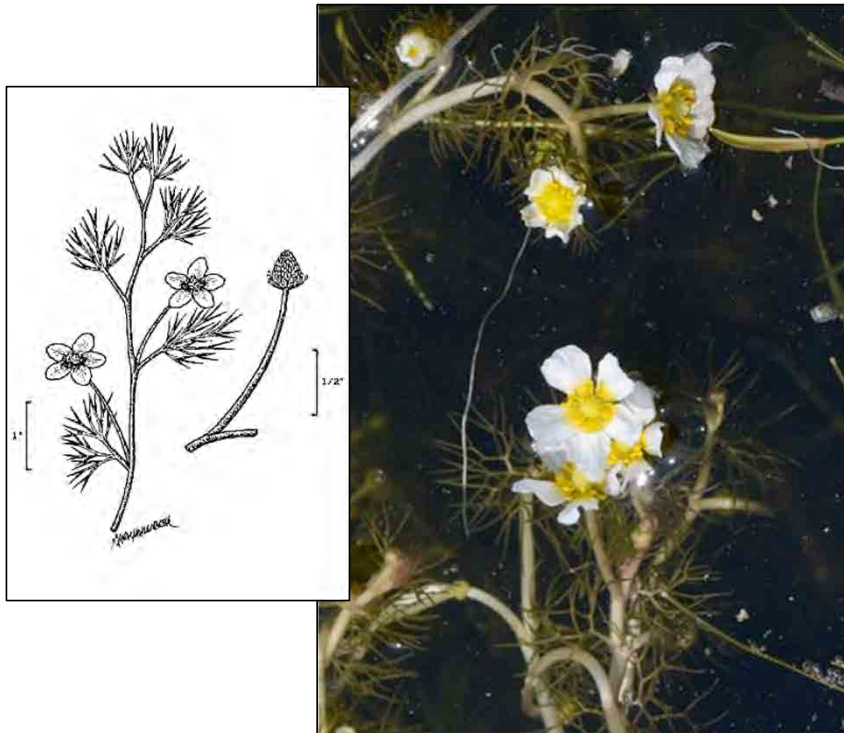
Northern watermilfoil
Myriophyllum sibiricum



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Finely Divided - Branched, Alternate

Alternate
Buttercup
(*Ranunculus longirostris*)



Alternate with bladders
Bladderworts
(*Utricularia* spp.)



Common bladderwort (*U. macrorhiza*)

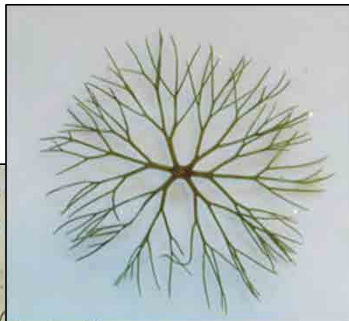
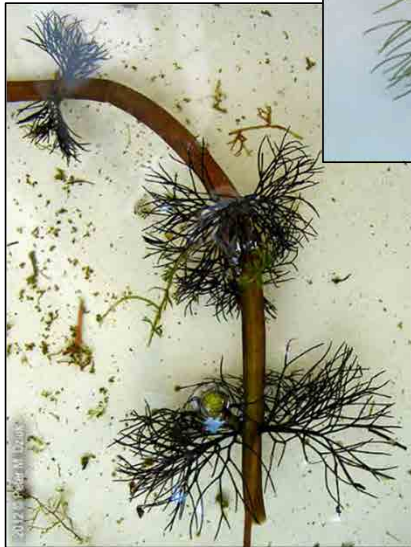


Purple bladderwort (*U. purpurea*)

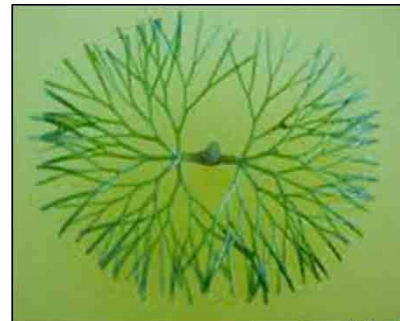


Finely Divided - Branched, Opposite

Opposite,
but looks whorled
Water marigold
(*Bidens beckii*)



Opposite
Fanwort
(*Cabomba caroliniana*)



Established Aquatic Invasive Plants in Michigan

Eurasian milfoil
Myriophyllum spicatum



Curly-leaf pondweed
Potamogeton crispus



Starry stonewort
Nitellopsis obtusa



Eurasian Watermilfoil

Myriophyllum spicatum



Key Characters:

- Feather-like leaves
- Leaves with **12 – 21** pairs of leaflets
- Leaves limp out of water
- Pinkish stem

Trivia:

- Originally from Europe
- First described by Carlos Linnaeus in 1753
- Reproduces readily by fragmentation
- Has difficulty invading lakes with well developed native plants

Curly-leaf Pondweed

Potamogeton crispus



Key Characters:

Simple leaves

Obvious midvein

Alternate leaf arrangement

Serrated leaf margin

Trivia:

- Native to Eurasia, Africa, and Australia
- First discovered in North America in 1880

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Starry Stonewort

- Tiny star-shaped, tan or white **bulbils** produced on rhizoids (clear filaments)
- Long, **uneven** length branchlets
- Smooth stem
- Brittle



P. Skawinski

B. Grabill

EAPW Watch List Species

Hydrilla (*Hydrilla verticillata*)

- **Whorls of 4-8 leaves** around the stem
- **Serrated** leaf edge
- **Teeth are also produced underneath the leaf**, along the midvein

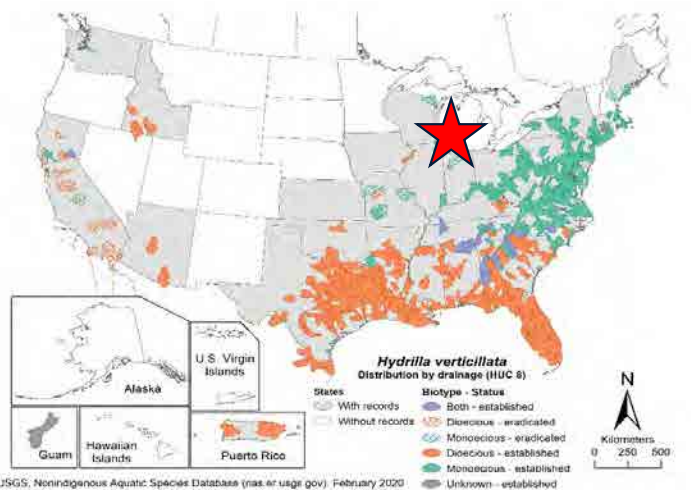
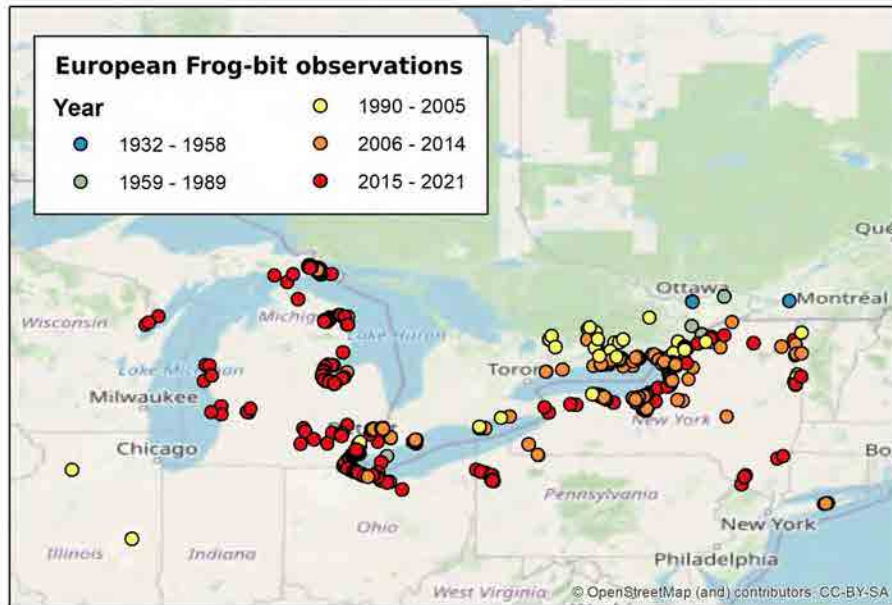


Illustration by Bruce Kerr

EAPW Watch List Species: European Frog-bit

Hydrocharis morsus-ranae



- First discovered in 1996 in Southeast Michigan
- Currently predominantly in Great Lakes wetlands
- High threat to our inland waters

WATCH FOR THESE Aquatic Invaders!

HYDRILLA



Leaves are whorled in groups of 4-8
Leaves are rough and have visible saw-toothed margins

Photo: Aquatic Nuisance
- Department of Environment and Natural Resources

WATER CHESTNUT



Green, floating leaves with sharply serrated edges
Small, white 4-petaled flowers

Photo: Laura J. Rydman/University of Connecticut, Bugwood.org

BRAZILIAN ELODEA



Generally 4 leaves per whorl
Submerged

Photo: Benjamin Pichler

EUROPEAN FROGBIT



Leathery, heart-shaped leaves
Free-floating
Leaf size: 1 1/2 - 2 1/4 in. across

Photo: Benjamin Pichler

WATER HYACINTH



Rounded, shiny green leaves with spongy stalks
Lavender flowers with central yellow fleck
Free-floating

Photo: MSU

WATER SOLDIER



Leaves are 16 in. long, sword-shaped, sharply serrated edges, bright green
Leaves may be emergent or submerged

Photo: Brian Kohn

WATER LETTUCE



Free-floating - forms a rosette of leaves that resembles an open head of lettuce
Fuzzy light green leaves with long feathery roots

Photo: MSU

PARROT FEATHER



Spikes of stiff, feathery leaves grow in whorls of 4-6
Bright green upper stem emerges up to 1 foot above water

Photo: MSU

EUROPEAN WATER CLOVER



Resembles a four leaf clover
Leaves are smooth and can be floating, submerged, or emergent
Leaf size up to 1 in. across

Photo: MSU

YELLOW FLOATING HEART



Flowers are bright yellow with 5 petals
Leaves are 2-6 in. across with scalloped edges

Photo: MSU

These 3 species are legal for sale and possession
Please only report sightings outside of cultivation

For more information and to report sightings, visit michigan.gov/invasives



An Underwater Forest

“In the end, we will only
conserve what we love...
We will love only what we
understand...
We will understand only what
we are taught.”

Chinese Philosopher, Lao-Tsu

Practice with Plants!

Submersed plants

Questions?

To learn more about the Cooperative Lakes Monitoring Program, visit:

MiCorps.net



Working Together to Protect Lakes

