AQUATIC PLANT MAPPING AND IDENTIFICATION

Jo Latimore and Erick Elgin













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MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY Extension



Outline for Today

- Introduction to Aquatic Plants
- Aquatic Plant Mapping protocol
- Plant Identification





An Underwater Forest

Michigan trivia

- 28 pondweed species
- 10 submersed carnivorous

species

• 8 milfoil species



Absorb wave energy

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- Absorb wave energy
- Habitat





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- Absorb wave energy
- Habitat

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Oxygen production



- Absorb wave energy
- Habitat

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- Oxygen production
- Nutrient cycling

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





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

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

LAKE STEWARDSHIP

- 1. Protect native plants
 - Reduce disturbance & removal
- 2. Enjoy them!
 - Snorkeling
 - Fishing
 - Etc...







COOPERATIVE LAKES MONITORING PROGRAM TRAINING FOR

Aquatic Plant Mapping









Why map aquatic plants?



Aquatic Plant Identification & Mapping

What papers are as analy lake?

Why we assuall plants responsible, Rented agastic plants are a visiting and assamily plant of rais, just as grasses, structure and forces are a mattain your of the land. Their mosts are a future for hisding rediments in plant, reducing remoins and maintaining bettern stability. They provide habitat for fish and invectorialistic prevalue advatare werein which to do age, raise yoing, and inder from pirothers. Mainthow, there have and assale memory's forage on parts, and use

Though juints are important to the lake, over-standard plants can manuforly affect for socialisative and transmit receivers. In this stantist, it is determined to transp. the use and its acadic parts for the maximum benefit of all cares.

To be sale to do this effectively, it is measury to yours the plant spectra present in the mean and near include abundance and location. A map of a lare showing the usant publication locations and densities will greatly and management creacits.



Sectory Desight Cherghan Opticality photon Country Later Country McCountry County 1

What halp does the CLMP offer to uniumere interview in paratic plants?

The Cooperation Later Meritaining Program (CLMP) and qualitative contracts that allow another mediate obtained assess the equate obtained assessment assessment may be versed as a "subplat" of the species of parits in the bala, then general loading and tracking abundlass. The CLMP everyoneral particles million information about a web standit pares that is often millioner and aquebic part millioner and aquebic part millioner

The COMP provides having and technical assistance in the operative models encoded in the manufact plant survey program. Forms in avea destilations and manufact plant assistance in unvey assign and mentification, and field technique, including initial encodes consultation, in an aveal of the solution models.

Upon consideran of the sorvey, inductees have a detailed using of the paint species growing in their uso, including any instant servers that may be transmission. They also all have created a map that avecast the open it distribution and density of the uses' plane position. These products will be equation. These products will be equation and instantion for actualities and as a television in the factor.

What it the prosence his tendocting a CLMP second plant

The CLMP used the procedure

sentiers in A Dissent's study for the

Identification Adoption and

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Routed Agoutts, Phints of Michigan

Londs. An electricity person of

this book can be obtained from

www.miccrostnet, under Lake

In a nativel, the procedure-

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21 Using a sampling take to have

piunt samples at pertitular deptits.

To be each semining point, from

samples are taken from the beat

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Monitoring and CLMP dominsentry

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 Plants are a beneficial part of a lake ecosystem

 Excess nutrients, invasive species, and other disturbances can upset their balance

 A plant map provides a basis for comparison, informs management, and reveals problems

Benefits of enrolling in the CLMP Aquatic Plant Mapping program

- Standard procedure
- Hands-on training
- One day of field assistance from MiCorps staff
- Ongoing assistance with plant ID, field procedures, and data reporting
- Data are shared with EGLE
- Baseline information for future lake management
- □ 2022 enrollment cost -\$250

Making a Plant Collection

- Helps with identification when mapping the lake
- Educational tool for your community or lake association
- Can be a reference for future work

What's growing in <u>your</u> lake?





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

Water Quality Series: WQ-55



MSU Extension WQ-55

Where to sample?

- How do I start?
 - Get a map!
 - Locate:
 - 1) Boat Ramps
 - 2) Public Beaches / Parks
 - Attached inlets (streams, creeks, canals)
 - 4) Quiet Bays and Coves



Example Lake < 100 acres = 15 transects



How Many Transects?

Lake Size (Acres)

Less than 100

No. of Transects

□ 5 to 15

□ 100 to 500 □ 15 to 30

Over 500

□ 30 to 50

Got an island? Add more transects!



What is a transect?

- How to sample a transect?
- How many tosses?
- How far do I throw it?
- How do I dispose of the plants?



AQUATIC PLANT SAMPLING RAKE

Cut the handles off of two garden rakes and bolt the rakes back to back with two "C" bolts. Use a small hose clamp between the rake tines to prevent side to side slipping. Drill a hole in the remaining wooden handle core and twist into the hole a moderately large eye bolt. The rope should be about 20 feet long. File off any sharp edges. Wear gloves when using the rake to protect the hands from cuts.

TWO "C" BOLTS

> SMALL HOSE CLAMP

ROPE

EYE BOLT

- 1. Pitch rake at each clock position and drag along lake bottom.
- 2. Haul rake back to boat.
- 3. Sort collected plants.



Adapted from: Simpson, J.T. 1991. Volunteer Lake Monitoring: a methods manual. EPA 440/4-91-002.

Example Field Recording Sheet

(p. 51)

Lake name: Gourty na			Density rating cha			art	
			Rake recover	y of aquatic pla	int.	Clensity rating	
Sampling date			Taken in sH 4	casts (teeth of	vake full)	Dense (D).	
Names of volunteers		Taken in 4 casts			Heavy (H)		
			Taken in 3 ca	sti		Moderate (M)	
			Taken in 2 ca	₫3		Sparse (5)	
			Taken in Lica	st		Found (F)	
		_	f for 4 for 6 for	at D			
Plant name or identification rul	nicer if known	Collected in 12 alclack position	Collected in 3 o'clock position	Collected in 6 o'clock position	Collected in 9 o'clock position	Density rating	
					-		

He 52 Example field recording sheet.

Transect line	Transect line no.		Position on transect line I foot 4 foot 8 foot X		
lant name or identification number, if known	Collected in 12 o'clock position	Collected in 3 o'clock position	Collected in 6 o'clock position	Collected in 9 o'clock position	Density rating
Stonewort	Х	X			
Coontail	X	X	X	X	
		-			

Aquatic Plant Density Rating

Dense	Species fills rake in all 4 casts			
Heavy	Species found, mixed with other			
	plants, in all 4 casts			
Moderate	Species found in 3 casts			
Sparse	Species found in 2 casts			
Found	Species found in 1 cast			

Transect line no.		Position on transect line I foot 4 foot 8 foot X			
Plant name or identification number, if known	Callected in 12 o'clock position	Collected in 3 o'clock position	Collected in 6 o'clock position	Collected in 9 o'clock position	Density rating
Stonewort	х	X		100	Sparse
Coontail	X	X	X	X	Heavy/ Dense

Transect line no.		Position o I fox 4 foc 8 foc	ot 🛄 ot 🛄 ot 🚺		
Plant name or identification number, if known	Collected in 12 o'clock position	Collected in 3 o'clock position	Collected in 6 o'clock position	Collected in 9 o'clock position	Density rating
Stonewort	Х	X			Sparse
Coontail	X	X	X	X	* Moderate

* Found on all rake throws but only in minor amounts.

How to Show Your Data

- □ 45 field sheets not very practical
- □ Map: Shows distribution
- Table: Shows relative abundance
- Do both!

Box 53. Aquatic Plants Numbered by Growth Pattern.

Free	floating
------	----------

Watermeal (0) 2 Star duckweed 3 - Lesser duckweed (0) 4 - Bg duckweed (0)

Low growing (1 to 3 feet)

20 - Stonewort (+)21 - Bushy pondweed (+)72 - Tern pondweed 113

Tall growing (4 to 10 feet); open scattered growth pattern

(0)

(0)

- 40 Native milfoil (01-)
- (0/-) 11 - Coontail
- 42 Clasping-leaf pondweed (0)
- 43 Floating-leaf pondweed (11)
- 44 Whitestern pondweed (0)
- 15 American pondweed (+)
- +6 Illinois ponoweed (+)
- 47 Water mangold (0)
- 48 Bladderwort
- 49 Buttercup

Shoreline (emergent)

6 - Cattail (+) 7 - Bulrush (+) 8 Arrow arum (1) 9 Arrowhead (1) (+) 10 Pickersweed 11 Smartweed 10 12 - White water life (1) 13 - Yellow water ity (+)14 - Water shield 113

Mid-water growing (2 to 5 feet)

- 30 Large-leaf condweed (+) 31 - Variable pondweed (+) 32- Thin-leaf pondweed (+)33 - Flat-stemmed pondweed (+) 34 - Wild celery (+)35 - Water star grass (+)(+)
- 36 Waterweed

Tall growing (4 to 10 feet); dense canopy growth pattern

(-)

- 50 Eurasian m foil (-)
- 51 Curly leaf bondweed ()
- 52 Sago pundweed (0) -)
- 53 Hydrilla

(+) = generally beneticial, (0) = generally neutral, (-) generally a nuisance

p. 55

Data Codes for Your Map

Transect 5

1-foot depth: White water lily (<u>Sparse</u>), Stonewort (<u>F</u>ound)

4-foot depth: Stonewort (<u>F</u>ound), Large-leaf pondweed (<u>S</u>parse), Coontail (<u>S</u>parse)

8-foot depth: Wild celery (<u>Sparse</u>), Native milfoil (<u>M</u>oderate), Illinois pondweed (<u>Sparse</u>)

Becomes... 5/ 1ft: 12S, 20F 4ft: 20F, 30S, 41S 8ft: 34S, 40M, 46S



Date sampled



Mapping Options: By Hand


Mapping Options: Google Maps



Mapping Options: Google Earth



Example Data Table

has a Example data shoot

(p. 58)

Lake name/count			sampling date	
Data sheet for	Whole lake	t year thore	*lid-depth	Deep water
Number of trans	605		Number of sampling sites	
Plant number-	Plant name	Districturion (number of sites wh	ere observed)	Awerson déreity

Example Data Sheet Calculation

(p. 57)

There were 15 sampling transects in the lake, giving 45 sampling sites. Coontail was present at 20 sites in the densities identified below.

Density	Number of observations	Multiplication factor	Teta density points
Found Sparse Modenate Heavy Dense	2 :0 2 3 2	! 2 3 4 5	2 20 6 12 10
TOTAL	19		50

50 (total density points) / 45 (sampling sites).

I I (lakewide density rating)

An average lakewide density rating of 1-1 is slightly above the "found" lovel

Record observations **19** and average lakewide density rating (11) on the data sheet.

Plant number	Plant name	Distribution (number of sites where observed)	Average density
41	Coontail	20	1.1
20	Stonewort	23	D.9

Striet highs known to be m	the lake at the time of the survey but not collected in the survey	

Plant Identification Photography

Required Photographs:

- At minimum, one representative photo of each invasive species found in your lake
- Label photos
- Make sure the photos are clear
 - ***Need to show identifying characters***
- Great for ID verification and documentation



Use photography card





Volunteer photos: (Left) Lotus & Maceday Lake in Oakland Co. (Top) Bristol Lake in Barry Co.

No ruler? A hand will do!



Submitting Your Data

- 1. Make copies of your data for your records.
- Enter your data into the online MiCorps Data Exchange (www.micorps.net) by October 31.
- 3. Send complete report to MiCorps
 - a. Completed report and map
 - b. Any photographs

Available Resources

PDF at www.MiCorps.net

Additional copies available for \$10 through the MSU Extension Bookstore

http://shop.msu.edu



University of Wisconsin-Extension Lakes or Amazon

\$29.95

www.uwsp.edu/uwexlakes



University of Wisconsin-Extension Lakes or Amazon

\$45.00

www.uwsp.edu/uwexlakes



Aquatic Plants of the Upper Midwest

A photographic field guide to our underwater forests

Fourth Edition

Paul M. Skawinski





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

Water Quality Series: WQ-55



MSU Extension WQ-55

Page 13

P lants that float on or grow above the water surface.				
Part One	(See þage 14.)	Free-floating Plants — Plant floats free in the water; not attached to the lake bottom in any way. Plants small, less than ½inch in size. (See figures on page 15.)		
Part Two	(See þage 16.)	Plants with Leaves that Extend Above the Water — Plant with leaves that extendout of the water. (See figures on pages 17 and 18.)		
Part Three	(See þage 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 þage 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 þage 28.)	Plants with Oval, Oblong or Lanceolate Leaves — Submerged leaves oval, oblong or lanceolate, as small as ½inch 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

#I	Choose one of the following: All leaves arising from base of plant (Fig. 3.3 I and Plate 2). Vallisneria americana (wild celery)see Portrait 3 4 Leaves arising from a stem (Figs. 3.32, 3.34 and 3.35)go to #2
#2	Choose one of the following: Stem flat (Figs. 3.32 and 3.33 and Plate 2). Potamogeton zosteriformis (flat-stemmed pondweed)see Portrait 33 Stem roundgo to #3
#3	Choose one of the following: 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)
#4	Choose one of the following: 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 5 I 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

Page 23





Plants with Long, Ribbon-like Leaves

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Field visits for first-time lakes



Questions?

Breau

Hold onto your butts

It's time to IDENTIFY

General Plant Identification



Flowers are rarely used



Aquatic Plant Anatomy – Leaf Type





• Simple







University of Minnesota Extension

Finely Divided Leaves

Forked

Feather-like or

Christmas Tree like

Branched (forked multiple times)

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Bladders

Finely Divided Leaves Counting branches/forks







Forking three times

Coontails: Ceratophyllum demersum Ceratophyllum echinatum

Aquatic Plant Anatomy – Leaf Margin









University of Minnesota Extension

Aquatic Plant Anatomy – Leaf Arrangement









University of Minnesota Extension

Aquatic Plant Anatomy – Leaf Attachment

Clasping



Stalked/petiolate





Counting Veins



Other Features

Apex

Midvein







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Leaf Blades



Leaf Blades



Water Celery - Vallisneria americana

Other Features

Rhizomes and Roots





Other Features

Turions and Winterbuds


Other Structures



- Bulbil
- •Bract
- •Tuber





General Identification Tips

Tips

- Identify fresh specimens
 - Refrigerate if you need to hold for longer
- Collect entire plant (flowers and seeds if present)
- Be aware of plasticity

Ask the following questions:

- 1. What plant community did the specimen come from?
- 2. What is the leaf arrangement?
- 3. Simple or finely divided leaf?



Questions or comments?



• Emergent (e.g. Cattail)

• Free-floating (e.g. Star Duckweed)

• Floating leaf plants (e.g. Water Shield)

• Submersed (e.g. Whitestem Pondweed)



Emergent Species







Free Floating

Ask yourself:

Is it smaller than my hand and does it have roots?



- Free-floating plants bigger than your hand likely indicate it is an invasive species (somewhat rare)
- 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



Free Floating European frog-bit

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







EUROPEAN FROG-BIT IDENTIFICATION

and the second that the

Narrow-leaf cattail

European Frog-bit

White Water Lily

Michigan Department of Natural Resources Wildlife Division

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)



Rooted floating

Rooted:

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





Rooted Floating Yellow lily pad, White waterlily



Note: Shape of leaf and rounded versus sharp lobes

Bull Lily (Nuphar variegata)





Yellow Waterlily (Nuphar advena)

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

Quick Aquatic Plant ID

• Emergent (e.g. Cattail)

• Free-floating (e.g. Star Duckweed)

• Floating leaf plants (e.g. Water Shield)





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)



Other Pondweed Features

Nodal Glands





Seeds





Stipule



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Example: Large-leaf Pondweed



Simple leaves, alternative, without midvein



Simple Leaves- Whorled



Waterweed (*Elodea canadensis*)

Invasive look-alike (*Hydrilla verticillata*)





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

Musk Grasses: Characeae Starry Stonewort Chara





Starry stonewort (Nitellopsis obtusa)

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





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.)



Entire Leaves, Basal, ribbon-like Water celery (V*allisneria americana*)



Submersed Plants

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

- Plants with **simple** leaves
 - Basal leaf arrangement

Plants with **finely divided** leaves




Finely Divided Leaves





Key Characters

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







Finely Divided- Forked Leaves

Coontail (*Ceratophyllum demersum*)

**Super

common**





Coontail (*Ceratophyllum*)



Forked leaves; no midrib One of several other types of submersed plants with finely-divided leaves

Finely Divided- Feathered Leaves

8 Species in Michigan!

Water-milfoil (*Myriophyllum* spp.)







"The feathery stems of northern watermilfoil rose from the soft bottom like spires on a gothic cathedral"

MILFOIL ID TIPS

- Leaf arrangement
- Leaflet number
- Stem color
- Bracts
- Habit





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



P. Skawinski

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, <u>uneven</u> length branchlets
- Smooth stem
- Brittle





WATCH FOR THESE **Aquatic Invaders!**

HYDRILLA



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

Priority Rodent Wales, Demonstrate P.P. Bolthood org.

Green, floating leaves with sharply serrated edges

Small, white 4 petaled flowers

Photo Navide 1 Menificity Linkerson of Consocious, Boassand one

EUROPEAN FROGBIT

WATER CHESTNUT



Generally 4 leaves per whort Submerged

FRED. V. Morgan TELLIGUE

Free-floating - forms a resette

of leaves that resembles an

Fuzzy light green leaves with

Recembles a four leaf dever

Leaves are smooth and can

be floating, submerged. of emergent.

Leaf size up to 1 in. across

open head of lettuce

long feathery roots

Reads INCOME

Prost, Miley

WATE IN



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

Fridd V Rogen Place V

WATER SOLDIER





Leaves may be emergent or submerged

Mog. Bharoo Bohahi

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 Miceul

YELLOW FLOATING HEART



Flowers are bright yellow with Spetals

leaves are 2-6 in. actoss with scalluped edges

491:50: ROW P.



WATER HYACINTH

WATER LETTUCE

EUROPEAN WATER CLOVER

These 3 species are legal for sale and possession. Nease only report signings outside of sultyation.

Rounded, shiny green leaves with spongy stalks avender flowers with central yellow fleck

Free-floating



Leaves are 16 in. long, sword-



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

Questions?

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