COOPERATIVE LAKES MONITORING PROGRAM

TRAINING FOR

Aquatic Plant Identification

Michigan Clean Water Corps

DEQ

Great Lakes Commission des Grands Lacs

Huron River Watershed Council

MICHIGAN STATE UNIVERSITY

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MICHIGAN STATE UNIVERSITY

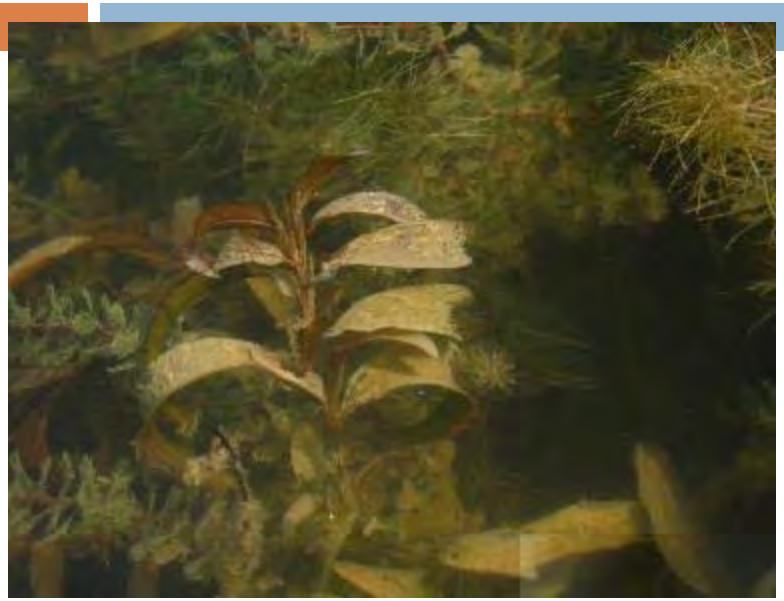
Outline for Today

- 9:00 – 10:15
  - Learn to identify aquatic plants
- 10:15 – 10:45
  - Break
- 10:45 – 11:15
  - How to make a plant collection
- 11:15 – Noon
  - CLMP's Aquatic Plant Mapping: How to map your lake's plants

Session 2

- Developing the Management Plan
  - Securing public input
    - What do citizens perceive as the problems and the solutions?
  - Control strategies
    - What are the pros and cons of the available control tools?
  - Developing the plan
    - Step-by-step process of developing the written plan.
  - Permitting requirements
    - When and where is a DEQ permit required?

What is an aquatic plant?



On The Fence…

- Some plants can't make up their mind

On The Fence…

- Some plants can't make up their mind

Adaptable and Admirable

- Provide sediment stabilization, aesthetic beauty, and oxygen production
- Can even reduce algae and pest populations!
- Even provide camouflage!

Identifying an Unknown

- Identify a fresh specimen!

Identifying an Unknown

- Examine the largest leaves

Identifying an Unknown

- Collect a sample in flower or fruit whenever possible

Identifying an Unknown

- If you must identify it later, collect several specimens and keep them in a cool, dark place
- Rinse off debris

Turion/winter bud production

Whorled watermilfoil


Day 0
IN GOD WE TRUST
LIBERTY
2007
D

Day 5

Day 10


Day 30

Common bladderwort (*Utricularia macrorhiza*)


Flat-leaf bladderwort
(*Utricularia intermedia*)

Turion/winter bud production

Pondweeds (*Potamogeton* spp.)

Curly-leaf pondweed

Fries' pondweed

Turion/winter bud production

Flat-stem pondweed (*Potamogeton zosteriformis*)

Turions

Growth from turions

Bulbil vs. TURION

Bulbil vs. TURION

Important for Identification

Midvein

Apex (tip)

Important for Identification

Margin

Stipule

Important for Identification

Clasping

Stalked/petiolate

Sessile

Important for Identification

Nodal glands

Fruits

Important for Identification

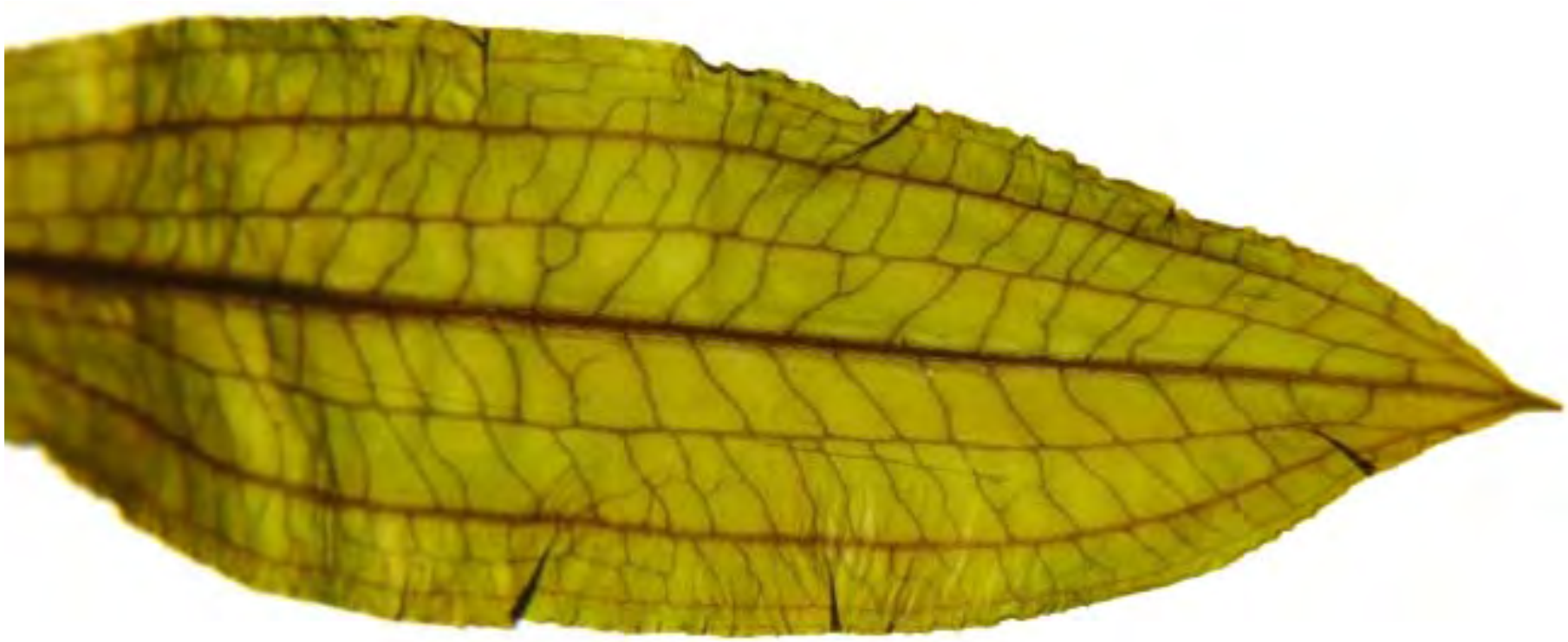
Leaf structure

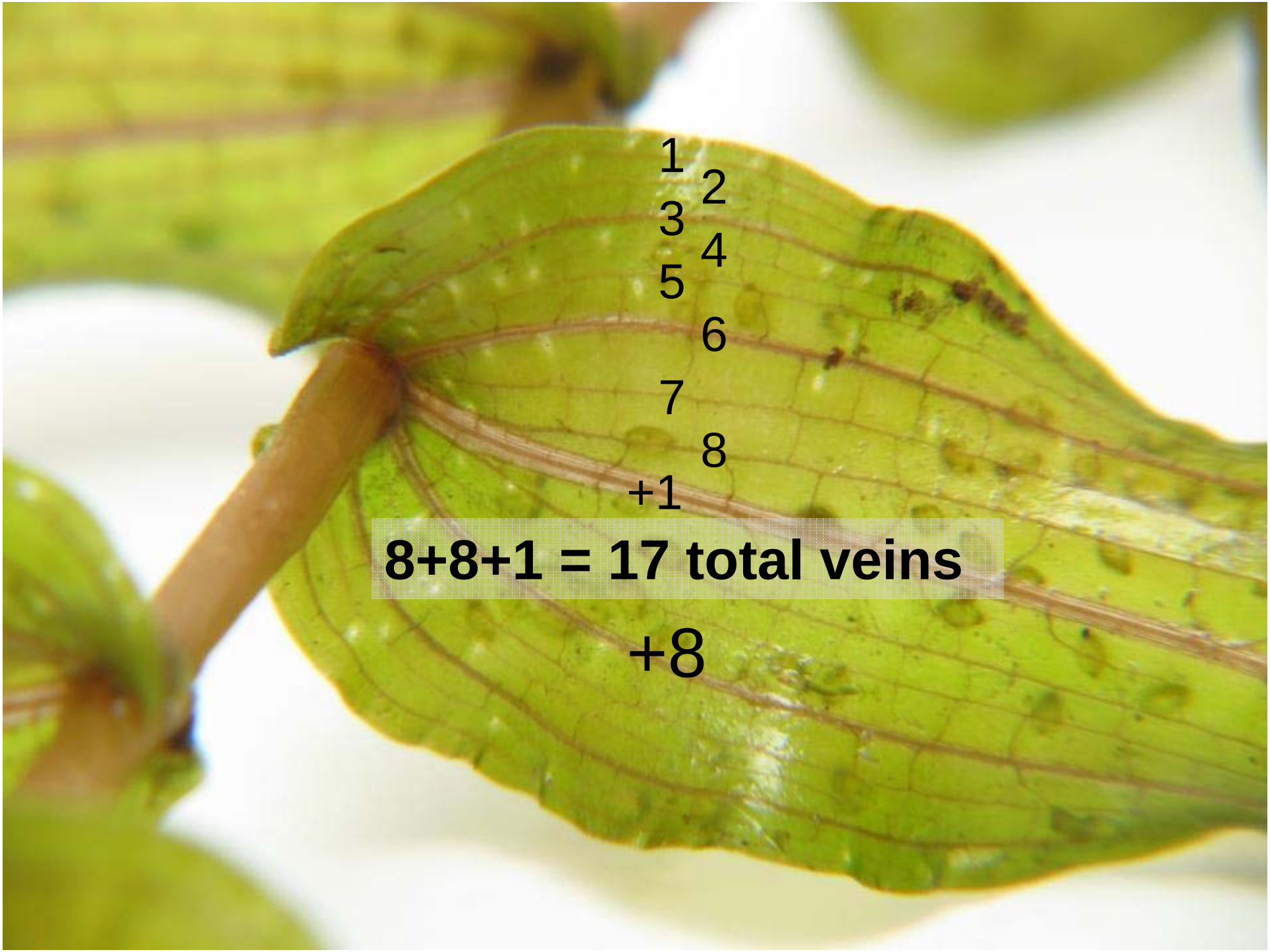
Terminology Review

Total veins per leaf

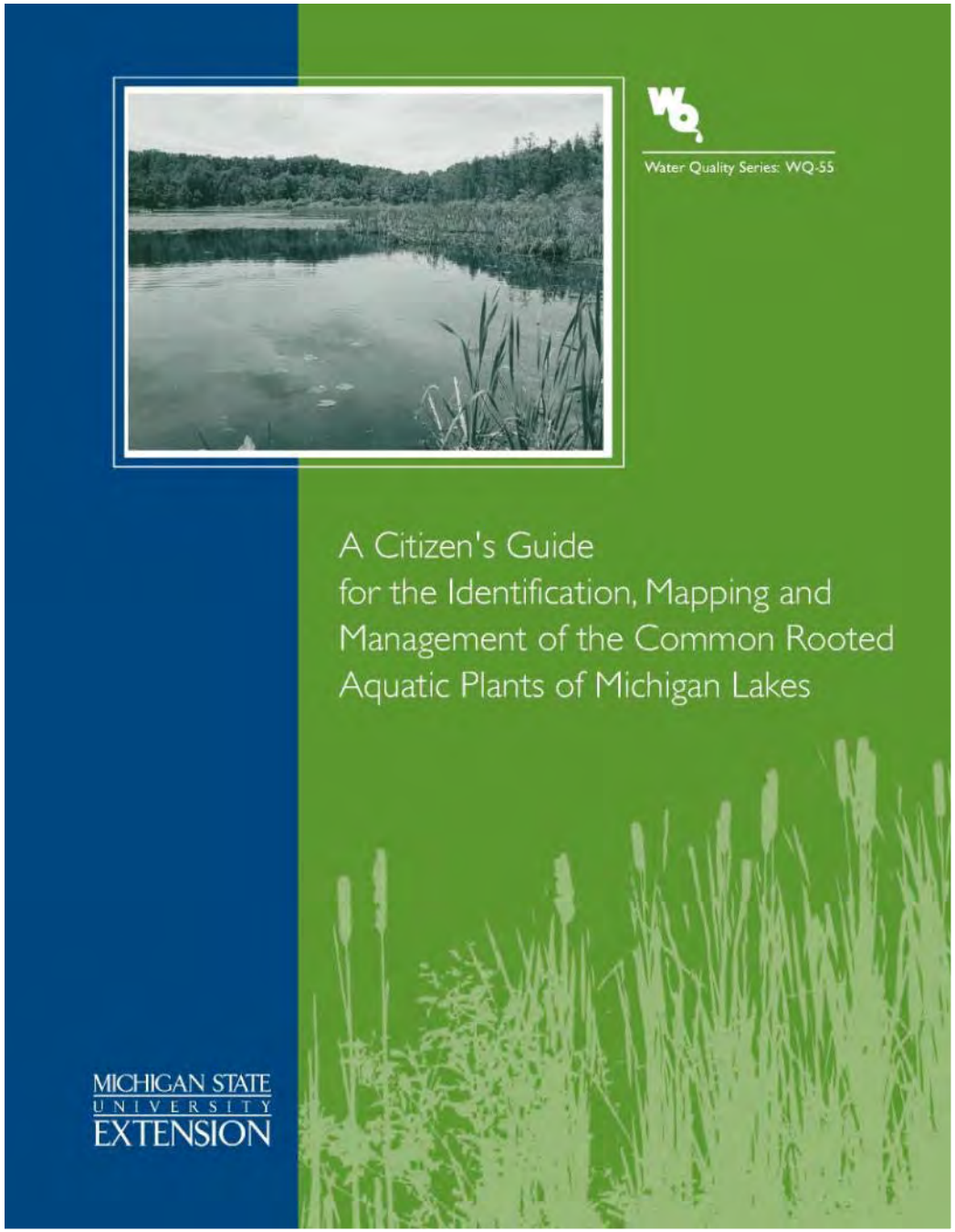
Important for Identification

Total veins per leaf




1
2
3
4
5
6
7
8
+1
8+8+1 = 17 total veins
+8

Available Resources



MSU Extension
WQ-55

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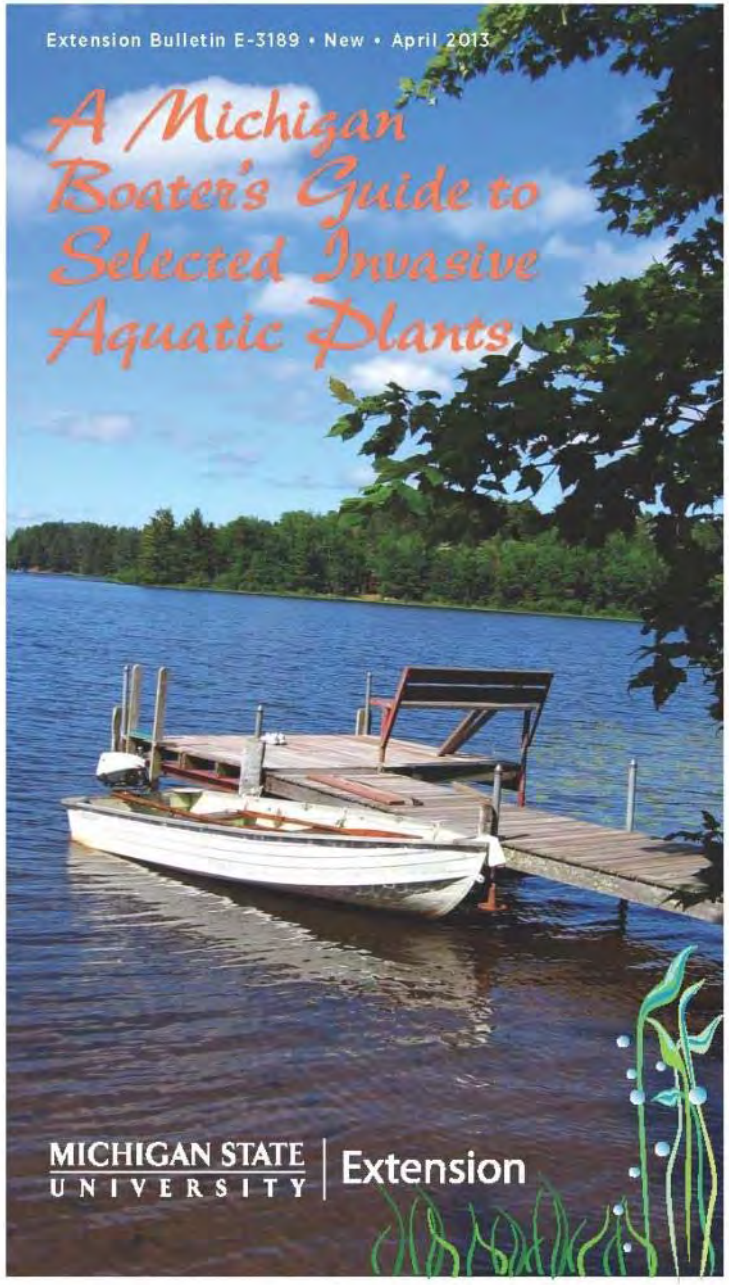
for $10 through the
MSU Extension Bookstore

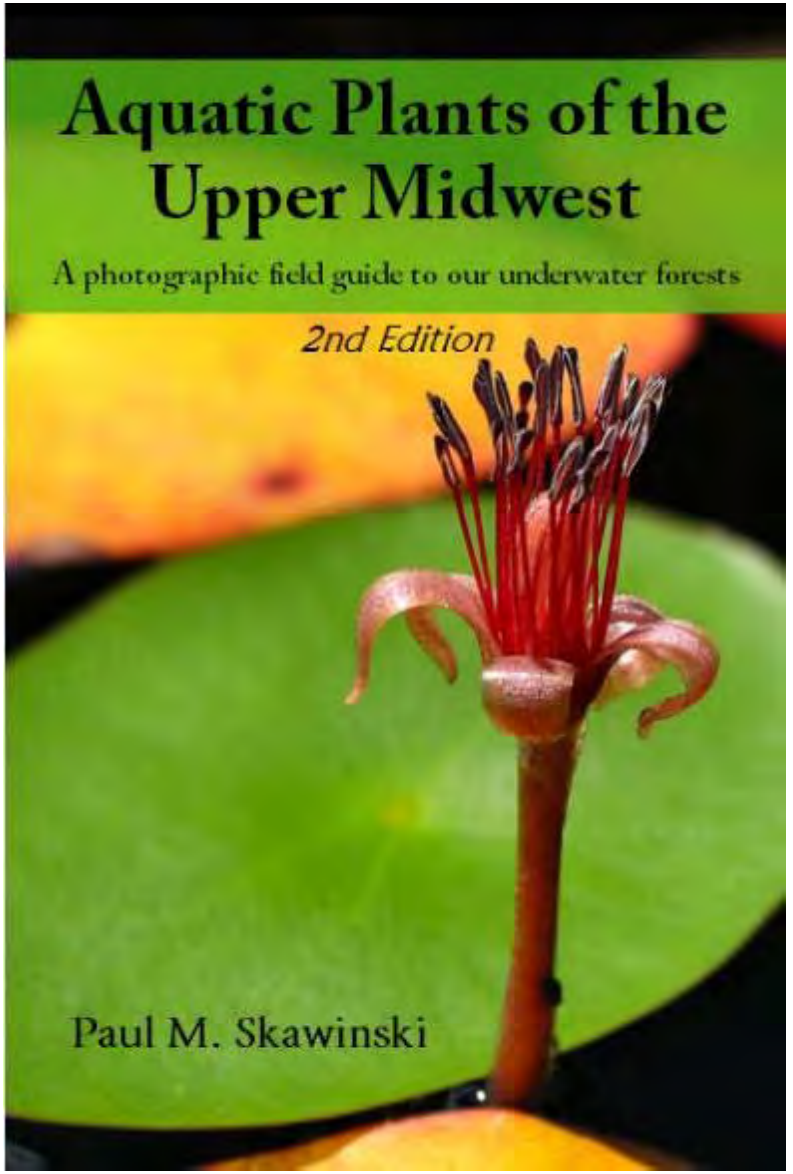
http://shop.msu.edu



Available through UW-Extension Lakes Program or Amazon

$38.00

www.uwsp.edu/cnr/uwexlakes/publications



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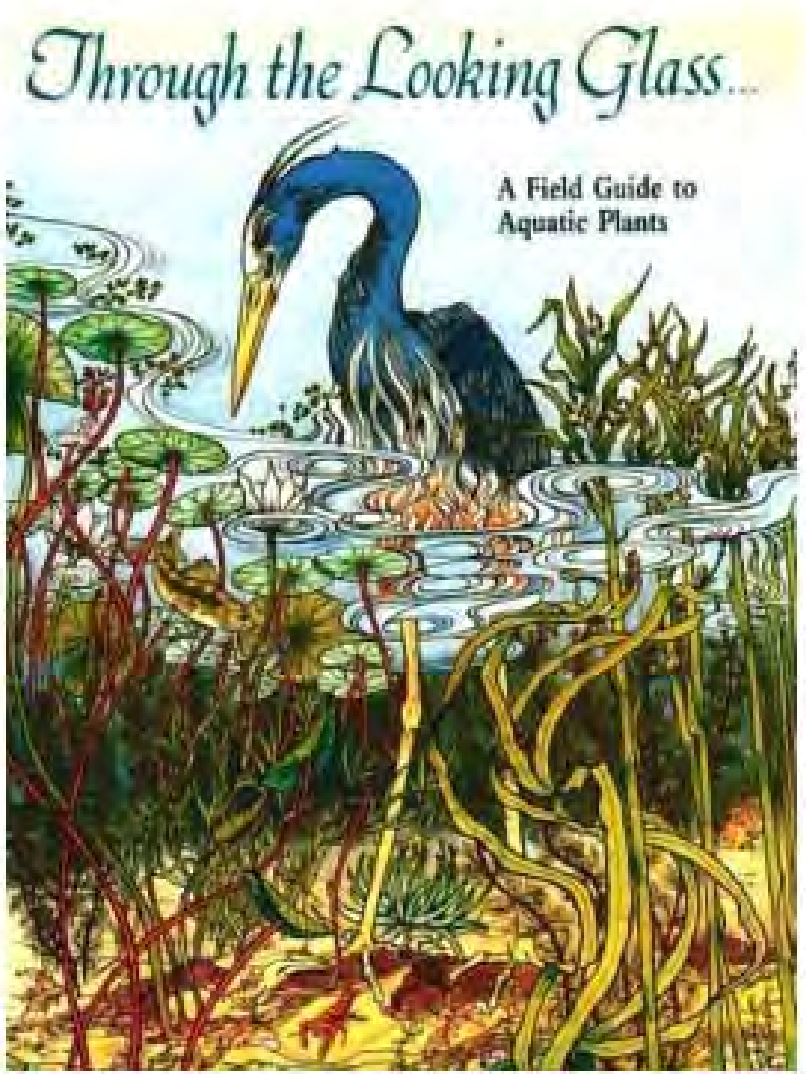

A Citizen's Key to the Common Rooted Aquatic Plants of Michigan Lakes

Parts to the Key

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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Plant on slide

Part Five

Plants with Long, Ribbon-like Leaves

#1

Choose one of the following:

All leaves arising from base of plant (Fig. 3.31 and Plate 2).
Vallisneria americana (wild celery) ..... **see Portrait 34**

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 round ..... **go 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).
Potamogeton robbinsii (fern pondweed) ..... **see Portrait 22**

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**

#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). *Potamogeton crispus* (curly-leaf pondweed) ..... **see Portrait 51**

Leaves long and flexible and leaf margins not finely toothed (Fig. 3.35 and Plate 2).
Heteranthera dubia (water star grass) (also known as *Zosterella dubia*) ..... **see Portrait 35**

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Plants with Long, Ribbon-like Leaves

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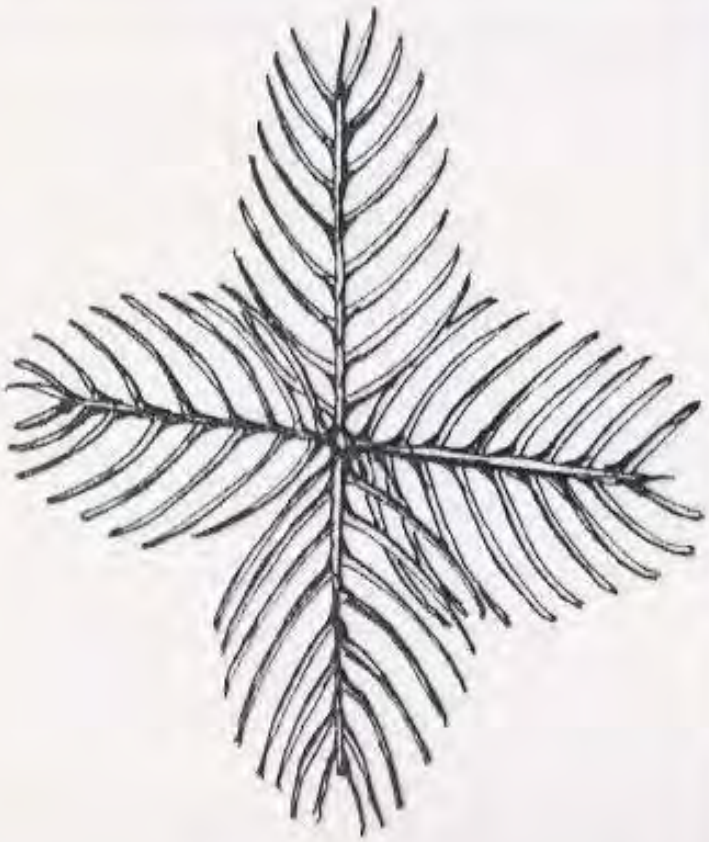
Practice with Plants!

Eurasian Watermilfoil

Allison Fox, University of Florida, Bugwood.org

Native Milfoil



Eurasian Milfoil

Curly-leaf Pondweed

Starry Stonewort

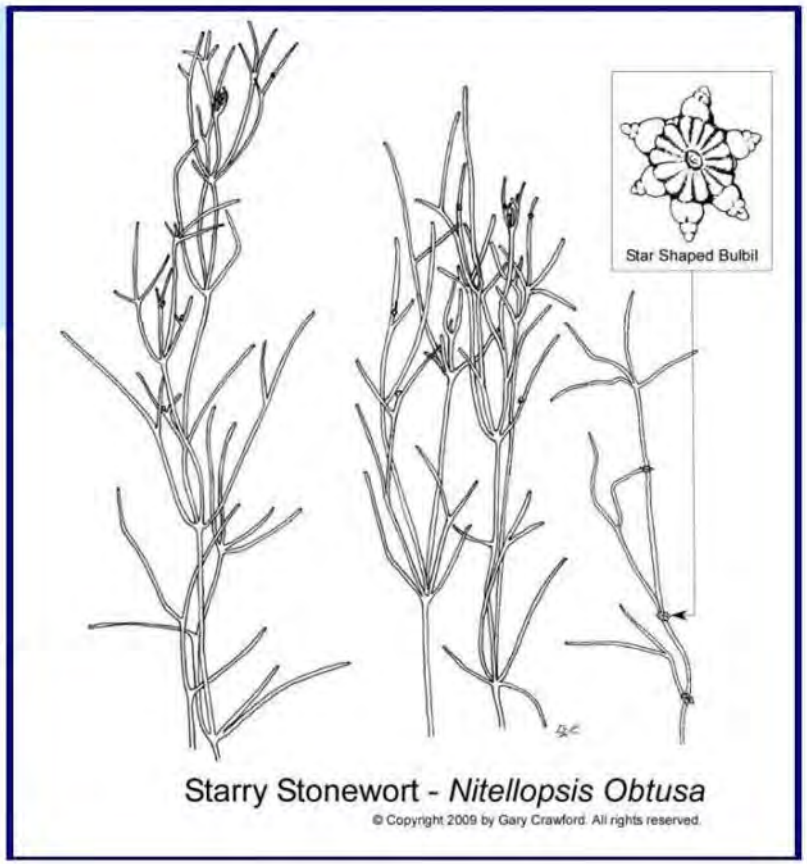
G. Douglas Pullman, Aquest Corporation

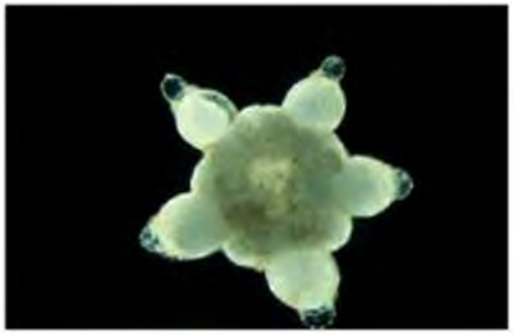
Starry Stonewort

Nitellopsis obtusa

(harmful exotic)

Long, uneven-length branches. Ragged appearance; forms mats. May have tiny, star-shaped "bulbils".





Muskgrass

Chara spp.

(beneficial native)

Shorter, rigid branches; may be covered in a brittle coating. Often smells "skunky" when broken.

Cooperative Lakes Monitoring Program

Drawing: Cayuga Lake Watershed Network. Photo: Texas A&M AgriLife Extension.

Hydrilla


Robert Vidéki, Dora
m Kft., Bugwood.org
Chris Evans, River to River CWMA, Bugwood.org

Hydrilla (exotic) Elodea (native)

Four or more leaves at each node.

Three leaves at each node.

Leaves margins clearly toothed and spines on mid vein.

Leaves margins not clearly toothed and no spines on mid vein.

Michigan's Aquatic Invasive Plant Watch List

Aquatic invasive species on the watch list have been identified as being an immediate and significant threat to Michigan's natural resources. These species either have never been confirmed in the wild in Michigan or have a limited known distribution. Early detection and timely reporting are crucial for preventing establishment and limiting impacts. For more information on these plants, visit: *www.misin.msu.edu*

Be on the lookout for these invasive species!

Yellow Floating Heart
Nymphoides peltata

Water-chestnut
Trapa natans

Parrot Feather Water-milfoil
Myriophyllum aquaticum

Water Soldier
Stratiotes aloides

Hydrilla
Hydrilla verticillata

Brazilian Water-weed
Egeria densa

European Frog-bit
Hydrocharis morsus-ranae

Water Lettuce
Pistia stratiotes

Water Hyacinth
Eichhornia crassipes

European Water-clover
Marsilea quadrifolia

These species are currently allowable for sale and possession. Please contact the DNR if these plants are observed outside of cultivation.

If you have seen any of these aquatic invaders, note their location and contact:

Michigan DNR Wildlife Division
Phone: (517) 243- 4077
www.mi.gov/invasivespecies

Questions about other aquatic invasive plants? Contact the DEQ Aquatic Nuisance Control Program at 517-284-5593, www.mi.gov/anc

Revised: February 2016


BREAK
TIME

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

COOPERATIVE LAKES MONITORING PROGRAM

TRAINING FOR

Aquatic Plant Identification and Mapping

Michigan Clean Water Corps

DEQ

Great Lakes Commission des Grands Lacs

Huron River Watershed Council

Lake and Stream

MICHIGAN STATE UNIVERSITY

MAPPING AQUATIC PLANTS IN THE LAKE

Why map aquatic plants?

Michigan Clean Water Corps

MiCorps Factsheet

Aquatic Plant Identification & Mapping

What plants are in your lake?

Why are aquatic plants important?
Rooted aquatic plants are a natural and essential part of lakes, just as grasses, shrubs and trees are a natural part of the land. Their roots are a fabric for holding sediments in place, reducing erosion and maintaining bottom stability. They provide habitat for fish and invertebrates by providing structure within which to forage, raise young, and hide from predators. Waterfowl, shore birds and aquatic mammals forage on plants, and use them as nesting materials and cover.

Though plants are important to the lake, over-abundant plants can negatively affect fish populations and human recreation. In this situation, it is advantageous to manage the lake and its aquatic plants for the maximum benefit of all users.

To be able to do this effectively, it is necessary to know the plant species present in the lake and their relative abundance and location. A map of a lake showing the plant population locations and densities will greatly aid management projects.

Stacey Daniels samples aquatic plants on Crystal Lake (credit: MiCorps Staff)

What help does the CLMP offer to volunteers interested in aquatic plants?
The Cooperative Lakes Monitoring Program (CLMP) uses qualitative techniques that allow volunteer monitors to generally assess the aquatic plants in their lake. This assessment may be viewed as a "snapshot" of the species of plants in the lake, their general location, and relative abundance. The CLMP assessment provides valuable information about a lake's aquatic plants that is often missing in lake and aquatic plant management programs.

The CLMP provides training and technical assistance to the volunteer monitors enrolled in the aquatic plant survey program. Training in plant identification and mapping is given on an annual basis. Technical assistance in survey design, plant identification, and field technique, including limited on-site consultation, is provided to the volunteer monitors.

What is the procedure for conducting a CLMP aquatic plant survey?
The CLMP uses the procedure written in *A Citizen's Guide for the Identification, Mapping and Management of the Common Rooted Aquatic Plants of Michigan Lakes*. An electronic version of this book can be obtained from www.micorps.net, under *Lake Monitoring* and *CLMP documents*.

In a nutshell, the procedure involves:
1) Using a lake depth map to establish sampling transects.
2) Using a sampling rake to take plant samples at particular depths on each transect.
3) At each sampling point, four samples are taken from the boat at the twelve, three, six, and nine o'clock positions.
4) Identifying the sampled plants and assigning a relative abundance.

Upon completion of the survey, volunteers have a detailed listing of the plant species growing in their lake, including any invasive species that may be problematic. They also will have created a map that shows the overall distribution and density of the lakes' plant population. These products will be valuable in lake management activities and as a reference in the future.

Cooperative Lakes Monitoring Program

The CLMP is the lake monitoring program of the Michigan Clean Water Corps (MiCorps). MiCorps was created through an executive order by Governor Jennifer M. Granholm to assist the Department of Natural Resources and Environment in collecting and sharing water quality data for use in water resources management and protection programs. For more information about the MiCorps program, please visit www.micorps.net.

- 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 Identification and 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 DEQ
- Baseline information for future lake management
- 2016 enrollment cost – only $250

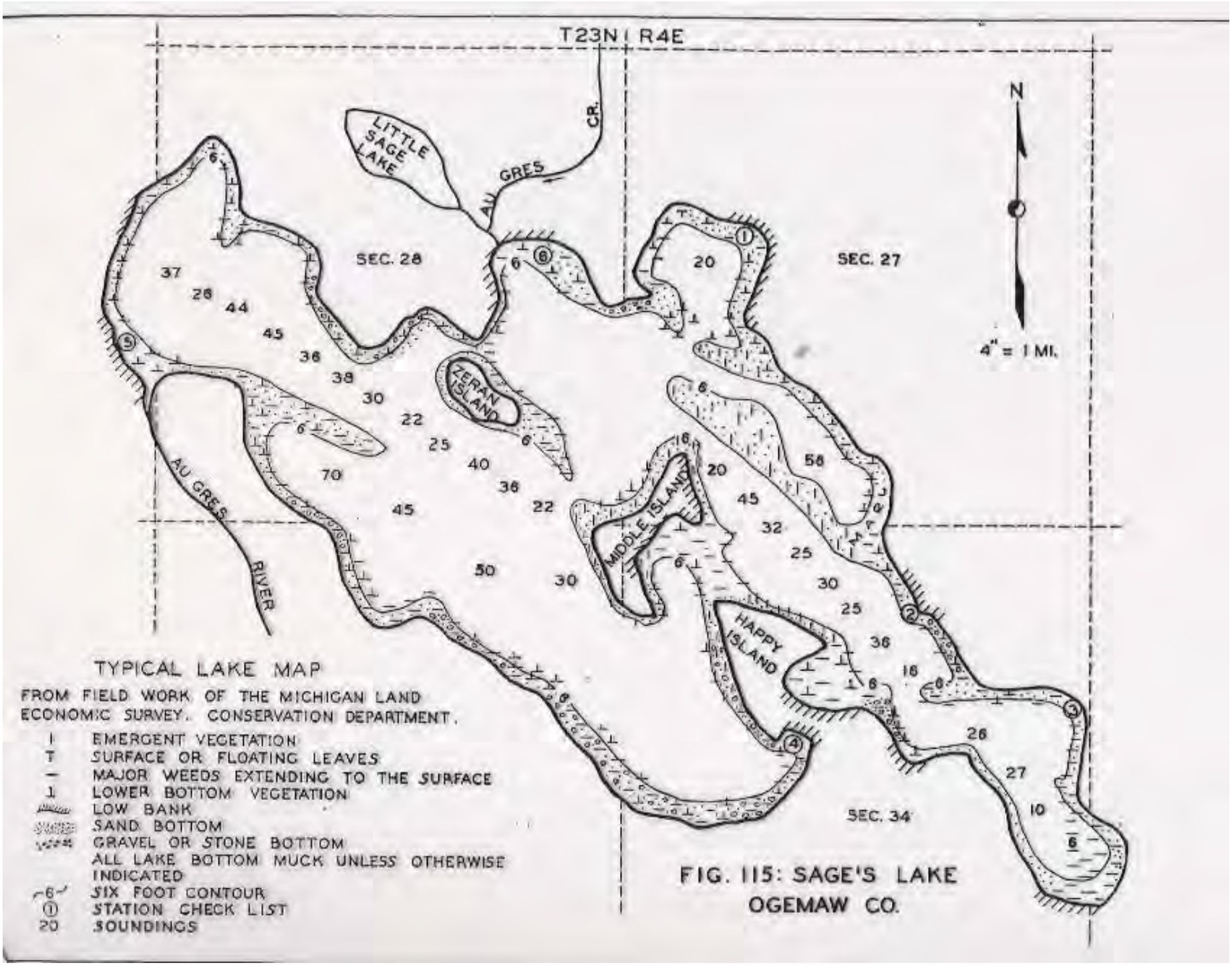


FIG. 115: SAGE'S LAKE
OGEMAW CO.

Two Aquatic Plant Surveys of Magician Lake, Cass County

First Survey: "Magician Lake is a marl lake and except for its smaller size is very similar to Higgins Lake, with good water clarity and few aquatic plants. Stonewort and bushy pondweed are the dominant plants that can be found and are visible at depths of fifteen feet."

Second Survey: "Magician Lake has marl and sand bottom sediments near shore and organic sediments in deeper water. The water was moderately clear with a Secchi disk reading of about 9 feet. Aquatic plants overall were sparse. The dominant plants found were stonewort and bushy pondweed. A very few medium-leafed pondweeds were also found."

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1928

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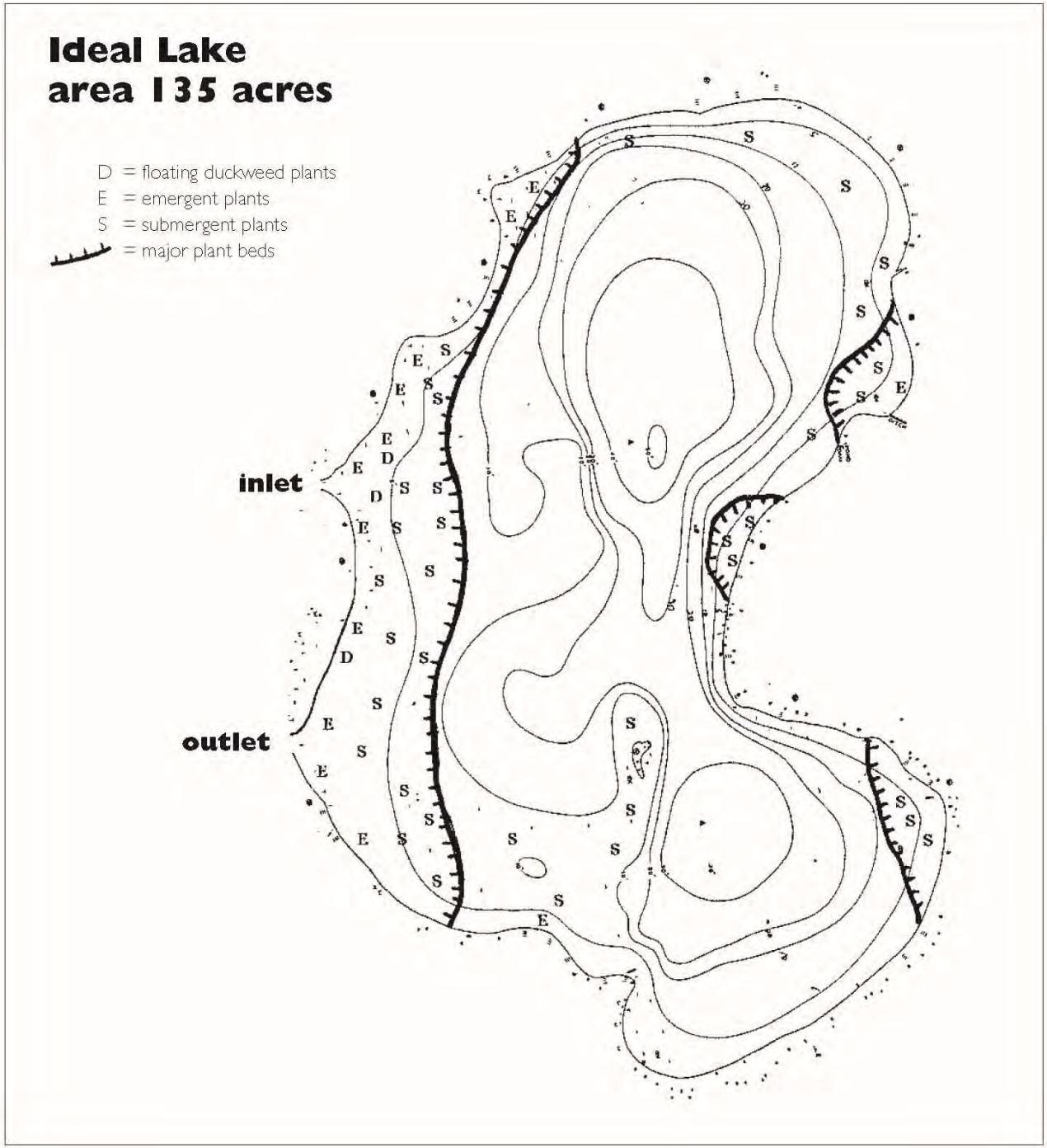
1981

Example Plant Location Map

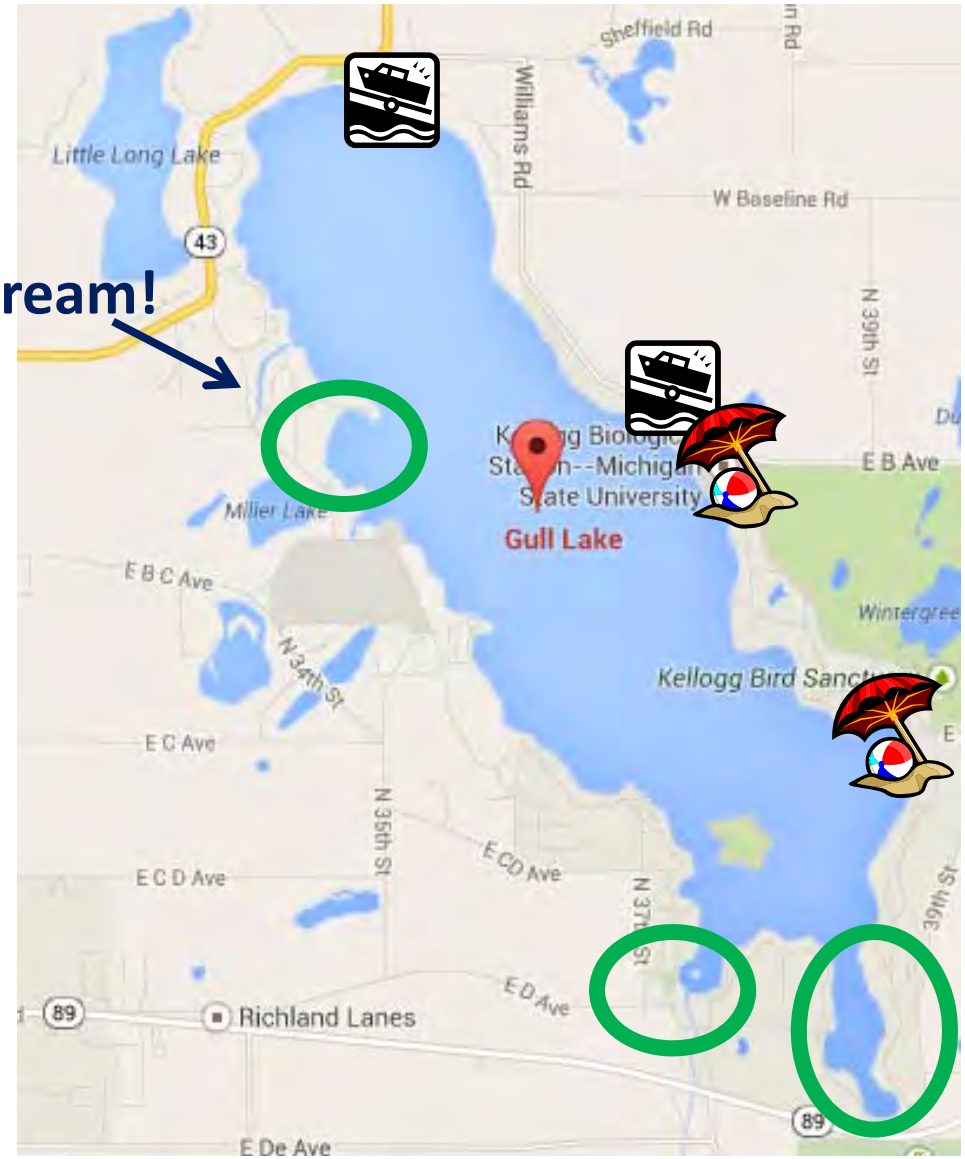


When to sample?

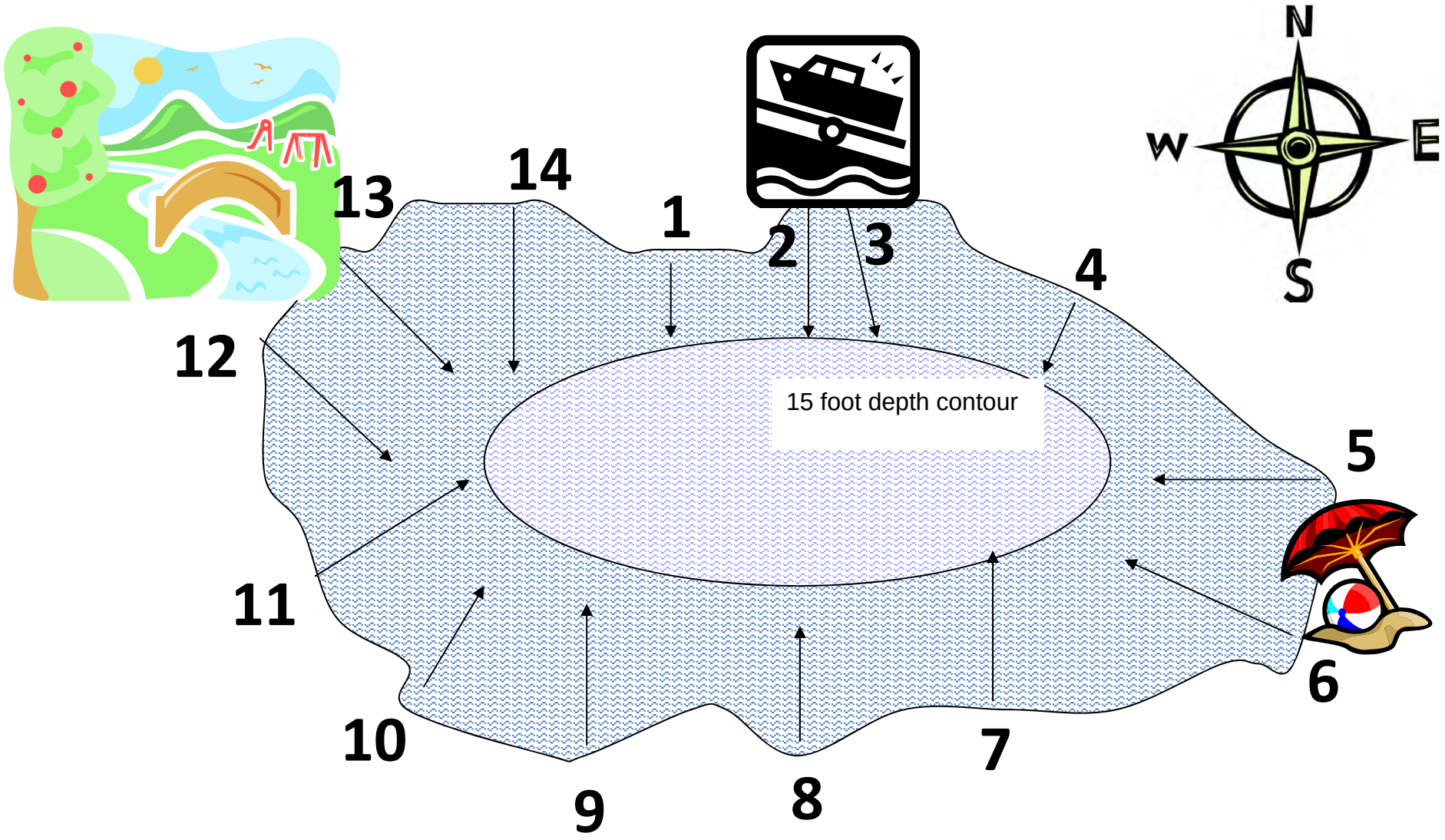
- July - August
  - Northern lakes can begin later
- Can spread effort out over the course of several days/weeks

Where to sample?

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



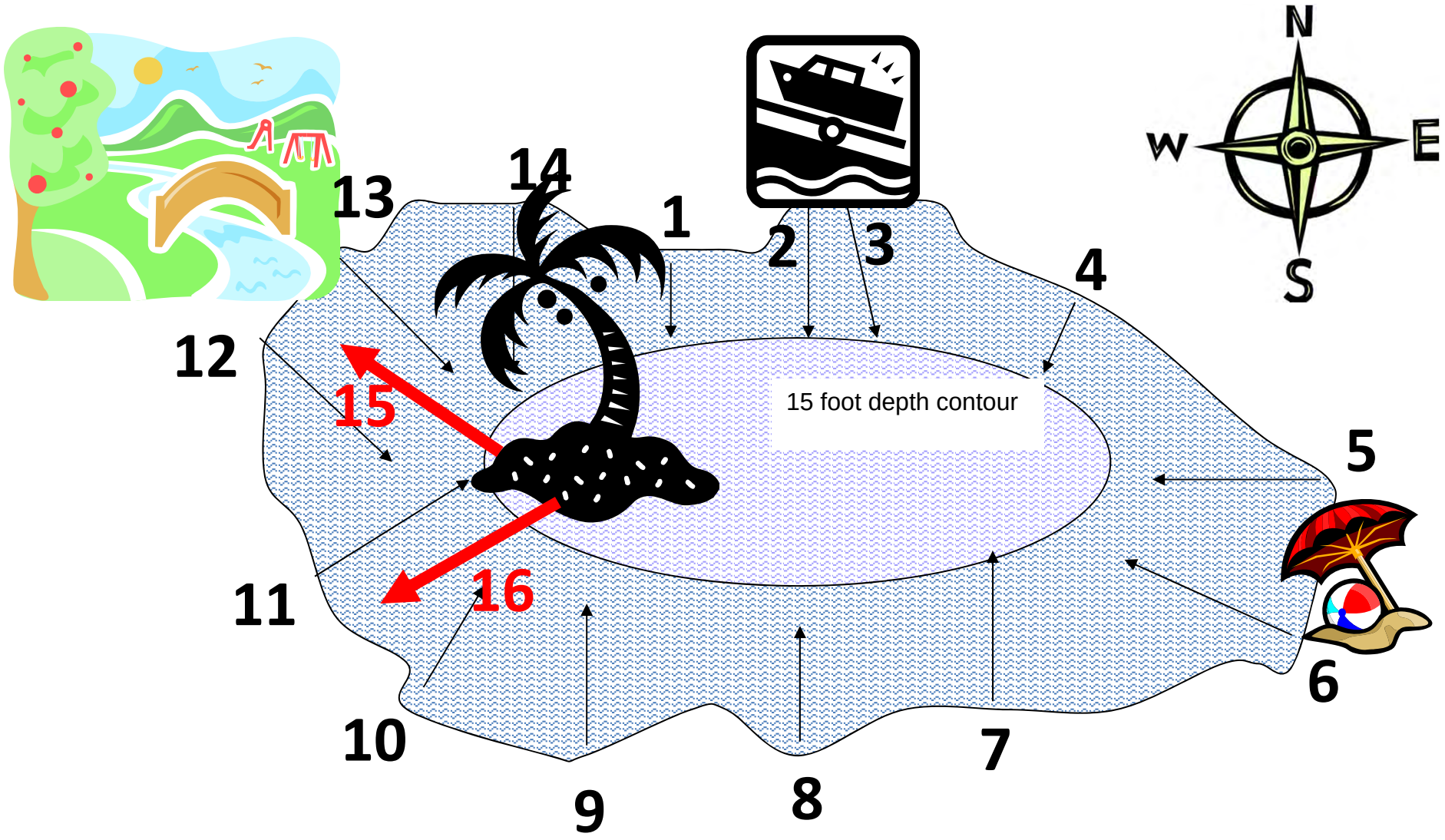
Example Lake < 100 acres = 15 transects



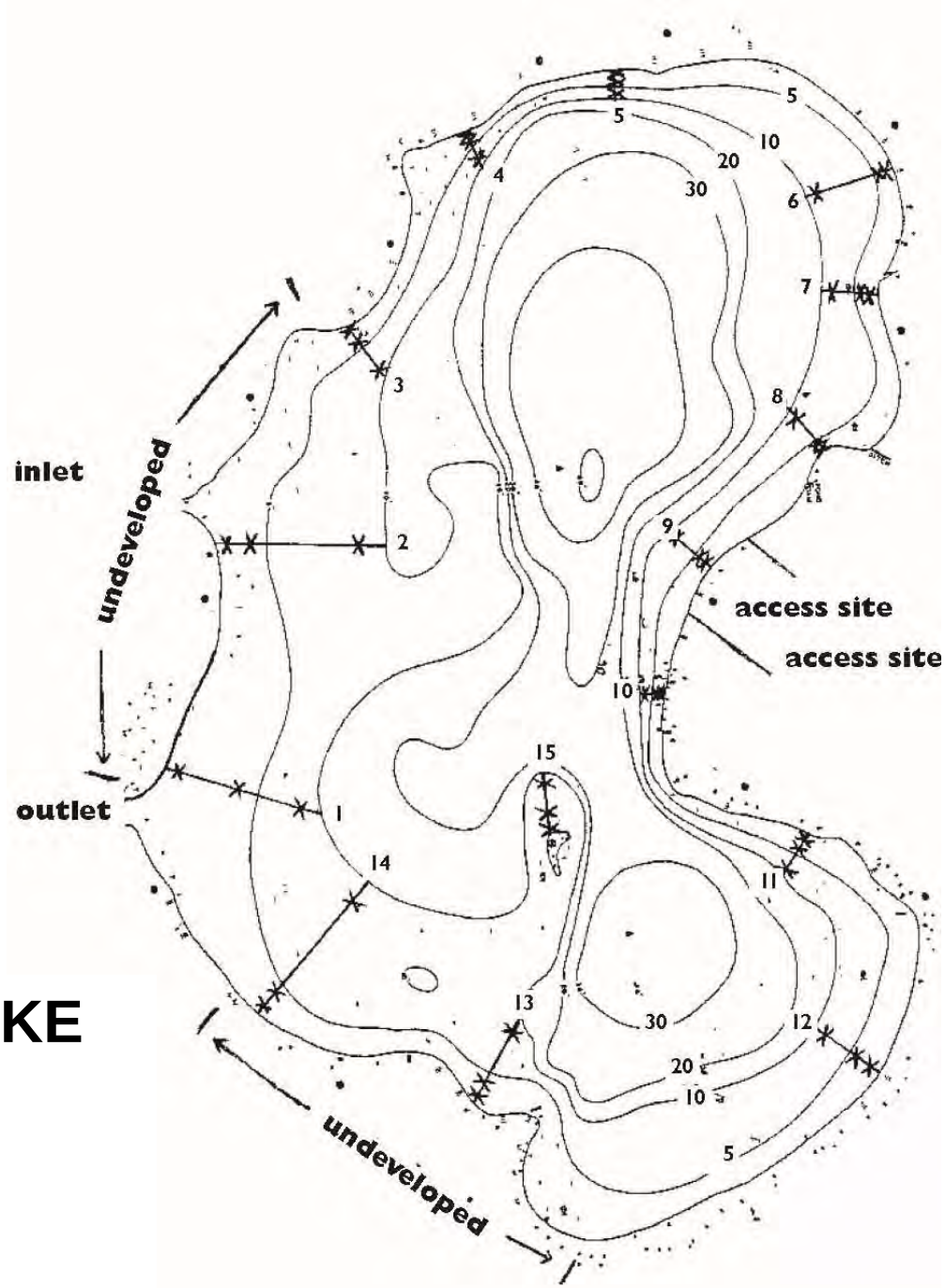
How Many Transects?

Lake Size (Acres)	No. of Transects
Less than 100	5 to 15
100 to 500	15 to 30
Over 500	30 to 50

Got an island? Add more transects!



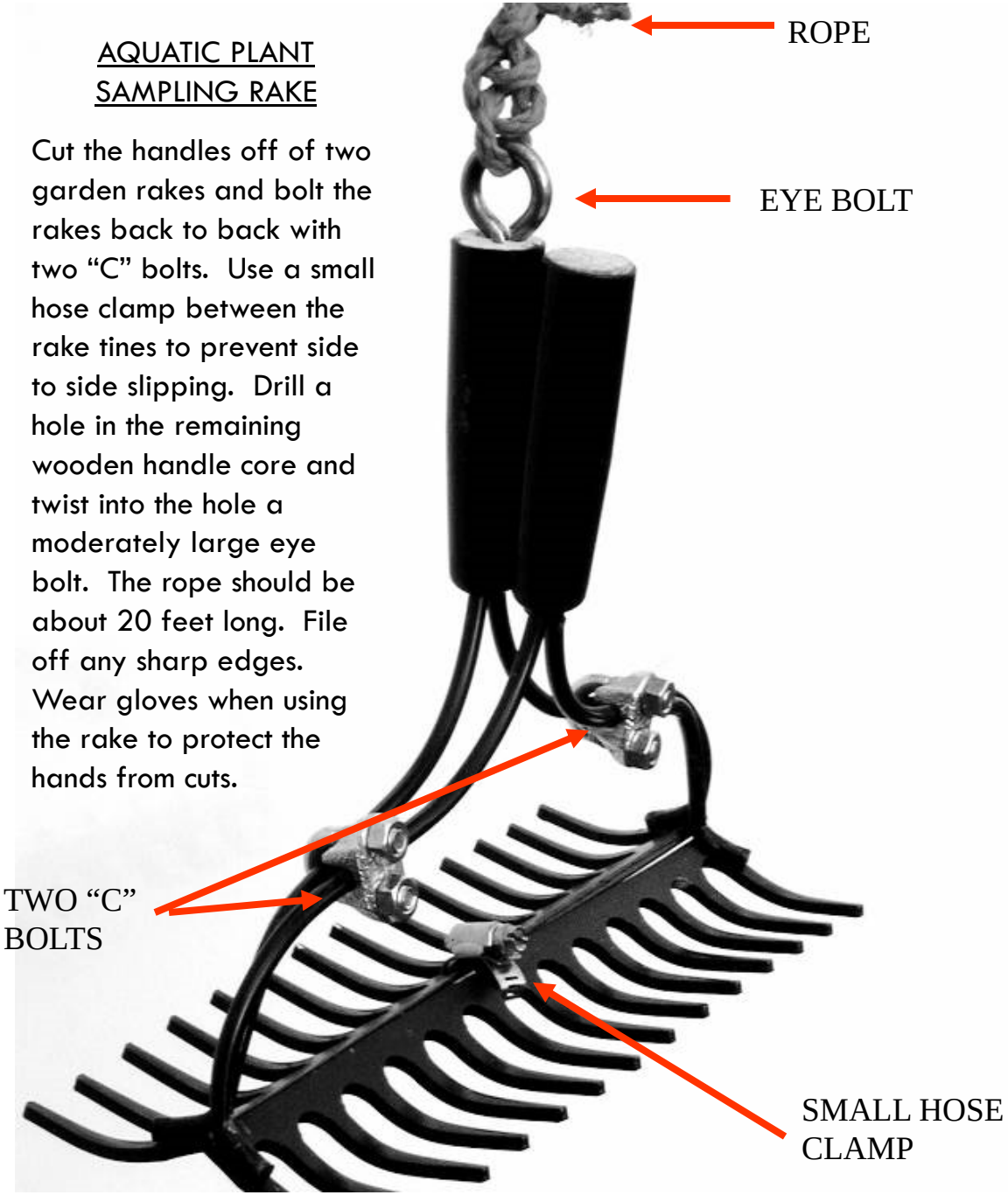
Example of Field Sampling Transect Map



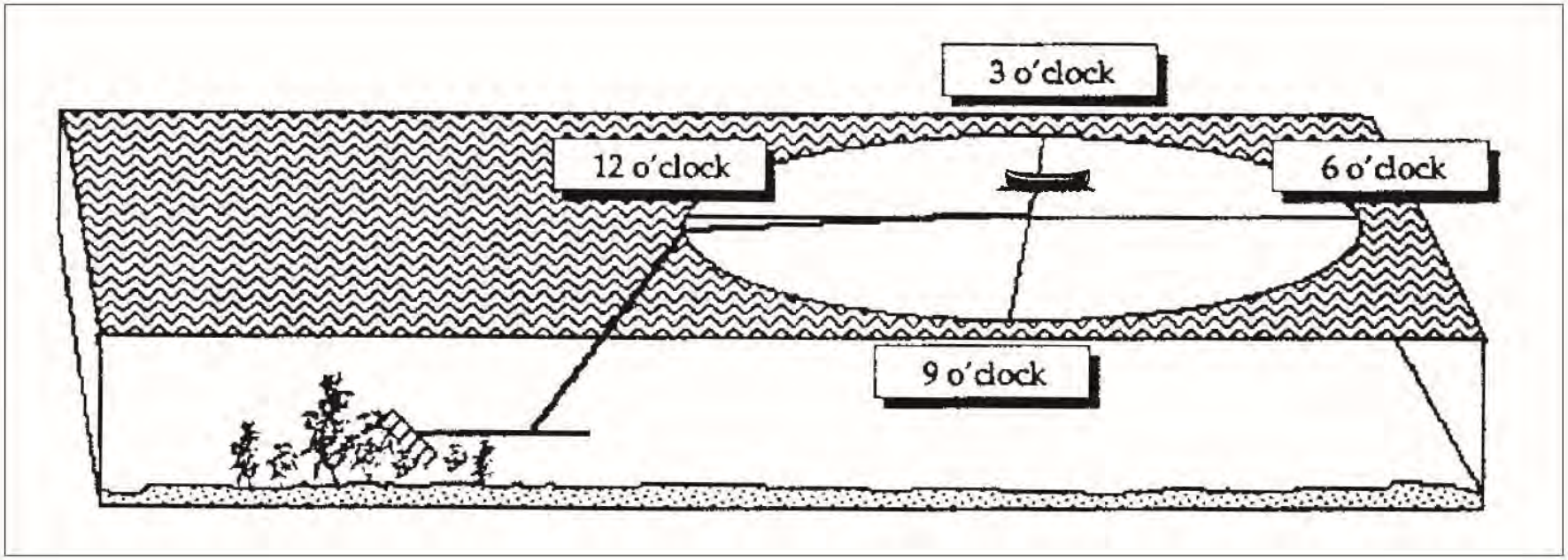
IDEAL LAKE
135 acres

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.



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

Fig. 5.2. **Example field recording sheet.**

Lake name:	County name:
Sampling date:	
Names of volunteers:	

Density rating chart	
Rake recovery of aquatic plant	Density rating
Taken in all 4 casts (teeth of rake full)	Dense (D)
Taken in 4 casts	Heavy (H)
Taken in 3 casts	Moderate (M)
Taken in 2 casts	Sparse (S)
Taken in 1 cast	Found (F)

Transect line no. _____

Position on transect line

1 foot ❑

4 foot ❑

8 foot ❑

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

Transect line no.

3

Position on transect line

1 foot ☐

4 foot ☐

8 foot ☒

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	X	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.

3

Position on transect line

1 foot ☐

4 foot ☐

8 foot ☒

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	X	X			Sparse
Coontail	X	X	X	X	Heavy/ Dense

Transect line no.

3

Position on transect line

1 foot ☐

4 foot ☐

8 foot ☒

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	X	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 5.3. A**quatic Plants Numbered by Growth Pattern.**

Free floating

1 -	Watermeal	(0)
2 -	Star duckweed	(0)
3 -	Lesser duckweed	(0)
4 -	Big duckweed	(0)

Shoreline (emergent)

6 -	Cattail	(+)
7 -	Bulrush	(+)
8 -	Arrow arum	(+)
9 -	Arrowhead	(+)
10 -	Pickerelweed	(+)
11 -	Smartweed	(+)
12 -	White water lily	(+)
13 -	Yellow water lily	(+)
14 -	Water shield	(+)

Low growing (1 to 3 feet)

20 -	Stonewort	(+)
21 -	Bushy pondweed	(+)
22 -	Fern pondweed	(+)

Mid-water growing (2 to 5 feet)

30 -	Large-leaf pondweed	(+)
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); open scattered growth pattern

40 -	Native milfoil	(0/–)
41 -	Coontail	(0/–)
42 -	Clasping-leaf pondweed	(0)
43 -	Floating-leaf pondweed	(+)
44 -	Whitestem pondweed	(0)
45 -	American pondweed	(+)
46 -	Illinois pondweed	(+)
47 -	Water marigold	(0)
48 -	Bladderwort	(0)
49 -	Buttercup	(0)

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

50 -	Eurasian milfoil	(–)
51 -	Curly-leaf pondweed	(–)
52 -	Sago pondweed	(0/–)
53 -	Hydrilla	(–)

(+) = generally beneficial, (0) = generally neutral, (–) generally a nuisance

Data Codes for Your Map

Transect 5

1-foot depth: White water lily (Sparse), Stonewort (Found)

4-foot depth: Stonewort (Found), Large-leaf pondweed (Sparse), Coontail (Sparse)

8-foot depth: Wild celery (Sparse), Native milfoil (Moderate), Illinois pondweed (Sparse)

Becomes...

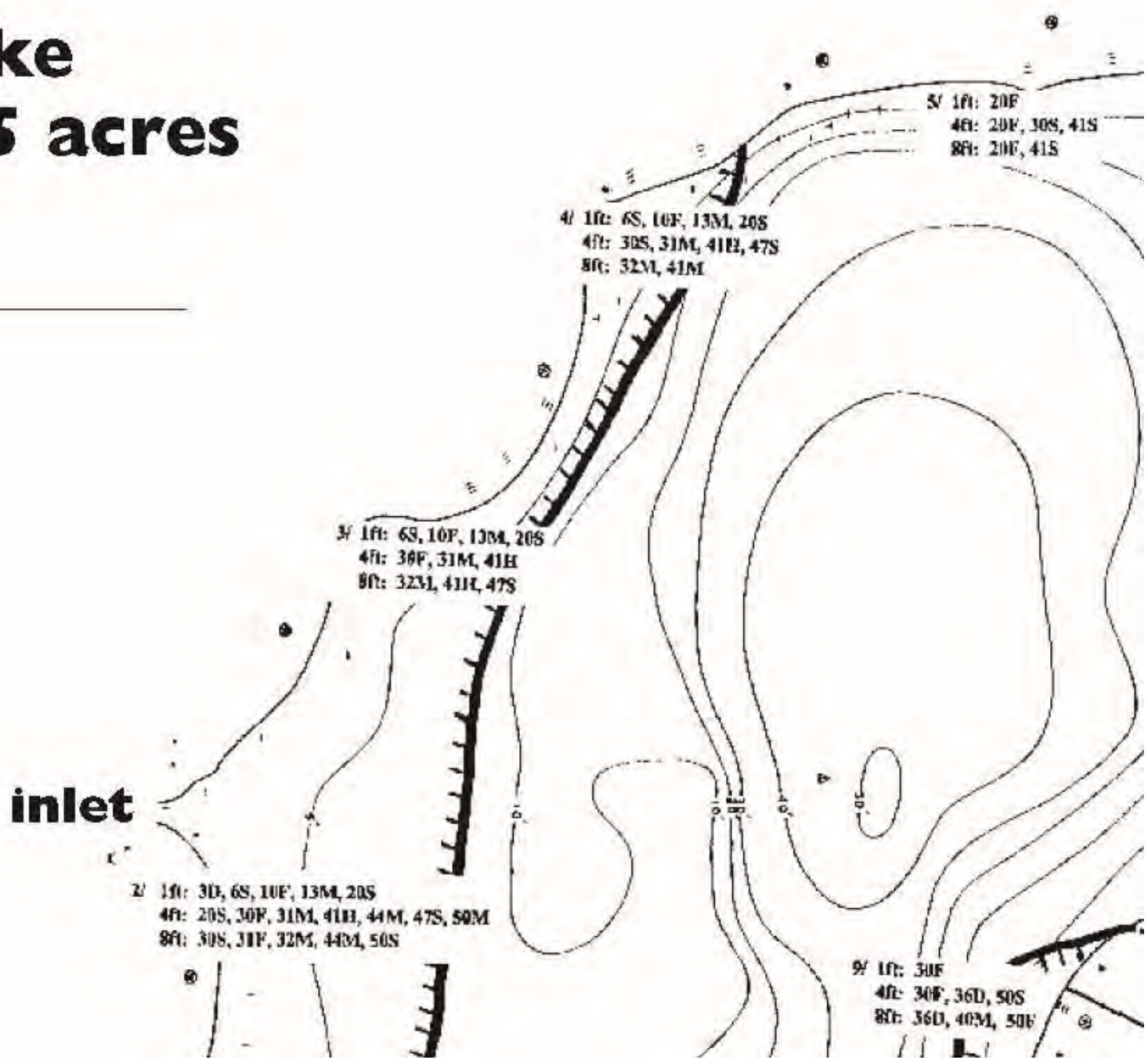
5/ 1ft: 12S, 20F

4ft: 20F, 30S, 41S

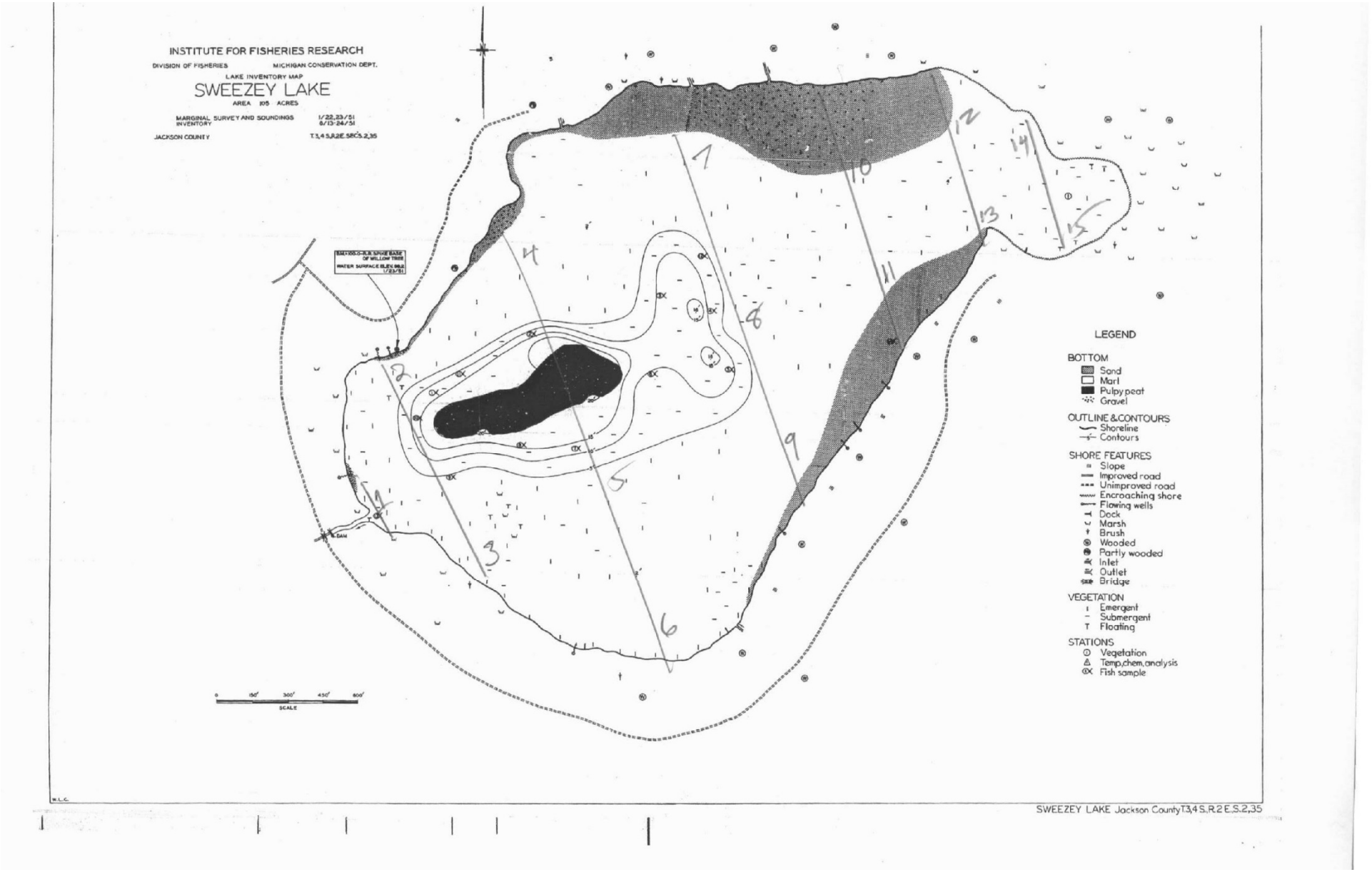
8ft: 34S, 40M, 46S

Ideal Lake
area 135 acres

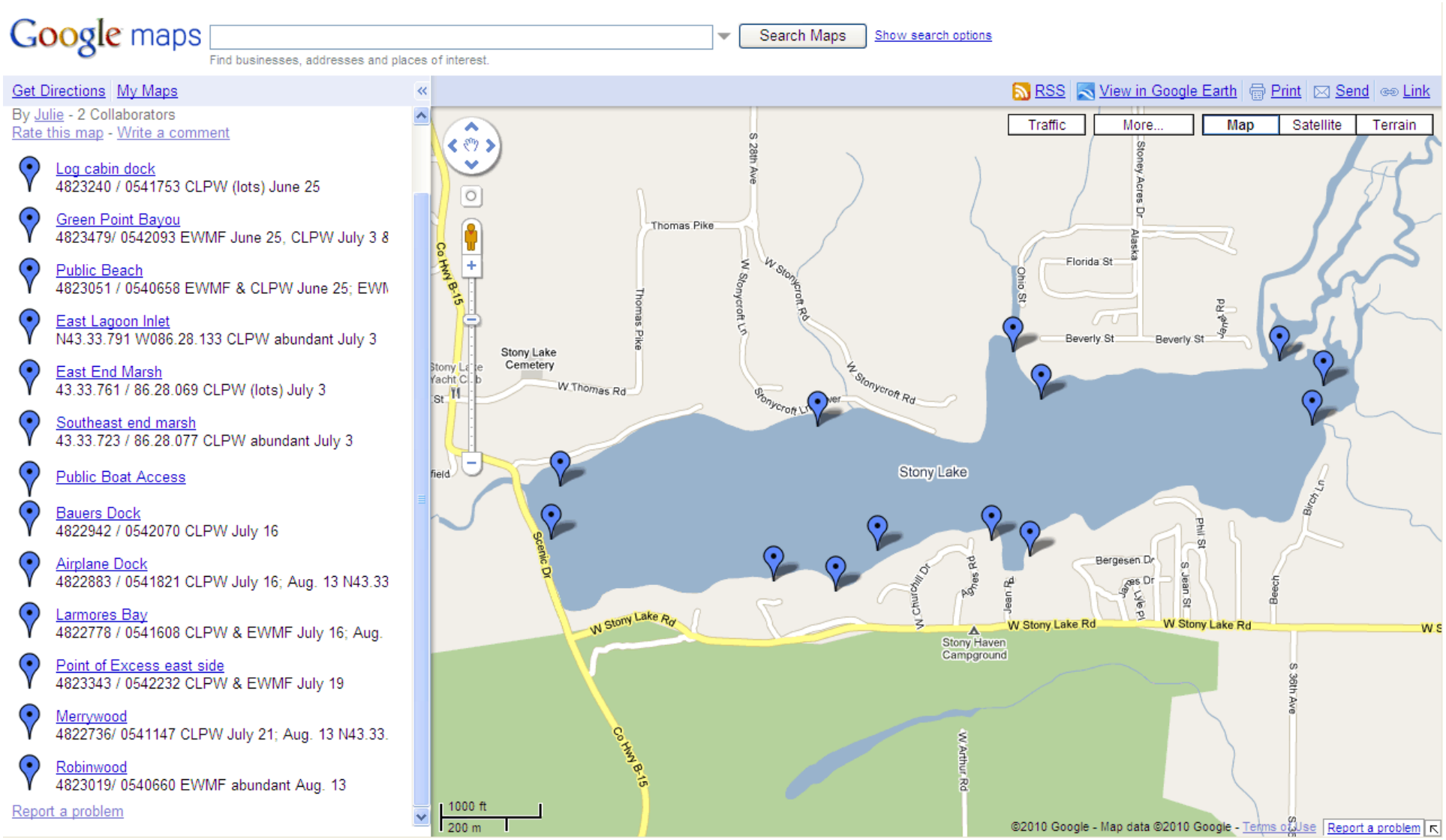
Date sampled _____



Mapping Options: By Hand



Mapping Options: Google Maps



Mapping Options: Google Earth

Mobile Mapping Applications

- Interested in using a tablet or smart phone to map your survey efforts?
  - We've developed some clever methods – stick around for a few minutes after training to learn more!

Example Data Table

Fig. 5.6. **Example data sheet.**

Lake name/county			Sampling date	
Data sheet for:	Whole lake	Near shore	Mid-depth	Deep water
Number of transects			Number of sampling sites	

Plant number	Plant name	Distribution (number of sites where observed)	Average density

Other plants known to be in the lake at the time of the survey but not collected in the survey.

Example Data Sheet Calculation

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	Total density points
Found	2	1	2
Sparse	10	2	20
Moderate	3	3	9
Heavy	3	4	12
Dense	2	5	10
TOTAL	20		50

50 (total density points) / 45 (sampling sites)
= 1.1 (lakewide density rating)

An average lakewide density rating of 1.1 is slightly above the "found" level.

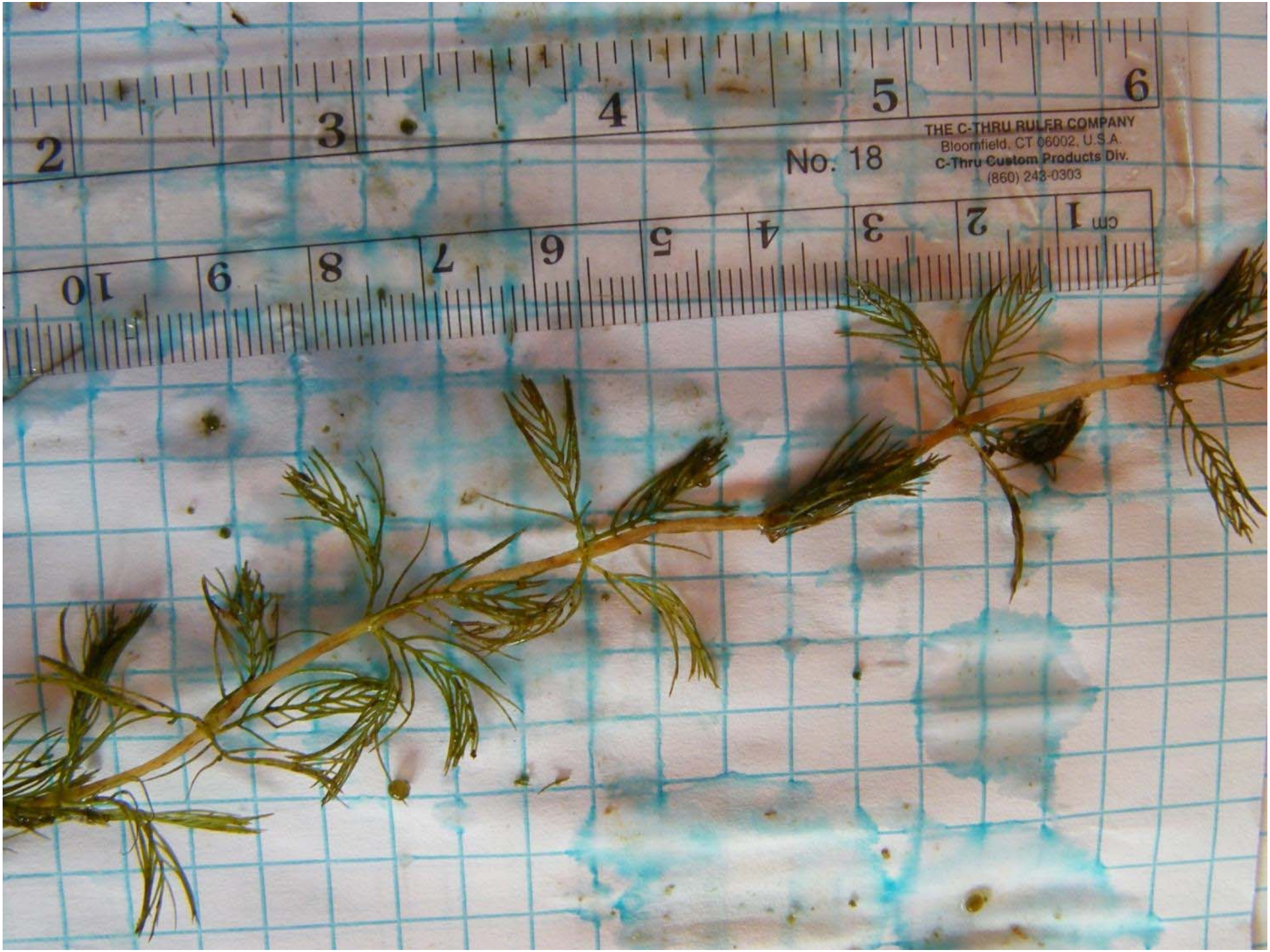
Record observations (20) and average lakewide density rating (1.1) on the data sheet.

Plant number	Plant name	Distribution (number of sites where observed)	Average density
41	Coontail	20	1.1
20	Stonewort	23	0.9

Other plants known to be in the lake at the time of the survey but not collected in the survey.
36 Waterweed

Field plant ID photography

- Rules for useful Plant ID photos
  - TAKE lots of pictures
    - even if you think there are TOO many!
  - Delete blurry photos
    - pretty much useless
  - Photos MUST show key characteristics
    - For example, milfoil leaflets
  - Size & Scale is essential
  - Location is essential


THE C-THRU RULER COMPANY
Bloomfield, CT 06002, U.S.A.
C-Thru Custom Products Div.
(860) 243-0303
No. 18

Forgot a ruler? A hand will do!

Make sure to capture the WHOLE plant! And where you sampled it!

Submitting Your Data

1. Make copies of your data for your records.
2. Enter your data into the online MiCorps Data Exchange (www.micorps.net) by October 30.
3. Send complete report to Jo Latimore at MSU
    a. Completed report and map
    b. Any photographs

What's growing in *your* lake?