$3.50

A Field Guide to VALUABLE UNDERWATER AQUATIC PLANTS of the Great Lakes

by Donald W. Schloesser

U.S. Fish and Wildlife Service
Great Lakes Fishery Laboratory
Ann Arbor, Michigan
and
Co[illegible]ve Extension Service
[illegible]tate University
[illegible]g, Michigan

[illegible]Bulletin E-1902
[illegible]6

[illegible] 644, Great Lakes Fishery Laboratory,
[illegible]d Wildlife Service, Ann Arbor, Michigan 48105.

QK
130
.S3
1986

USGS LIBRARY - LAFAYETTE
3 1822 00014182 0

USGS National Wetlands Research Center
Library
700 Cajundome Blvd.
Lafayette, LA 70506

QK
130
.S3
1986

INDEX

	Page
Introduction and use of this guide	3
Macroscopic Algae	8
Cladophora	9
Muskgrass	10
Nitellas	11
Nitellopsis	12
Vascular Plants	13
Coontail	14
Eurasian watermilfoil	15
Naiad	16
Quilwort	17
Water stargrass	18
Watermilfoil	19
Waterweed	20
Wild celery	21
Pondweed Family	22
Clasping-leaf pondweed	24
Curly pondweed	25
Fern pondweed	26
Flatstem pondweed	27
Narrow-leaf pondweed	28
Variable pondweed	29
Whitestem pondweed	30
Glossary	31
Sources of additional information	32

#15491524

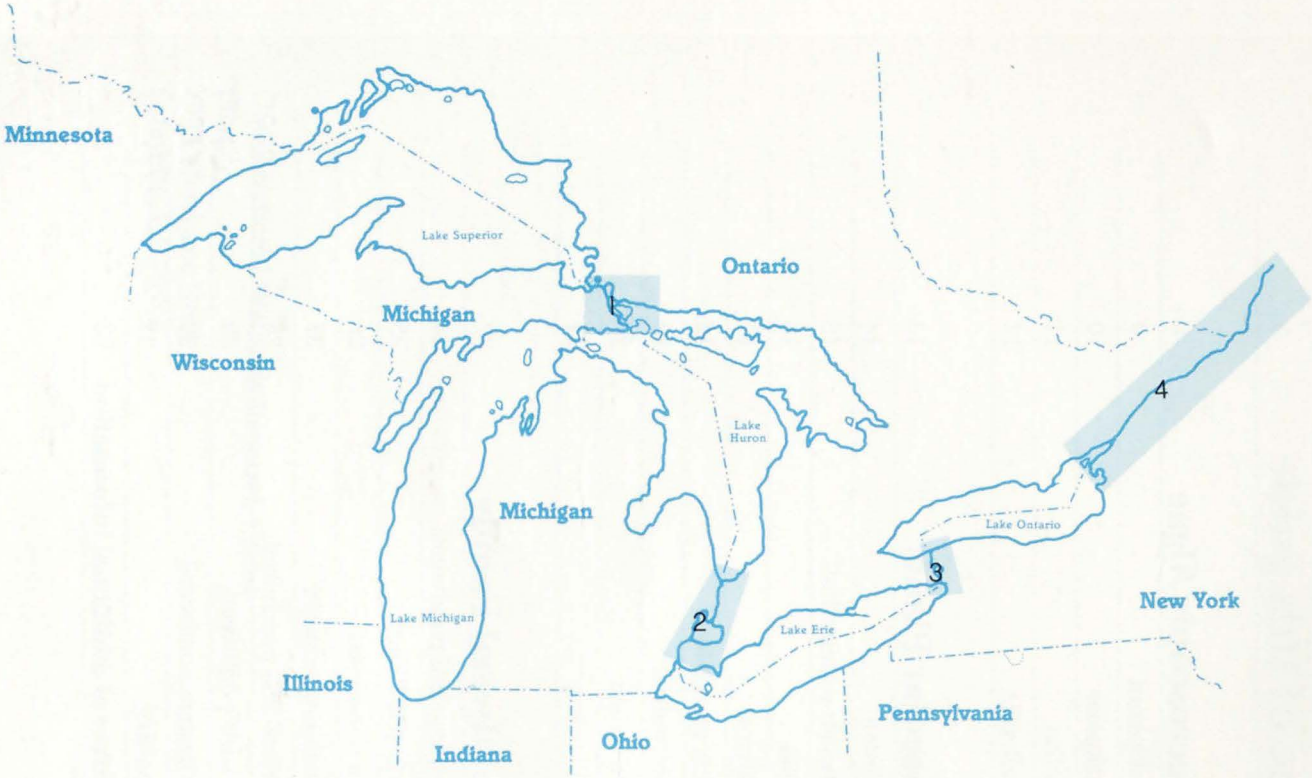


Figure 1. Location of the four connecting rivers of the Great Lakes: 1. St. Mary's River between Lakes Superior and Huron; 2. St. Clair-Detroit River System between Lakes Huron and Erie; 3. Niagara River between Lakes Erie and Ontario; and 4. St. Lawrence River between Lake Ontario and the Atlantic Ocean.

INTRODUCTION

Underwater plants are a valuable part of the Great Lakes ecosystem, providing food and shelter for aquatic animals. Aquatic plants also help stabilize sediments, thereby reducing shoreline erosion. Annual fall die-offs of underwater plants provide food and shelter for overwintering small aquatic animals such as insects, snails, and freshwater shrimp.

In some areas, underwater plants may be the dominant primary producer in the food chain supporting animal populations. Fish, for example, are usually more abundant where underwater plants are found. Plants and associated animals are a source of food for fish and waterfowl in the Great Lakes (Table 1). Despite the importance of underwater plants in the Great Lakes, very little is known about them, partly because of the difficulty of observing the plants in their natural habitat.

The purpose of this field guide is to aid in the identification of common underwater plants in the Great Lakes. These plants are found mostly in shallow, nearshore waters along sheltered bays, peninsulas, and the four connecting rivers of the Great Lakes, including the St. Lawrence River (Figure 1). Connecting rivers are especially favorable for aquatic plants because they are shallow, have a consistent flow of water, and are protected from heavy wave action typical of other Great Lakes shorelines.

Table 1. Underwater plants that provide cover, or food, or both to fish, or food to waterfowl in connecting rivers of the Great Lakes.

	Musk-grass	Coon-tail	Eurasian water-milfoil	Naiad	Water stargrass	Water-weed	Wild celery	Clasping-leaf pond-weed	Narrow-leaf pond-weed
Fish									
Alewife	x		x	x	x	x	x	x	x
Black crappie	x		x		x	x	x	x	x
Bluegill			x	x	x	x	x		
Bluntnose minnow	x		x	x	x	x	x	x	x
Brown bullhead	x		x	x		x	x	x	x
Largemouth bass	x	x	x	x	x	x	x	x	x
Muskellunge	x		x	x	x	x	x	x	x
Northern pike		x	x	x		x	x		
Rockbass	x	x	x	x	x	x	x	x	x
Yellow perch	x		x	x	x	x	x		x
Waterfowl									
American coot	x		x	x		x		x	
Black duck	x			x	x				x
Bufflehead	x			x			x		
Canvasback			x		x	x	x		
Common scoter	x			x			x	x	
Goldeneye	x		x	x			x		
Greater scaup	x		x	x			x	x	x
Lesser scaup	x	x	x	x	x	x	x	x	x
Mallard			x			x	x		x
Redhead	x	x	x	x		x	x	x	x
Ringneck	x		x	x			x		x

HOW TO USE THIS GUIDE

Color pictures of each plant type are accompanied by a short description of key features to help identify the plant. Descriptions are primarily based on leaves attached to underwater plant stems. The submerged leaves usually offer better characteristics for identification than floating leaves and are found more frequently than floating leaves.

Two photos of each plant are included. The smaller photo shows the overall look of the plant. The larger photo shows greater detail. Approximate scale is also indicated for each large photo. In some cases, a drawing is included to illustrate certain features of a particular plant.

Usually, plants included in this report can be identified by inspection of the plant with the unaided eye. In some instances, such as when counting leaf veins, the use of a hand lens of 5 to 10X magnification will be useful.

Table 2 shows whether a plant type is common, uncommon, or not reported in each of the four connecting rivers. This information was compiled through personal communication with scientists knowledgeable about underwater plants in connecting waters of the Great Lakes. It is by no means definitive — to date, only the St. Clair-Detroit River System has been intensively surveyed. Also, the composition and abundance of submersed plants in these rivers continually changes. For example, plants such as curly pondweed, Eurasian watermilfoil, and Nitellopsis were introduced into the Great Lakes only during the last 50 years, but are now common in one or more of the connecting rivers.

Table 2. The occurrence and relative abundance of underwater plants in the four connecting rivers of the Great Lakes (C = common, U = uncommon, NR = not reported).

	St. Mary's River	St. Clair-Detroit River System	Niagara River	St. Lawrence River
Macroscopic Algae				
Cladophora	U	C	C	C
Muskgrass	C	C	NR	C
Nitelias	C	U	C	NR
Nitellopsis	NR	U	NR	C
Vascular Plants				
Coontail	NR	U	C	C
Eurasian watermilfoil	NR	C	C	NR
Naiad	NR	C	U	U
Quilwort	C	NR	NR	NR
Water stargrass	NR	C	C	C
Watermilfoil	U	U	NR	C
Waterweed	U	C	C	C
Wild celery	U	C	C	C
Pondweed Family				
Clasping-leaf pondweed	C	C	C	U
Curly pondweed	NR	U	C	C
Fern pondweed	C	U	NR	U
Flatstem pondweed	U	U	NR	C
Narrow-leaf pondweed	U	C	C	C
Variable pondweed	C	C	U	U
Whitestem pondweed	C	U	NR	NR

VALUE OF INDIVIDUAL PLANTS

Along with each picture of an underwater aquatic plant are symbols identifying the values of the plant to animal populations. These identified values are primarily based on studies of water bodies other than the Great Lakes.

= **Provides good habitat for fishes.**

= **Is important as spawning habitat for some fishes.**

= **Provides habitat to small invertebrate animals eaten by fishes.**

= **Is important waterfowl food.**

= **Provides habitat to small invertebrate animals eaten by waterfowl.**

= **Provides small invertebrate animals and foliage eaten by wildlife.**

= **Interferes with recreation when luxuriant growth or decomposing mats occur.**

Macroscopic Algae

Macroscopic algae are algae that may grow up to a meter long. Each filament composing a mat of algae consists of cells that are capable of growing into a new plant. Macroscopic algae harbor many small aquatic animals used by fish and waterfowl for food.

Some forms of macroscopic algae (especially Cladophora) may be noticed when it detaches from the bottom and accumulates in mats along shorelines (Figure 2). Exact identification of these plants is dependent on microscopic features.

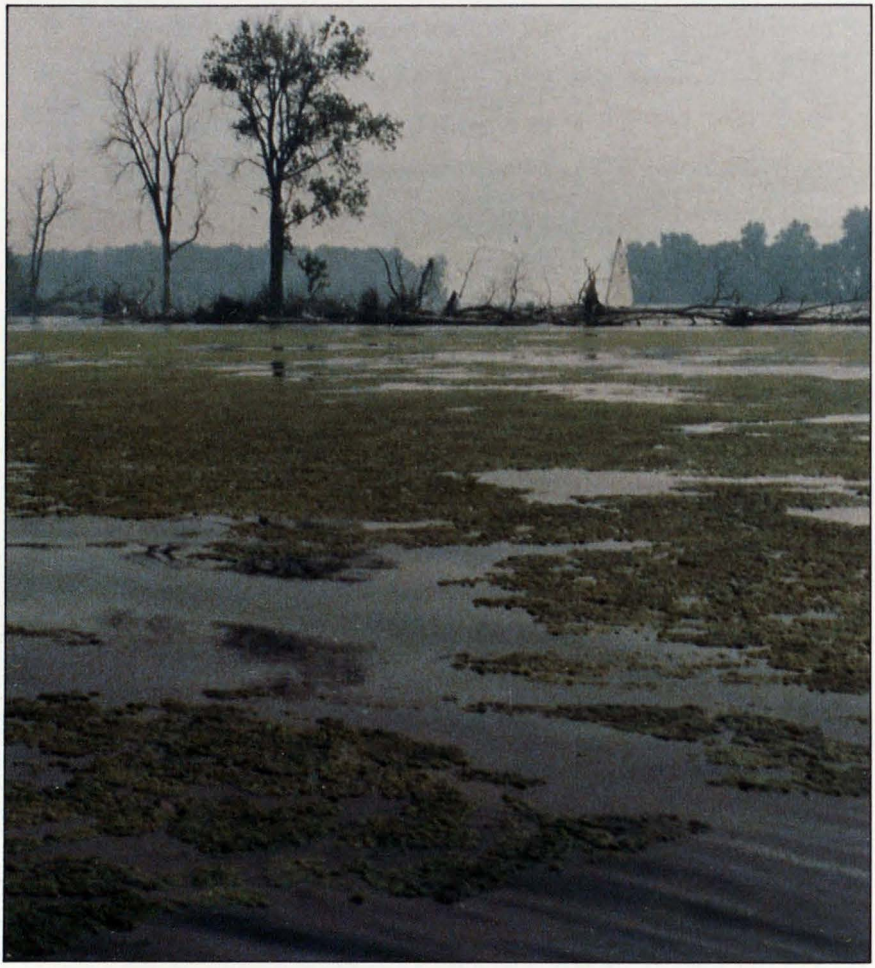
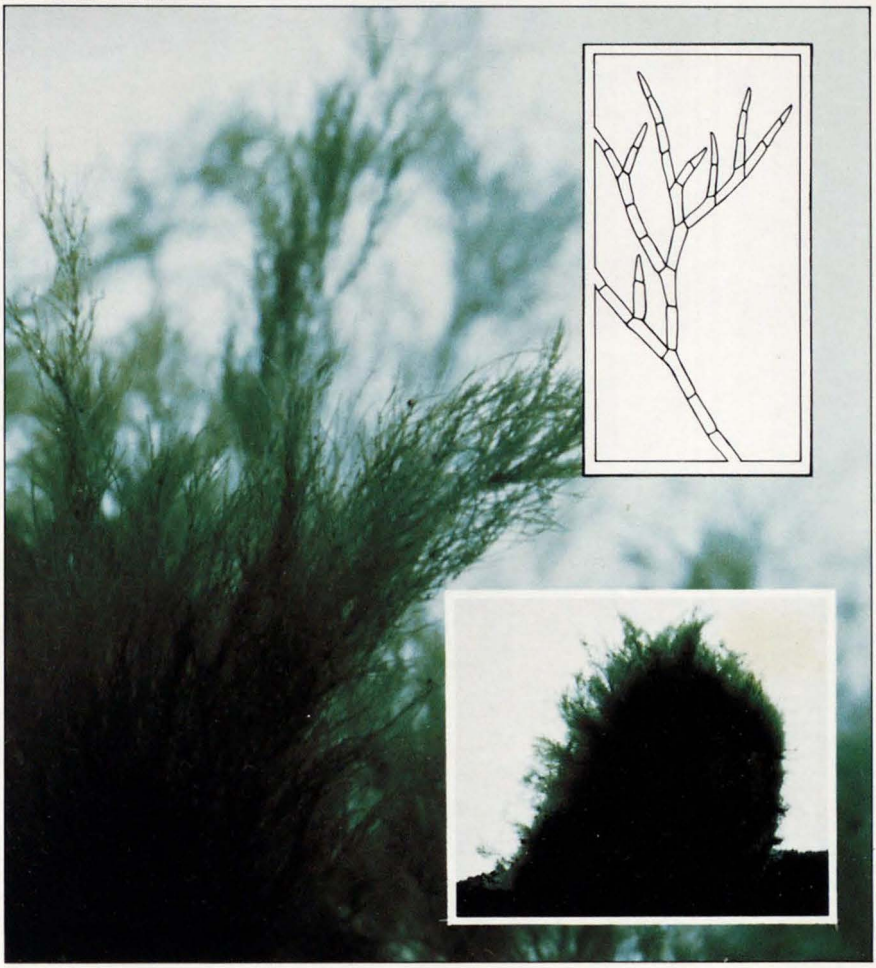


Figure 2. Detached, floating mats of a macroscopic algae, mostly Cladophora, along the shore of a connecting river channel in the Great Lakes.

5x actual size

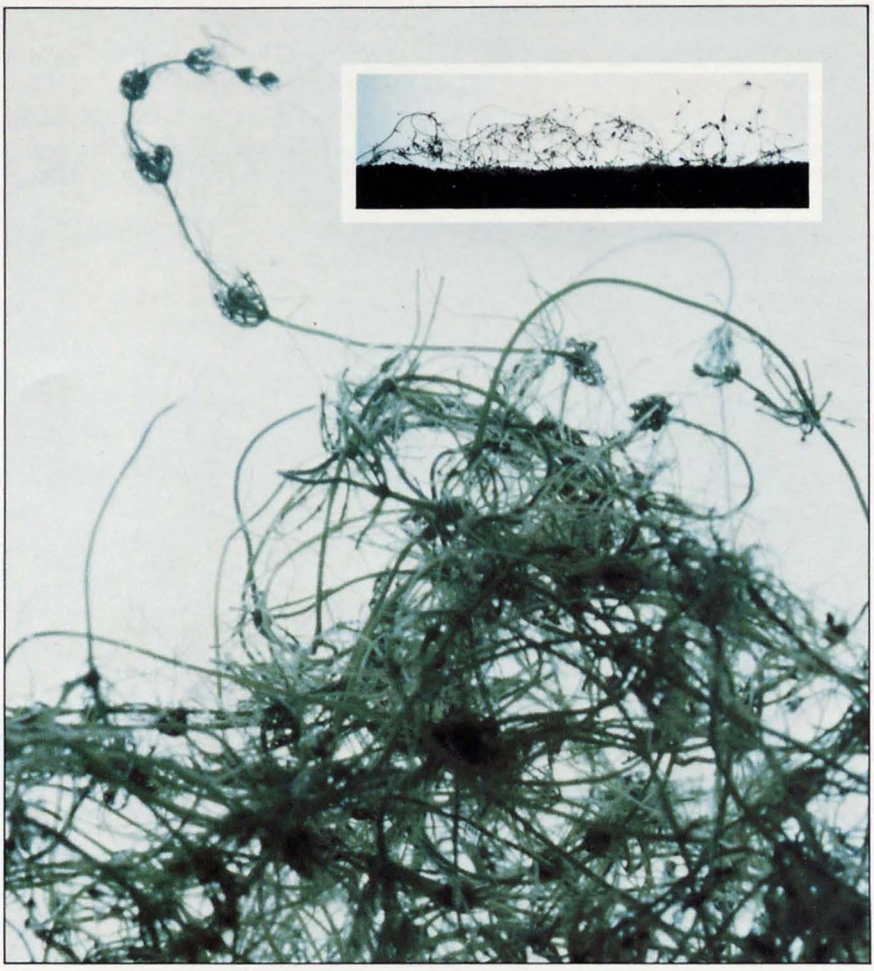


Cladophora

(*Cladophora* spp. Kuetz.)

Cladophora grows as thin, almost-microscopic, hair-like threads up to 10 centimeters long. These hair-like threads form slippery mats attached to rocks and other solid objects at or just below the water line. Detached mats accumulate in areas (Figure 2) and may foul beaches and cause taste and odor problems in drinking water. Cladophora has become more abundant during the past century in many areas where an excess of nutrients, such as nitrogen and phosphorus from sewage, enter the Great Lakes.

2× actual size

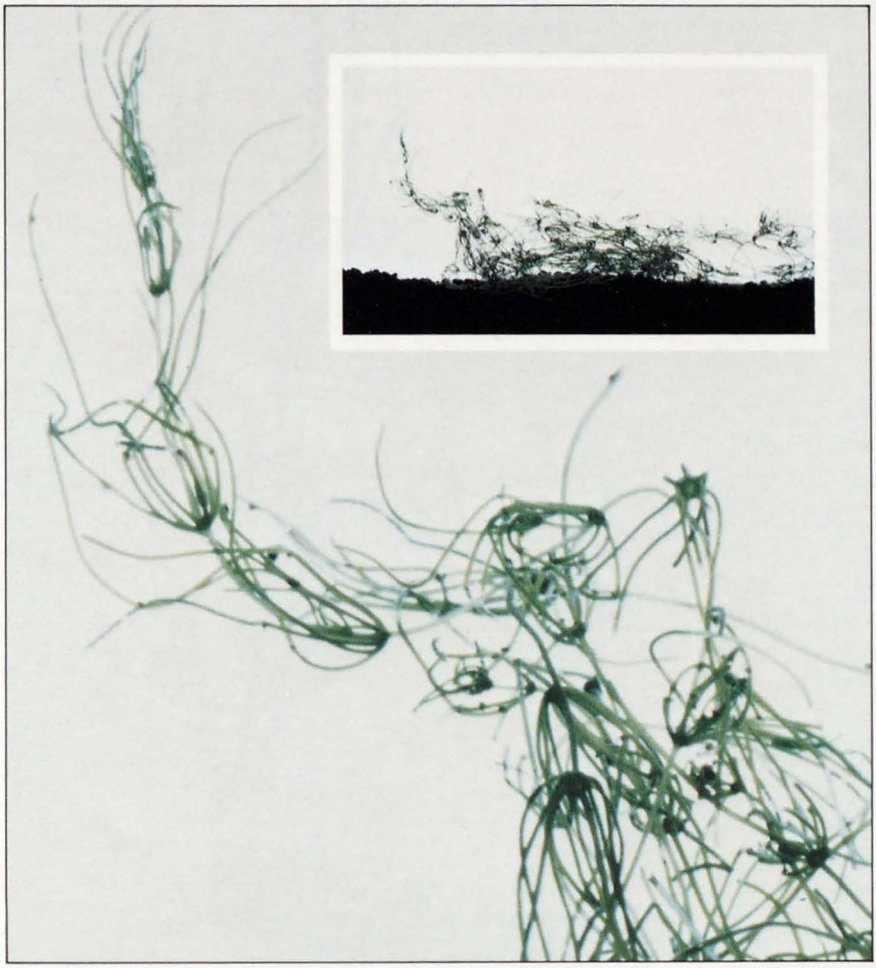


Muskgrass

(*Chara* spp. L.)

Muskgrass typically has short, even-length branches that arise from the main stem and emit a distinctive musky or skunk-like odor when crushed between the fingers. Plants are often covered with a coating of lime that makes them rough to the touch. In many areas, muskgrass covers much of the bottom where it overwinters as a green plant. Muskgrass and Nitellas (following plate) are often difficult to distinguish from each other and, therefore, may be identified as Characeae, the family to which these two algae belong.

2× actual size

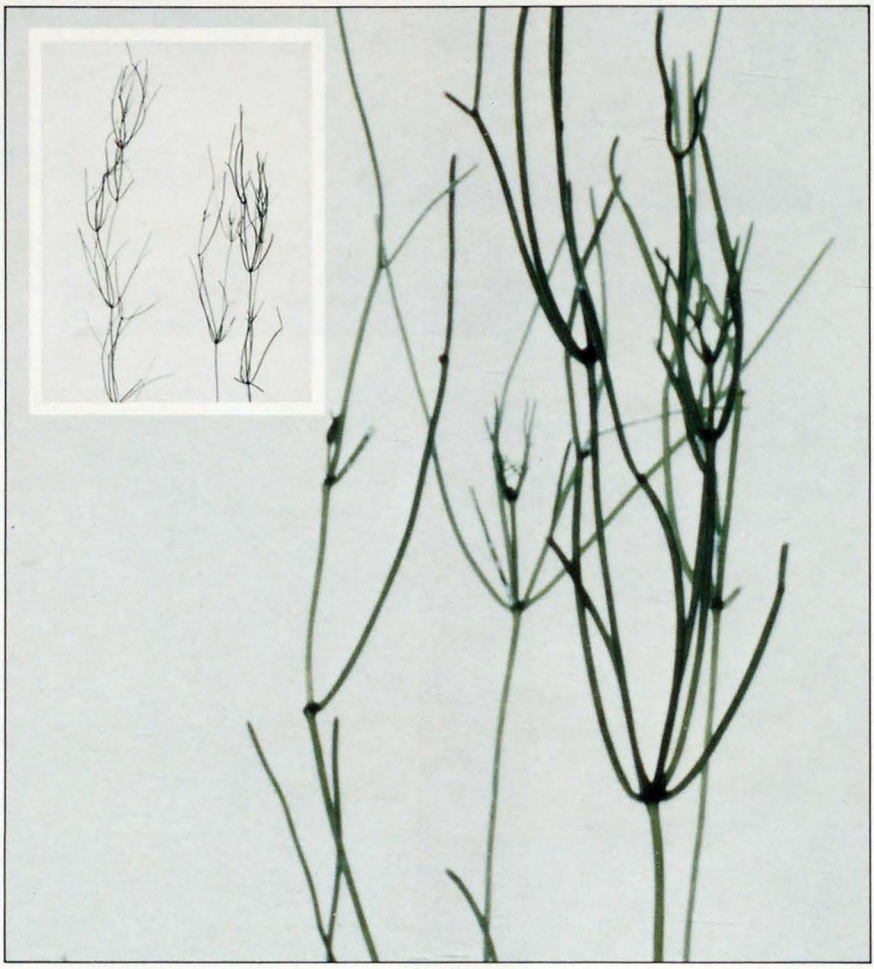


Nitellas

(*Nitella* spp. (Ag.) Leonhardi)

Nitellas has medium, even-length branches that may have many smaller clusters of branches near the tips of the stems. Although this plant may form a carpet on the bottom beneath other larger underwater plants, it is often found in deeper water (up to 27 meters deep) where few other plants are present.

2× actual size



Nitellopsis

(*Nitellopsis obtusa* (Desv. in Lois.) J. Gr.)

Nitellopsis has long, uneven-length branches that look angular at each joint and may have one cream-colored bulb at the base of each cluster of branches. This plant was first discovered in the Great Lakes in the St. Lawrence River in 1978. Since then, it has also been found in the St. Clair and Detroit Rivers, and will probably spread to other parts of the Great Lakes. Like Nitellas, Nitellopsis is sometimes found in deep, slow moving water where other plants are scarce.

Vascular Plants

Vascular plants have a more complex structure than macroscopic algae, including tube-like vascular bundles for nutrient transport. They range in size from less than 1 meter to greater than 4 meters in length and are diverse in form. Although some commonly found types are easy to identify (e.g., coontail and waterweed), others require careful examination (e.g., water stargrass and narrow-leaf pondweed). Vascular plants are a prominent feature of the shallow waters of connecting rivers of the Great Lakes (Figure 3).

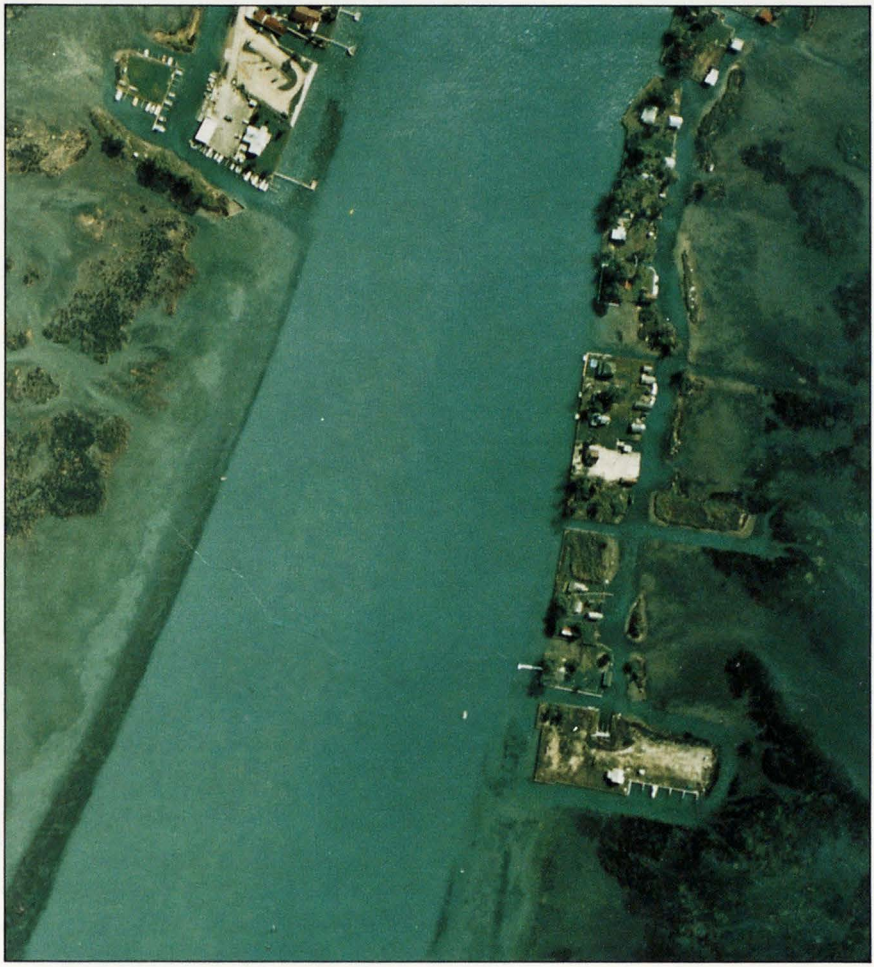
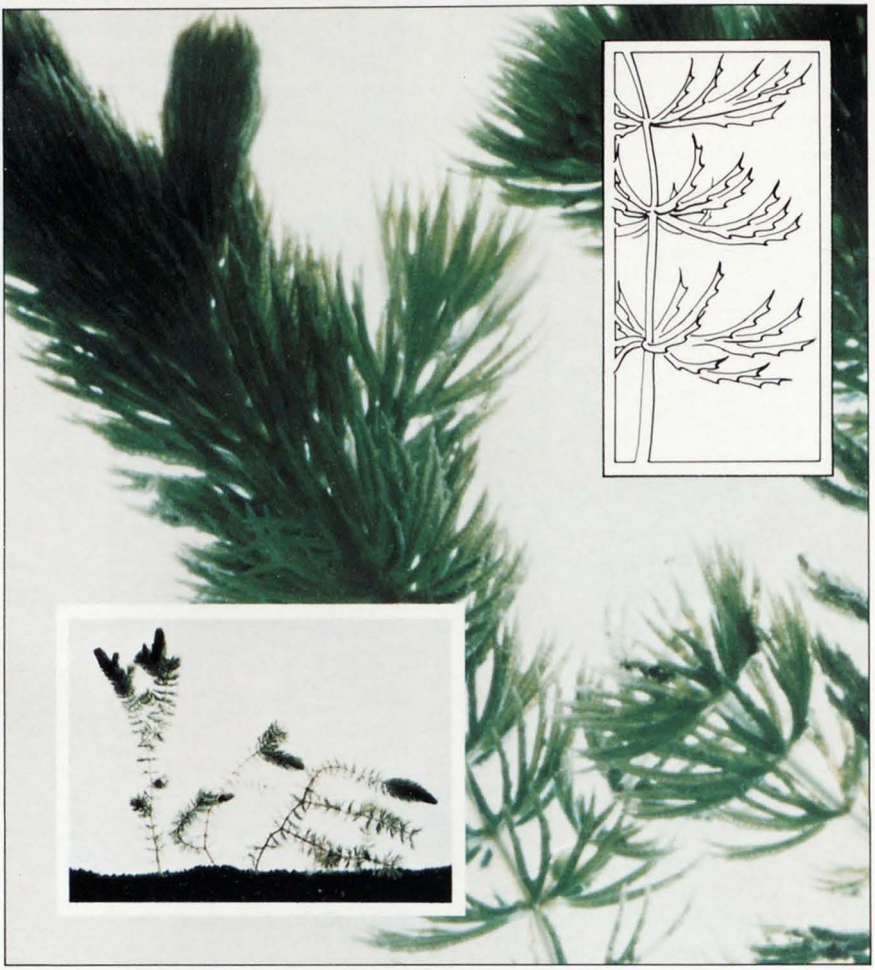


Figure 3. Aerial photograph showing prominent aquatic plant beds located along a connecting river channel of the Great Lakes.

2× actual size



Coontail

(*Ceratophyllum demersum* L.)

Coontail is usually less than a meter long and is found in relatively quiet water. It has clusters of finely-forked leaves that appear bushy (like a raccoon's tail) at or near the end of the stems. Leaves have small teeth along one side and are sometimes stiff with a coating of lime. Coontail may harbor up to 50% more food organisms for fish and waterfowl than other aquatic plants because it has many fine branches available for colonization by small aquatic animals.

3x actual size

Eurasian Watermilfoil

(*Myriophyllum spicatum* L.)

Eurasian watermilfoil appears brownish-green to brown, usually with some red on stems. Stems may be up to 3 meters and have clusters of 4 or 5 feather-like leaves that are more abundant near stem tips than lower stems. Each leaf has between 5 and 24 pairs of small leaflets. Eurasian watermilfoil is a European invader of water bodies in North America that may spread from lake to lake by small fragments transported by boats and trailers. This milfoil can crowd out other underwater plants used by fish and waterfowl. However, Eurasian watermilfoil provides habitat to many aquatic animals because it has many fine leaves and overwinters as a decaying mat upon which they feed.

3x actual size

Naiad

(*Najas flexilis* (Willd.) Rostk. and Schmidt)

Naiad is light to dark green with slender stems up to 1 meter long, but usually less than 0.3 meter long. Leaves are spear shaped and usually crowded near the tip of the stem, sparse on the lower portion of the stem, and enlarged at the point where the leaves join the stem. Naiad has been established and propagated as a source of food for waterfowl.

3× actual size

Quilwort

(*Isoetes* spp. L.)

Quilwort is a small plant up to 1/3 of a meter long with tufts of quill-like leaves originating from a swollen base. Plants are usually restricted to areas of clean water where other plants are absent. Occasionally, quilwort may grow partly or entirely out of the water.

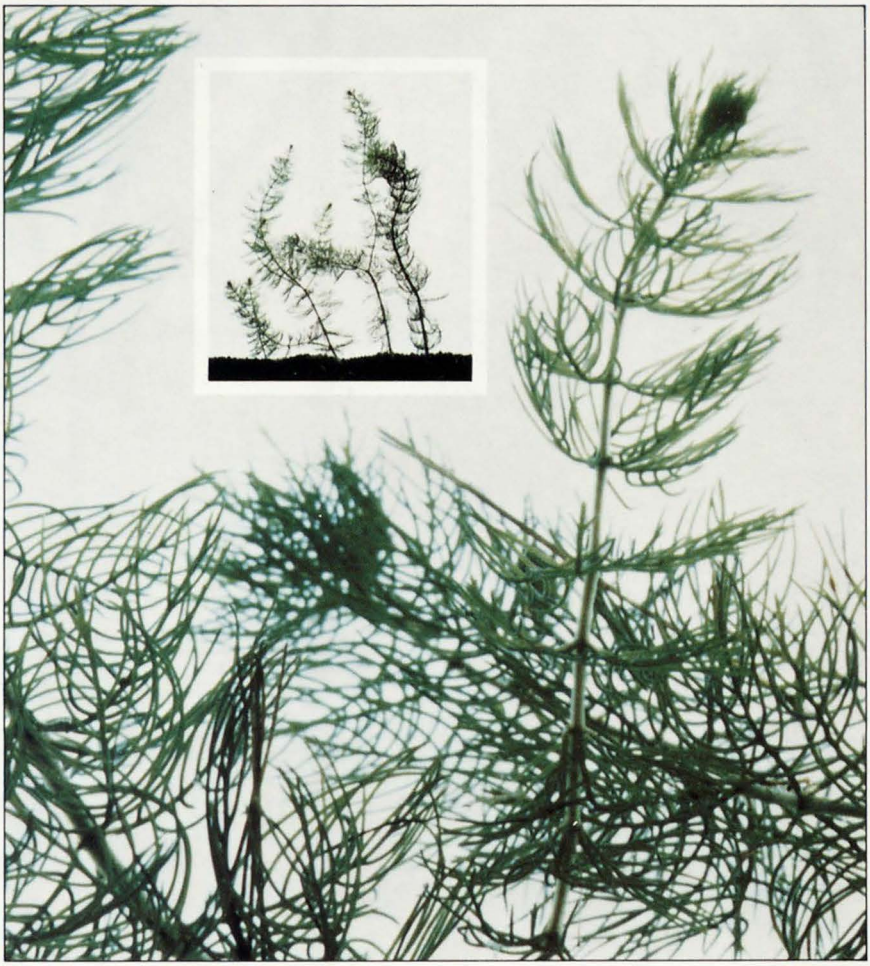
3× actual size

Water Stargrass

(*Heteranthera dubia* (Jacq.) MacM.)

Water stargrass is dark green to brown with thread-like leaves scattered on flexible, crooked stems that may be up to 2 meters long. Leaves are similar to those of narrow-leaf pondweed but lack a prominent vein or midrib in the middle. Water stargrass usually becomes abundant in late summer. It settles to the bottom in late autumn where it forms a decaying mat in the winter that provides habitat to many small aquatic animals.

3× actual size



Watermilfoil

(*Myriophyllum exalbescens* Fern.)

Watermilfoil appears brownish green to grey green with clusters of 4 or 5 feather-like leaves on stems that may be up to 2 meters long. Each leaf has between 4 and 14 pairs of small leaflets. Leaves are usually crowded together toward stem tips where growth occurs and absent on lower portions of the stems. Plants are rarely found in water more than a meter deep.

2× actual size

Waterweed

(*Elodea canadensis* Michx.)

Waterweed has slender stems up to 3 meters long with three leaves in clusters around the stems. Leaves are bunched toward the ends of the stems where new growth occurs; older leaves usually decay and break off the lower stems. Waterweed may rapidly colonize an area and then decline in abundance within 5 to 7 years.

2× actual size

Wild Celery

(Vallisneria americana Michx.)

Wild celery has straight ribbon-like leaves that all arise from the base of the plant. Leaves are limp, long, and usually have a light green midrib (Figure 4b). In summer, plants may have small pods on the ends of long stalks that originate at the base of the plants. The leaves and underground tubers of wild celery are preferred food for waterfowl, such as mallards, canvasbacks, goldeneyes, and scoters.

Pondweed Family
(Potamogetonaceae)

Identification of pondweed species is notoriously difficult because structural differences among species are often small (e.g., clasping-leaf and whitestem pondweeds), environmental factors often influence the growth form of a species, and hybridization between species is common (e.g., variable and whitestem pondweeds). The growth form of a species may be related to current velocity, depth, clarity, temperature of water, time of year, nutrients, bottom type, etc.

Hybridization between species often results in an intermediate form that has some characteristics of both species and is, therefore, difficult to identify.

Some characteristics useful in identifying pondweeds include: 1) all pondweeds have leaves scattered singly on the stems, especially on older portions of the plant; 2) some species may have floating leaves that look different (Figure 4a) than submersed leaves; 3) all pondweed leaves have a midrib; however, this characteristic may be difficult to see, especially on narrow-leaf pondweeds; and 4) some species have a prominent sheath and/or stipule at the base of each leaf (Figure 4b).

Pondweeds are among the most important waterfowl foods in the United States.

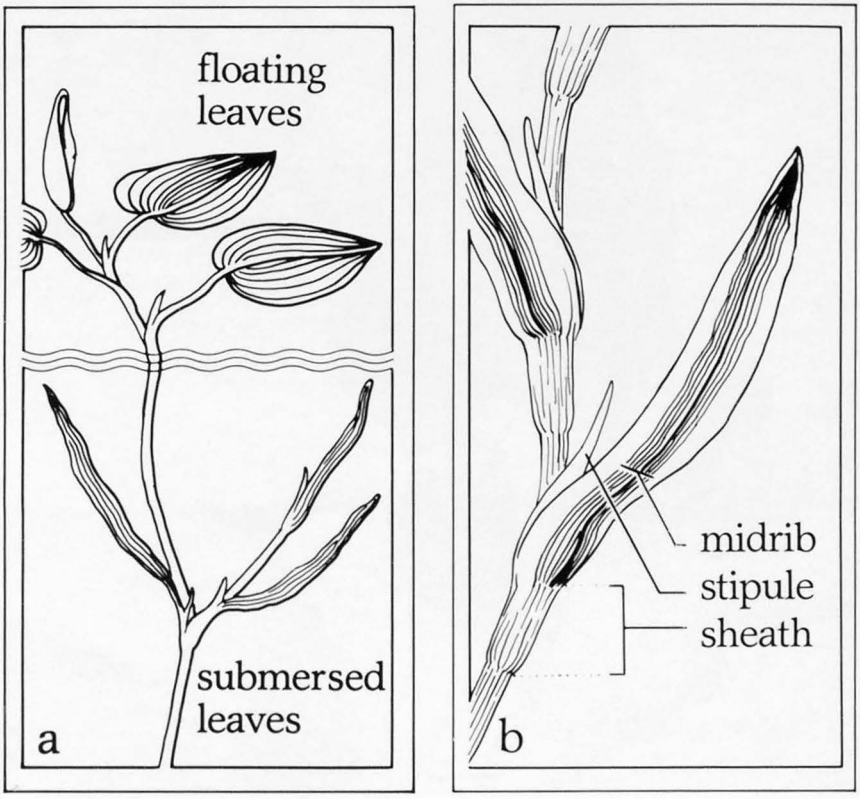


Figure 4. Characteristics of pondweeds; (a) whole plant, and (b) stem and leaf.

actual size

Clasping-leaf Pondweed

(*Potamogeton richardsonii* (Benn.) Rydb.)

This pondweed gets its name from the leaves which partially surround its stems. Leaves have 3 to 7 easily visible veins that run the length of each leaf, 10 to 16 weaker veins, and usually wavy margins. Stipules are between 1 and 2 centimeters long and are found wrapped around the stems near the base.

2× actual size

Curly Pondweed

(*Potamogeton crispus* L.)

Curly pondweed gets its name from the wavy margins on the sides of its leaves. Leaves are dark green with a redish hue and have small teeth along the margins. Plants may grow up to 2 meters long. This pondweed is a European invader of water bodies in North America that may spread by re-rooting of small plant fragments. Curly pondweed is important in spring as a provider of small aquatic animals for migrating waterfowl and as a spawning substrate for fish because it is one of the most abundant macrophytes from April to June.

2× actual size

Fern Pondweed

(*Potamogeton robbinsii* Oakes)

Fern pondweed is usually dark-green with flat leaves pointing away from the stem on two sides, thereby giving it the appearance of a fern. Leaf bases form a sheath around the stems (Figure 4b) and may have stipules present on new leaves located near the ends of the stems. Fern pondweed is known to provide habitat for small aquatic animals used as food by predator fishes, especially northern pike.

3× actual size

Flatstem Pondweed

(***Potamogeton zosteriformis*** Fern.)

This pondweed is named for its flat stems that are between 1 and 5 millimeters wide. Stems usually form angles where leaves join them, giving the plant a zig-zag appearance, especially on older portions of the plant. Stipules are present but may be overlooked because they wrap around the stems.

2× actual size

Narrow-leaf Pondweed

(*Potamogeton* spp. L.)

This group of pondweeds contains about 15 species with narrow, thread-like leaves that are very difficult to differentiate. Leaves are usually less than 3 millimeters wide. Plants are light to olive green and usually less than 2 meters long. Narrow-leaf pondweeds (e.g., *Potamogeton pectinatus*) compose up to 50% of the pondweeds eaten by waterfowl. In addition, muskrat, deer, and beaver feed on narrow-leaf pondweeds.

actual size

Variable Pondweed

(*Potamogeton gramineus* L.)

Variable pondweed is extremely variable in shape and size. However, this plant usually has dark green submersed and floating leaves present. Stems often appear dark brown. Submersed leaves have 3 to 7 veins that run the length of each leaf, while floating leaves have 11 to 19 veins. Typically, the leaves have stipules, wavy edges, and tend to curl inward. Variable pondweed hybridizes with other broad-leaf species of the pondweed family and may be especially difficult to identify.

2× actual size

Whitestem Pondweed

(*Potamogeton praelongus* Wulfen)

Whitestem pondweed has white or light green stems and large oblong leaves between 8 and 20 centimeters long. Leaves have 3 to 5 easily visible veins per leaf, 13 to 35 weaker veins, and sometimes wavy margins. Stipules (Figure 4b) are between 1 and 8 centimeters long and are easy to see because they do not surround the stems for most of their length. Tips of the leaves are shaped like the bow of a boat. Stems may be up to 3 meters long. Whitestem pondweed provides excellent feeding grounds for predator fishes, such as bass, walleye, northern pike, and muskellunge, because it is a large, robust plant that harbors many small aquatic animals and fishes.

GLOSSARY

centimeter a unit of length in the metric system equal to about 2/5 inch in the English system.

hybrid a plant derived from two plants of different species; is known to occur between species of the pondweed family.

lime calcium carbonate; a white, flaky substance often found on aquatic plants.

leaflet a division of a compound leaf; they make watermilfoils appear feathery.

macroscopic large enough to be observed by the naked eye.

meter a unit of length in the metric system, equal to about one yard in the English system, or 39.37 inches.

microscopic indistinguishable without the use of a microscope; very small or fine.

midrib the main or central vein of a leaf; see Figure 4b.

millimeter a unit of length in the metric system, equal to about 1/25 inch in the English system.

primary producer plants capable of manufacturing food from sunlight and simple inorganic substances.

sheath the lower part of a leaf that surrounds the stem; often visible on plants of the pondweed family; see Figure 4b.

stipule an appendage at the base of a leaf; see Figure 4b.

tuber a thickened underground stem important for vegetative reproduction.

vascular bundle a network of cells found in higher plants for transporting nutrients and water.

vascular plant a plant having a conducting system of vascular bundles for transporting nutrients and water.

vein vascular bundle found in a leaf.

SOURCES OF ADDITIONAL INFORMATION

Fassett, N.C. (1969.) *A manual of aquatic plants.* Revision Appendix by E.C. Ogden. Univ. of Wisconsin Press, Madison, Wisconsin. 405 pp.

Hotchkiss, N. (1964.) *Pondweeds and pondweedlike plants of Eastern North America.* Circular 187, U.S. Fish and Wildlife Service, Washington, D.C. 30 pp.

Hotchkiss, N. (1967.) *Underwater and floating-leaved plants of the United States and Canada.* Resource Publication No. 44, U.S. Fish and Wildlife Service, Washington, D.C. 124 pp.

Schlosser, D.W., and B.A. Manny. (1982.) *Distribution and relative abundance of submersed aquatic macrophytes in the St. Clair-Detroit River ecosystem.* Admin. Rep. 82-7, U.S. Fish and Wildlife Service, Great Lakes Fishery Laboratory, Ann Arbor, Michigan. 49 pp.

Sculthorpe, C.D. (1967.) *The biology of aquatic vascular plants.* Edward Arnold Ltd., London. 610 pp.

Voss, E.G. (1972.) *Michigan Flora: Part I: Gymnosperms and monocots.* Cranbrook Inst. of Sci., Bull. 55. 488 pp.

Acknowledgements

I thank C. Carnes, J. Geis, J. Hiltunen, E. Mills, and C. McNabb for information about the occurrence of underwater aquatic plants in connecting rivers of the Great Lakes.

Edited by Eric Meves, Great Lakes Fishery Laboratory, Ann Arbor, Michigan. Photographic consultant Dick James, 1426 Marian Avenue, Ann Arbor, Michigan. Illustrations by C. Gill. Produced by ANR Information, Michigan State University, East Lansing, Michigan

MSU is an Affirmative Action/Equal Opportunity Institution. Cooperative Extension Service programs are open to all without regard to race, color, national origin, sex, or handicap.

Issued in furtherance of Cooperative Extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. W.J. Moline, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

This information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by the Cooperative Extension Service or bias against those not mentioned. This bulletin becomes public property upon publication and may be reprinted verbatim as a separate or within another publication with credit to MSU. Reprinting cannot be used to endorse or advertise a commercial product or company.

IP-5M-TCM-HP-New. Price $3.50, for sale only.