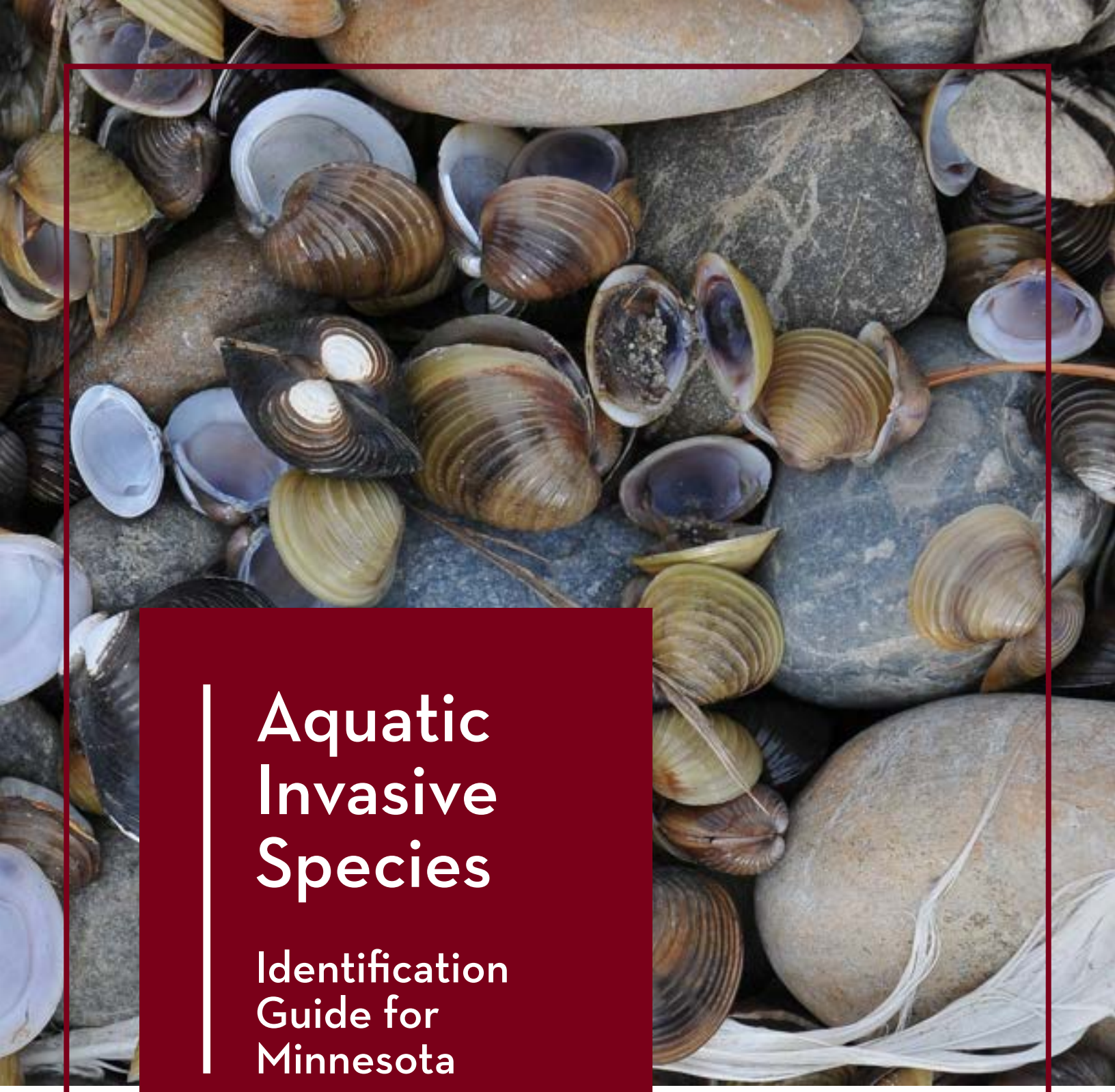

Aquatic Invasive Species

Identification Guide for Minnesota

Aquatic & Wetland Plants • Invertebrates • Fish

AIS DETECTORS

UNIVERSITY OF MINNESOTA


1
2
3
4
5
6
7
8
9
10

AIS Identification Guide

Fourth Edition

AIS DETECTORS

UNIVERSITY OF MINNESOTA

Driven to Discover®

The AIS Detectors program is jointly supported by the Minnesota Aquatic Invasive Species Research Center and University of Minnesota Extension. Funding for the development of this book is provided in part by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources, the Clean Water Fund, the State of Minnesota, and private donations.

How to use this book

This ID book contains tips for identifying a number of aquatic invasive species (AIS) that are considered high-risk to Minnesota waters, as well as some common native and non-native lookalike species.

As you look at identifying characteristics and descriptions in the pages that follow, bear in mind that colors and sizes can be variable. These are general guidelines, not definitive taxonomic identification characteristics. Whenever possible, we highlighted key or unusual characteristics about a species, but individuals can often look very similar. They may also sometimes be found outside of the suggested habitats. If you are in doubt as to whether you have found an AIS, be sure to submit a report to the DNR through the EDDMapS website (eddmaps.org), the EDDMapS app, or by contacting a DNR AIS Specialist.

You will notice two different styles of maps in this book: for native species, we use watershed maps to highlight where they are generally found. Again, this can vary — these maps are a guideline. For invasive species, we use county maps to provide more localized distribution information. Maps are current using available data as of February 2025.

For more information on this book and AIS research, please visit maisrc.umn.edu.

If you find an AIS

If you find an aquatic invasive species occurrence, follow these steps:

1. Take photos of the AIS.
You should take multiple photos, including:

- Photos of the entire plant or animal (or as much as can clearly be captured in the frame).
- Close-ups of identifying features (such as leaves, fins, shape, colors, etc.).
- A photo that has an object in it for scale (such as a coin or a ruler).
- One photo of the general area where the AIS was found.

2. Use EDDMapS to submit the report.
You can do this using the EDDMapS app on your mobile device or on the EDDMapS website at eddmaps.org. You should include:

- The date and time you made the observation.
- The species you believe you have found.
- The location you made the observation. Be specific.
- Photographs of the specimens.
- If you are using the EDDMapS app, be sure to upload your report from the queue.

3. Collect a sample of the AIS.

- For animals such as invertebrates and fish, collect the entire animal.
- For smaller animals such as zebra mussels or spiny water flea, you may want to include a few animals.
- For plants, you want to include as much of the plant as you reasonably can. Try to collect portions of the stem with leaves attached, any flowering structures if present, reproductive parts such as flowers or fruits, and organs such as tubers, turions, roots and rhizomes.
- Place the collected sample in a sealed container, something as simple as a Ziploc bag will do. If you have a large animal, like a carp, put it on ice in a cooler. You may also choose to wrap the plant or animal in a damp paper towel or newspaper prior to putting it into its container.
- Put a piece of paper with the location the sample was collected, the date of collection, and your name and contact information on it in the container with your sample. Be sure to write in pencil so that it doesn't bleed or run when wet.

4. Contact your local AIS specialist.

- Inform them that you have a sample of a suspected AIS and ask for further direction on what they would like you to do with it.
- The contact information for AIS Specialists is on the DNR's website: z.umn.edu/mn-dnr

The MNDNR is responsible for confirming and communicating new AIS occurrences.

If your report is accurate, MNDNR will verify your report and it will become publicly viewable on the EDDMapS distribution maps.

If you are interested in learning more about AIS identification and getting involved, consider becoming an AIS Detector. Visit aisdetectors.org for more information.

Acknowledgments

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Quick reference guide

Eurasian watermilfoil

	Eurasian watermilfoil	Northern watermilfoil	Hybrid watermilfoil	Coontail	Water marigold	White water crowfoot	Bladder-worts
Leaves alternate						X	X
Bladders present on leaves							X
Leaves whorled	X	X	X	X	X		
Leaflets on a central axis	X	X	X				
Leaves with <12 leaflets (4-11)		X	X				
Leaves with ≥12 leaflets (12-20)	X		X				

Hydrilla

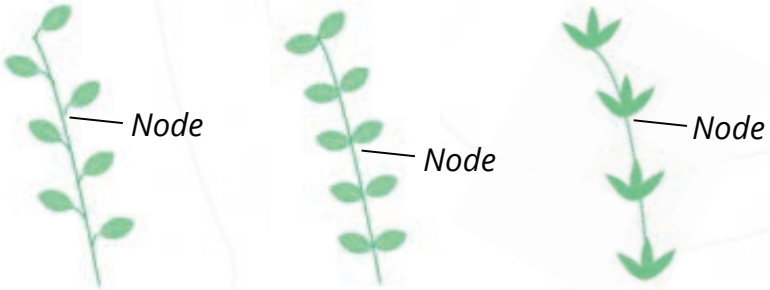
	Hydrilla	Brazilian waterweed	Elodea (waterweed)
≤ 3 leaves in a whorl			X
≥ 3 leaves in a whorl	x (usually 5)	x (usually 4)	
Showy white flowers		X	
Serrated leaf margins	X	x (under magnification)	

Starry stonewort

	Starry stonewort	*Chara* spp.	*Nitella* spp.	Sago pondweed	Water stargrass
Alternate, flat leaves					X
Branchlets (leaf-like structures)				X	
Whorled branchlets, like stem	X	X	X		
Strong odor		Some species			
Rough stems		X			
Forked branchlets	X		X		
Forked tips symmetrical			X		
Stays rigid out of water	X				
Star-shaped bulbils	X				

Introduction to aquatic plants

Leaf arrangements



Alternate *Opposite* *Whorled*

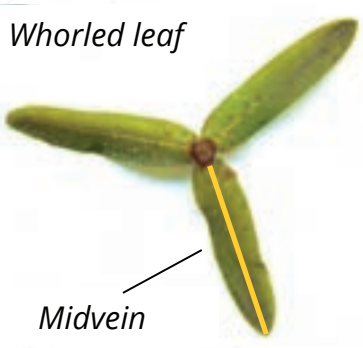
Leaf types

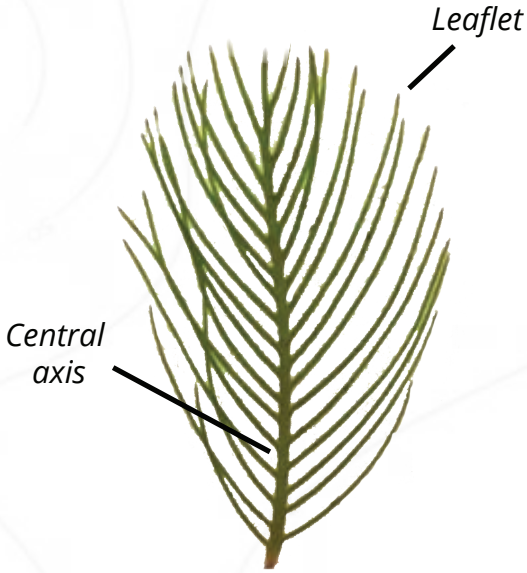
Simple (undivided)

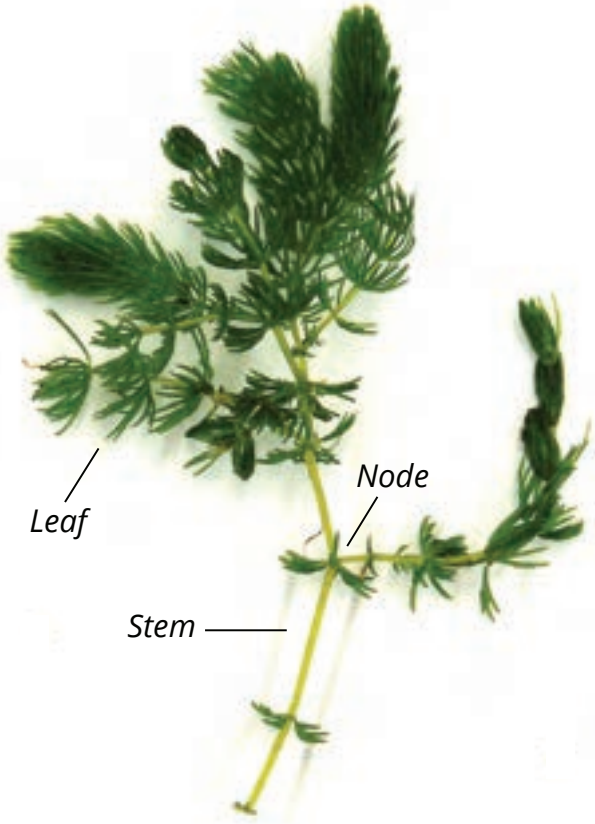
Compound (divided into leaflets)

Leaf margins

Entire *Serrate* *Undulate*







INVASIVE

Eurasian watermilfoil

Myriophyllum spicatum

KEYS TO ID

- Feathery looking with four leaves per whorl
- Leaves have central axis with 12 - 20 leaflet pairs
- Can grow up to 10 feet long
- Produces pink and white flowers on spike above surface
- Leaves become limp when taken out of water

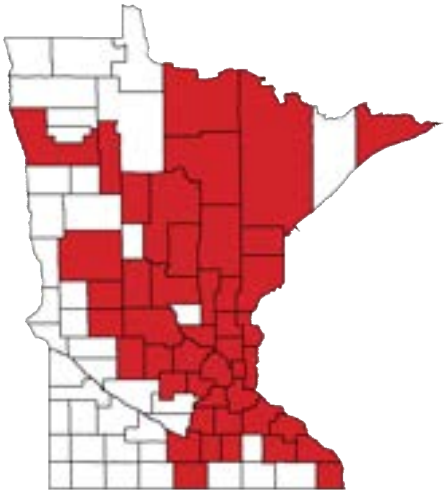
LOOKS SIMILAR TO

- Northern watermilfoil (native)
- Coontail (native)
- Bladderworts (native)
- White water crowfoot (native)
- Water marigold (native)

WHERE TO LOOK

- In lakes, ponds, and slow-moving areas of rivers or streams
- Grows best in depths of 3 - 15 feet

CURRENTLY FOUND



Above-surface flowers

Four leaves per whorl with 12-20 leaflet pairs per leaf

Note: Eurasian watermilfoil is known to hybridize with northern watermilfoil.

Hybrid watermilfoil is also considered invasive and should be reported.

Northern watermilfoil

Myriophyllum sibiricum

NATIVE

KEYS TO ID

- Four leaves per whorl
- Each leaf has between 4 - 11 leaflet pairs
- Leaves have a central axis and are rigid when taken out of water

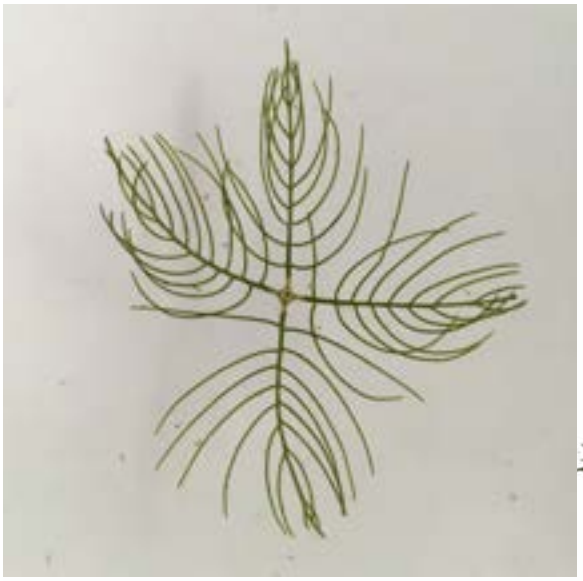
LOOKS SIMILAR TO

- Eurasian watermilfoil (invasive)
- Coontail (native)
- Bladderworts (native)
- Water marigold (native)
- White water crowfoot (native)
- Minnesota has six native milfoil species; this is the most common

WHERE TO LOOK

- In depths of up to 20 feet

CURRENTLY FOUND



Four leaves per whorl with 4-11 leaflet pairs per leaf

NATIVE

Coontail

Ceratophyllum demersum

KEYS TO ID

- Leaves are forked and toothed, with no central axis, and are branching
- Can grow up to six feet long
- Often free-floating

LOOKS SIMILAR TO

- Eurasian watermilfoil (invasive)
- Water marigold (native)
- Northern watermilfoil (native)
- Bladderworts (native)
- White water crowfoot (native)

WHERE TO LOOK

- In water up to 20 feet deep
- Upper leaves may reach surface and form dense patches
- Can become highly abundant and form “oil slicks” when it dies back

CURRENTLY FOUND

Whorl detail

Bladderworts

Utricularia spp.

NATIVE

KEYS TO ID

- Thin leaves branching and zig-zagging can give a "fractal" appearance
- Leaves are highly dissected and have no central axis
- Has bladders, some of which may be filled with invertebrate victims of these carnivorous plants
- Has snapdragon-like flowers

Leaf detail

LOOKS SIMILAR TO

- Eurasian watermilfoil (invasive)
- Northern watermilfoil (native)
- Coontail (native)
- Water marigold (native)
- White water crowfoot (native)
- Minnesota has eight bladderwort species

WHERE TO LOOK

- Usually found in shallow waters
- Can be either free-floating or buried in the sediment

CURRENTLY FOUND

Flower detail

NATIVE

White water crowfoot

Ranunculus aquatilis syn. *Ranunculus longirostris*

KEYS TO ID

- Grows in mats on the water's surface
- Alternating leaves are highly dissected
- Produces flowers with yellow centers and five white petals
- Often has modified leaves at surface

LOOKS SIMILAR TO

- Eurasian watermilfoil (invasive)
- Water marigold (native)
- Northern watermilfoil (native)
- Bladderworts (native)
- Coontail (native)

WHERE TO LOOK

- In ponds, slow-moving streams, and marshes
- Can grow up to 6 inches above water's surface

CURRENTLY FOUND

Leaf detail

Water marigold

Bidens beckii

NATIVE

KEYS TO ID

- Opposite to whorled, highly dissected leaves that are variable along stems
- Leaves do not have a central axis
- Produces yellow buttercup flowers with more than five petals in mid- to late-summer
- Has two simple emergent leaves under the flower that are serrated

LOOKS SIMILAR TO

- Eurasian watermilfoil (invasive)
- Coontail (native)
- Northern watermilfoil (native)
- Bladderworts (native)
- White water crowfoot (native)

WHERE TO LOOK

- In water up to 12 feet deep
- Flowers are above water

CURRENTLY FOUND

Flower detail

Leaf detail

INVASIVE Hydrilla

Hydrilla verticillata

KEYS TO ID

- Leaves are bright green with a prominent midvein down the center and are between 1/5 and 3/4 inches long
- Leaves directly attached to stem (stalkless) in whorls of 3 - 10; often 5
- Has two forms, monoecious and dioecious. Monoecious Hydrilla is more cold-tolerant and poses a larger threat to Minnesota
- Ascending stems can grow up to 30 feet long
- Tubers or turions may be present
- Leaves have sharply toothed serrated edges that may require a hand lens to see

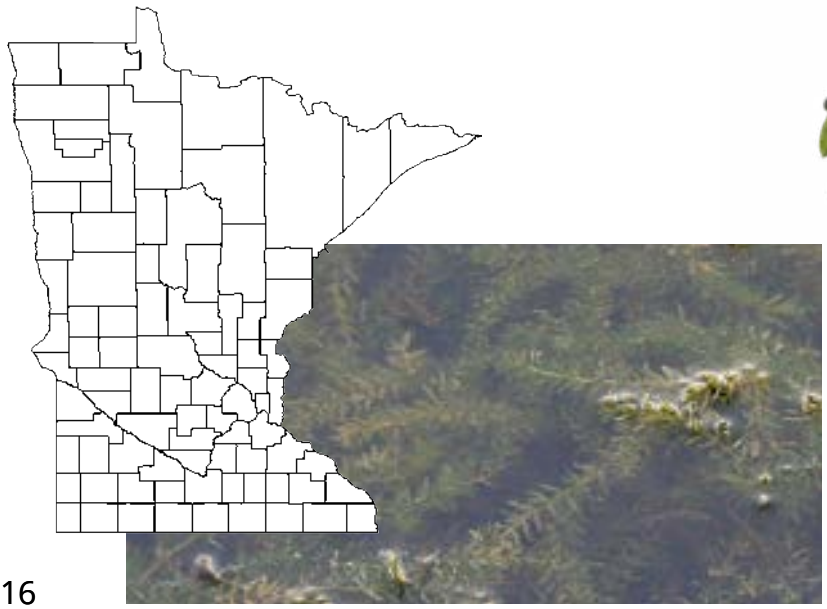
LOOKS SIMILAR TO

- *Elodea* (native)
- Brazilian waterweed (invasive)

WHERE TO LOOK

- Streams, lakes, and ponds
- In shallow or deep waters
- May invade deep waters where native plants can't grow
- Has not been found in Minnesota

CURRENTLY FOUND



Common waterweed

Elodea canadensis

NATIVE

KEYS TO ID

- Whorls of 3 oval-shaped leaves; whorls of 4 may occur
- Can grow up to three feet tall
- Leaves have smooth edges and are between ¼ and ⅔ inches long

Three leaves per whorl

LOOKS SIMILAR TO

- Hydrilla (invasive)
- Brazilian waterweed (invasive)
- Minnesota has three native *Elodea* species

WHERE TO LOOK

- In water up to 10 feet deep
- Near stream inlets
- May be free-floating

CURRENTLY FOUND

INVASIVE

Brazilian waterweed

Egeria densa

KEYS TO ID

- Leaves in whorls of 4 - 6
- Leaves are between ⅖ and 1.5 inches long
- Small white flowers with 3 petals may be visible
- Can form dense mats that look bushy
- Finely serrated leaf margins may be visible under magnification

Flower detail

LOOKS SIMILAR TO

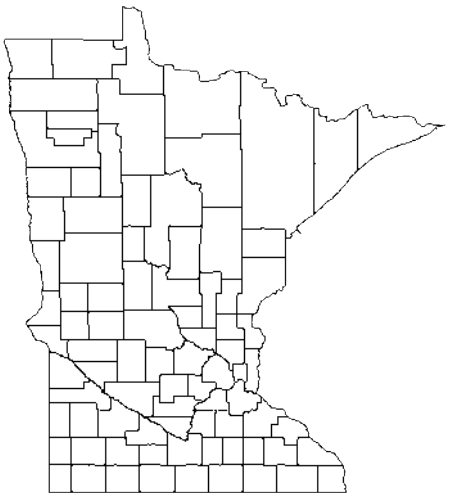
- *Elodea* (native)
- *Hydrilla* (invasive)

WHERE TO LOOK

- Submersed; can be free-floating or rooted
- No established populations in Minnesota

Magnified leaf showing serrated margins

CURRENTLY FOUND



Starry stonewort

Nitellopsis obtusa

INVASIVE

KEYS TO ID

- Long, smooth branchlets are attached in whorls of 5 - 8 and branch asymmetrically at tips
- Stems are smooth
- Small, star-shaped bulbils form on clear threads at base of plant and may be found above or below the sediment surface
- Small, orange spheres called antherida may be visible; these are male reproductive structures
- Branchlets typically several inches long, longer than *Chara* or *Nitella*
- Can fill water column and form surface mats

LOOKS SIMILAR TO

- Native *Chara* (native)
- Native *Nitella* (native)
- Sago pondweed (native)
- Water stargrass (native)

Actual size of bulbils

WHERE TO LOOK

- Generally found in shallower waters, often near boat accesses

CURRENTLY FOUND

Below: orange antheridia

NATIVE

Muskgrasses

Chara spp.

KEYS TO ID

- Stems are typically rough and crunchy
- Thin branchlets form whorls around thin stems
- Branchlets are not forked at tips
- May produce bulbils, but not star-shaped
- May have musky odor

Whorled branchlets

LOOKS SIMILAR TO

- Starry stonewort (invasive)
- Native *Nitella* (native)
- Sago pondweed (native)
- Water stargrass (native)
- Minnesota has nine *Chara* species

WHERE TO LOOK

- Fully submerged
- Along lake bottoms forming patches called meadows

CURRENTLY FOUND

Stoneworts

Nitella spp.

NATIVE

KEYS TO ID

- Stems are smooth
- Branchlets fork into two or three tips at end
- Unlike starry stonewort, forked tips are of equal length
- Typical branchlets are around an inch in length, much shorter than starry stonewort
- Becomes limp when out of water

LOOKS SIMILAR TO

- Starry stonewort (invasive)
- Native *Chara* (native)
- Sago pondweed (native)
- Water stargrass (native)

WHERE TO LOOK

- Often in deeper zones of lake
- At depths up to 30 feet

CURRENTLY FOUND

Branchlets; smooth stems

Enlarged to show detail

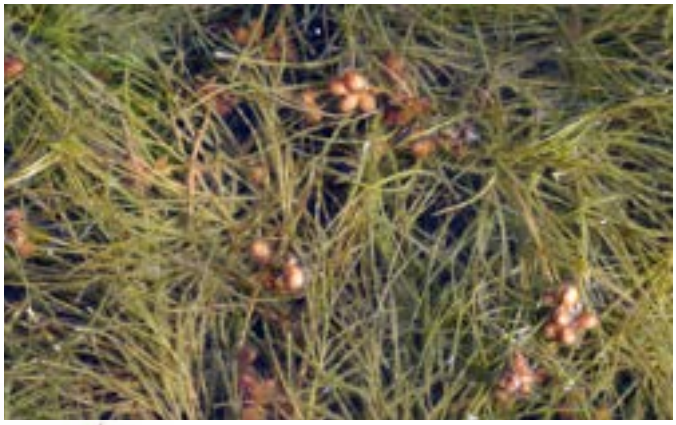
NATIVE

Sago pondweed

Stuckenia pectinata

KEYS TO ID

- Has narrow, stiff leaves alternating off the slender stem
- The base of leaves are tightly attached to stem for about ¼ of an inch before coming off the stem
- Leaves are very fine and almost look like pine needles
- Produces clusters of egg-shaped fruits
- Grows up to three feet tall



Fruit

LOOKS SIMILAR TO

- Starry stonewort (invasive)
- Native *Chara* (native)
- Native *Nitella* (native)
- Water stargrass (native)

WHERE TO LOOK

- Usually in shallow waters up to six feet
- Entirely submersed in water

CURRENTLY FOUND

Alternating leaves

Water stargrass

Heteranthera dubia

NATIVE

KEYS TO ID

- Small yellow flowers visible above water in mid- to late-summer
- Leaves lack a visible midvein
- Slender and branching stems with alternating leaves
- Leaves are narrow and flat
- May create dense mats

LOOKS SIMILAR TO

- Starry stonewort (invasive)
- Native *Chara* (native)
- Sago pondweed (native)
- Native *Nitella* (native)

WHERE TO LOOK

- Mostly in shallow waters and near stream banks
- On sandy or muddy bottoms

CURRENTLY FOUND

Yellow flowers

Actual size

INVASIVE

Curly-leaf pondweed

Potamogeton crispus

KEYS TO ID

- Thin, submerged leaves have distinct
- "teeth" and wavy edges
- Produces turions that look like small, greenish-brown pinecones
- Generally the first pondweed to come up in the spring; dies back in midsummer
- Leaves do not clasp around stem where they connect

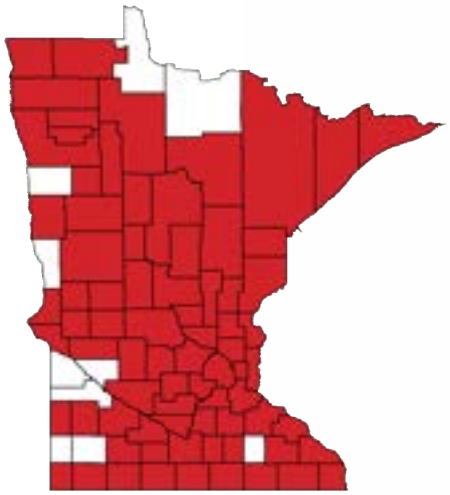
LOOKS SIMILAR TO

- Clasping-leaf pondweed (native)

WHERE TO LOOK

- Lakes, rivers, and streams in waters up to 15 feet deep

CURRENTLY FOUND



Teeth on edges

Turions

Actual size

Clasping-leaf pondweed

Potamogeton perfoliatus

NATIVE

KEYS TO ID

- Leaves alternate along the stem
- Leaves are wide and wavy, but don't have "teeth" like curly-leaf pondweed
- Leaves clasp around stem

LOOKS SIMILAR TO

- Curly-leaf pondweed (invasive)
- Also called Richardson's pondweed

WHERE TO LOOK

- Fully submersed
- In water up to 12 feet

CURRENTLY FOUND

Leaves clasping stems; enlarged to show detail

Actual size

NOTES

Quick reference guide

Purple Loosestrife

	Purple loosestrife	Blue vervain	Joe pye-weed	Fireweed
Smooth leaf margins	X			X, sometimes wavy
Stem shape	Square to 6-sided	Square	Round	Round
Flowers grow in vertical clusters	X	X		X
Leaf arrangement	Opposite or whorled	Opposite	Whorled	Alternate
Single ring of flowers in bloom at a time		X		

Hybrid cattail

	Hybrid cattail	Narrow-leaf cattail	Broadleaf cattail	Yellow iris	Blue flag iris
Leaf width	¼″ - ½″	¼″ - ½″	> ½″	~ 1″	~ 1″
Distance between male and female inflorescence	< 1″	> 1″	No gap	N/A	N/A
Dominant flower color	Tan-brown	Tan-brown	Tan-brown	Yellow	Blue-purple and white
Ridge-like thickening in center of leaf				X	
Leaf arrangement at base	Stacked	Stacked	Stacked	Fan-like	Fan-like

Phragmites

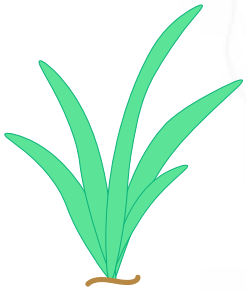
	Invasive *Phragmites*	Native *Phragmites*	Reed canary grass	Miscanthus
Height	8 – 20 feet	8 – 15 feet	2 – 6 feet	4 – 8 feet
Inflorescence	Silver to purple, up to 20″ tall	Silver to tan, 10 – 15″ tall	Purple to tan, 6″ tall	Finger-like silvery spikes
Flowering seasons	Late summer to early fall	Late summer	Spring	Late summer to early fall
Leaves	1″ wide, sheath tightly wraps stem	½ – 1″ wide, sheath loosely wraps stem	½ – ¾ ″ wide, rough texture	¼ – 1″ wide, with prominent white midvein
Ligule	<1 mm, fuzzy	>1 mm, fuzzy	4 – 9 mm, transparent	¼ – 1″ wide, with prominent white midvein
Stem color	Green to tan	Red to gold	Green to tan	Green to bronze

Introduction to wetland plants

Alternate

Opposite

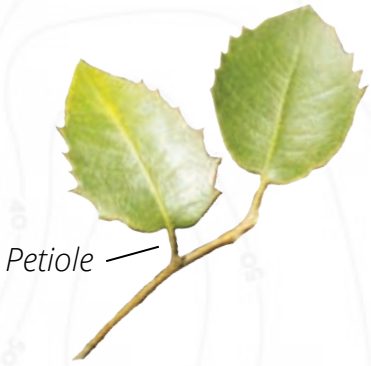
Whorled



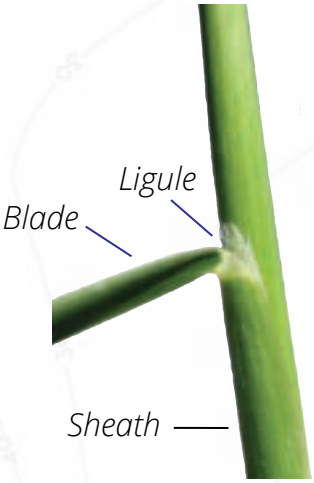
Basal

Leaf attachments

Sessile



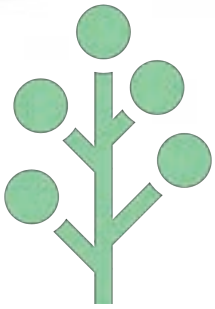
Petiolate



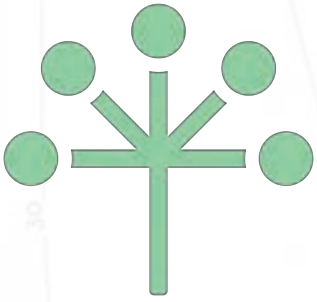
Sheathing

Flower arrangements

Single



Spike



Umbel

INVASIVE

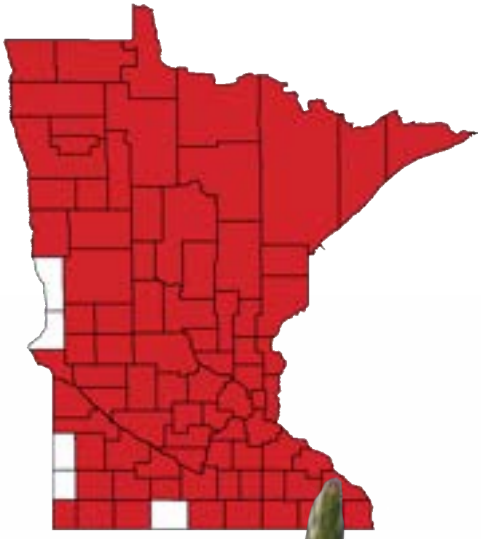
Purple loosestrife

Lythrum salicaria

KEYS TO ID

- Grows 3 - 7 feet tall
- Purple-pink flowers grow on tall spikes
- Multiple rings of flowers bloom at the same time from the bottom of the spike up
- Leaves are opposite or whorled with smooth edges
- Stems are typically square but can be up to 6-sided

CURRENTLY FOUND



LOOKS SIMILAR TO

- Blue vervain (native)
- Fireweed (native)
- Joe-pye weed (native)

WHERE TO LOOK

- Wetland areas including wet meadows, stream banks, pond or lake edges, and ditches

Square stems and leaves with smooth edges

Blue verain

Verbena hastata

NATIVE

KEYS TO ID

- Grows 1- 6 feet tall
- Blue-violet flowers grow on densely packed spikes and have five petals each
- Flowers bloom in a single, tight ring
- Leaves have sharply toothed edges and have opposite arrangement
- Stems are square and somewhat hairy

LOOKS SIMILAR TO

- Purple loosestrife (invasive)
- Fireweed (native)
- Joe-pye weed (native)

WHERE TO LOOK

- Shore areas, moist fields, and ditches
- Prefers sunny areas

CURRENTLY FOUND

Opposite leaves with sharply toothed edges (above)
Flowers have spikes (below)

NATIVE

Joe-pye weed

Eutrochium spp.

KEYS TO ID

- Grows 2 - 10 feet tall
- Purplish flowers grow in clusters and have a fuzzy appearance
- Leaves are whorled with toothed margins
- Round stems may have hairs present

Whorled leaves with toothed margins

LOOKS SIMILAR TO

- Purple loosestrife (invasive)
- Blue vervain (native)
- Fireweed (native)
- There are two native joe-pye weeds in Minnesota: Spotted joe-pye weed and Sweet joe-pye weed

WHERE TO LOOK

- Wetlands, wet meadows, and shorelines

CURRENTLY FOUND

Fireweed

Chamaenerion angustifolium

NATIVE

KEYS TO ID

- Grows 3 - 7 feet tall
- Purple flowers grow on spikes and have four paddle-shaped petals alternating with four darker lance-shaped sepals
- Leaves are alternate with a white midrib and sometimes wavy edges
- Stems are round

Alternating leaves with a white midrib (left)
Alternating petals and sepals (right)

LOOKS SIMILAR TO

- Purple loosestrife (invasive)
- Blue vervain (native)
- Joe-pye weed (native)

WHERE TO LOOK

- Moist soils
- Woodland edges
- Shorelines

CURRENTLY FOUND

INVASIVE

Hybrid cattail

Typha × glauca

KEYS TO ID

- Leaf width is between ¼ - ½ inch
- Gap between bottom, velvety-brown female flower and top, soft, tan-yellow male flower is between ¼ - 1 inch
- Pollen shed as single grains or clusters of 2, 3, or 4 grains

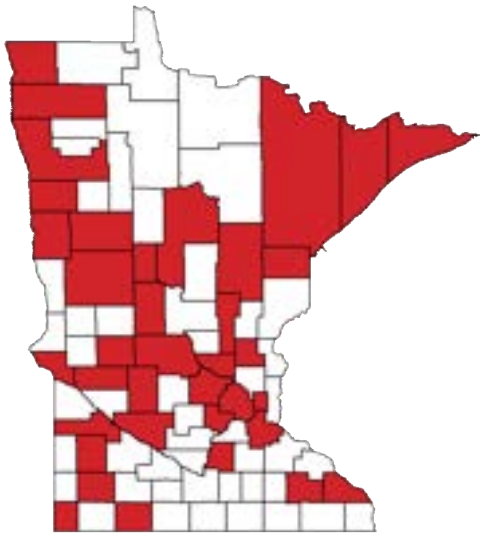
LOOKS SIMILAR TO

- Narrow-leaf cattail (invasive)
- Broadleaf cattail (native)
- Yellow iris (invasive)
- Blue flag iris (native)

WHERE TO LOOK

- Wetlands, ditches, edges of lakes, ponds, and streams

CURRENTLY FOUND



Narrow-leaf cattail

Typha angustifolia

INVASIVE

KEYS TO ID

- Leaf width is between ¼ - ½ inch
- Gap between bottom, velvety-brown female flower and top, soft, tan-yellow male flower is 1 inch or more
- Pollen shed as single grains

Large gap between female and male flowers

Cattail seeds are spread by wind on dandelion-like fluff

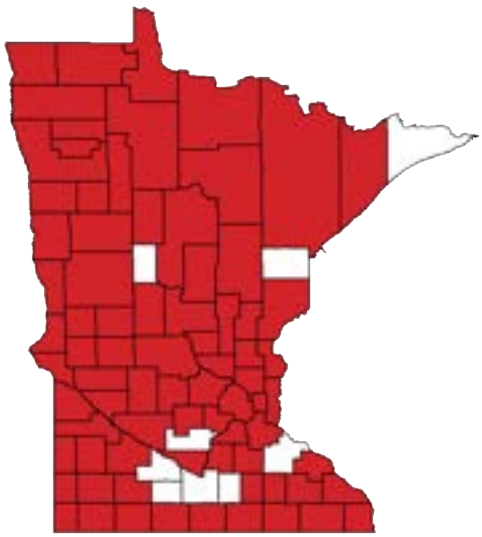
LOOKS SIMILAR TO

- Hybrid cattail (invasive)
- Broadleaf cattail (native)
- Yellow iris (invasive)
- Blue flag iris (native)

WHERE TO LOOK

- Wetlands, ditches, edges of lakes, ponds, and streams

CURRENTLY FOUND



NATIVE

Broadleaf cattail

Typha latifolia

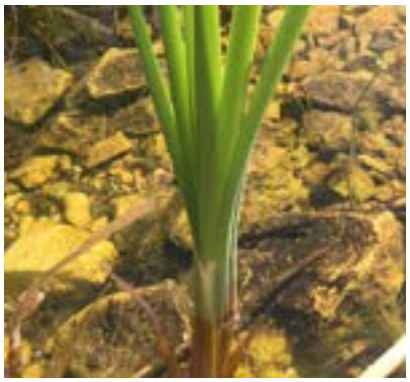
KEYS TO ID

- Leaf width is greater than ½ inch
- No gap between bottom, velvety brown female flower and top, soft, tan-yellow male flower
- Pollen shed in clusters of four grains

No gap between female and male flowers

LOOKS SIMILAR TO

- Narrow-leaf cattail (invasive)
- Hybrid cattail (invasive)
- Yellow iris (invasive)
- Blue flag iris (native)



Wider leaves

WHERE TO LOOK

- Wetlands, ditches, edges of lakes, ponds, and streams

CURRENTLY FOUND

Yellow iris

Iris pseudacorus

INVASIVE

KEYS TO ID

- Sword-like leaves form in flattened, fan-like clusters
- Center of leaf thickens sharply into a ridge
- Bright, yellow flowers usually grow with 2-3 on a stalk

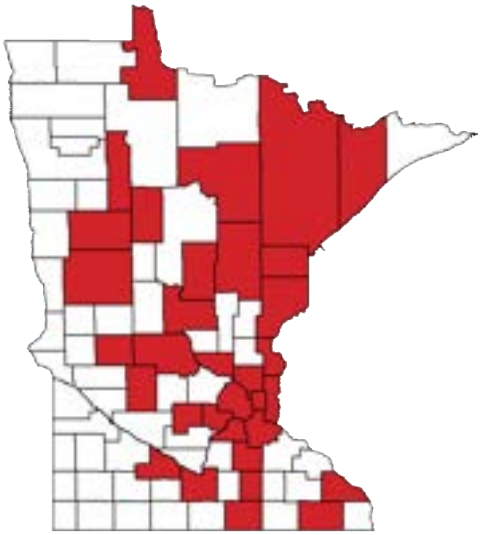
LOOKS SIMILAR TO

- Hybrid cattail (invasive)
- Narrow-leaf cattail (invasive)
- Broadleaf cattail (native)
- Blue flag iris (native)

WHERE TO LOOK

- Shorelines, shallow water, and ditches

CURRENTLY FOUND



Leaf with ridged center

Leaves make a fan-like pattern at the base; note thickening/ridge along centers of leaves (noted with arrow)

NATIVE

Blue flag iris

Iris virginica, Iris versicolor

KEYS TO ID

- Sword-like leaves form in flattened, fan-like clusters
- Center of leaf thickens gradually
- Blue-violet flowers with yellow and white markings

LOOKS SIMILAR TO

- Narrow-leaf cattail (invasive)
- Hybrid cattail (invasive)
- Broadleaf cattail (native)
- Yellow iris (invasive)

WHERE TO LOOK

- Shorelines, shallow water, wetlands, and ditches

CURRENTLY FOUND

Leaf thickens gradually

Leaves make a fan-like pattern at the base

Invasive Phragmites

Phragmites australis sp. *australis*

INVASIVE

KEYS TO ID

- Tall; up to 20 feet
- Full, show seed heads that are silver to purple in color
- Leaf sheaths wrap tightly around stem with narrow ligule (< 1mm)
- Green stems that may feel ridged

LOOKS SIMILAR TO

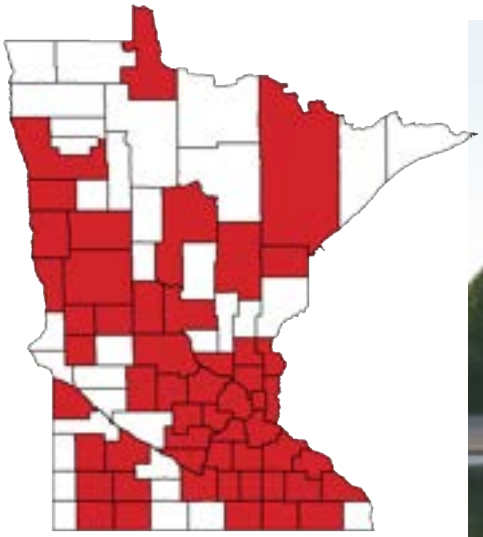
- Native *Phragmites* (native)
- Reed canary grass (native and invasive)
- *Miscanthus* (invasive)

WHERE TO LOOK

- Wetlands, ditches, edges of lakes, ponds, and streams

Leaf sheaths wrap tightly around stem (left)
Ligule is a thin, discrete brown line (right)

CURRENTLY FOUND



NATIVE

Native Phragmites

Phragmites australis ssp. *americanus*

KEYS TO ID

- Tall; up to 15 feet
- Wispy seed heads that are silver to tan in color
- Leaf sheaths wrap loosely around stem with > 1 mm ligule
- Smooth stems golden to red in color

LOOKS SIMILAR TO

- Invasive *Phragmites* (invasive)
- Reed canary grass (native and invasive)
- *Miscanthus* (invasive)

WHERE TO LOOK

- Wetlands, ditches, edges of lakes, ponds, and streams

Leaf sheaths wrap loosely around stem (left)
Ligule is a thick, smudgy line (right)

CURRENTLY FOUND

Reed canary grass

Phalaris arundinacea

*

KEYS TO ID

- Leaves are ¼ - ¾ inch wide with a rough texture and up to 10 inches long
- Translucent ligule
- Hairless, hollow, smooth stems
- Seed heads about 6 inches tall and are green to purple to tan, blooming May to mid-june

Translucent ligule (left)
Seed heads can be purple (right)

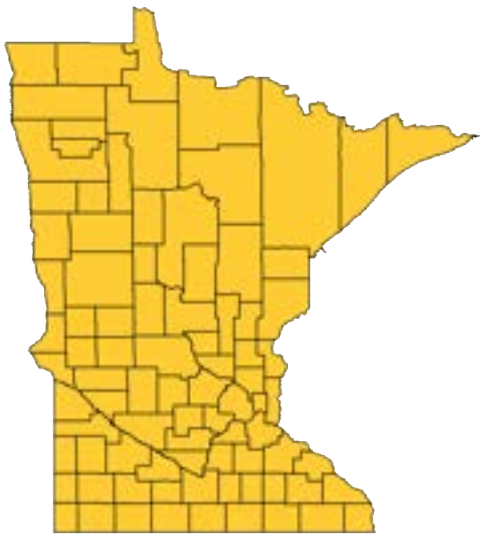
LOOKS SIMILAR TO

- Invasive *Phragmites* (invasive)
- Native *Phragmites* (native)
- Miscanthus (invasive)

WHERE TO LOOK

- Ditches, stream banks, wetlands
- May also be found in upland areas

CURRENTLY FOUND



** There is recent in-depth research on which populations of reed canary grass in Minnesota are native and which are non-native. Findings from University of Minnesota researchers indicate that reed canary grass populations along the rivers they sampled in Minnesota are likely predominantly native. Regardless of origins, reed canary grass can form dense, dominant cover and require control when there are management goals related to maintaining or restoring other plant species.*

INVASIVE

Miscanthus

Miscanthus spp.

KEYS TO ID

- Grows 4 - 8 feet tall
- Seed heads resemble corn tassels, but are more dense and arch to one side of the stalk
- Long arching leaves, less than 1 inch wide, with a distinct, whitish midvein

Long arching leaves with a white midvein

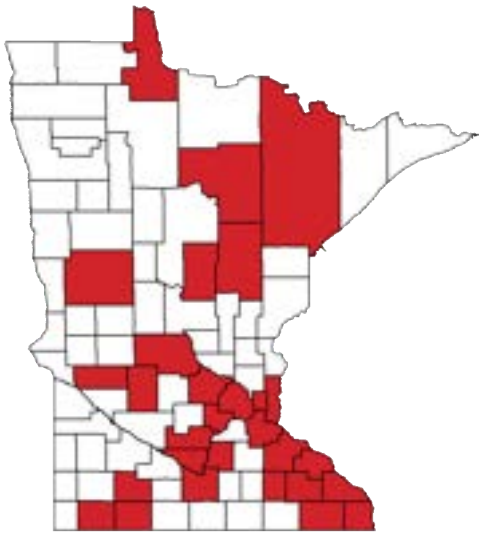
LOOKS SIMILAR TO

- Invasive *Phragmites* (invasive)
- Native *Phragmites* (native)
- Reed canary grass (native and invasive)

WHERE TO LOOK

- Sunny to semi-shaded areas along roads, ditches, woodland edges, and clearings
- Common in ornamental plantings

CURRENTLY FOUND



Quick reference guide

Rusty crayfish

	Rusty crayfish	Clearwater crayfish	Calico crayfish	Virile crayfish
Red spot on carapace	X			
Black band on pincers	X	X		
Dark v-shaped mark on abdomen		X		
Notched gap in pincers			X	
Orange tip on pincers	X	X	X	X
Blue tint & white bumps on claws				X
Oval gap when pincers closed	X	X		

Zebra and quagga mussels

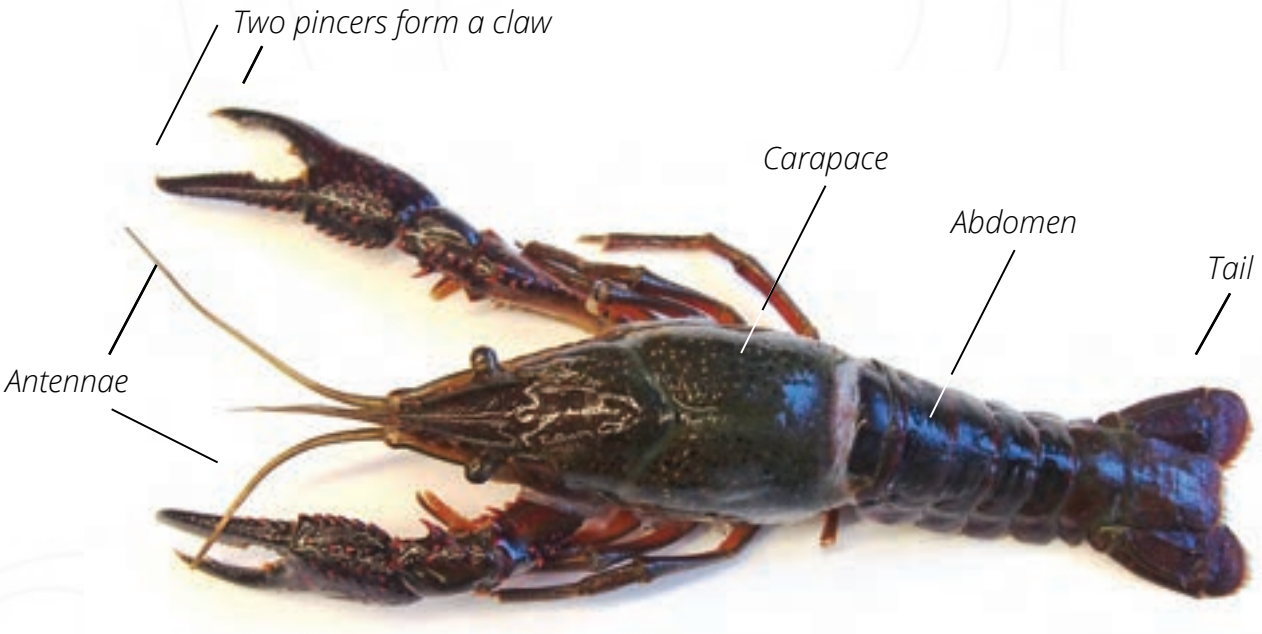
	Zebra mussels	Quagga mussels	Native mussels	Asian clam	Snails
Adults attach to hard surfaces	X	X			X
Two shells	X	X	X	X	
Symmetric shape				X	
Ridges on shell			Some species	X	
Spiral-shaped shell					X
Striped pattern	Zig-zags	Rings	Some species		
Flattened ventral edge	X		Some species		
Curved line where shells meet		X	Some species		
Coloration lightens toward hinge		X	Some species		

Spiny waterflea

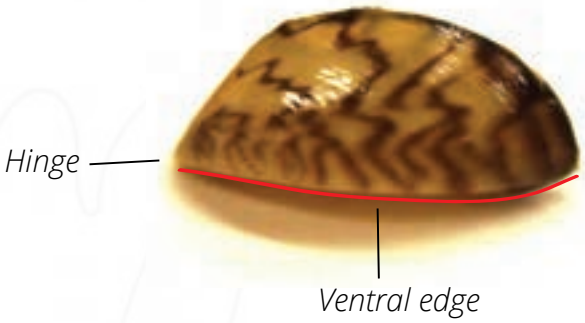
	Spiny water flea	Fishhook water flea	Other zooplankton
Long, spine-like tail	X	X	
Barbs on tail	X	X	
Black eyespot(s)	X	X	X
Egg sac (on females)	Round, bulbous	Long, pointed	
Hook at end of tail		X	
Can clump on angling gear	X	X	X

Introduction to invertebrates

Crayfish



Mussels and clams



Snails

INVASIVE

Rusty crayfish

Faxonius rusticus

KEYS TO ID

- Red spots on the sides of carapace
- Small black bands at the tip of each pincer on claws
- When claws close, there is an oval-shaped gap
- Can grow up to 5 inches long

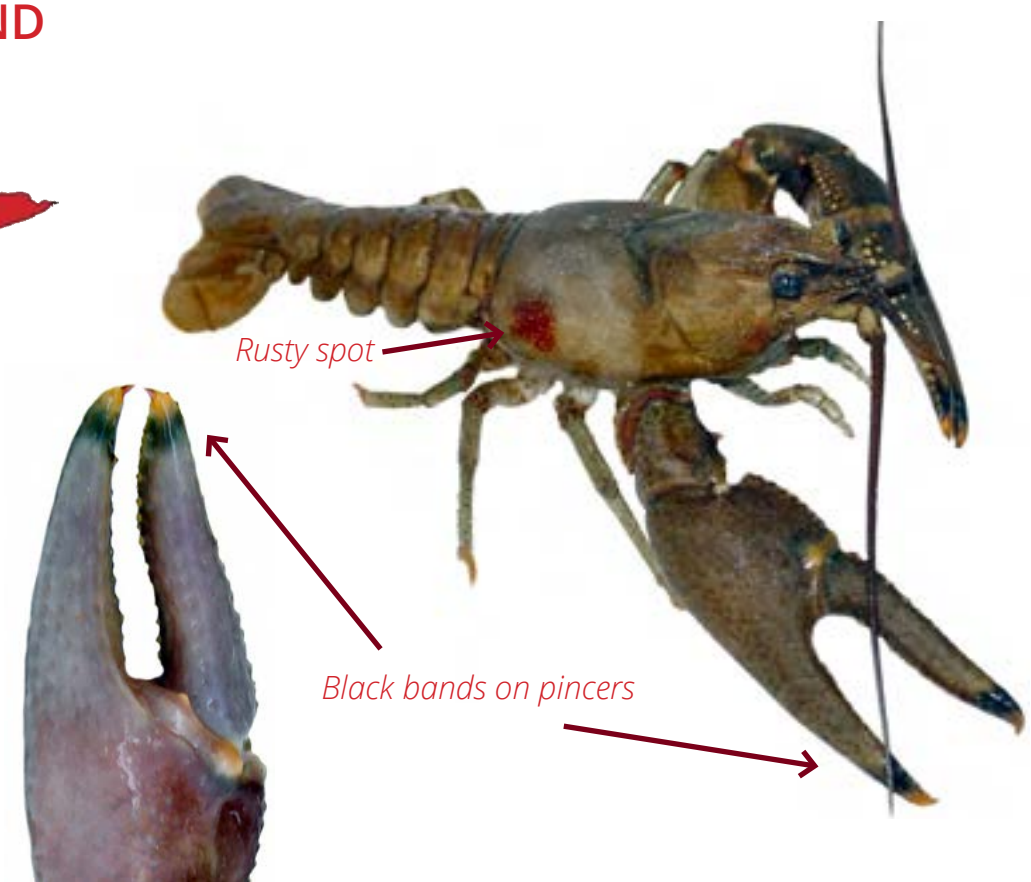
LOOKS SIMILAR TO

- Red swamp crayfish (invasive)
- Northern clearwater crayfish (native)
- Calico crayfish (native)
- Virile crayfish (native)
- Young or smaller specimens can often be difficult to tell apart

WHERE TO LOOK

- Often found in shallow water up to three feet deep
- On a wide variety of bottom types

CURRENTLY FOUND



Red swamp crayfish

Procambarus clarkii

INVASIVE

KEYS TO ID

- Can grow up to 5 inches long
- Red bumps on claws
- Black wedge-shaped stripe on top of abdomen

LOOKS SIMILAR TO

- Rusty crayfish (invasive)
- Northern clearwater crayfish (native)
- Calico crayfish (native)
- Virile crayfish (native)
- Young or smaller specimens can often be difficult to tell apart

WHERE TO LOOK

- All types of freshwater
- Burrowed into bottoms of lakes, rivers, and ponds

CURRENTLY FOUND

NATIVE

Northern clearwater crayfish

Faxonius propinquus

KEYS TO ID

- No red spot on side of carapace
- Claws are similar to rusty crayfish with black band at the tip
- Dark wedge-shaped marking down abdomen
- Can grow up to 4.5 inches

LOOKS SIMILAR TO

- Rusty crayfish (invasive)
- Red swamp crayfish (invasive)
- Calico craytish (native)
- Virile crayfish (native)
- Young or smaller specimens can often be difficult to tell apart

WHERE TO LOOK

- In clear, rocky streams and rocky lake shores

CURRENTLY FOUND

Calico crayfish

Faxonius immunis

NATIVE

KEYS TO ID

- No red spot on carapace
- Distinctive notch in the pincers of their claws
- Can grow up to 3.5 inches
- Have patterned, splotchy coloration

LOOKS SIMILAR TO

- Rusty crayfish (invasive)
- Red swamp crayfish (invasive)
- Virile crayfish (native)
- Northern clearwater crayfish (native)
- Young or smaller specimens can often be difficult to tell apart

WHERE TO LOOK

- In shallow waters under plants for cover
- Will burrow in muddy bottoms of ponds

CURRENTLY FOUND

NATIVE

Virile crayfish

Faxonius virilis

KEYS TO ID

- No red spot on side of carapace
- Narrow claws with no black band
- Claws may have a blue tint with small white bumps
- Can grow up to 5 inches long

LOOKS SIMILAR TO

- Rusty crayfish (invasive)
- Red swamp crayfish (invasive)
- Calico crayfish (native)
- Northern clearwater crayfish (native)
- Young or smaller specimens can often be difficult to tell apart

WHERE TO LOOK

- In a wide variety of habitats
- Under stones in lakes, streams, and wetlands
- Not found in swift-moving waters

CURRENTLY FOUND

Zebra mussels

Dreissena polymorpha

INVASIVE

KEYS TO ID

- Stripes are generally in zigzag pattern
- Pattern is variable; some may lack striping altogether and can be solid tan or brown
- Have a flat edge and won't topple over when set on it
- Shells form straight line when closed
- Range from ⅕ - 2 inches long

Stripes are zigzag

Byssal threads

Straight line

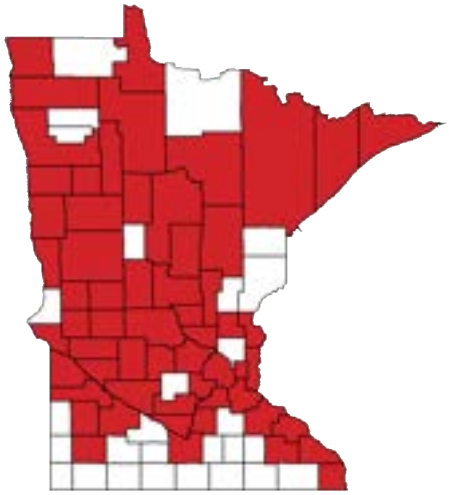
LOOKS SIMILAR TO

- Quagga mussels (invasive)
- Freshwater golden clam (invasive
- Chinese mystery snail (invasive)
- Native snails (native)
- Native mussels (native)

WHERE TO LOOK

- Often found attached to submerged objects (such as boats and docks as well as plants and rocks)
- May leave behind byssal threads when removed
- Newly settled mussels are usually in shallow areas; adults are common in depths of 10 - 20 feet

CURRENTLY FOUND



Zebra mussels covering native mussel

INVASIVE

Quagga mussels

Dreissena bugensis

KEYS TO ID

- Stripes generally more ring shaped and lighten closer to the hinge
- Wide range of coloration - some may appear to have almost no striping
- Will topple over when placed on ventral edge
- Shells form S-shape when closed
- Range from ⅛ - 2 inches long

LOOKS SIMILAR TO

- Zebra mussels (invasive)
- Chinese mystery snail (invasive)
- Freshwater golden clam (invasive)
- Native mussels (native)
- Native snails (native)

WHERE TO LOOK

- Often found attached to submerged objects (such as boats and docks as well as plants and rocks)
- May leave behind byssal threads when removed
- May inhabit softer substrates (such as silt) and deeper water than zebra mussels

CURRENTLY FOUND

Freshwater golden clam

Corbicula fluminea

INVASIVE

KEYS TO ID

- Ranges from light to dark gold to tan in color
- Symmetric shape; rounder than zebra mussels
- Shells have ridged concentric rings
- Can grow up to 2 inches long

LOOKS SIMILAR TO

- Zebra mussels (invasive)
- Quagga mussels (invasive)
- Chinese mystery snail (invasive)
- Native snails (native)
- Native mussels (native)

WHERE TO LOOK

- In soft substrates like sand or mud

CURRENTLY FOUND

NATIVE

Freshwater mussels

Family Unionidae

KEYS TO ID

- Typically have asymmetrical shell shape
- Grow significantly larger than zebra mussels, quagga mussels, and freshwater golden clam
- 51 different species live in Minnesota
- Often called clams

LOOKS SIMILAR TO

- Zebra mussels (invasive)
- Chinese mystery snail (invasive)
- Freshwater golden clam (invasive)
- Quagga mussels (invasive)
- Native snails (native)
- Collectively called “unionids”

WHERE TO LOOK

- Embedded in the bottom of lakes and rivers throughout Minnesota

CURRENTLY FOUND

Top: Native mussel on its own.
Bottom: Native mussel being smothered by zebra mussels. The uncovered part of this mussel was buried in the river bottom.

Chinese mystery snail

Cipangopaludina chinensis

INVASIVE

KEYS TO ID

- Grow up to 2 inches long
- Light to dark brown
- Have an operculum covering, often missing when dead

Operculum

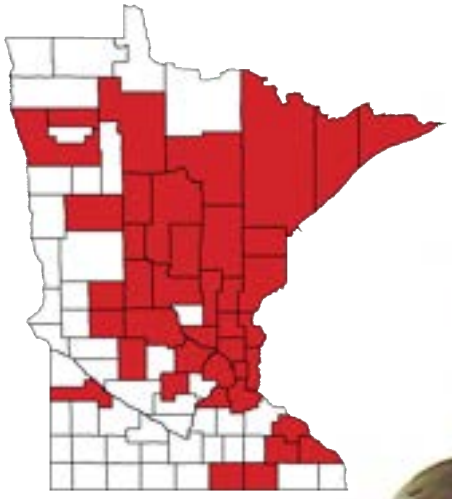
LOOKS SIMILAR TO

- Zebra mussels (invasive)
- Quagga mussels (invasive)
- Freshwater golden clam (invasive)
- Native mussels (native)
- Native snails (native)

WHERE TO LOOK

- In lakes and slow-moving rivers

CURRENTLY FOUND



NATIVE Snails

KEYS TO ID

- Single shell with spirals
- Generally under 2 - 3 inches in length

LOOKS SIMILAR TO

- Zebra mussels (invasive)
- Quagga mussels (invasive)
- Chinese mystery snail (invasive)
- Freshwater golden clam (invasive)
- Native mussels (native)

Pond snail

WHERE TO LOOK

- Most aquatic habitats (from woodland pools to streams, rivers, wetlands, ponds, and lakes) throughout the state

Ramshorn snail

CURRENTLY FOUND

Limpet snail

Limpet snails are native to Minnesota but do not have the typical spiraled shell, and can be found attached to other animals or objects - often leading to confusion with zebra or quagga mussels.

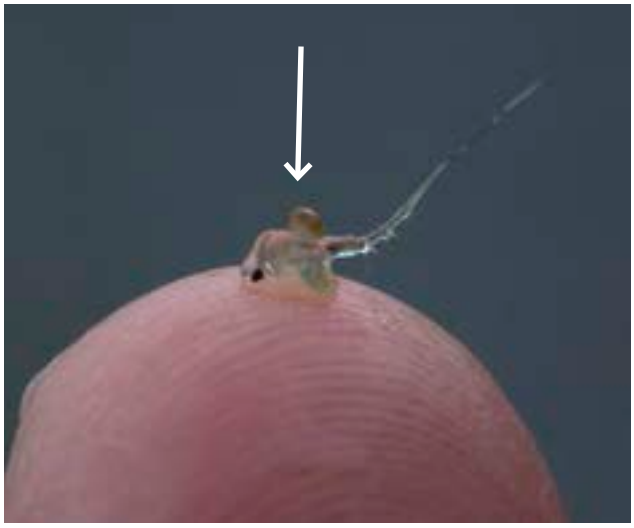
Spiny water flea

Bythotrephes longimanus

INVASIVE

KEYS TO ID

- Range from ¼ - ⅝ of an inch in length
- Have long, spiny tails with 1 - 4 pairs of barbs
- Have distinctive black eye spots
- Females may have bulbous brood chamber on back
- Most abundant during late summer and autumn



Brood chamber holding early development eggs

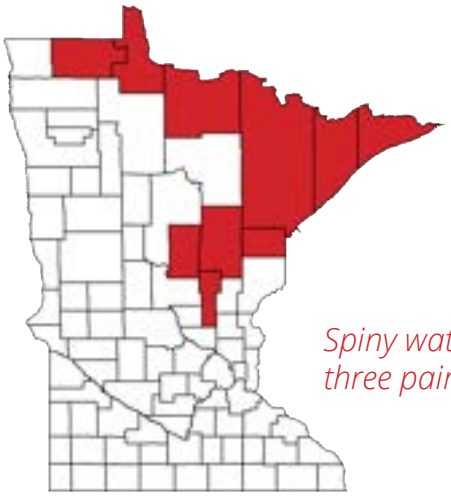
LOOKS SIMILAR TO

- Fishhook water flea (invasive)
- *Leptodora* (native)
- *Chaoborus* (native)

WHERE TO LOOK

- Most often found on fishing line or other equipment in clumps that resemble a gelatinous blob
- Usually found in deep lakes but can establish in shallow lakes and rivers
- Suspended in water column

CURRENTLY FOUND



Spiny water flea with three pairs of barbs

INVASIVE

Fishhook water flea

Cercopagis pengoi

KEYS TO ID

- Range from about ¼ to ½ inch
- Have long tail with up to three pairs of barbs and a characteristic "hook" near the end
- Have distinctive eye spot
- Females may have pointed brood chamber on back

LOOKS SIMILAR TO

- Spiny water flea (invasive)
- *Leptodora* (native)
- *Chaoborus* (native)

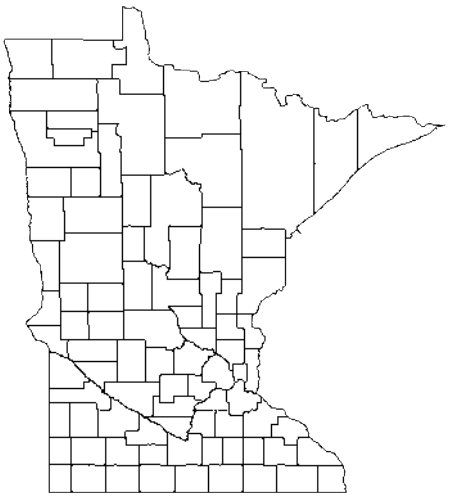
Hook *Three pairs of barbs*

WHERE TO LOOK

- Clogged on nets or other fishing gear
- Brackish and freshwater lakes
- Has not been found in Minnesota

Female with resting eggs

CURRENTLY FOUND



Fishhook water flea (top)
Spiny water flea (bottom)

Predatory zooplankton

Leptodora sp. and larval *Chaoborus* sp.

NATIVE

KEYS TO ID

- No long, spine-like tail
- *Leptodora* grow up to 0.8 inches long with two antennae and one eye
- *Chaoborus* have two small eyes at the front of their bodies, lack spines on their tail, and also lack long antennae
- Both are almost entirely transparent

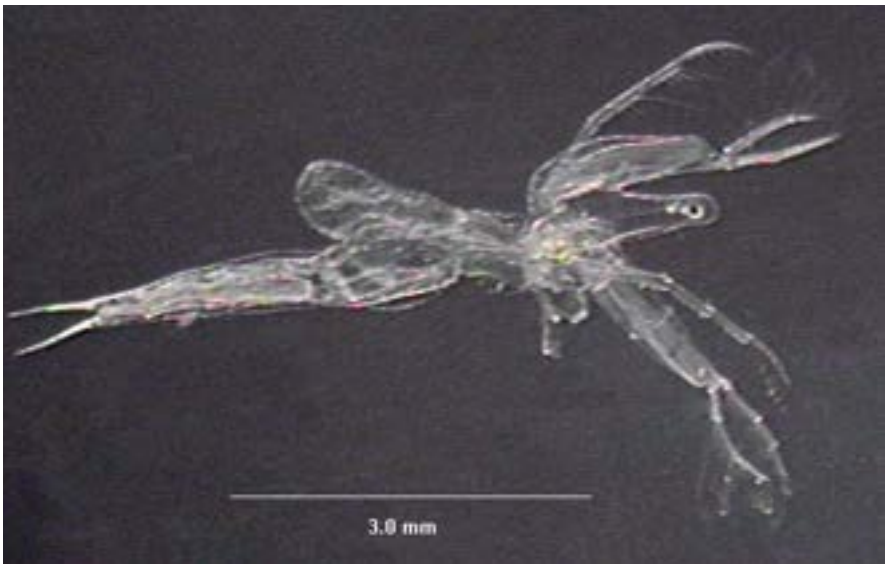
LOOKS SIMILAR TO

- Spiny water flea (invasive)
- Fishhook water flea (invasive)

WHERE TO LOOK

- Collected on fishing line
- Very widespread throughout Minnesota

CURRENTLY FOUND



Leptodora kindtii

Larval *Chaoborus*

NOTES

Quick reference guide

Bighead and silver carp

	Bighead carp	Silver carp	Gizzard shad	Mooneye	Shiners
Color	Gray with dark patches; silvery white underside	Silver; sometimes with a green hue	Silver-white	Silver	Varies
Eye location	Center below midline	Center below midline	Center above midline	Center above midline	Center above midline
Keel	Short	Long	Long	Short	N/A
Shoulder spot			X		
Teeth				X	
Long final ray of dorsal fin			X		

Common Carp/Goldfish

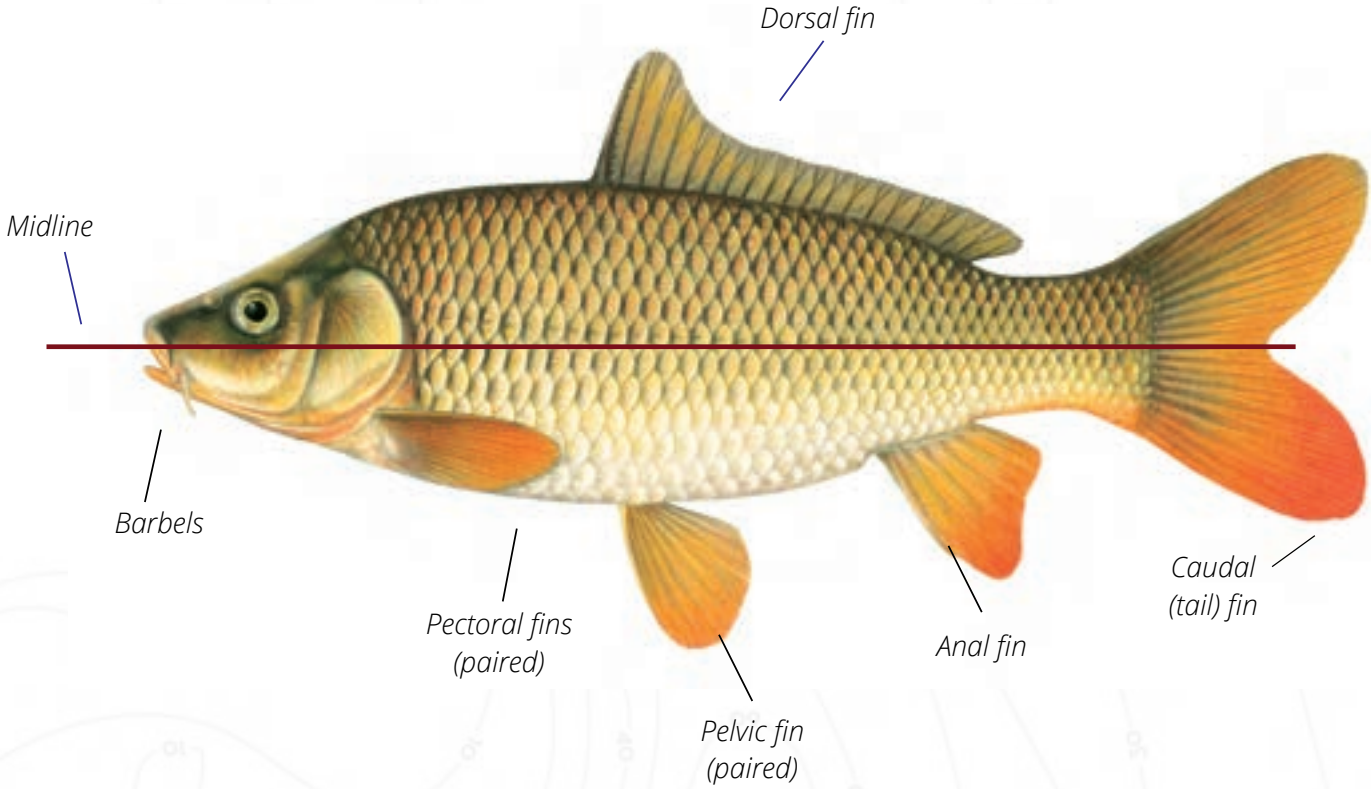
	Common Carp	Goldfish (wild-type)	Smallmouth Buffalo	River Carpsucker	Golden Shiner
Has barbels	X				
Elongated Dorsal Fin	X	X	X	X	
Mouth Type	Downward facing	Forward facing	Downward facing	Downward facing	Upward facing
Adult Size	Typical: 1-2 ft Max: 4 ft	Typical: 6-12 inches Max: 18 inches	Typical: 14-20 inches Max: 28 inches	Typical: 12-18 inches Maximum: ~25 inches	Typical: 4-7 inches Max: 12 inches

Northern Snakehead

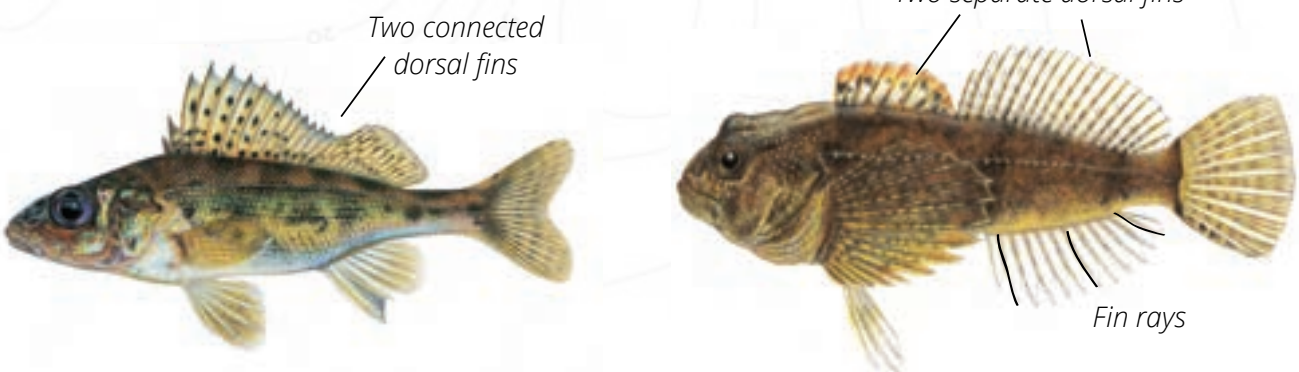
	Northern snakehead	Burbot	Bowfin
Scales on head	X	Tiny (may appear scaleless)	
Single barbel on chin		X	
Elongated anal fin	X	X	
Single dorsal fin	X		X
Pelvic fins halfway down body			X

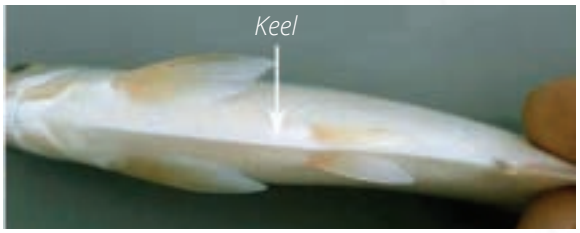
Introduction to fish

Fish characteristics



Variations in fins





INVASIVE

Bighead carp

Hypophthalmichthys nobilis

KEYS TO ID

- Shades of gray with black blotches on back and sides
- Eyes point downward; center of the eye is even with or below the midline
- No teeth in upper or lower jaw
- Short keel between pelvic and anal fins
- Average size of bighead carp caught in Minnesota is nearly 40 inches; early life stage could be confused with minnows

LOOKS SIMILAR TO

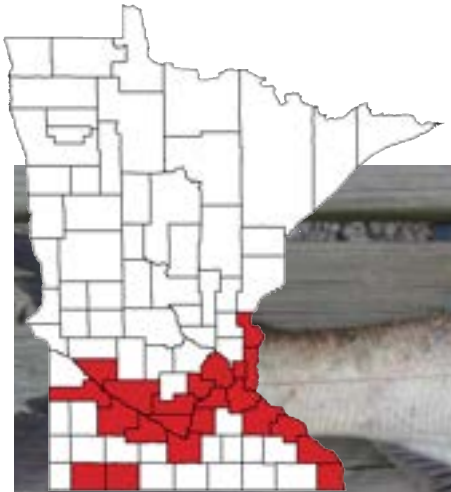
- Silver carp (invasive)
- Gizzard shad (native)
- Mooneye (native)
- Emerald shiner (native)

Juvenile

WHERE TO LOOK

- Prefer turbulent, nutrient-rich rivers
- Need flowing water to reproduce; will use backwaters and slow areas other times of the year

CURRENTLY FOUND



Note: Adult bighead carp have been found in (or would have had to pass through) stretches of the Minnesota, Mississippi, and St. Croix Rivers in highlighted counties.

Adult

Silver carp

Hypophthalmichthys molitrix

INVASIVE

KEYS TO ID

- Silver in color; can be greenish on back
- Eyes point downward
- Center of the eye is even with or below the midline
- No teeth in upper or lower jaw
- Long keel that extends in front and behind pelvic fins
- Average size of silver carp caught in Minnesota is nearly 33 inches; early life stage could be confused with minnows

Fry (top)
Adult (middle)
Juvenile (bottom)

LOOKS SIMILAR TO

- Bighead carp (invasive)
- Gizzard shad (native)
- Mooneye (native)
- Emerald shiner (native)

WHERE TO LOOK

- Can jump up to ten feet in the air
- Prefer turbulent, nutrient-rich rivers; can tolerate a wide range of temperatures
- Need flowing water to reproduce; will use backwaters and slow areas other times of the year
- No known established populations in Minnesota; individuals have been caught intermittently

CURRENTLY FOUND

Note: Adult silver carp have been found in (or would have had to pass through) stretches of the Mississippi, St. Croix, and Ocheyedan Rivers in highlighted counties.

NATIVE

Gizzard shad

Dorosoma cepedianum

KEYS TO ID

- Silver to white with a distinguishing shoulder spot
- Last ray on dorsal fin much longer than the others
- Upper edge of the eye located above the tip of the upper lip
- No teeth in upper or lower jaw
- Generally grow about 8 - 12 inches long

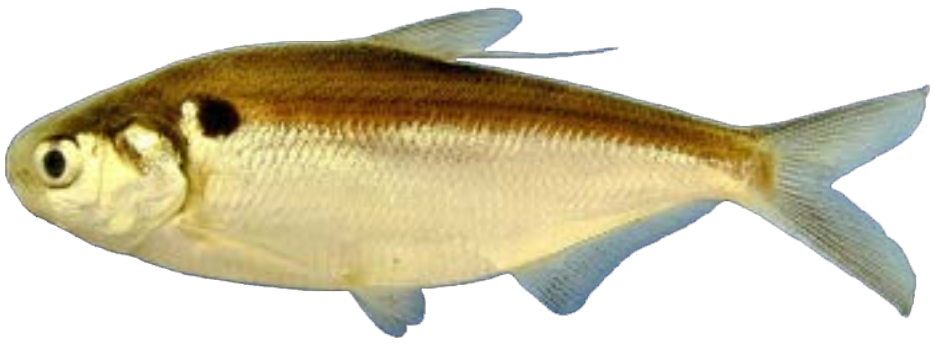
LOOKS SIMILAR TO

- Bighead carp (invasive)
- Silver carp (invasive)
- Mooneye (native)
- Emerald shiner (native)

WHERE TO LOOK

- Prefer shallow waters with soft, muddy bottoms
- Also found in slow moving areas of rivers

CURRENTLY FOUND



Mooneye

Hiodon tergisus

NATIVE

KEYS TO ID

- Silver in color
- Keel extends from anal to pelvic fin
- Upper edge of the eye is located above the tip of the upper jaw
- Has teeth on both jaws and roof of mouth
- Grow up to 15 inches long

LOOKS SIMILAR TO

- Bighead carp (invasive)
- Silver carp (invasive)
- Gizzard shad (native)
- Emerald shiner (native)

WHERE TO LOOK

- Prefer large, clear lakes and rivers

CURRENTLY FOUND

NATIVE

Emerald shiner

Notropis atherinoides

KEYS TO ID

- Emerald-silver color on its sides
- Upper edge of the eye is located above the tip of the upper jaw
- No teeth on upper or lower jaw
- Generally grow about 3 - 4 inches long

LOOKS SIMILAR TO

- Bighead carp (invasive)
- Silver carp (invasive)
- Gizzard shad (native)
- Emerald shiner (native)

WHERE TO LOOK

- Tend to school in large groups near surface of the water at dusk to feed

CURRENTLY FOUND

Common Carp

Cyprinus carpio

INVASIVE

KEYS TO ID

- Two sets of barbels around mouth
- Subterminal (downturned) mouth
- Scales outlined with darker pigment, can create cross-hatch look across fish
- Elongated dorsal fin
- Typically ~ 1-2 feet long (Approx. max. 4ft)

Mouth and eye detail

LOOKS SIMILAR TO

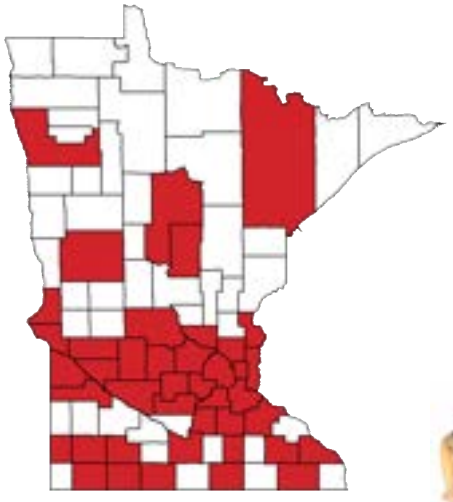
- Goldfish (invasive)
- Smallmouth buffalo (native)
- River carpsucker (native)
- Golden shiner (native)

WHERE TO LOOK

- Lakes, ponds, and water impoundments
- Rivers with low to moderate flow
- Typically found in more turbid/ productive waters

Scale detail

CURRENTLY FOUND



INVASIVE

Goldfish (wild-type)

Carassius auratus

KEYS TO ID

- Mouth is forward facing with no barbels
- Large scales; typically olive to bronze in color and may have cross-hatch appearance
- Elongated dorsal fin
- "Fancy-type" goldfish come in many different body shapes and colors (orange, yellow, black, white)
- Typically 6-12 inches long (Approx. max. 18 inches)

Examples of 'fancy'-type goldfish

LOOKS SIMILAR TO

- Bighead carp (invasive)
- Gizzard shad (native)
- Mooneye (native)
- Emerald shiner (native)

WHERE TO LOOK

- Ponds, lakes and slow-moving streams
- Areas with ample vegetation
- Areas with nearby pedestrian access (frequently introduced via aquarium releases)

CURRENTLY FOUND

Wild-type Goldfish

Smallmouth buffalo

Ictiobus bubalus

NATIVE

KEYS TO ID

- Small, downward facing mouth with no barbels
- Large scales with paler outline; dark gray to olive in color
- Elongated dorsal fin, first few rays significantly taller than rest
- Typically 14-20 inches long (Approx. max. 28 inches)

LOOKS SIMILAR TO

- Goldfish (invasive)
- Common carp (invasive)
- River carpsucker (native)
- Golden shiner (native)
- There are 3 buffalo species native to Minnesota

Color variation and extended dorsal fin

WHERE TO LOOK

- Deep areas of streams and rivers
- Some lakes
- Prefers clear waters

CURRENTLY FOUND

NATIVE

River carpsuckers

Carpiodes carpio

KEYS TO ID

- Downward facing mouth with knob (nipple) at center of lower lip
- Elongated dorsal fin, first few rays significantly taller than rest
- Large, silvery solid-colored scales
- No barbels
- Typically 12 - 18 inches long (Approx. max. 25 inches)

Mouth detail

LOOKS SIMILAR TO

- Common Carp (invasive)
- Goldfish (invasive)
- Smallmouth buffalo (native)
- Golden shiner (native)

WHERE TO LOOK

- Large streams and rivers
- Backwaters, slow-moving areas

CURRENTLY FOUND

Golden shiner

Notemigonus crysoleucas

NATIVE

KEYS TO ID

- Upward facing mouth with no barbels
- Solid gold to olive colored scales (juveniles may have dark stripe)
- Scaleless keel extends from pelvic fins to anal fin
- Short dorsal fin with soft first ray
- Typically 4 - 7 inches long (Approx. max. 12 inches)

LOOKS SIMILAR TO

- Common Carp (invasive)
- Goldfish (invasive)
- Smallmouth buffalo (native)
- River carpsucker (native)

Juvenile

WHERE TO LOOK

- Lakes and ponds
- Stream impoundments, areas with minimal current

CURRENTLY FOUND

INVASIVE

Northern Snakehead

Channa argus

KEYS TO ID

- Single, elongated dorsal fin
- Scales present on top of head
- Elongated anal fin
- Distinct light and dark spots and stripes
- Pelvic fins just behind pectoral fins

Scales visible on head

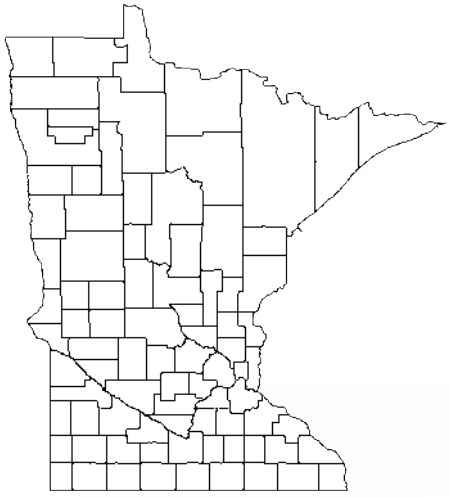
LOOKS SIMILAR TO

- Burbot (native)
- Bowfin (native)

WHERE TO LOOK

- Lakes, streams, rivers
- Stagnant ponds and swamps

CURRENTLY FOUND



Burbot

Lota lota

NATIVE

KEYS TO ID

- Single barbel on chin
- Two dorsal fins, first short and second elongated
- Very small, fine scales (may appear scaleless)
- Elongated anal fin
- Mottled, blotchy color patterns
- Pelvic fins under pectoral fins

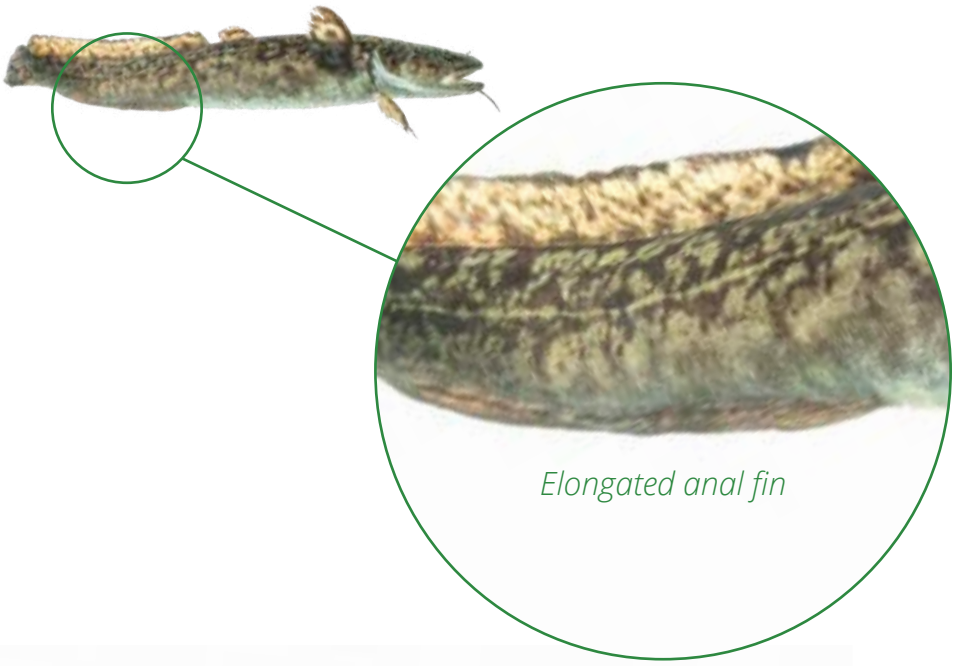
Barbel detail

LOOKS SIMILAR TO

- Northern snakehead (invasive)
- Bowfin (native)

WHERE TO LOOK

- Larger lakes and rivers
- Cold-water habitats



Elongated anal fin

CURRENTLY FOUND

NATIVE

Bowfin

Amia calva

KEYS TO ID

- Single, elongated dorsal fin
- No scales on top of head
- Pelvic fins halfway down body length
- Short anal fin
- Black eyespot near tail (absent in mature females)

LOOKS SIMILAR TO

- Northern snakehead (invasive)
- Burbot (native)

WHERE TO LOOK

- Lakes, streams, rivers
- Stagnant ponds and swamps

CURRENTLY FOUND

Female

Male

NOTES

Glossary

Alternate leaves: Leaves are attached to the stem singly and on alternate sides
Anal fin: Located on the underside of a fish between the tail and pelvic fins, near the anus
Antheridia: Male reproductive structures that are small and orange to red on starry stonewort and some *Chara* and *Nitella* species
Axis: The main stem about which plant parts such as branches are arranged
Basal: A leaf arrangement where all the leaves emerge from a central point at the base of the plant
Bivalve: A mollusk that has two shells that meet at a hinge
Branchlet: A small branch or a subdivision of a branch
Bulbil: Asexual reproductive structure found on some charophytes. Bulbils of starry stonewort are white and star-shaped
Byssal threads: A mass of strong, silky filaments which mussels use to attach to surfaces
Carapace: A hard shell on the backs of crayfish
Dissected: Leaves that are deeply or repeatedly divided
Dorsal fin: Located on the top of a fish, it may be a single fin, with or without spines, or consist of two connected or unconnected parts — a sharp-spined part and a soft-rayed part
Fry: Immature fish from the time they hatch to the time they become fingerlings
Inflorescence: The flowering head or cluster of flowers on a plant
Invasive species: Species that are not native to a given ecosystem, and cause (or have high potential to cause) harm, whether economic, environmental, or harm to human health
Invertebrate: An animal that lacks a spine
Keel: A ridge on the belly of the fish which is present only in some species
Leaflet: A part or division of a compound leaf
Ligule: A membrane near where the leaf blade meets the leaf sheath and wraps around the stem
Midvein: The vein in the center of a leaf
Native species: A species that is naturally occurring within a given geographic area, i.e., not found there because of intentional or unintentional human introduction
Node: The place on the stem where a leaf or branch is attached (or has been attached)
Operculum: In a snail, the hard covering protecting the shell opening when the snail is retracted inside.
Pectoral fins: Located on both sides of the fish near the gill; help with balance, steering, and controlling depth
Pelvic fins: Located on the bottom of the fish in front of the anal fin; help balance the fish and keep it level
Petiole: A slender stalk that attaches a leaf to the stem of a plant
Rhizome: Root-like underground stems that grow horizontally for vegetative spread
Serrated: Having a saw-toothed edge or margin notched with toothlike projections
Sessile: A type of leaf attachment where the leaf attaches directly to the stem
Sheath: A structure at the base of a leaf that wraps around the stem
Spike: A flower arrangement where many flowers are arranged vertically along the flower stalk
Submersed/submerged: Submersed plants are usually found entirely underwater, but the flowers and fruits may rise above the water surface
Substrate: The surface on which an organism lives, grows, or obtains its nourishment
Tubers: A short, thick stem that grows underground and can produce a new plant
Turbidity: A measure that provides an estimate of the cloudiness of water due to silt, organic and inorganic matter, plankton, and microscopic organisms
Turions: A vegetative bud that detaches from a parent plant and can produce new plants via asexual reproduction
Umbel: A flower arrangement where many flowers form a cluster on a series of approximately equal-length stalks originating from a common center point
Ventral edge: On a bivalve, the surface opposite the hinge
Whorl: A ring of three or more similar structures radiating from a common point

Photo credits

AQUATIC PLANTS

Introduction: Cayte (leaf arrangements); Benjamint444 (simple leaf); Evelyn Fitzgerald (compound leaves); Debivort (leaf margins); Christian Fischer (midvein); Megan M. Weber (axis and leaflet); Christine Lee (node and stem)
Eurasian watermilfoil: Megan M. Weber; Paul Skawinski, UW-Extension Lakes | Northern watermilfoil: Megan M. Weber
Coontail: Christine Lee | Bladderwort: Megan M. Weber; Veledan; Christa Rittberg
White water crowfoot: Donald Cameron; Christine Lee; Trish Steel | Water marigold: Christine Lee; Peter Dziuk
Hydrilla: Michael J. Grodowitz, U.S. Army Engineer Research and Development Center; David Enrique; Sharleen Johnson
Common waterweed: Christine Lee; Minnehaha Creek Watershed District
Brazilian waterweed: Joss Carr, David Liu, Minnehaha Creek Watershed District; Lamiot; Lara Gudmundsdottir
Starry stonewort: Dave Hansen; Christine Lee; Paul Skawinski, Aquatic Plants of the Upper Midwest
Muskgrasses: Christian Fischer; Megan Weber
Stoneworts: Kristian Peters; Paul Skawinski
Sago pondweed: Christine Lee; Christian Fischer | Water stargrass: Paul Skawinski
Curlyleaf pondweed: Paul Skawinski; Leslie J. Mehrhoff
Clasping leaf pondweed: Paul Skawinski

WETLAND PLANTS

Introduction: Cayte (leaf arrangements); Alpsdake (sessile); Rod Belshee (petiolate); Harry Rose (sheathing)
Purple loosestrife: Liz Shlapack; Earl Woolsey
Blue vervain: Judy Gallagher; Ann C. McKenzie; Aaron Carlson
Joe-pye weed: Sue Wetmore; Sara Hollerich Giles
Fireweed: Christine Hanrahan; Elizabeth T. Knuth; Jeffrey Lee
Hybrid cattail: Ryan Hodnett; Jerry Cannon; Megan M. Weber
Narrowleaf cattail: Radio Tonreg; Svetlana Nesterova; Hank Fabian
Broadleaf cattail: Patrick Leary; Damon Tighe; Jeffrey Lee
Yellow iris: Shirley Zundell; Damon Tighe
Blue flag iris: Megan M. Weber; Sandra Wolkenberg
Invasive Phragmites: Andy Fyon; Julia Bohnen
Native Phragmites: Michael Hough; Julia Bohnen
Reed canary grass: Megan M. Weber; spacecowboy; Ron Halvorson
Silvergrass: Stephen; Marcel Kettern

INVERTEBRATES

Rusty crayfish: Jeff Gunderson | Red swamp crayfish: Christine Lee
Northern clearwater crayfish and Calico crayfish: Chris Taylor | Virile crayfish: Sam Stukel, USFWS
Zebra mussels: Christine Lee | Quagga mussels: Megan M. Weber; Christine Lee
Asian clam: Minnehaha Creek Watershed District; Böhringer Friedrich
Freshwater mussels: Christine Lee; U.S. Fish and Wildlife Service
Chinese mystery snails: Christine Lee
Snails: Christine Lee; Alfredo Eloisa (limpet snail)
Spiny waterflea: Donn Branstrator; Jeff Gunderson; Minnehaha Creek Watershed District
Fishhook waterflea: J. Liebig, NOAA GLERL; Mart Simm
Predatory zooplankton: Piet Spaans *(Chaoborus)*; Great Lakes Environmental Research Laboratory *(Leptodora)*

FISH

Introduction: Joseph Tomelleri (illustrations); John Lyons (keel)
Bighead carp: Asian Carp Regional Coordinating Committee
Silver carp: Michigan Sea Grant; Asian Carp Regional Coordinating Committee; Christine Lee
Gizzard shad: Brian Gratwicke; Chad Thomas
Mooneye: Konrad Schmidt | Emerald shiner: Andrew Kornacki; Konrad Schmidt
Goldfish: Yung-Lun Lin, Minnesota Department of Natural Resources
Common carp: Davio
Smallmouth buffalo: Brett Billings, Sam Stukel; USFWS
River carpsuckers: USFWS, Richard Kazmaier
Golden shiner: Attila Oláh, Zakqary Roy
Northern snakehead: United States Geological Survey, Andrhea Massey
Burbot: Josh Tivin, USFWS
Bowfin: Brian Gratwicke; Ryan Hagerty, USFWS

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