

Capital Region PRISM Partnership for Regional Invasive Species Management

"Detect, prevent, and control invasive species, through direct action and education to protect biodiversity, the natural environment, economy, and quality of life."



**INVASIVE SPECIES
MANAGEMENT**
CAPITAL REGION

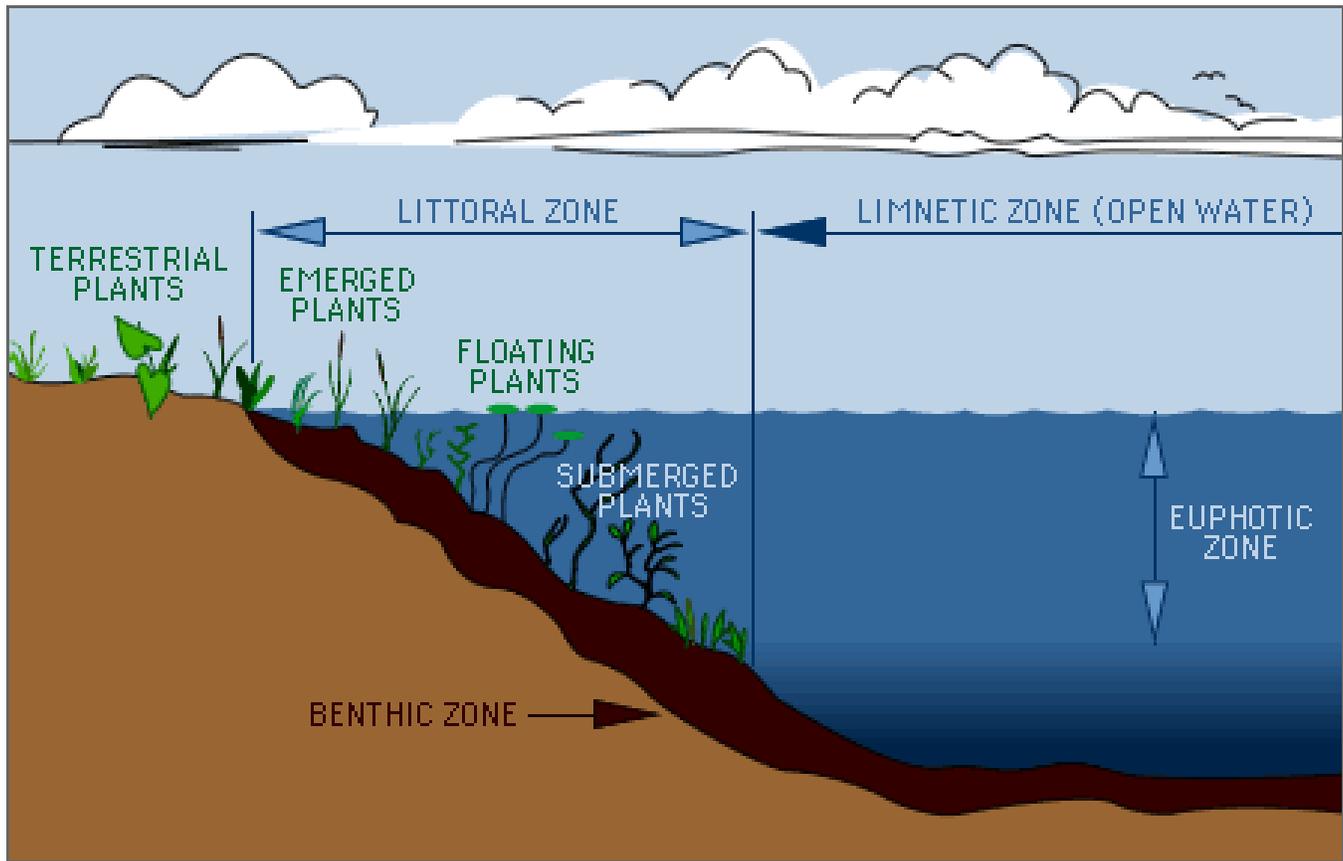
Aquatic Invasive Species Spread Prevention Program Identification Fact Sheets

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**Department of
Environmental
Conservation**

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Littoral zone – the area near shore where sunlight is able to penetrate down to the sediment allowing aquatic plants to grow.

Limnetic zone – the open and well-lit zone of the waterbody.

Euphotic zone – the layer of water that absorbs enough light for photosynthesis to occur.

Benthic zone - the sediment layer at the bottom of a body of water, such as the oceans floor of the bottom of a lake, stretching from the shore to the deepest point.

Submerged plants – plants growing completely below the water surface.

Emerged plants – plants rooted in the benthic zone with part of the plant emerging from the water surface.

Floating plants – plants rooted in the benthic zone, or free floating, with a majority of the plant submerged with floating leaves on the water surface.

Macrophyte – a plant growing in or near water

Benthos – organisms living in the benthic zone

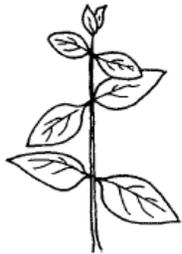
Dichotomous Key

Used to help identify aquatic plants. It may be easier to identify plant characteristics when plants are submerged in water. A magnifying glass may also be useful to see detail.

Leaf Arrangements



Alternate



Opposite



Whorled

Leaf Margins



Entire



Toothed or
Serrated



Pinnately
Lobed



Finely Divided

Leaf Shapes



Triangular



Heart



Strap or
Elongate



Oval



Elliptical

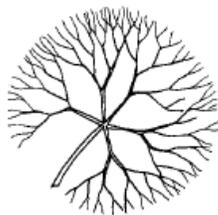


Lance or
Blade

Finely-divided Leaf Patterns



Fork-divided

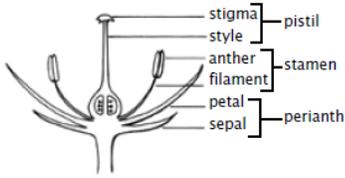


Branch-divided

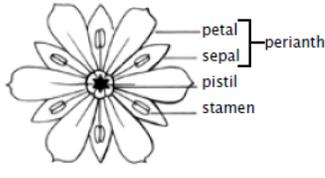


Feather-divided

Flower Structures

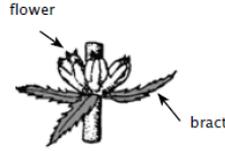


Flower parts (side view)

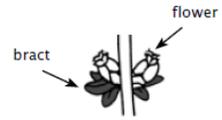


Flower parts (top view)

Bracts are specialized leaves associated with flowers. Note the "leaf-type" of the bracts and their size in relation to the flowers.

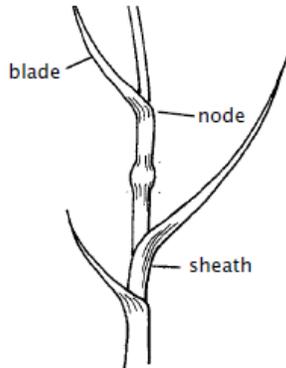
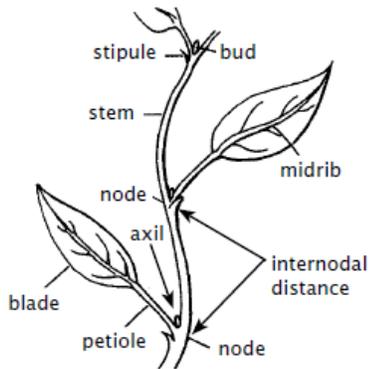


Bracts are serrated and larger than flowers (variable water-milfoil)

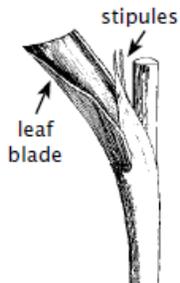


Bracts are entire and smaller than flowers (Eurasian water-milfoil)

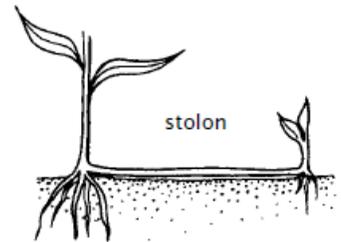
Stem and Leaf Structures



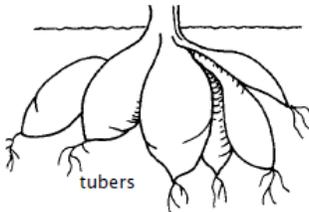
Turions, also called winter buds, are compacted vegetative buds produced along the stem that can overwinter and form a new plant



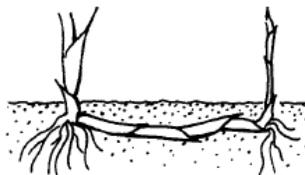
Stipules are sheath-like tissues associated with the leaf bases of some species



Root Structures



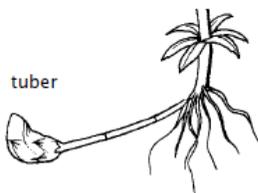
tubers



rhizome



corm



tuber

AQUATIC INVASIVE PLANTS

Common Name	Scientific Name
Brazilian waterweed	<i>Egeria densa</i>
Floating primrose willow	<i>Ludwigia peploides ssp glabrescens</i>
Yellow floating heart	<i>Nymphoides peltata</i>
Brittle naiad	<i>Najas minor</i>
Curly-leaf pondweed	<i>Potamogeton crispus</i>
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>
European frogbit	<i>Hydrocharis morsus-ranae</i>
Water chestnut	<i>Trapa natans</i>
Carolina fanwort	<i>Cabomba caroliniana</i>
Hydrilla	<i>Hydrilla verticillata</i>
Yellow iris	<i>Iris pseudacorus</i>
Variable-leaf watermilfoil	<i>Myriophyllum heterophyllum</i>
Water hyacinth	<i>Pontederia crassipes</i>
Water lettuce	<i>Pistia stratiotes</i>
Waterwheel	<i>Aldrovanda vesiculosa</i>
Parrot feather	<i>Myriophyllum aquaticum</i>
Starry stonewort	<i>Nitellopsis obtusa</i>
Watercress	<i>Nasturtium officinale</i>

AQUATIC INVASIVE ANIMALS

Common Name	Scientific Name
Round Goby	<i>Neogobius melanostomus</i>
Northern Snakehead	<i>Channa argus</i>
Chinese mitten crab	<i>Eriocheir sinensis</i>
Spiny waterflea	<i>Bythotrephes longimanus</i>
Fishhook waterflea	<i>Cercopagis pengoi</i>
Bloody red shrimp	<i>Hemimysis anomala</i>
Quagga mussel	<i>Dreissena rostriformis bugensis</i>
Zebra mussel	<i>Dreissena polymorpha</i>
Asian clam	<i>Corbicula fluminea</i>
Tench	<i>Tinca tinca</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Silver and Bighead Carp	<i>Hypophthalmichthys molitrix/nobilis</i>
New Zealand mud snail	<i>Potamopyrgus antipodarum</i>
Oriental weatherfish	<i>Misgurnus anguillicaudatus</i>
Eastern/Western mosquitofish	<i>Gambusia holbrooki/Gambusia affinis</i>
Chinese mystery snail	<i>Cipangopaludina chinensis</i>
Banded mystery snail	<i>Viviparus georgianus</i>

OTHER

Common Name	Scientific Name
Purple loosestrife	<i>Lythrum salicaria</i>
Flowering rush	<i>Butomus umbellatus</i>

BRAZILIAN WATERWEED *Egeria densa*

Origin: South America

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention / Physical / Chemical / Biocontrol

Brazilian waterweed is a submerged aquatic plant with bright green stems and leaves with a very leafy appearance. Leaves are linear, up to 2.5 cm long and ½ cm wide with finely toothed margins, and grow in whorls of four to eight leaves. Stems are cylindrical and grow until they reach the water surface, where they can form dense mats. White, three-petaled flowers grow just about the water surface to 2 cm in diameter. Only male plants are found in the U.S.; these reproduce via stolons and fragmentation.

HABITAT

Brazilian waterweed inhabits slow-flowing freshwaters. This species is tolerant of a wide range of temperatures and light levels, and can occur as deep as 7 m.

THREAT

Dense populations of Brazilian waterweed can disrupt water flow, trap sediment and alter water quality, as well as reduce the abundance and diversity of native vegetation. Severe infestations may impair recreational uses of a water body including boating, fishing and swimming.

MANAGEMENT

*Prevention is the best management practice to ensure that this species remains un-introduced. Education of the public about practices such as clean, drain, and dry, as well as timely reporting of sightings, can keep this invasive at bay. Brazilian waterweed may be physically removed only if extreme care is taken to remove fragments from the water. Chemical control can reduce infestations, although it is not species-specific and may damage other beneficial aquatic plants in the area. Triploid Grass Carp (*Ctenopharyngodon idella*) may also be used to control Brazilian waterweed infestations. However, the stocking of Grass Carp requires a permit.*



FLOATING PRIMROSE WILLOW *Ludwigia peploides ssp glabrescens*

Origin: Central and South America, parts of the southern US

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Prevention / Physical / Chemical

Floating primrose willow is a floating-leaved, perennial aquatic invasive plant. Leaves are alternately arranged, appearing whorled from above. They are oval, shiny and smooth, growing up to four inches in length. The stems float and are fleshy and reddish, growing 8 inches to 2 feet long. Early growth of the plant is a rosette of leaves. The flowers are bright yellow and five petaled, emerging above the water in late July to August.

HABITAT

Floating primrose willow grows in freshwater, stagnant or slow moving waters, such as in wetlands, streams, ponds and lake shorelines.

THREAT

This plant can form dense monocultures that outcompetes native vegetation. It can shade out other plants and is allelopathic, preventing growth of other plants and reducing favorable habitat for wildlife. Additionally, this impacts dissolved oxygen and reduces waterflow.

MANAGEMENT

Prevention is the best management practice to ensure that this species remains un-introduced. Education of the public about practices such as clean, drain, and dry, as well as efficient reporting of sightings, can keep this invasive at bay. These plants may be removed by hand in conjunction with being chemically treated.



YELLOW FLOATING HEART *Nymphoides peltata*

Origin: Eurasia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention / Mechanical / Physical / Chemical

Yellow floating heart is a perennial, rooted, aquatic invasive plant that resembles water lilies. The stems can grow up to 2 m long and lie just below the water surface, where they may and branch into smaller plantlets. Round or heart-shaped floating leaves grow to 3-12 cm in diameter and are green or yellow-green with slightly wavy margins. The undersides of the leaves can be purple in color. Yellow floating heart can produce two to five bright yellow, five-petaled flowers, between May and October, depending on the temperature. These produce a capsule of flat, shiny seeds that have margins of stiff hairs. They can also reproduce vegetatively from fragments and rhizomes.

HABITAT

Yellow floating heart grows in slow-moving waters to 4 m depths, including lakes, ponds, swamps, and channels. It can tolerate anaerobic environments and survive on mudflats. This species overwinters as rhizomes.

THREAT

Yellow floating heart can form dense patches of vegetation that can outcompete and displace native plants and create stagnant, low-oxygen conditions in the water below. If a population of yellow floating heart is large enough, fish and other wildlife may be forced to relocate. The patches can also impede recreational activities, including boating, fishing, and swimming.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Hand-pulling and mechanical removal may be used to control populations, although care should be taken to remove all plant pieces from the water. Chemical treatment can also be effective in managing infestations.



BRITTLE NAIAD *Najas minor*

Origin: Eurasia & Northern Africa

INVASIVE RANKING: Moderate

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Brittle naiad is an annual submersed aquatic plant that is compact but bushy in appearance with thin, branching stems that can grow up to 1.5 m in length. Stems and roots can fragment easily. The leaves are oppositely arranged, stiff, curled, and pointed, with visible spines along the margins. The seeds, which grow along the stem, are slightly recurved, purplish in color, and have tiny, rectangular pits arranged in longitudinal rows. Care must be taken when identifying this species, as it is similar in appearance to native waternymph species.

HABITAT

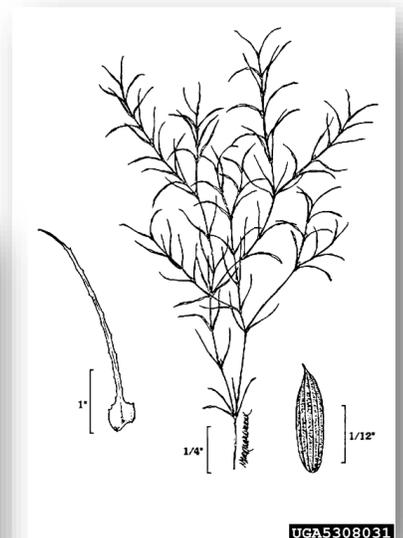
Brittle naiad inhabits still or slow-moving waterbodies. This species is capable of growing in depths up to 4 m, and is more tolerant of turbidity and high-nutrient conditions than native species of the same genus.

THREAT

Brittle naiad can form dense stands in shallow water that inhibit the growth of native aquatic macrophytes. This can also result in unfavorable habitat for fish and waterfowl. Dense infestations will also hinder swimming, fishing, boating, and other forms of recreation.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Small infestations may be removed manually or mechanically to reduce biomass. However, since this plant spreads very easily, it is crucial to avoid fragmentation during removal. Herbicides can be effective in controlling larger infestations.



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CURLY-LEAF PONDWEED *Potamogeton crispus*

Origin: Europe, Africa, and Australia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Curly-leaved pondweed is a submerged perennial aquatic plant that can grow to about 5 m long. It has rigid, reddish-green, oblong leaves with finely toothed, wavy margins and blunt tips, which grow in an alternate arrangement. This species produces very small greenish-red flowers on a spike above the water surface. It also reproduces using overwintering buds, called turions.

HABITAT

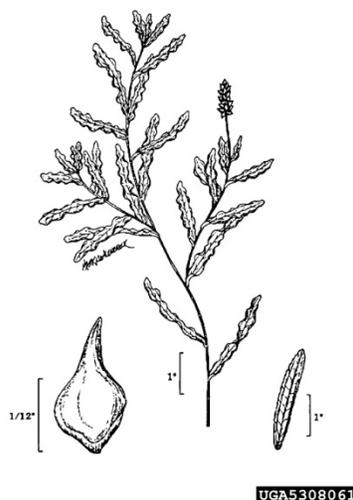
Curly-leaved pondweed grows in a wide variety of environments, including shallow, deep, still, flowing, slightly brackish, or freshwater water up to a depth of about 6 m.

THREAT

This species is one of the first to grow in the spring and can grow quickly, allowing curly-leaved pondweed to outcompete native plants for light and space thereby reducing the biodiversity and value of aquatic habitat. Curly-leaved pondweed's senescence during midsummer can cause a critical loss of dissolved oxygen. The decomposition process can result in increased levels of phosphorous, which can lead to algal blooms. Dense infestations will also inhibit boating, fishing, swimming, and other recreational activities.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. This plant may be removed manually, provided all fragments and stem parts are also removed. Herbicides have been effective in controlling infestations.



EURASIAN WATERMILFOIL *Myriophyllum spicatum*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Biocontrol / Prevention

Eurasian watermilfoil is an invasive submerged aquatic plant that can be easily mistaken for several native plants. Each leaf is blunt-tipped and finely divided into at least 12 pairs of leaflets, arranged in whorls of four on brown or green stems. The plant can grow up to 6 m in length. Tiny pink flowers may occur on emergent spikes in mid-June and again in late July. Although each plant can produce 100 seeds in a season, it reproduces more successfully via fragmentation.

HABITAT

This invasive can be found to depths of 10 m in lakes, ponds, and quieter sections of rivers and streams. It can grow in fresh or brackish water, across a wide range of temperatures, and thrives in disturbed areas with nutrient loading, intense plant management, and/or abundant motorboat use.

THREAT

Eurasian watermilfoil can spread very easily through fragmentation. This species forms dense mats that outcompete and displace native species, degrade habitat, and inhibit recreational activities.

MANAGEMENT

*Education about practices such as clean, drain, and dry, as well as timely reporting of sightings is an important management practice to reduce the spread of this species and prevent new infestations. Once Eurasian watermilfoil is established, it is very hard to control. Mechanical control can enhance the spread of an infestation by creating and transporting plant fragments. If extreme care is taken to prevent or remove fragments, small infestations may be mechanically or manually removed. Many herbicides can control milfoil populations. Biocontrol insects or the triploid Grass Carp (*Ctenopharyngodon idella*) may also be options for control.*



EUROPEAN FROGBIT *Hydrocharis morsus-ranae*

Origin: Europe

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Mechanical / Physical / Prevention

European frogbit is a free-floating annual aquatic plant. The leaves are small, kidney or heart shaped (1.5-6.5 cm long), and leathery, with undersides that may be dark purple. The plant is not anchored to bottom sediments. Three-petaled white flowers with yellow centers bloom in summer. The leaf stem of European frogbit lacks a midline groove, which distinguishes it from American frogbit (*Limnobium spongia*). European frogbit leaves, although smaller in size, may resemble those of white and yellow water lilies.

HABITAT

European frogbit grows well in quiet, open waters including marshes, ditches, swamps, and sheltered coves. This species grows well in calcium rich waters.

THREAT

European frogbit has rapid vegetative spread and forms dense mats, which can crowd out other macrophytes and limit light penetration into the water column. With limited light below the vegetative mats, native plants may not be able to survive, limiting native biodiversity. It can also inhibit recreational use such as swimming, fishing, or boating.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Hand-pulling or harvesting may be an effective management strategy for small infestations or infestations in closed systems such as ponds. High density shade treatments can reduce biomass. European frogbit is also susceptible to some herbicides



WATER CHESTNUT *Trapa natans*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Water chestnut is a floating-leaved, annual, aquatic plant. Linear, oppositely arranged submersed leaves are replaced by feathery adventitious roots early in the growing season. On the water surface, the plant forms a rosette of green, glossy, triangular floating leaves with toothed edges and inflated petioles. Plant stems are cord-like and can grow up to 5 m. small, white, four-petaled flowers bloom from the center of the rosette during the summer, eventually producing large, four-spined seeds.

HABITAT

Water chestnut grows best in quiet, shallow, high nutrient water bodies with a soft bottom substrate. They prefer waters with an alkaline or neutral pH.

THREAT

Populations of this species can form very dense mats of interlocking and stacking rosettes. These thick mats completely shade the water column and suppress most other aquatic plant growth in the area. Dense mats also inhibit boating, swimming, and fishing. The seeds are painful when stepped upon.

MANAGEMENT

Small populations can be controlled by hand pulling the plants prior to seed maturation. Large infestations have been controlled by the use of mechanical harvesters or the application of aquatic herbicides. Biocontrol options are in development. As always, the best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



FANWORT *Cabomba caroliniana*

Origin: South America

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Fanwort is a submerged invasive aquatic plant with green, delicate, fan-like underwater leaves that are usually about 5 cm across and arranged opposite each other in pairs along the stem. Small oval floating leaves are occasionally present. Small (2 cm or smaller) white flowers form and bloom throughout late spring and summer. It can also reproduce vegetatively via fragmentation.

HABITAT

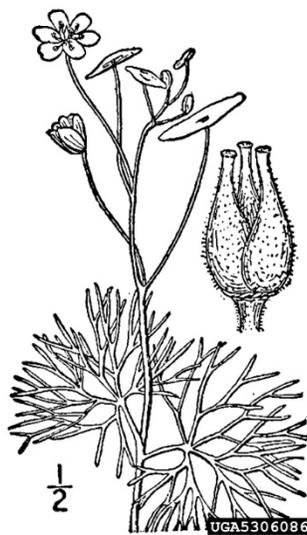
Fanwort grows up to depths of 10 m rooted in the muddy substrate of slow moving waters of lakes, ponds, and occasionally rivers. It can grow under a wide range of of nutrient levels, light levels, temperatures, and pH levels.

THREAT

Fanwort can be an aggressive weed. Once established, fanwort forms dense mats that can out-compete and displace native vegetation, which leads to a decline in biodiversity. Dissolved oxygen can be depleted when the mats of fanwort decompose. Infestations also inhibit recreational activities, including boating, fishing, and swimming.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Harvesting can greatly reduce fanwort biomass in a water body. However, mechanical and manual removal are likely to create and spread fragments, which are capable of producing new plants. Several herbicides are effective in controlling fanwort populations. Benthic barriers can also be effective in small areas, although they are not species specific.



HYDRILLA *Hydrilla verticillata*

Origin: Asia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Biocontrol / Prevention

Hydrilla is a submerged herbaceous perennial plant with visibly serrated leaves that grow in whorls of three to eight, often five. The undersides of Hydrilla leaves can be spiny and the midrib of each leaf is often reddish. Hydrilla can spread by seeds, tubers (which resemble tiny bulbs in the sediment), plant fragments, and turions (overwintering buds located on the stems). This invasive plant looks similar to American or Canadian waterweed (*Elodea canadensis*), a common native and aquarium aquatic plant, which has smooth leaves usually arranged in whorls of three and no tubers or turions.

HABITAT

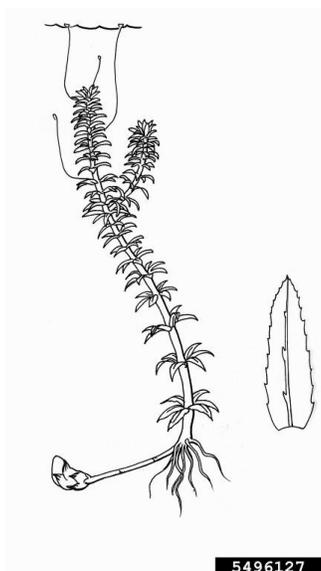
Hydrilla inhabits freshwater lakes, ponds, rivers, impoundments, and canals. Hydrilla is shade-tolerant and can thrive in a wide range of nutrient conditions and depths.

THREAT

Hydrilla spreads quickly, and once established, forms dense stands that crowd out native species and disrupt aquatic habitats. Hydrilla can also clog waterways and restrict water flow, which may damage water control structures and inhibit recreational activities such as swimming, boating, and fishing.

MANAGEMENT

Several techniques have been used to manage Hydrilla. Mechanical removal can be effective only if all parts of the plant are removed including the long-lasting tubers. Herbicides and physical barriers, such as benthic mats, are also effective. Biological agents can also be a successful management strategy, although they are not widely used in NY. The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



YELLOW IRIS *Iris pseudacorus*

Origin: Eurasia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Physical / Chemical / Prevention

Long, flat, erect leaves with sharp pointed tip. Can reach lengths up to 2ft long, but flowering stems are usually shorter. Bright yellow, three sepal flowers bloom on round flowering stalk between May and June. By mid-summer, flower develops into large, green seed pod that can hold dozens of flat, round seeds. Seed pods burst open in fall to release seeds, which are spread by water.

HABITAT

Grows in wetlands and on stream banks, ponds, and ditches. It is tolerant of a wide range of conditions..

THREAT

Can form dense colonies. Such monocultures alter habitat and displace native species. This plant is also poisonous to livestock and other animals. Can also clog intake and drainage pipes.

MANAGEMENT

New infestations may be prevented through education and awareness of invasive species and native garden species that may be more suitable to cultivate. Small-scale infestations may be removed by hand via digging, although resin can cause skin irritation. The entire root system must be removed to eliminate the plant. Removing the flowers and seed pods will help slow its dispersal. Large-scale infestations likely require multiple herbicide applications.



VARIABLE-LEAF WATERMILFOIL *Myriophyllum heterophyllum*

Origin: Native to United States, but historically known only in the Southeast and Midwest

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Rooted aquatic plant with both submerged and emergent leaves. Submerged leaves are feather-like, with five to fourteen pairs of green to reddish leaflets, and are arranged in whorls of four to six around red-brown stems. Emergent parts can grow to 15-20 cm above the water; leaves are highly variable bracts that are stiff, usually toothed, and may reach 2.5 cm in length. Flowers grow in spikes 7-15 cm tall in late June to August. Spreads primarily by fragmentation rather than seeds.

HABITAT

Grows in lakes, ponds, and pools in streams up to depths of about 1.8 m, occasionally deeper. This species prefers clear and neutral to slightly acidic water.

THREAT

An aggressive plant competitor that can outcompete and displace native vegetation, which can alter habitats for fish, waterfowl, and aquatic organisms. Dense growth inhibits recreational activities including boating, fishing, and swimming.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Hand pulling, diver assisted suction harvesting, benthic barrier placement, as well herbicide treatment are all effective options for management of variable-leaf watermilfoil. Care should be taken to remove all parts and fragments of the plant to prevent further spread.



WATER HYACINTH *Pontederia crassipes*

Origin: South America

INVASIVE RANKING: Not assessed in NYS

MANAGEMENT STRATEGY: Physical / Chemical / Prevention

Thick, glossy, oval to lance shaped leaves. Bulb shaped petioles keep leaves afloat. 6-8 leaves per plant that grow in rosettes. Dark, feathery free floating roots. Flowering spikes emerge between August and September. Flowers are lavender with the top petal containing a yellow spot surrounded by dark blue. Turns into three-celled capsule that can contain hundreds of seeds. Can also reproduce by stolons and fragments.

HABITAT

Inhabits slow-moving freshwaters including ponds, lakes, swamps, and canals. It can tolerate short-term exposure to freezing temperatures.

THREAT

Thick mats of water hyacinth can obstruct waterways, alter water temperatures and chemistry, and displace native species. Mats reduce light and oxygen availability in aquatic ecosystems. Water hyacinth can also provide habitat for disease carrying mosquitoes. Obstructed waterways can negatively affect transportation, irrigation, and recreation.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Plants may be cut and removed from the waterbody. Herbicide treatment can be effective. Bioherbicides have been developed for control of this plant.



WATER LETTUCE *Pistia stratiotes*

Origin: The center of origin is unknown, the species is present on all continents except Antarctica.

INVASIVE RANKING: Not assessed

MANAGEMENT STRATEGY: Physical / Chemical / Prevention

Grey-green leaves arranged in rosettes. Resembles head of lettuce but has distinct parallel veining and soft hairs. Leaf widens at apex. Feathery, dense roots reach down about 2 ft below the surface. Also produces stolons. Small, inconspicuous flowers bloom in clusters on flowering stalks that are hidden by the leaf axil. Several male flowers surround single female flower on a plant. Female develops into green fruit containing hundreds of seeds.

HABITAT

Native to tropical and subtropical lakes and will inhabit slow moving waters including ponds, lakes, swamps, and canals. It is restricted by cold sensitivity, although the seeds have the potential to overwinter.

THREAT

Thick mats of water lettuce can obstruct waterways, reduce water flow, reduce dissolved oxygen concentrations, degrade aquatic habitats, displace native species, and impact recreation and infrastructure. Water lettuce also provides habitat for disease-carrying mosquitoes.

MANAGEMENT

Prevention is the best management practice to ensure that this species remains un-introduced. Education of the public about practices such as clean, drain, and dry, as well as timely reporting of sightings, can keep this invasive at bay. Plants may be physically removed and transported to shore for disposal. Manipulation of water levels in conjunction with physical removal of plants prior to flowering can reduce seed germination. Chemical treatment is also an effective treatment, although herbicides may not affect the seeds.



WATERWHEEL *Aldrovanda vesiculosa*

Origin: Europe, Africa, Asia, and Australia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

Rootless, free-floating, submerged, carnivorous aquatic plant. Approximately 1 cm-long leaves grow in whorls of six to eight on a stem that can reach 20 cm in length. A cross-section of one whorl resembles the spokes of a wheel. The leaves have kidney-shaped, hinged trap structures with fringed hairs. Waterwheel plants can have up to 20 whorls of leaves. Small, emergent, pinkish flowers bloom in late summer. This species also produces turions, which overwinter in temperate climates, and can reproduce by fragmentation.

HABITAT

Grows in slightly acidic, nutrient poor waters with high organic matter content.

THREAT

This species may compete with other submersed, carnivorous species, including native bladderworts. It could also affect invertebrate populations and food webs in the aquatic community.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



PARROT FEATHER *Myriophyllum aquaticum*

Origin: South America

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Physical / Prevention

Parrot feather is an invasive aquatic plant with both submerged and emergent leaves. Submerged leaves are feathery, reddish-orange, and grow in whorls of four to six leaves. Where the plant reaches the water surface, it creates dense mats of short spikelets up to 30 cm above the water surface. Leaves are still whorled and feathery, but are stiffer and gray-green or bright blue-green. Small, white flowers may be present along the emergent part of the stem.

HABITAT

Parrot feather grows well in high nutrient, shallow, slow moving water to depths of 9 meters, and can survive a wider range of environmental conditions.

THREAT

Parrot feather can form dense mats, which may compete with native vegetation, constrict water flow, and reduce dissolved oxygen concentrations leading to stress of aquatic organisms. These can all negatively impact human activities in the water.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Management of parrot feather is difficult once it is established. Mechanical control methods tend to pread fragments that re-establish the plant. Chemical control has had mixed results due to a waxy layer on the leaves. There are no biological controls permitted for use on this species in the US.



STARRY STONEWORT *Nitellopsis obtusa*

Origin: Eurasia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

Macroalgae that is anchored into sediment, grows up to 2m long with whorls of 4-6 branchlets, asymmetrical branching structure, small white star-shaped bulb

HABITAT

Grows at depths up to 9 m in a broad range of slow-moving aquatic habitats, including low light and low nutrient conditions. It is adapted to both fresh and brackish habitats.

THREAT

Starry stonewort forms dense 'pillows' of vegetation, which outcompete aquatic plants and interfere with human and fish movement. Dense infestations are correlated with low abundance and diversity of other plant species, and can completely block fish spawning.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Once established, the algae spreads readily through its easily dislodged bulbils and plant fragments, making manual or mechanical control challenging. Starry stonewort's response to copper-based algaecides and herbicides is mixed and requires further research, although this may be a feasible management option.



WATERCRESS *Nasturtium officinale*

Origin: Eurasia

INVASIVE RANKING: Moderate

MANAGEMENT STRATEGY: Physical / Chemical / Prevention

Hollow, succulent stems root at nodes. Compound with 3-7 leaflets. Leaflets have wavy margins and grow between 1-4 in. Terminal leaflet is largest. Distinct peppery taste. Terminal flowering spikes emerge in late spring. Flowers are white, small, and have four petals. Light green, elongated, curved fruit forms on spreading flowering spike. Each fruit has four rows of seeds.

HABITAT

Found along the edges of cold lakes, reservoirs and slow moving streams. Prefers gravel soil and areas with high sun and humidity.

THREAT

Alters nitrogen levels in the water and forms dense mats that can change the flow of water and decrease habitat for native species.

MANAGEMENT

Manual removal is effective for small populations. Be sure to remove plant before it goes into seed to reduce the risk of spreading. Herbicide can be effective. Do not release water garden individuals or seeds into free-living state.



PURPLE LOOSESTRIFE *Lythrum salicaria*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Physical / Biocontrol / Prevention

Purple loosestrife is a showy wetland plant that grows up to 2.5 m tall. Leaves are 5-14 cm long, sword-shaped, and oppositely arranged. Stems are square and hairy, with an upright growth habit. Purple flowers have five to seven petals and grow in pairs or clusters on tall spikes; flowering starts in June and lasts into early fall. Older plants can have many woody stems growing from a single root crown.

HABITAT

Purple loosestrife will grow in wet meadows, tidal and non-tidal marshes, the edges of waterways and ponds, and in ditches. It can tolerate a wide range of conditions, including shading and flooding, but prefers moist, organic soils.

THREAT

Once established, purple loosestrife outcompetes and replaces native wetland species, which decreases biodiversity. This reduces the quality of habitat and food sources important to wetland wildlife, such as marsh birds and waterfowl. Dense stands of purple loosestrife also alter biogeochemical and hydrological processes in wetlands.

MANAGEMENT

*Small infestations can be pulled by hand, though this must be completed before seeds are produced. Care must be taken to completely remove the root crown. The soil should not be overly disturbed when removing plants in case it releases seeds from the seedbank. All plant parts should be bagged and removed, and may be burned. Herbicides approved for aquatic use, preferably broadleaf-specific, can also effectively control small stands. Biocontrol options include: *Galerucella* spp. beetles, which eat the leaves and target the area of the plant that produces seeds; *Hylobius transversovittatus*, a root-mining weevil; and seed-eating beetles *Nanophyes marmoratus* and *N. brevis*. These insects can suppress populations to non-significant levels, although they do not eradicate them.*



FLOWERING RUSH *Butomus umbellatus*

Origin:

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Physical / Prevention

Flowering rush is an aquatic perennial plant that can grow on shore or in shallow water. Leaves grow up to 1 m long and are triangular in cross section. The plant can grow to 1.5 m, with umbrella-shaped clusters of three-petaled flowers from white to dark pink. Plants bloom from June to August, but do not flower in deep water. Flowering rush reproduces through seeds, branching and fragmentation of rhizomes, and production of bulbils on rhizomes and inflorescences.

HABITAT

Flowering rush lives where cattails are typically found, growing in freshwater lakes, riparian areas, and wetlands. It can tolerate water depths to about 2 m.

THREAT

Flowering rush can form dense stands that displace native species, which can reduce biodiversity. Dense stands of flowering rush can also alter water temperatures, water and nutrient flow, and sedimentation rates.

MANAGEMENT

Plants may be removed physically, but care should be taken to account for all parts, as it can spread via floating seeds, rhizomes, and root fragments. Removed material should be dried to prevent any new shoot growth. Cutting the plants below the water surface can reduce abundance, but will not kill them. Chemical control is usually not effective due to the herbicide washing off the plant and requires multiple treatments.



ROUND GOBY *Neogobius melanostomus*

Origin: Eurasia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

Round Gobies are small, brown and black blotched fish with large, frog-like heads. There is a black spot on their front dorsal fin, which is a characteristic of the species. They grow to just under 30 cm in size. Round Gobies can be distinguished from native sculpins (Cottidae) by their fused pelvic fins, or suctorial disc, which helps them attach to surfaces in flowing water.

HABITAT

Round Gobies are bottom dwellers of fresh or brackish water. They can thrive in a wide variety of habitat types, including open sand, dense macrophytes, and rocky substrates.

THREAT

Round Gobies are aggressive fish that can outcompete native species for food, shelter, and nesting sites. They also prey on eggs of many native fish species. Round Gobies bioaccumulate many contaminants, which are then passed on to larger game fish and then potentially to humans.

MANAGEMENT

Prevention and education are the best management strategies. Clean, drain, and dry all equipment prior to moving between waterbodies, and do not release live bait. Little can be done to eradicate populations once they are established.



NORTHERN SNAKEHEAD *Channa argus*

Origin: Asia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

The Northern Snakehead is a long, thin fish with a somewhat flattened head. It is brown with dark blotches, and has a single dorsal fin running along the length of the body. The anal fins are located directly behind the pectoral fins, unlike the native bowfin, whose anal fins are located much farther back on the body. They can grow larger than 80 cm.

HABITAT

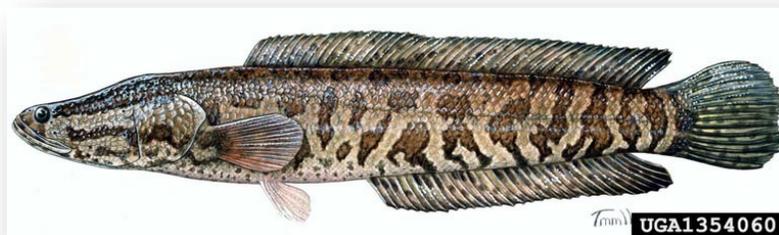
Northern Snakehead lives in canals, lakes, and rivers, preferring shallow, stagnant waters with a muddy substrate and aquatic vegetation. It is tolerant of a wide range of temperatures and poorly oxygenated waters.

THREAT

This species may compete for resources with native species, including foods and habitat. Competition for aquatic insects puts native fish populations at risk, and can disrupt recreational and commercial fishing. Juvenile fish are capable of overland movement and can survive up to four days out of water.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



CHINESE MITTEN CRAB *Eriocheir sinensis*

Origin: Pacific coast of China and Korea

INVASIVE RANKING: Moderate

MANAGEMENT STRATEGY: Prevention

The Chinese mitten crab has equal-sized claws with white tips and hair. It has eight walking legs that are over twice as long as the width of the carapace. The carapace is smooth and round with four spines along the side, and can be up to 10 cm wide and light brown to olive in color.

HABITAT

The Chinese mitten crab may be found in estuaries, bays, and rivers with ample aquatic vegetation. Although they are born in a marine environment, these crabs migrate to and inhabit freshwater during the majority of their life cycle, between two and five years, before returning to saltwater to reproduce.

THREAT

These crabs are aggressive and may compete with native species. Burrows can destabilize streambanks and lead to erosion and habitat loss.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



SPINY WATERFLEA/FISHHOOK WATERFLEA

Bythotrephes longimanus/*Cercopagis pengoi*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Prevention

Spiny and fishhook waterfleas are tiny crustaceans less than 1.25 cm in length, with long, sharp, barbed tails. The tail of spiny waterflea is straight, while the fishhook waterflea has an angled tail-spine with a distinguishing “fishhook” like loop at the end of the tail.

HABITAT

These species inhabit freshwater and brackish lakes. The fishhook and spiny water fleas prefer cooler temperatures over warmer areas of a lake.

THREAT

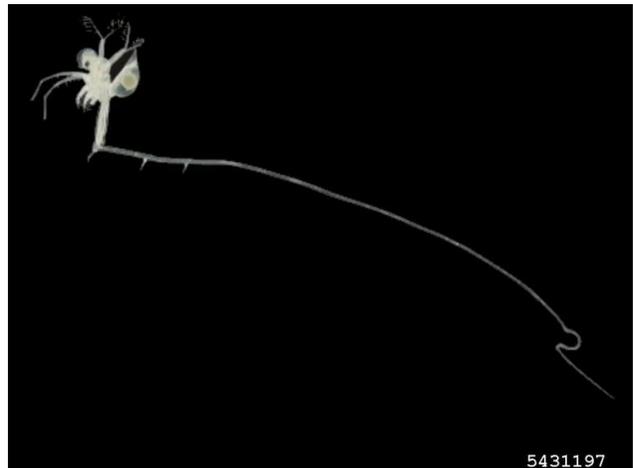
Spiny and fishhook waterfleas are predators of small zooplankton, such as Daphnia. This results in direct competition between the waterfleas and small planktivorous fishes. Few predators can eat them due to the long, spiny tails, which can result in exponential waterflea population growth. The waterfleas also contribute to biofouling issues, as their tails collect on fishing equipment and lines.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water



Spiny waterflea



Fishhook waterflea

BLOODY RED SHRIMP *Hemimysis anomala*

Origin: Eurasia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

Bloody red shrimp are small invertebrates that can grow to about 0.5-1.5 cm. Their coloring may range from ivory and translucent to red-orange and is variable in changing temperature and light conditions. This species has eight pairs of legs, which is a distinguishing trait. With magnification, a characteristic flat-ended tail with two prominent spikes can be seen. Bloody red shrimp display a distinctive swarming behavior that is unique in the Great Lakes. Swarms may cover several square meters. Individuals, typically males, will migrate from deeper waters to the upper water column at twilight and return to the profundal zone at dawn.

HABITAT

Bloody red shrimp typically live in quiet areas of brackish or freshwater lakes and reservoirs, but may also establish populations in rivers and streams. This species prefers hard or rocky substrates with water temperatures of about 10-15° C. Specimens have been collected at depths ranging from 0.5-50 m, although it generally inhabits 6-10 m depths.

THREAT

Bloody red shrimp rapidly consume a variety of zooplankton, phytoplankton, detritus, and insect larvae, putting it in direct competition with many native aquatic organisms including young fish. Zooplankton biomass and diversity may also be reduced.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



QUAGGA MUSSEL *Dreissena rostriformis bugensis*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Biocontrol/ Prevention

Quagga mussels are filter-feeding, freshwater, bivalve mollusks. Their appearance is variable, but shells usually have dark concentric rings that fade toward the hinge. Shells can grow to about 4 cm and are rounded, with a slightly bowed bottom that causes the mussel to tip over if set on its flattest surface.

HABITAT

Quagga mussels inhabit freshwater at varying depths depending on temperature, where they are sheltered from wave attack. They can live on a wide variety of soft and hard surfaces.

THREAT

Quagga mussels can outcompete and crowd out native species. As filter feeders, they remove particles from the water, which affects water quality and the food chain of aquatic ecosystems. They also cover many surfaces and can be a nuisance to humans due to their sharp shells.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Not much can be done once established. Manual removal may be performed on small, accessible populations. In closed systems, such as water treatment plants, other control methods can be used, including chemical, thermal, electrical, and biological controls.



ZEBRA MUSSEL *Dreissina polymorpha*

Origin: Eurasia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Biocontrol / Prevention

Zebra mussels are filter-feeding, freshwater, bivalve mollusks that attach to most surfaces in aquatic environments. Zebra mussels are small, up to 3 cm long, and D-shaped with light and dark yellow to brown alternating stripes. This species is similar in appearance to the quagga mussel (*Dreissena rostriformis bugensis*), but they can be distinguished by the presence of a flattened underside. When placed on a flat surface, zebra mussels will remain upright.

HABITAT

Zebra mussels inhabit freshwater lakes, rivers, reservoirs, streams, and ponds up to depths of widely varying depths. They attach to any stable substrate including sand, silt, cobbles, macrophytes, concrete, and metal. They do not tolerate salinity or low dissolved oxygen.

THREAT

Zebra mussels can outcompete and displace native species. Although they have some predators, they breed faster than they can be consumed. As filter feeders, they remove particles from the water, affecting the clarity, content, and ultimately the food chain of aquatic ecosystems. They can also attach to and cover many surfaces, which can cause slippery and sharp conditions, and clog intakes or other pipes.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Zebra mussels are very difficult to control once established. In closed systems such as water treatment plants, chemical, thermal, electrical, and biological controls may be used.



ASIAN CLAM *Corbicula fluminea*

Origin: Asia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Chemical / Mechanical / Physical / Prevention

The Asian clam is a freshwater bivalve mollusk. The outside shells are yellow-green to brown; where color chips away, white spots can be seen underneath. The inside of the shells are white to light purple. Adults are small, usually less than 4 cm in length.

HABITAT

The Asian clam is a filter feeder that removes particles from the water column. It can be found on or slightly buried in the sediment of freshwater water bodies. The species is cold intolerant and limited to warmer regions of freshwater systems.

THREAT

The Asian clam displaces already threatened native mussels, resulting in biodiversity decline, an unbalanced food chain, and increased possibility of algal blooms. The Asian clam can also cause millions of dollars in damage, clogging commercial and industrial water intake pipes.

MANAGEMENT

In closed environments such as power plants, chemical, physical, and mechanical methods can be used. In natural systems, prevention through education and stewardship is the best management strategy. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



TENCH *Tinca tinca*

Origin: Europe & Western Asia

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

Tench are a member of the minnow/carp family Cyprinidae and were introduced to the U.S. as a food and sport fish. Tench can grow up to 18 inches in length and weight up to 10-12 pounds. Tench have dark olive to pale golden coloring and a white bronzy belly and bright red/orange eyes. They have a terminal mouth with a barb at each corner. Fins are dark colored and rounded, with no spines.

HABITAT

Tench inhabit weedy/muddy water bottoms. They have high reproductive rates, long lifespans and can survive in low-oxygen environments. They are generalist predators whose diet includes fish eggs, snails and other benthic invertebrates which puts them in direct competition with many native fish species.

THREAT

. There is concern Tench may spread to the St. Lawrence River and eventually to Lake Ontario and other Great Lakes. Tench have the ability to diminish aquatic food-webs, increase water turbidity, and introduce non-native parasites into the Great Lakes.

MANAGEMENT

Early detection of Tench is extremely important in preventing their spread into the Great Lakes basin. The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



RUSTY CRAYFISH *Orconectes rusticus*

Origin: Ohio River Basin

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

Rusty crayfish grow to about 10 cm in length and are dark brown with rust-colored spots on both sides of the carapace. It has relatively large, robust claws that are gray-green to red-brown with black bands on the tips. The moveable claw is smooth and S-shaped, forming an oval gap when the claws are closed.

HABITAT

Rusty crayfish live in waterbodies and waterways with clear, well-oxygenated water and rocks, logs, and debris for shelter. This species prefers cobbly bottom sediment but will tolerate a variety of substrates, including silt, clay, sand, and gravel substrates.

THREAT

Rusty crayfish are aggressive and reproduce quickly, which allows them to outcompete and displace native crayfish species. This can also negatively impact the structure and biodiversity of the aquatic community.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



SILVER / BIGHEAD CARP

Hypophthalmichthys molitrix / *Hypophthalmichthys nobilis*

Origin: China

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

The silver carp is a deep-bodied fish that is laterally compressed. They are a very silvery in color when young and when they get older they fade from a greenish color on the back to silver on the belly. They have very tiny scales on their body but the head and the opercles are scaleless. They have a large mouth without any teeth in the jaw, but they have pharyngeal teeth. Its eyes are situated far forward on the midline of the body and are slightly turned down.

Silver carp are unlikely to be confused with native cyprinids due to size and unusual position of the eye. They are most similar to bighead carp (*H. nobilis*) but have a smaller head, and upturned mouth without teeth, a keel that extends forward past pelvic fin base, lack the dark blotches characteristic of bighead carp and have highly branched gill rakers. Juvenile fish lack spines in fins. The species is known for leaping out of the water when startled.

HABITAT

The Great Lakes provide a wide range of habitat types which would serve as good spawning, recruitment, and maturation areas for Asian carp. Spawning habitat could be provided in the flowing waters of Great Lakes tributaries, while young Asian carp prefer warm, biologically productive, backwaters and wetlands. When not feeding on plankton, Asian carp have been known to feed on detritus and root in the bottom of protected embayments and wetlands. This disturbance could have significant impacts on Great Lakes wetlands and shoreline vegetation which provide spawning habitat for native fish and breeding areas for native waterfowl.

THREAT

Silver and bighead carp are filter-feeders which feed on plankton (drifting animal, plant, or bacteria organisms that inhabit the open waters of waterbodies), with an apparent preference for bluegreen algae). Asian carp can dominate native fisheries in both abundance and in biomass. Bighead carp can reach 110 pounds, although 30 to 40 pounds is considered average (silver carp are generally smaller). Bighead carp can live over 20 years, maturing at about 7 years. Asian carp can consume 5 to 20 percent of their body weight per day. As most native fish feed on plankton during their larval and juvenile life stages this high level of feeding on plankton by Asian carp can have serious impacts on the stability of the food web.



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NEW ZEALAND MUD SNAIL *Potamopyrgus antipodarum*

Origin: New Zealand and nearby islands

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

The New Zealand mud snail has an elongated shell with seven or eight whorls that coil to the right. Shell colors range from dark gray or brown to light brown. Some variants within the species in the Great Lakes region exhibit a keel or ridge in the middle of each whorl. The snail is usually 4-6 mm in length within the Great Lakes region.

HABITAT

This species can live in fresh and brackish water; where it may be found on and around macrophytes, often in littoral zones of lakes or slow streams with muddy substrates. It can also live in high flow environments, where it burrows into the sediment.

THREAT

Abundant populations of introduced New Zealand mud snail may outcompete other grazing invertebrates and inhibit colonization by other macroinvertebrates. It has yet to colonize streams in the Great Lakes basin, but these are areas where the snail is expected to have significant impact. These snails alter nutrient (nitrogen and carbon) flows, and consume large amounts of the food available to filter feeders.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



ORIENTAL WEATHERFISH, DOJO, WEATHER LOACH

Misgurnus anguillicaudatus

Origin: Eastern Asia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Physical / Prevention

The invasive Oriental Weatherfish is a bottom-feeding, insectivorous fish with an eel-like body. It is colored a marbled brown and greenish gray dorsally and pale silver ventrally. It has a small, underslung mouth with fleshy lips surrounded by six barbells. Individuals average 15 cm in length, but may grow as long as 28 cm.

HABITAT

These fish are often found in shallow, slow-moving waters with muddy or silty substrates. They can survive in oxygen-poor waters by breathing air using a modified intestine and survive long droughts by estivating in soft substrates.

THREAT

This species competes with native fish populations for aquatic insects as a food source. Macroinvertebrate abundance may be drastically reduced. This species has been associated with increased turbidity and nitrogen levels in standing water.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through pet trade, fishing, and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. Once established, removing individuals with backpack electrofishing and bait nets can be effective in managing populations.



EASTERN MOSQUITOFISH/WESTERN MOSQUITOFISH

Gambusia holbrooki/Gambusia affinis

Origin: Southern Atlantic and Gulf slope drainages, Mississippi Basin

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Prevention

Mosquitofish are small, gray or brown invasive fish. They have short bodies, growing up to about 7 cm, with a flat-topped head and a mouth that is pointed upward for surface feeding. The dorsal and caudal fins are rounded. Small black dots may be present on the body and tail, as well as a small dark-colored bar below the eye. These species are very similar in appearance to each other.

HABITAT

Mosquitofish can live in a variety of freshwater habitats including rivers, springs, and marshes, although they prefer shallow, warmer waters lacking predatory fish.

THREAT

Due to their aggressive and predatory behavior, mosquitofish can greatly disrupt food webs and negatively impact native fish populations through predation and competition. Despite their name, these fish are not particularly efficient mosquito predators, as they prefer larger prey; they may benefit mosquitos by consuming predators and competitors of the mosquitos. They may also displace native fish species that act as more efficient mosquito control agents. Mosquitofish populations may also result in algal blooms if too many grazing zooplankton are consumed.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As these species are most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body.



Eastern Mosquitofish



Western Mosquitofish

CHINESE MYSTERY SNAIL *Cipangopaludina chinensis*

Origin: Southeast Asia

INVASIVE RANKING: Very High

MANAGEMENT STRATEGY: Prevention

The shell of the Chinese mystery snail is up to 6 cm tall, smooth, light to dark olive-green with vertical striping, and has six or seven whorls.

HABITAT

They can occupy any slow-moving body of water with a muddy substrate.

THREAT

Chinese mystery snails can be hosts for parasites which are harmful to humans. They can also outcompete native snail species for food and space.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. If established, they can be manually removed using hand or fishing nets. Due to the species' operculum (trap door mechanism), which seals the animal inside its shell, few chemical controls are effective; those that are effective are also likely harmful to native species.



BANDED MYSTERY SNAIL *Viviparus georgianus*

Origin: Southeastern United States

INVASIVE RANKING: High

MANAGEMENT STRATEGY: Prevention

The shell of the banded mystery snail is up to 4cm tall, red horizontal bands along the shell, with 3-5 whorls that are separated by deeply indented incisions.

HABITAT

Freshwater with little movement, tolerant of many different types of substrate and pH levels

THREAT

Cause mortality of large mouth bass eggs, carry parasites, outcompete native species.

MANAGEMENT

The best management strategy is prevention through education and stewardship. As this species is most commonly spread through fishing and boating equipment, it is important to use precautions such as cleaning, draining, and drying your boat and other aquatic equipment before moving to another water body. If established, they can be manually removed using hand or fishing nets. Due to the species' operculum (trap door mechanism), which seals the animal inside its shell, few chemical controls are effective; those that are effective are also likely harmful to native species.

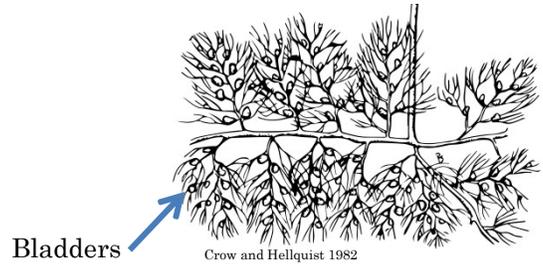


A Steward's Guide to Aquatic Hitchhikers

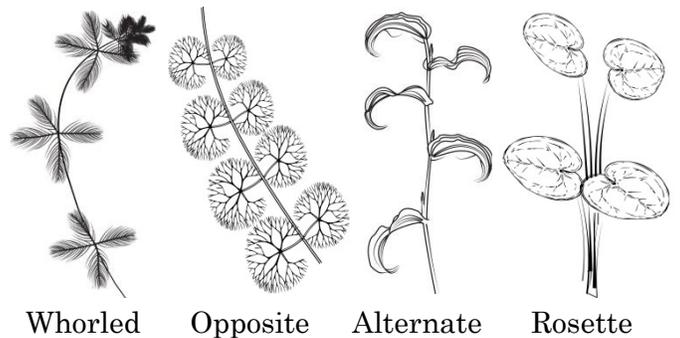
Differentiating invasive and native aquatic plants with confidence

Sean A. Regalado – Adirondack Watershed Institute

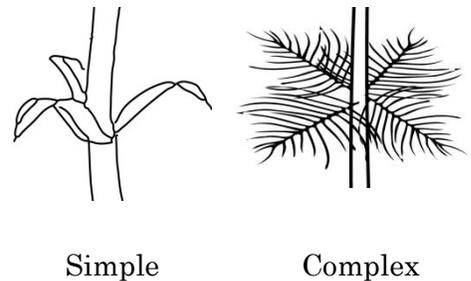
- 1a The plant has bladders **Bladderwort**
- 1b The plant has no bladders 2



- 2a The plant is whorled 3
- 2b The plant is opposite 9
- 2c The plant is alternate 10
- 2d The plant forms a rosette 11

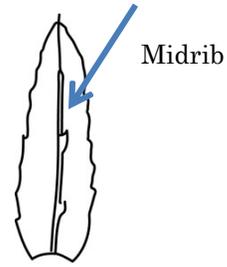


- 3a The leaves are simple 4
- 3b The leaves are complex 6



- 4a The whorl has exactly three simple leaves **Elodea**
- 4b The whorl has four or more simple leaves 5

5a The simple leaves have toothed margins and midribs. Four to eight leaves per whorl **Hydrilla (invasive)**

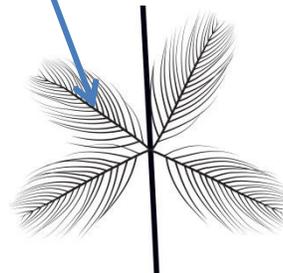


5b The simple leaves are not toothed. Often only four per whorl **Brazilian Elodea (invasive)**

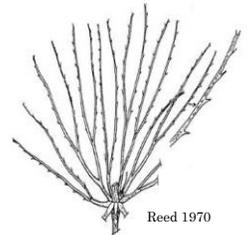


6a Each leaf is complex with many "leaflets" growing only from a midrib(Milfoils) 7

Hydrilla



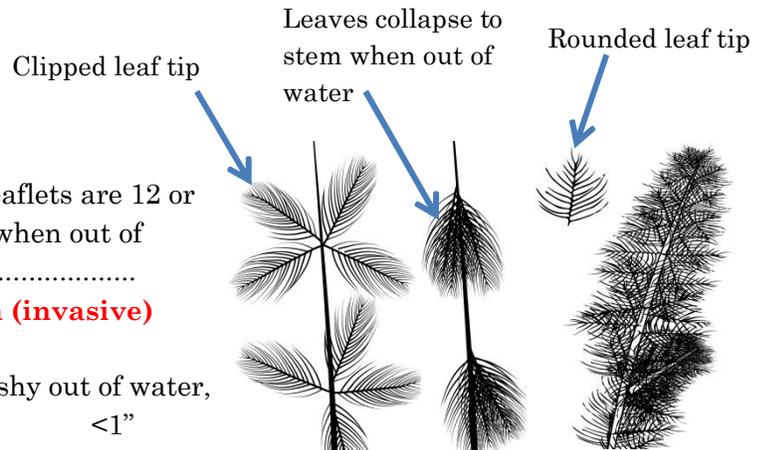
Brazilian Elodea



6b Each leaf is complex with each leaflet leaf NOT growing from a midrib **Other**

No single midrib (other)

7a The tips of the complex leaves appear clipped, leaflets are 12 or more in number, leaves collapse upon the stem when out of water, and whorls are >1" apart **Milfoil, Eurasian (invasive)**



7b The tips are rounded and the leaves remains bushy out of water, and whorls are <1" apart8

Eurasian water milfoil

Other Milfoil

8a Stem robust, thick, and dark red and whorls slightly offset, whorls may contain 4-6 feathery leaves **Milfoil, variable (invasive)**



8b Stem not robust, thick, or dark red. Often perfectly whorled with bright green leaflets..... **Milfoil, native**

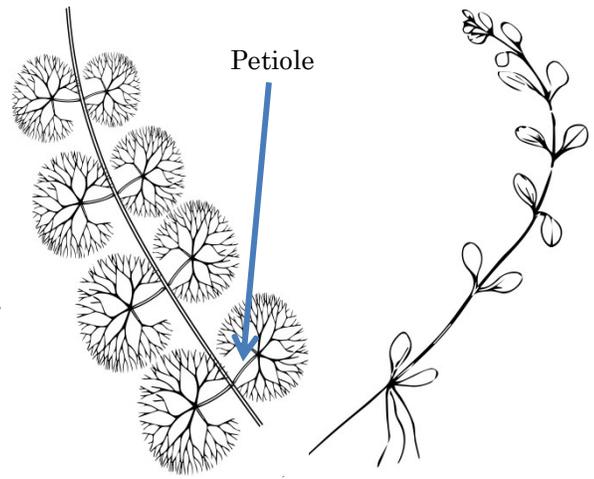


Variable leaf milfoil

Native Milfoil

9a Leaves are complex with many forked leaflets attached by a petiole to the stem **Fanwort**

9b Leaves are simple **Other**



Fanwort

Other

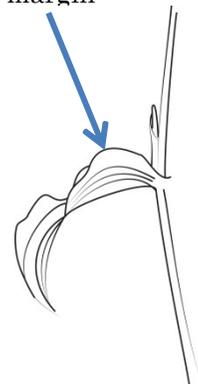
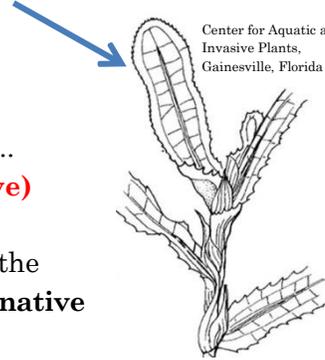
10a Leaves are generally ½ inch wide and 2-3 inches long with numberless small teeth along the margin of the leaf
..... **Curly leaf pondweed (invasive)**

10b Leaves without numberless small teeth along the margin of the leaf **Pondweed, native**

Toothed margin

Smooth margin

Center for Aquatic and Invasive Plants, Gainesville, Florida



Curly leaf pondweed

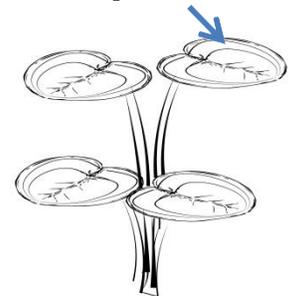
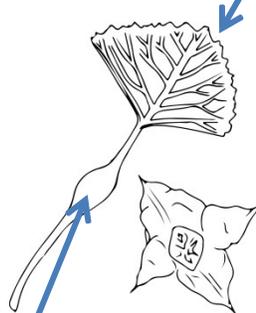
Native pondweed

11a Leaves are triangle shaped, clearly dentate with airbladders on stem, and may have a hard nut with four ½ inch barbed spines **Water chestnut (invasive)**

11b Leaves are heart shaped with the venation on the underside of the leaf following the margin of the leaf in a parallel heart shape..... **European frogbit (invasive)**

Dentate margin
Center for Aquatic and Invasive Plants, Gainesville, Florida

Parallel, heart shaped venation



Airbladder

Water chestnut

European frogbit

Glossary of Terms

Alternate	Pertaining to an arrangement of leaves where only one leaf is born at each level of the stem.
Complex	A leaf that is divided by either many leaflets or is extremely sinuous.
Bladder	In terms of aquatic plants, this is the carnivorous sack of bladderworts that captures micro invertebrates and other small organisms. Bladders range in size from 0.2 mm to 1.2 cm.
Dentate	Pertaining to a leaf with a triangular, tooth like edge.
Leaflet	A small leaf like part of a true leaf.
Margin	The edge of a leaf.
Opposite	Pertaining to leaves occurring two at a node on opposite sides of the stem.
Petiole	The stalk of a leaf.
Rosette	The arrangement of leaves in a dense, radiating cluster forming the base of the majority of plant mass.
Simple	Pertaining to a leaf that is not divided.
Whorled	Pertaining to leaves arranged in a circle at one level of the stem.