

Watercraft Inspection Steward Field Guide

A FIELD GUIDE TO The Lower Hudson Valley's Aquatic Invasive Species

NOT FOR DISTRIBUTION



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General Overview

An invasive species is defined as one that is non-native to the ecosystem, causes harm or has the potential to cause harm to the economy, ecology, or to human health, and the species' harmful impacts significantly outweighs its benefits. Some of the invasive species found in the Lower Hudson Region are already widespread, while others can be established, emerging, or still a threat. There are also species that are approaching the region, and can be found in neighboring regions.

This field guide does not list all of the species approaching or already in the region. It gives a general overview of the most common species found throughout the area (water chestnut), and species that we are on the lookout for (hydrilla).

New Regulations

A new amendment to Subdivision (i) of § 377.1 of Title 9 NYCRR has been approved by the New York Office of Parks, Recreation, and Historic Preservation that is designed to control the introduction and spread of aquatic invasive species at facilities under OPRHP jurisdiction. Under the newly amended legislation, one must take *reasonable precautions* to stop the spread of AIS:

- Summarized: Prior to launching and when leaving the site, the operator shall inspect for and remove any plant, aquatic life or animal, or parts thereof, and dispose in designated receptacles or in such a manner to avoid contact of the material with the waterbody. Measures must also be taken before arriving at a new site or leaving the current site to drain the watercraft (bilge area, livewells, bait wells, and ballast tanks) – Effective Nov. 12, 2014

NY Senate also amended the navigation law to include a section about universal AIS signage at launches.

- Summarized: The Department of Environmental Conservation will design and establish universal signage which will be posted at any access point to the navigable waters of the state relating to the threat and mitigation of AIS. Owners of each public boat launch shall conspicuously post the universal sign at each public boat launch in the state

Prohibited Species

New York State has listed numerous terrestrial and aquatic species as prohibited and regulated. These new regulations were published in September 2014, and became effective in March 2015. The new regulation (6 NYCRR Part 575 Prohibited and Regulated Invasive Species) prohibits 69 plants, 15 fish species, 17 aquatic invertebrates, 5 terrestrial and aquatic vertebrates 3 species of algae and cyanobacteria, and more. These prohibited species range from the mute swan to hydrilla to the spiny water flea.

Aquatic Invasive Species now prohibited in NY include:

- Killer Green Algae
- Didymo
- Golden Algae
- Fanwort
- Brazilian Waterweed
- Hydrilla, Water Thyme
- European Frogbit
- Yellow Iris
- Purple loosestrife
- Parrot-feather
- Broadleaf Water-milfoil
- Broadleaf water-milfoil hybrid
- Eurasian watermilfoil
- Yellow floating heart
- Curly leaf pondweed
- Water chestnut
- Northern Snakehead
- Bullseye Snakehead
- Giant Snakehead
- Walking Catfish
- Western Mosquitofish
- Eastern Mosquitofish
- Largescale Silver Carp
- Silver Carp
- Bighead Carp
- Oriental Weatherfish
- Black Carp
- Round Goby
- Sea Lamprey
- Tubenose Goby
- Tench
- Chinese Mystery Snail
- Japanese Mystery Snail
- Faucet Snail
- Spiny Water Flea
- Fishhook Water Flea
- Asian Clam
- Suminoe Oyster
- Carpet Tunicate
- Zebra Mussel
- Quagga Mussel
- Chinese Mitten Crab
- Asian Shore Crab
- Bloody Red Shrimp
- Rusty Crayfish
- New Zealand Mud Snail
- Vined Rapa Whelk
- Asian Sea Squirt
- Mute Swan

Stop Aquatic Hitchhikers

There are many pathways for spreading aquatic invasive species. An invasive species can be introduced for cultural reasons (e.g. food), through accidental introductions (e.g. hitchhiker on boat, ballast water, dumping aquaria species), through the pet and aquarium trade (releasing aquarium pets and plants into a waterbody), bait, waterfowl, and more. The best defense that we have against new introductions is **PREVENTION**. An important way to prevent one of the biggest AIS pathways – hitchhikers on boats – is by using clean boating practices when entering a new body of water and before leaving a body of water. The three key components to clean boating include:

Clean – Remove all visible mud, plants, fish, animal, organisms, and debris from your boat, trailer, and any equipment that came into contact with the water. Always clean your boat before leaving a body of water. Discard all potential hitchhikers in the proper disposal station when provided, or above the high water line.

Drain – Eliminate water from all equipment (motors, live wells, ballast, waders, etc.) before leaving the site.

Dry – Dry anything that came into contact with the water. If possible, decontaminate your boat and equipment with hot (<140°F), high pressure water. If this is not an option, allow your boat to dry for at least 5 days before entering new waters.



**STOP AQUATIC
HITCHHIKERS!**[™]

Prevent the transport of nuisance species.
Clean all recreational equipment.

www.ProtectYourWaters.net

Chinese Mystery Snail

Cipangopaludina chinensis/Bellamya chinensis

Identification

The Chinese mystery snail has large, globose, smooth, and strong shells. The shell can grow 6.5 cm in height, usually has 6-7 convex whorls and the inner coloration is white to pale blue. It exhibits light coloration as a juvenile and olive green, greenish brown, brown, or reddish brown coloration as an adult. The shell has an oblong-shaped operculum (“trap door”) that displays concentric growth rings. The operculum allows the snail to close the opening of the shell when water conditions become unfavorable or when being attacked by a predator

Impacts

Chinese mystery snail was found to cause declines in growth and abundance of native snail species, likely through competition for food. They are also less vulnerable to predation by the invasive rusty crayfish due to their larger size and thicker shells than native snails. The Chinese mystery snail can also reduce algal biomass, which changes the Nitrogen:Phosphorus ratio. They are also a nuisance to water intake pipelines, often clogging the screens and inhibiting the flow of water.

Chinese mystery snails can also serve as vectors for transmitting parasites and diseases, and host some parasites that can infect humans.

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Native Range

The Chinese mystery snail is native to Eastern Russia, China, Japan, Korea, Philippines, Taiwan, and Vietnam.

Spread

Probably introduced through the aquarium trade or as an importation for food markets, the Chinese mystery snail spreads by recreational activities through bait buckets or water holding areas on boats (ballast, live well, etc.). It can still be introduced through accidental introductions from aquariums.

The Chinese mystery snail is **a threat** in the Lower Hudson Valley.

Asian Clam

Corbicula fluminea

Identification

The Asian clam is a freshwater clam with a triangular yellowish brown to black shell with concentric, evenly spaced ridges on the shell surface. They are usually less than 25 mm but can grow up to 65 mm in length. It can be found on numerous substrates including silt, mud, sand, and gravel, and can tolerate salinities of up to 13 ppt for short periods of time.

Impacts

The Asian clam is highly successful coupling the nutrients in the water column and bottom sediments, filtering out phytoplankton and other particles suspended in the water that are also important food sources for filter-feeding organisms. They also excrete significant amounts of inorganic nutrients that can, in turn, stimulate algae and macrophyte growth. Asian clams have mass mortality events that occur in the summer, followed by the release of nutrients via decomposition, which can also lead to negative water quality effects. The shells create new habitat for species that prefer harder substrates (e.g. zebra mussels).

Asian clams are known to colonize intake pipes of water treatment systems and power stations. Unlike zebra mussels, the Asian clam does not attach to hard substrates. The juvenile clams pass through filter screens and settle on the floors of intake pipes where they reproduce and continue to accumulate in pipes while getting transported deeper into the system, eventually blocking structures with shells, altering flow, and increasing sedimentation rates.



Native Range

The Asian clam is native to eastern and southern Asia and was introduced as a food source.

Spread

The Asian Clam is hermaphroditic and capable of self-fertilization. It can spawn year round in warmer waters, and can release hundreds of thousands of veligers each day, which are then spread by water currents and human activity. The veligers and mature clams are able to attach themselves to boats, trailers, and equipment and can be transferred in bait buckets or water compartments including live wells and bilges.

The Asian Clam is **emerging** in the Lower Hudson Valley.

Zebra Mussel

Dreissena polymorpha

Identification

The zebra mussel has a triangular shell with a sharply pointed shell hinge end. The mussel can grow up to 5 centimeters, but most rarely exceed 4 cm. There is a prominent dark and light banding pattern on the shell. It is tan in color with broad, transverse color bands that are either smooth or zigzag in shape. The mussel attaches to hard surfaces using byssal threads, which distinguishes this mussel from other similar mussels in the region. The shell's "D-shape" gives it a straight midventral line and a prominent ridge that allows it to sit flat on its ventral side, unlike other mussel species.

Impact

Zebra mussels were first discovered in the Hudson River in 1991, and by 1992 their densities were reaching over 100,000 individuals per square meter. In such great densities, they were able to filter all of the water in the freshwater portion of the Hudson every 2-4 days, compared to the native mussels that filtered the water every 2-3 months. This causes a reduction in phytoplankton numbers and biomass which limits food for fish larvae, and eventually other consumers further up the food chain. Zebra mussel colonization can impede fish foraging and can affect spawning fishes.

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Zebra mussels also clog intake pipes, ship hulls, and more, causing damage to boats and water treatment plants.

Native Range

The zebra mussel is native to Europe, Russia, Turkey, and Ukraine.

Spread

Female zebra mussels can produce up to one million eggs in a season. These free-floating veligers can be transported undetected in bait buckets, bilge water, and live wells. The mussels can also survive out of water for up to five days and can easily be transported to other waterbodies on boats, trailers, and other equipment.

The zebra mussel is **established** in the Lower Hudson Valley.

Spiny Water Flea

Bythotrephes longimanus (*B. cederstroemi*)

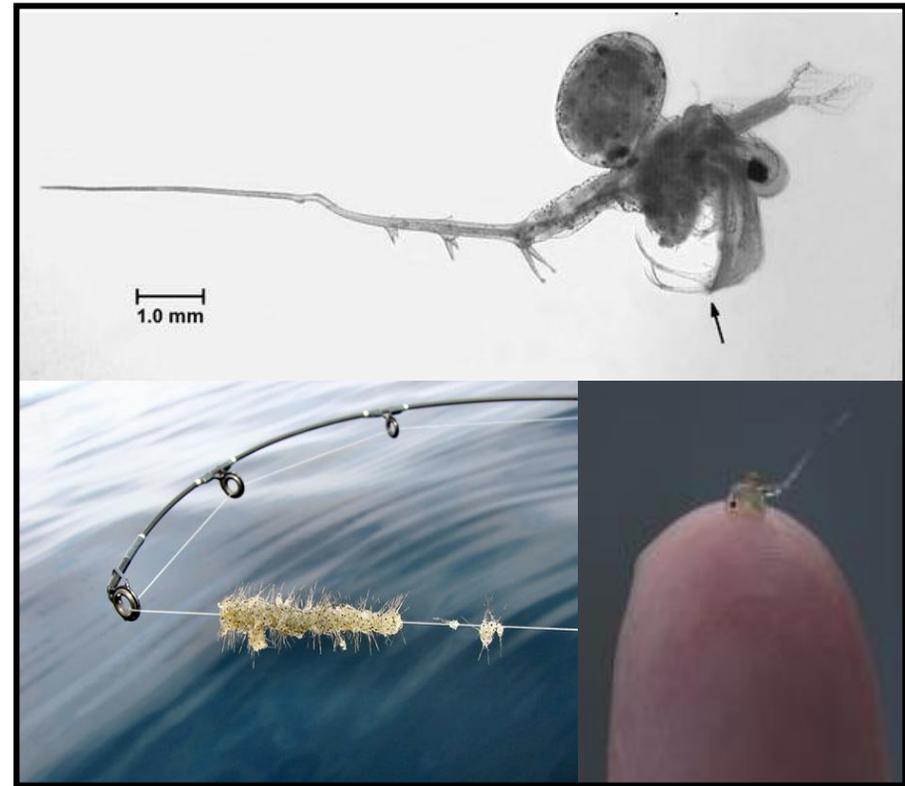
Identification

Spiny water flea is a carnivorous crustacean similar to the sea monkey, reaching 10-15 mm at maturity. Its long, spiny tail comprises about 2/3 of its body length. The head has one black eye and a pair of sickle-shaped mandibles. The spiny water flea has two swimming antenna behind its head and four pairs of legs used to catch their prey.

Impacts

The spiny water flea has directly impacted the native, herbivorous zooplankton including the species *Daphnia*, an important food for many native larval fish species. This makes the spiny water flea a direct competitor of the larval fish species. With its rapid reproduction, it is sometimes able to outcompete them.

The spiny water flea is also a nuisance for anglers and fisherman. They attach themselves in gelatinous globs on fishing lines, downriggers, anchor ropes, and fishing nets. The eggs are able to resist drying and freezing, and can establish a new infestation once entering another body of water. Eggs can also pass through the digestive tracts of fish. Females carrying eggs can be twice their normal weight, and their increased predation is another way for the eggs to disperse.



Native Range

Native to the Northern Europe and Asia

Spread

The spiny water flea collects on fishing lines and fishing gear, forming jelly-like globs. Eggs are able to survive being dried out and can survive on fishing gear for extended periods of time, which is why cleaning your boats and equipment is important. The spiny water flea can also spread in water containers on boats, so draining water from bilges, live wells, etc. is extremely important.

The spiny water flea is **approaching** the Lower Hudson Valley

Chinese mitten crab

Eriocheir sinensis

Identification

The Chinese mitten crab has a distinguished square shaped carapace that can reach 5-7 cm with a maximum carapace of 10 cm. Another distinguishing feature is the hair-like covering on the claws, resembling mittens. The color varies from yellow to brown, and is rarely purple.

Impact

The Chinese mitten crab is an opportunistic omnivore, consuming macroalgae, invertebrates, and fish which can diminish the food sources for the native crabs. Their burrowing activity can damage dikes and increase river embankment erosion, and can even cause bank collapses. Chinese mitten crabs have become a nuisance for recreational and commercial anglers by getting entangled in fishing gear, causing damage to fishing nets. They also reproduce and migrate in such high numbers that they can block water intakes and drainage systems



Native Range

The Chinese mitten crab is native to southeast Asia, southern China, and the Korean peninsula.

Spread

The Chinese mitten crab is spreading across the world in ballast water transfers, and by clinging to ship barges and hulls, which is why clean boating practices are so necessary. This species has also become popular in seafood markets.

The Chinese mitten crab is **widespread** in the Lower Hudson Valley.

Asian shore crab

Hemigrapsus sanguineus

Identification

The Asian shore crab has a somewhat square carapace with unusual patterns and can range in color from brownish orange to greenish black to purple. Each side of the carapace has three distinct anterolateral teeth. The crab also has a light and dark banding pattern on the walking legs. Its claws have red spots. It can reach 2-3 inches in width. Females are capable of producing three to four clutches per season, each containing up to 50,000 eggs.

Impact

The Asian shore crab is an opportunistic omnivore and has a very broad diet that can include macroalgae, salt marsh grass, larval and juvenile fish, and small invertebrates. This gives it the potential to affect populations of native crabs, fish, and shellfish by disrupting the food web. It has been known to out-compete native mud crabs, blue crabs, and lobsters. It occupies habitats very similar to our native mud crabs, overwhelming and dominating their habitat.

Native Range

The Asian shore crab is native to Russia, Korea, China and Japan.



Spread

Originally introduced by release of larvae in ballast water, the Asian shore crab continues to spread over great distances because their larvae are suspended in the water for approximately one month before developing into juvenile crabs, allowing the currents to move the larvae far away.

The Asian shore crab is **approaching** the Lower Hudson Valley.

Rusty crayfish

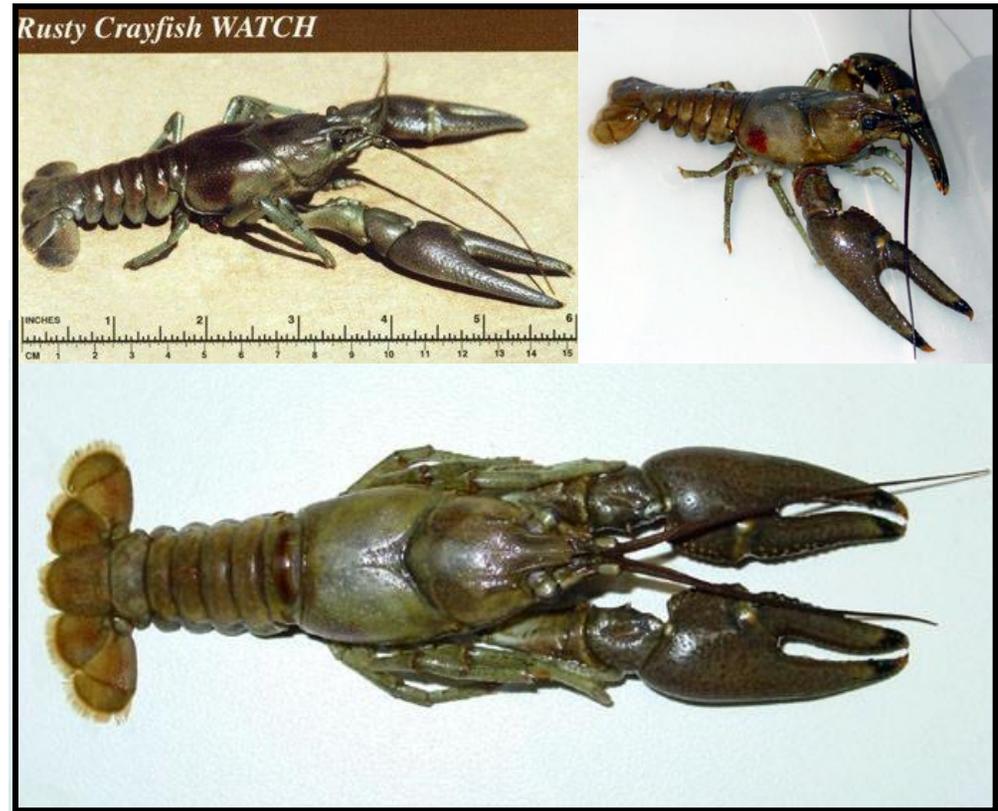
Orconectes rusticus

Identification

The rusty crayfish can reach up to 10 cm in length and has robust claws with dark, rusty spots on either side of its carapace. While usually prominent, the rusty colored spots do not develop well in some waters. A rust colored band also appears dorsally down the center of the abdomen. Its greenish color is most pronounced on its walking legs. Its claws are grayish green to reddish brown and have a black band at the tips.

Impact

The rusty crayfish has a range of ecological impacts on introduced environments that include competition and displacement of native crayfish, increased predation on snails, native and threatened bivalves, reduction of macrophyte abundance, reduction of sport fish abundance, reduction of macroinvertebrate abundance, and other cascading trophic interactions. Rusty crayfish reduce sport fish populations by either egg predation or competition with juveniles. It also displaces native or existing crayfish species, which can result in less food for fish.



Native Range

The rusty crayfish is native to Ohio, Kentucky, and Michigan.

Spread

The most common mode of spread for the rusty crayfish is by anglers using them as bait, or are released by anglers, aquarium hobbyists, and commercial harvesters. Females can carry fertilized eggs or a male's sperm, so a single female can establish new populations.

The rusty crayfish is currently **established** in the Lower Hudson Valley.

Goldfish

Carassius auratus

Identification

Goldfish are small to moderately sized fish with an elongated, stocky body. Wild populations vary in color from gold to olive green to creamy white, and fades to silvery-white along the belly. They have long dorsal fins with 15-21 rays and a hard serrate spine at the origin of the dorsal and anal fins. Their life span is usually 6-7 years, but can live up to 30.

Impact

Cyanobacteria passing through the goldfish intestine stimulate cyanobacterial growth, which can result in algae blooms. The goldfish is a bottom-sucking feeder which causes the re-suspension of nutrients, leading to algae blooms. Goldfish also prey on the eggs, larvae, and adults of native fish species. Their feeding method increases water turbidity and decreases the native aquatic vegetation. Goldfish likely compete with native fish species for habitat and food, eventually displacing the natives.

Native Range

The goldfish is native to central Asia, China, and Japan.



Spread

Goldfish have been introduced into our waterways through many means. Wild populations have established through the release of pet goldfish. They are used for ornamental purposes and can escape confinement in outdoor ponds. It is thought that the first recorded goldfish release was the result of an intentional release by settlers wanting to add it to the North American fish fauna. For a period of time in the 1800s, the US Fish Commission raised the species and distributed it to many states for aquaria, fountains, and ornamental lakes. Since then it has been reported in nearly every state.

The goldfish is currently **established** in the Lower Hudson Valley.

Northern Snakehead

Channa argus

Identification

The northern snakehead has a torpedo-shaped body that tapers toward the tail. They have a single, long dorsal fin, long anal fin, and a small head with a large mouth. They can grow up to 85 cm in length. Resembling a fish with a large mouth and sharp teeth and a truncated, not rounded tail, the northern snakehead is easily identifiable by the dark irregular blotches on its sides that lay on top of a golden tan to pale brown body. It can also darken its color to the point of almost obscuring the blotches.

Impact

If left unchecked, the northern snakehead will expand its range and could potentially alter the balance of aquatic ecosystems. The northern snakehead is a voracious feeder of aquatic fauna and can eat prey up to 33% of their own body length. They are capable of surviving in waters with very low oxygen content, giving them a competitive advantage over native species that require more oxygen. The predatory fish eats numerous species of fish, crayfish, dragonfly larvae, beetles, and frogs.



Native Range

The northern snakehead is native to China, Russia, and Korea

Spread

The northern snakehead likely entered the United States via pet shops and live fish markets, where they were sold before their threat was realized. Pet owners often unknowingly released them into the wild when they grew too big for aquarium tanks, or as part of religious or cultural practices.

The northern snakehead is currently **emerging** in the Lower Hudson Valley.

Common Carp/Koi

Cyprinus carpio

Identification

Carp can grow up to 120 cm in length and weigh 60 kg. The common carp is recognized by its small eyes, thick lips, two barbells at each corner of the mouth, large scales outlined in black, and strongly serrated spines in the dorsal and anal fins. The head is short, with a rounded snout and toothless, sucker-like mouth. In the wild, common carp are usually olive green to bronze or silver with a pale underside. Koi carp are brightly colored with orange, yellow, white, or black markings.

Impact

Carp are known to damage aquatic macrophyte populations, which are integral to the ecosystem functioning. They pose a threat to wetlands that are used as spawning and nursing habitats by native species. They can stimulate algal blooms by increasing nutrient release from sediments and decreasing algal grazing by cladocerans. Carp negatively affect species abundance and diversity of macrophytes and some macroinvertebrates, which can lead to declines in biodiversity. Carp stir up sediment during feeding which results in siltation and bioturbation. They can often drive native species out by overtaking their habitats and can outcompete native species and eat their eggs. They can also destroy the native vegetation.



Native Range

The common carp is native to Europe in rivers around the Black Sea and the Aegean basin.

Spread

Common carp were introduced to the United States both deliberately in an attempt to imitate the European environment, and accidentally through escaping ornamental or aquaculture fish. It has been introduced worldwide as a food fish in temperate freshwaters. Anglers sometimes use juvenile carp as bait.

The common carp is currently **widespread** to the Lower Hudson Valley.

Oriental Weatherfish

Misgurnus anguillicaudatus

Identification

The Oriental weatherfish varies in color from brown to yellow with greenish, grey-brown, or black marbling. The eel-like body is long, laterally compressed, reaching about 15 cm with a maximum length of 30 cm. Its small, narrow mouth is subinferior with 10 barbels. Four of these barbels are smaller and placed below the lip. It has thick, fleshy lips. Pectoral fins are triangular with a stout spine. It has a dark spot on the upper half of the base of the caudal fin. (9 dorsal rays, 6-7 pelvic rays, 7-8 anal rays). It gets its name as “weatherfish” because it becomes more active in response to changes in barometric pressure.

Impact

Oriental weatherfish can cause significant reductions in macroinvertebrate numbers and biomass. It has been associated with elevated ammonia, nitrate/nitrite, and turbidity levels – similar to the water quality impacts of carp. The Oriental weatherfish impacts native fisheries by reducing populations of their macroinvertebrate prey, by competing for shelter and spawning sites, and by preying on eggs and juveniles. It is a highly adaptive species with high competitive ability, high reproductive capacity, high survivorship, and high dispersal ability.



Native Range

Oriental weatherfish are native to Cambodia, China, Hong Kong, India, Japan, Korea, Russia, Taiwan, Thailand, and Vietnam.

Spread

The original means of introduction is through escaped fish farms. The Oriental weatherfish is a common aquarium fish and is popular in the aquarium trade. It is also spread through its use as live bait. Eggs are not guarded and scatter in open water, allowing currents to take the fish to new, previously uninvaded bodies of water.

The Oriental weatherfish is currently **emerging** in the Lower Hudson Valley.

Round Goby

Neogobius melanostomus

Identification

The round goby is a small, soft-bodied fish readily distinguished from other freshwater fish in North America by the presence of a fused pelvic fin that forms a suction cup shaped fin on the ventral surface. It has a brownish gray body with dark brown lateral spots. There is usually a large, oblong black spot present at the end of the dorsal fin. The head length is about 23% of the total body length. Spawning males can turn almost solid black. Their soft body and large round head have frog-like raised eyes. This fish can grow 10-25 cm long.

Impact

The round goby is thriving and harming the native sport fish populations. It is able to outcompete the native species including lake trout, sculpin, and logperch for food sources, habitat, and spawning sites. It spawns more frequently than other species and feeds on their eggs and young juveniles.



Native Range

The round goby is native to Asia and parts of Europe.

Spread

The round goby was introduced to the Great Lakes through ballast water on cargo ships. They are mistaken with some common baitfish, so boaters and fisherman can unknowingly carry them from one body of water to another in bait buckets, bilge water, and more.

The round goby is currently **a threat** to the Lower Hudson Valley.

Sea Lamprey

Petromyzon marinus

Identification

The sea lamprey is eel-like and has long, flexible, cylindrical, scaleless bodies with a deeply notched dorsal fin that separates it into two distinct parts. It can reach 50 cm in length. It has no scales and no paired fins. Adult sea lampreys have a disc-like mouth that contains circular rows of over 100 sharp, hooked teeth. Adults can be olive-brown, yellow-brown, green, red, or blue mottled with darker shades of the same color, or nearly black. The underside is typically white or grey.

Impact

Sea lampreys attack and are parasite feeders on other fish, which often results in the death of the fish. They can destroy up to 40 pounds of fish during their adult lifetime. Typically, only one out of seven fish attacked by a sea lamprey will survive. The population explosion in the 1940s and 1950s contributed significantly to the collapse of economically important Great Lakes fish species.

Native Range

The sea lamprey is native to the east coast of North America, the Northeast Atlantic coast from Norway, Iceland, and the Barents Sea, to northern Africa, and the western Mediterranean Sea.



Spread

The sea lamprey appeared in Lake Erie in 1921 via the Welland canal, and took 25 years to spread to the remaining Great Lakes. Larval lampreys are used as bait in non-native areas. Adults can attach themselves to boats going through the canal systems, allowing it to travel to previously uninvaded areas. The sea lamprey also travels over long distances while attached to other fish.

The Sea lamprey is native to the Hudson River and has not been found to cause a problem. It is an ecological threat to non-native areas, including the Great Lakes and Lake Champlain.

Fanwort

Cabomba caroliniana

Identification

Fanwort is a submersed freshwater perennial plant. It can be found rooted or as floating fragments that can survive up to eight weeks. The branching stems have reddish-brown hair and can grow 6 meters or longer, growing from the rhizomes below the sediment. The submerged leaves are divided into fine branches, giving it a feathery appearance. Leaves are oppositely arranged, green, and about 5 cm in diameter. Floating leaves are narrow, small and oval or diamond shaped arranged in an alternating pattern. Flowers are small and range in color from white to pink to purple, with a diameter of less than 1.5 cm.

Impact

Fanwort is a very competitive plant, giving it the opportunity to form dense stands and reduce sunlight for and crowd out previously well-established, native species. These monocultures are bad for biodiversity and can affect the water quality. When large mats of the vegetation die off, their decomposition causes oxygen reductions. This plant can also clog drainage canals and freshwater streams, which impedes recreational and agricultural uses.

*Commonly mistaken for native Coontail (*Ceratophyllum demersum*)



Native Range

Fanwort is native to southern Brazil, Paraguay, Uruguay, and northeast Argentina.

Spread

Fanwort has spread through both intentional and unintentional releases in the aquarium trade. This species is capable of reproducing vegetatively through fragmentation, allowing it to spread via hitchhiking on boats, trailers, and other recreational equipment.

Fanwort is currently **emerging** in the Lower Hudson Valley.

Brazilian Waterweed

Egeria densa

Identification

Brazilian waterweed is a freshwater perennial with bright green stems and leaves with short internodes which gives the plant a leafy appearance. Leaves are minutely serrated and linear, 1-3 cm long, and up to 5 mm wide. The leaves are found in whorls of 4-8, but the lowest leaves are opposite or in whorls of 3. Stems are erect, cylindrical, simple or branched, and grow until they reach the surface of the water where they form dense mats.

Impact

This species forms monospecific stands that can restrict water movement, trap sediment, and cause fluctuations in water quality. The monospecific stands push out native species, reducing the biodiversity of the area. Introduced worldwide through the aquarium trade, even in its native range it becomes a nuisance species and causes economic impacts.

Dense beds can interfere with recreational water uses including boat navigation, swimming, fishing, etc. Fragments of the plant can also break off and clog intake structures of water treatment plants.

Native Range

Brazilian waterweed is native to South America.



Spread

Brazilian waterweed has spread via aquarium and water garden releases. It is only able to reproduce vegetatively by plant fragments which hitchhike on boats, trailers, and equipment and spread to new waterbodies. Brazilian waterweed has the ability to cover 100 acres of water per year.

Brazilian waterweed is currently **emerging** in the Lower Hudson Valley.

*Commonly mistaken for Hydrilla and native Elodea

Hydrilla

Hydrilla verticillata

Identification

Hydrilla is a submerged aquatic perennial with heavily branched stems towards the water surface. The plant can grow in depths of up to 30 feet, growing up to a foot per day. The northern biotype, monoecious hydrilla, mats the floor, creating a “shag rug” look. When the water is warm enough, the hydrilla grows vertically towards the surface, creating dense mats that block the sunlight for native species below. Leaves are strap-shaped with pointed tips and serrated edges, growing in whorls of 4-8 (usually 5). Leaf color can vary from green, translucent, yellow, to brown.

Impact

Hydrilla can impact the ecology and economy in numerous ways. When hydrilla mats the surface, it blocks sunlight for native species below it, displacing them and forming a monoculture. Hydrilla can grow up to a foot each day, easily overtaking large bodies of water. It can thrive in many water types, ranging from stagnant or moving, freshwater to brackish water, high or low sunlight, high or low nutrient levels, etc. It also creates tubers that remain viable under the sediment for up to 10 years, making treatments or removals more difficult. When large mats of hydrilla die later in the season, algae blooms can be created, causing fish kills. Hydrilla is also a host to a species of cyanobacteria that has caused deaths of at least 99 bald eagle and thousands of American coots.

Hydrilla can also devastate recreational activities including swimming, boating, fishing, and more, which can harm tourism industries. Hydrilla infestations also lower the value of waterfront



homes. Large mats of hydrilla can break off and clog water intakes at plants, which can be expensive to fix.

Native Range

The dioecious plant (found in the south) is native to southern India, and the monoecious plant is native to Korea. Both species are not found on every continent except Antarctica.

Spread

Hydrilla can spread vegetatively through fragmentation, making it a potential hitchhiker on boats, trailers, and other equipment. It can also spread via turions, or overwintering buds, that can flow downstream and start new populations. Hydrilla also produces tubers, which are potato-like structures that lay a few inches below the sediment. These can remain viable for up to 10 years, making hydrilla management projects more difficult.

Hydrilla is currently **emerging** in the Lower Hudson Valley.

*Commonly mistaken for Brazilian waterweed and native Elodea

Parrot-feather

Myriophyllum aquaticum

Identification

Parrot-feather is named for the feather-like leaves arranged around the stem in whorls of 4-6. It has both emergent and submerged aquatic leaves and can easily be mistaken for Eurasian watermilfoil. The submersed leaves are 1.5-3.5cm long with 20-30 divisions per leaf. Emergent leaves are 2-5 cm long with 6-18 divisions per leaf. The bright green emergent leaves are stiff and darker green than the submersed. The emergent stem and leaves can grow up to a foot above the water and look almost like a small fir tree. Submersed leaves are limp and appear to be decaying with very robust stems.

Impact

Parrot-feather has been introduced worldwide as an aquarium plant. It can spread vegetatively via fragmentation and can alter the physical and chemical characteristics of a lake or stream once established. Infestations can shade out the algae in the water column that serve as the basis of the aquatic food web. It is also good habitat for mosquito larvae. Parrot-feather can also restrict recreational opportunities and activities in the infested bodies of water.



Native Range

Parrot-feather is native to South America.

Spread

In the United States, there are only female parrot-feather plants, so it is restricted to spreading vegetatively through fragmentation. This means it can easily spread as a hitchhiker on boats, trailers, and other equipment that comes into contact with the water.

Parrot-feather is currently a **threat** in the Lower Hudson Valley.

Variable leaf/Broadleaf milfoil

Myriophyllum heterophyllum

Identification

Variable leaf milfoil is a submersed aquatic plant with emergent flowering spikes. Submerged leaves are feather-like, green, 2-5 cm long and 2-4 cm wide, dissected into 7-11 leaflets and whorls of 4-5. The emergent spike can reach 5-15 cm above the water surface. This species can be very difficult to differentiate from Eurasian watermilfoil and other milfoil species. The stem of the variable leaf milfoil is sturdier than others, and the submerged leaves are thicker and rougher. Unlike Eurasian watermilfoil, when you pull variable leaf milfoil from the water, it can hold its form.

Impact

Variable leaf milfoil is an aggressive plant that can grow up to one inch per day. It can form dense vegetative mats and reduce water movement. When decomposing, it reduces water quality and available oxygen which can harm fish and other aquatic organisms. The thick mats often outcompete native vegetation. It can also clog boat motors and deter people from water related activities.

Native Range

Variable leaf milfoil is native from southwestern Quebec and Ontario to North Dakota and southward to New Mexico and Florida.



Spread

This species of milfoil primarily spreads vegetatively through fragmentation, which are able to hitchhike on boats, trailers, and other equipment. Currents are also able to move fragments long distances.

Variable leaf milfoil is currently **emerging** in the Lower Hudson Valley.

Eurasian watermilfoil

Myriophyllum spicatum

Identification

Eurasian watermilfoil is an aquatic perennial, dicot herb with long branch stems and feather-like whorled leaves. Its small reddish flowers emerge from the water on a spike. Stems are slender and smooth, reaching up to 6 m long and range in color from reddish-brown to whitish-pink. The leaves are olive green and are typically less than 5cm long. Each leaf is soft, deeply divided and feather-like, and can be found in whorls of 3-6 (usually 4). A distinguishing feature of Eurasian watermilfoil is the end of each leaf, as the leaf divisions end in almost a straight, horizontal line rather than coming to a point (see top left picture).

Impact

Eurasian watermilfoil grows in dense patches, forming a monoculture which shades out native species. It is less of a food source than the natives that it replaces, and supports fewer insects that serve as the food resources for fish. Predatory fish lose foraging space and are less efficient at obtaining prey in infested areas. When large mats of the plant decay, oxygen levels drop, altering the ecosystem. Dense mats of Eurasian watermilfoil also impede water movement and limit recreational activities



Native Range

Eurasian watermilfoil is native to Europe, Asia, and northern Africa.

Spread

Eurasian watermilfoil does not rely on seeds for reproduction. Instead, it reproduces vegetatively via fragmentation. These fragments break off and float long distances with water currents. Fragments can also be transported long distances by hitchhiking on boats, trailers, and equipment.

Eurasian watermilfoil is current **widespread** in the Lower Hudson Valley.

Brittle Naiad

Najas minor

Identification

Brittle naiad is a submersed, annual herb with compact, bushy growth. Stems can reach up to 2.5 m long and are abundantly branched near their apex. Its leaves are opposite, but can appear to be in a whorl at the tip. The leaves can grow 1-2 inches long, and are toothed, stiff, curved, and pointed. Its flowers are inconspicuous. As stated in the name, this species is very brittle and easily breaks into pieces.

Impact

Brittle naiad is able to establish dense monocultures, excluding other native vegetation and affecting fish and waterfowl biodiversity. Unlike many other aquatic invasive plants, brittle naiad does not produce long stems that spread on the surface of the water. But its dense monocultures still capable of interfering with recreational activities like swimming, boating, and fishing, and can reduce the aesthetic appeal of the waterbody. Brittle naiad can also reduce the discharge capacity of channels as well.

Native Range

Brittle naiad is native to Austria, Belgium, Bulgaria, Czech



Republic, France, Germany, Hungary, Italy, Poland, Portugal, Romania, Siberia, Ukraine, Morocco, India, Turkey, and Japan.

Spread

Brittle naiad can reproduce vegetatively through fragmentation. These fragments can hitchhike on boats or other equipment and be transported to a previously uninfested body of water and start new populations. Waterfowl also spread the species by ingesting the seeds and excreting them in new locations. Wind and currents can pull fragments of brittle naiad to new locations, where the viable fragments can establish new infestations.

While not prohibited, brittle naiad is considered invasive and is **established** in the Lower Hudson Region.

Curly-leaf pondweed

Potamogeton crispus

Identification

Curly-leaf pondweed is a submerged perennial plant with oblong, reddish-green to translucent, wavy, alternate leaves with finely toothed margins. Leaves are 0.5-1.5 cm wide and 3-10 cm long. Stems are branched and somewhat flat. The plant can reach 1 m in height. The plant flowers and fruits in late spring to early summer. When it dies off, it leaves fruits and turions to survive the summer. The turions produce new, small plants that overwinter.

Impact

This pondweed is able to tolerate low light levels and temperature conditions, allowing it to grow sooner than native plants. Curly-leaf pondweed can grow in very dense beds that can outcompete native plants, creating a monoculture. Dense surface mats can disrupt recreational activities. It can spread through fragmentation. Curly-leaf pondweed can increase algal blooms, decreasing the aesthetic value of waterfront properties. It can reduce the fetch of a lake and can stratify the water column in normally unstratified systems.

Native Range

Curly-leaf pondweed is native to Eurasia, Africa, and Australia.



Spread

This pondweed produces burr-like overwintering buds called turions that can spread long distances with the current, allowing it to reproduce vegetatively. Curly-leaf pondweed also produces seeds and can be spread by waterfowl ingesting them. Fragments can also spread on recreational equipment including boats and trailers.

Curly-leaf pondweed is currently **established** in the Lower Hudson Valley.

European Frogbit

Hydrocharis morsus-ranae

Identification

European frogbit is an herbaceous, annual aquatic that can reach 20 cm in length. It is a free-floating plant whose leaves are usually floating, but can be emergent if the vegetation is dense enough. The leathery, glabrous leaves are cordate-orbicular in shape measuring about 1-6 cm in length and width. The lower leaf circle is dark purple. European frogbit resembles a quarter-sized lily pad.

Impact

European frogbit can impede water flow in irrigation systems and canals, and lessen recreational and aesthetic values on waterfront properties. This can lead to a decrease in tourism.

Dense monocultures and mats of European frogbit block light penetration in the water column, reducing available light for native species. They can also deplete oxygen levels by limiting water circulation and increasing decomposition of dead plants, which changes the water quality and affects the ecosystem.



Native Range

European frogbit is native to Asia and Europe.

Spread

European frogbit can spread both vegetatively and by turions. Spreading vegetatively, or by fragmentation, allows frogbit to spread as a hitchhiker on boats and trailers. It also grows turions, which float to the surface and grow in the spring. A single plant can produce 150 turions each season.

European frogbit is currently **a threat** in the Lower Hudson Valley.

Yellow floating heart

Nymphoides peltata

Identification

The yellow floating heart is a perennial, water lily-like plant that mats the surface of the water with long stalked, heart-shaped leaves. The leaves are 3-10 cm long, and are usually purple underneath. It has a showy, five petaled yellow flower growing on long stalks and rising a few inches out of the water. There can be multiple flowers per stalk. The flower edges are distinctively fringed.

Impact

The yellow floating heart can grow very dense patches and displace the native species. The plants can also limit movement in the water column, creating stagnant areas with low oxygen levels below the floating mats. Dense patches can hinder recreational activities including boating, swimming, and fishing.

Native Range

The yellow floating heart is native to Asia and Europe.



Spread

Originally introduced as an aquatic ornamental for outdoor water gardens, it continues to be spread accidentally through outside water gardens. The hairs on the seeds also allow the seeds to attach to waterfowl, which can also spread the plant.

Yellow floating heart is currently a **threat** in the Lower Hudson Valley.

Water chestnut

Trapa natans

Identification

Water chestnut is a rooted, floating plant. Its floating leaves are arranged in rosette. The individual leaves are 2-4 cm long and are sharply dentate along the leaf margins. The lower surface has conspicuous veins and short, stiff hairs. Submerged lower leaves are alternate and feather like and can reach 15 cm in length. The fruit is a four-horned nut-like structure about 3 cm wide and develop underwater.

Impact

Water chestnut can completely mat the surface, causing competition with native species for light, nutrients and space. When it decomposes, it can lower dissolved oxygen levels which can lead to fish kills. It has little value for waterfowl. The spiny fruit can hurt people and animals when stepped on. Big infestations can impede recreational activities and commercial navigation.

Native Range

Water chestnut is native to Europe, Asia, and Africa.



Spread

Water chestnut produces nut-like seeds that germinate in the spring, and each seed is capable of producing 10-15 rosettes. Each plant is capable of producing 20 seeds per season. These seeds sink to the bottom and are able to remain viable for up to 12 years. This plant also spreads vegetatively through fragmentation. Fragments are able to spread on boats, trailers, and other equipment.

Water chestnut is currently **established** in the Lower Hudson Valley.

Yellow Iris

Iris pseudacorus

Identification

Yellow iris is a perennial monocot that forms dense stands in waters up to 25 cm deep. It can grow between 40-150 cm tall. Its rhizomes are 1-4 cm in diameter with roots up to 30 cm long. The leaves are broad up to 100 cm long and 30 mm wide with a raised midrib, and comes to a fine point. Flowers are yellow and 8-10cm in diameter.

Impact

The yellow iris thick rhizomes create a sort of mat that prevent the germination and seedling growth of other plant species. This can also congest water flow. They also change the ecosystem by compacting soil and elevating the topography, creating a drier habitat with increased rates of siltation and sedimentation. It is a fast growing, fast spreading plant that can outcompete other native wetland species and form impenetrable thickets.

This species is poisonous, harming fish and animals that touch or eat it. It is capable of causing skin irritation to humans.



Native Range

Yellow iris is native to Africa, Asia, and Europe.

Spread

The yellow iris can reproduce vegetatively through underground stems, or rhizomes, which form into roots and allow it to re-grow new plants each season.

Yellow iris is currently **emerging** in the Lower Hudson Valley.

Purple loosestrife

Lythrum salicaria

Identification

Purple loosestrife is an erect perennial herb with a woody four-sided stem. Leaves are generally whorled and opposite, lance-shaped but heart-shaped or rounded at the base. Mature plants can have up to 50 stems emerging from a single rootstock. The plant can grow from 1.2-3 m. Showy, magenta-colored flowers with 5-7 petals.

Impact

Purple loosestrife can outcompete and replace native grasses, sedges, and other flowering plants that provide higher quality food sources and habitat. It forms dense monocultures that restrict native wetland plant species and can overrun wetlands to almost entirely eliminate open water habitat. Recreational and aesthetic values of wetlands and waterways are diminished when dense stands come in and decrease biodiversity. Purple loosestrife can also alter decomposition rates and nutrient cycling and water chemistry.

Native Range

Purple loosestrife is native to Eurasia, Britain, central and southern Europe, central Russia, Japan, China, southeast Asia and northern India.



Spread

Purple loosestrife has a very long flowering season, allowing it to produce two to three million seeds each year from its 30-50 flowering stems. It also produces vegetatively through underground stems, or rhizomes.

Purple loosestrife is current **widespread** in the Lower Hudson Valley.

Phragmites/Common Reed

Phragmites australis

Identification

Phragmites is a tall, perennial grass with erect, rigid, smooth, and hollow culms that can be 2.5 cm in diameter and up to 4 m tall. The culms terminate in dense, 30 cm long panicles. The leaves are typically 25-50 cm long and 1-4 cm wide. Phragmites has an extensive rhizome network and roots that grow at depths of 1 m. The feathery flower head is 13-40 cm long and is composed of many long branches that point upwards.

Impact

Phragmites is a vigorous growing plant capable of turning biodiversity rich habitats into dense monotypic stands that overtake available growing space and push out native species. It alters wetland hydrology and can increase the potential for fire. It also reduces and degrades wetland wildlife habitat because of its dense growth habit, which can reduce the biodiversity. It is capable of changing the marsh hydrology by decreasing salinity in brackish wetlands, changing the topography, and outcompeting other plant species.

Native Range

Originally from Europe, Phragmites is now found on every continent except Antarctica, and is even encouraged to grow in some regions, particularly in eastern Europe.



Spread

Phragmites spreads vegetatively through rhizome and stolon fragments. Rhizomes can break off and can be moved downstream through the currents, establishing in previously uninfested areas. Fragments can also spread via machinery. It also produces wind-dispersed seeds, but this seed viability is low.

Phragmites is currently **widespread** in the Lower Hudson Valley.

Native Lookalikes

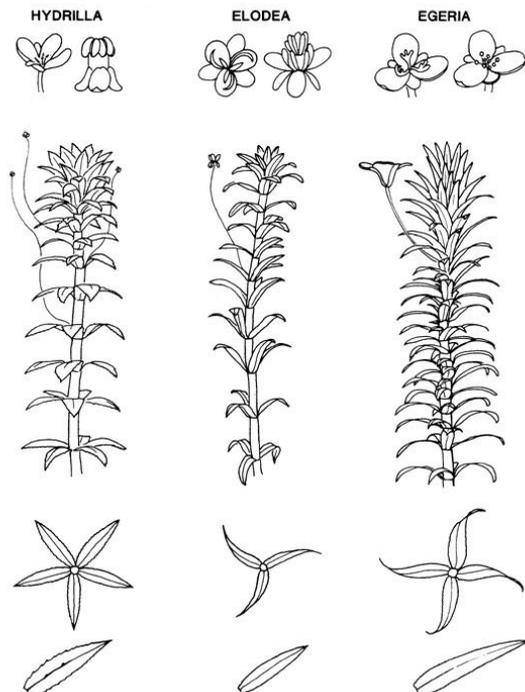
American waterweed/Common Elodea *Elodea canadensis*

Native elodea is commonly mistaken for hydrilla and Brazilian waterweed (and vice versa). While these species may look very similar, they have extremely different effects on the ecology. It is important to note the distinguishing differences between the species.

Elodea, often thought of as the typical aquarium plant, can be identified by its:

- 3 leaves/whorl (occasionally 4)
- Visibly smooth leaf margins (finely toothed under a microscope)
- Purple tint on stem below each whorl
- **NO** tubers

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Coontail/Hornwort *Ceratophyllum demersum*

Native coontail is a submersed plant found in all 50 states, including many New York lakes and ponds. It is commonly mistaken for the invasive plants Eurasian watermilfoil and fanwort. Its serrated, forked leaves are arranged in whorls around the stem, with 5-12 leaves per whorl. It is somewhat hard and crusty when held. When pulled out of the water, coontail holds its form pretty well, which is a distinguishing characteristic that allows us to differentiate it from fanwort and Eurasian watermilfoil.



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1. Main picture: <<https://www.pinterest.com/ridetheferry/udson-river-valley/>>
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1. <http://www.nps.gov/plants/alien/pubs/midatlantic/img/trna-Mike_Naylor.jpg>
2. <<http://estuarylive.pbworks.com/f/1239720123/1239720123/waterchestnutsbrowser.jpg>>
3. <http://www.reformrivers.eu/system/files/DSC_0089_LR.JPG>

Yellow Iris

1. <http://www.wildflowersofontario.ca/yellow_iris2.jpg>
2. <<http://www.adirondackalmanack.com/wp-content/uploads/2012/06/IMG1227.jpg>>

Purple Loosestrife

1. <<http://www.nps.gov/plants/ALIEn/fact/lysa1.htm>>
2. <<http://kboo.fm/content/theinvasionofinvasivespeciesinurbanaturalareas>>
3. <http://www.ecy.wa.gov/programs/wq/plants/weeds/images/PurpleLoosestrife.jpg>

Phragmites

1. <http://nyis.info/index.php?action=invasive_detail&id=42>
2. <<http://www.fs.fed.us/database/feis/plants/graminoid/phraus/all.html>>
3. <<http://www.invasiveplants.net/phragmites/>>

Native Elodea

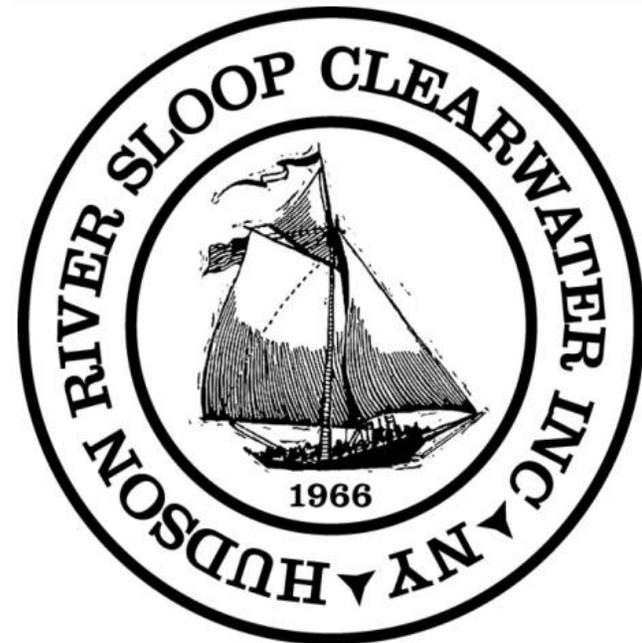
1. <http://plants.ifas.ufl.edu/node/183>

Coontail/Hornwort

1. <http://www.illinoiswildflowers.info/wetland/plants/coontail.html>



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