Second Edition 2015

Pennsylvania's Field Guide to

Aquatic Invasive Species

Sea Grant
Pennsylvania

Acknowledgements

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Great Lakes RESTORATION

Pennsylvania's Field Guide to Aquatic Invasive Species

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Sea Grant Pennsylvania

Introduction

Preventing the introduction and spread of aquatic invasive species (AIS) should be a top priority in Pennsylvania. The state has more than 84,000 miles of streams, 77 miles of Great Lakes shoreline, and many inland lakes, while sharing five major watersheds with other states and Canada. Once invasive species become widely established, controlling their spread is both technically difficult and expensive, and eradication can be nearly impossible.

Global trade, human activities, recreation, and climate change are helping invasive species spread at accelerated rates. As a result, they are changing the health and natural diversity of watersheds across the Commonwealth. In the Great Lakes region alone, nearly 200 species from around the world have been recorded, with a continuing trend of one new non-native species introduction every six to eight months.

Identifying and preventing the introduction and spread of AIS are the keys to averting long-term ecosystem damage and ensuring the highest probability of effective control. This field guide is designed to aid natural resource professionals and other interested individuals in AIS early detection and reporting. This reference guide can help waterways conservation officers, regional biologists, volunteer monitors, resource managers, educators, students, and others working in Pennsylvania's waters. It includes general information for AIS identification, collection, verification, and reporting.

This field guide is designed to aid science professionals and other interested individuals in AIS early detection and reporting.

Using the Field Guide

The purpose of this guide is to help slow or stop the spread of invasive species in Pennsylvania. Therefore, in addition to identification, it includes sections on prevention, reporting, and collecting specimens.

The focus of the first section is prevention, since it is important that readers understand how to avoid AIS introduction and spread to new locations. It highlights significant vectors of spread for AIS and describes preventative actions that can be taken.

The second section focuses on how to report species. It is important that new infestations are reported quickly and accurately, and that specimens are collected correctly so that subsequent control or management actions can be taken. Information described in the Pennsylvania AIS Rapid Response Plan is used to ensure species are collected according to recommended guidelines and reported to the appropriate jurisdictional authorities.

The last section contains "species profiles" that highlight important characteristics to help distinguish AIS from other species.

Species are grouped together by taxonomy, with a different color representing each:

- Aquatic and facultative plants (green)
- Invertebrates (teal)
- Fish (blue)
- Pathogens (orange)
- Algae (yellow)
- Reptiles (maroon)

Species are ordered alphabetically by common name. Each profile contains photographs, illustrations, maps, and narrative descriptions to highlight important facts or features of that species.

Profiles follow the general format below:

Species at a Glance: Brief overview and interesting facts

Identification: Key characteristics for identifying the species

Similar Species: Methods for distinguishing invasive species from native look-a-likes

Habitat: Description of the preferred environment

Spread: Highlights pathways and vectors in which the species can be transferred to new locations

Distribution: Native and invasive range information, including distribution in the United States and Pennsylvania – ***Note: Distribution information was taken from the USGS Non-Indigenous Aquatic Species database, the USDA NRCS plants database, iMap Invasives, and the Aquatic Plants of Pennsylvania reference guide and represents data from 2015. This information may not be completely accurate and may quickly go out of date. Please use additional resources to verify species locations in your area.***

Impacts: Potential or documented influence on biodiversity, the economy, or human health

Additional tips for using the guide:

- At the beginning of each taxonomic grouping is a reference section with important information for identification.
- Each reference section contains images and diagrams highlighting important anatomical structures and features of the species within that group. Reviewing these features may be helpful in identifying species.
- Definitions for words in **bolded letters** can be found in the glossary on page 165.
- The back cover of the field guide can be used as a ruler to help measure specimens in the field.
- For the most up to date information on species and distribution information, please reference the electronic version of the field guide on the Pennsylvania Sea Grant website, or download the smart phone application.

Prevention

Preventing the arrival and spread of species into Pennsylvania's waterways remains the number one line of defense in the battle against AIS. By taking precautionary steps, the harmful ecological, economic, and health impacts associated with AIS introduction could be prevented.

AIS can hitchhike on boats, trailers, equipment, fishing tackle, motors, clothing, diving gear, and boots, or in bait buckets, bilges, and live wells. Some species can survive out of the water on damp clothing or equipment for several days to weeks, and some are so small they are nearly impossible to detect.

The following section describes common ways that humans can spread AIS through their activities and outlines the prevention measures that can be taken to reduce AIS spread.

Boating and angling

Boats, boat trailers, fishing equipment, waders, and other gear that comes in contact with water can transport AIS from one waterbody to another. Microscopic AIS, such as zebra mussel **veligers** or didymo cells, may be lurking in bait buckets, live wells, or bilges, waiting to be discarded into a new area. Plants tangled around boat motors and trailers can be released into new environments, transforming valuable fishing and boating areas into mangled mats of weeds. Some species may even harm boats and equipment, jam steering equipment, and ruin boat engines.

Follow these guidelines to protect Pennsylvania waterways:

Boaters

- Check for and remove plants, mud, and aquatic life from boat and equipment before transporting.
- Drain water from boat, live well, bilge, and bait bucket thoroughly before transporting.
- Clean boat and gear with hot water* and/or
- Dry everything for at least five days.

Anglers

- Avoid using felt-soled boots.
- Clean waders, hip boots, dip nets, and field gear before transport.
- Drain water from equipment.
- Thoroughly rinse waders, hip boots, and gear with hot water,* OR
- Soak in 2% bleach; or a 5% solution of salt, antiseptic hand cleaner, or dishwashing liquid for 30 minutes, OR
- Dry gear for five days before reuse.

* *Use the highest temperature water possible; 140° F is ideal for killing AIS.*

Diving and swimming

- Check all gear that was in contact with water (including regulators, buoyancy compensators [BCs], wetsuits, masks, snorkels and any other dive gear).
- Thoroughly clean all diving gear, including both the inside and outside of the BC, to ensure that no mud or organic matter is present.
- After cleaning, soak equipment and inside of BC with hot water* or salt water (1/2 cup salt/gallon) for 30 minutes. Because salt can harm equipment, be sure to thoroughly rinse with freshwater after cleaning.
- Allow clothing, gear, and other equipment to dry completely before entering different waters.

Aquarium and water garden animals and plants

Never release unwanted pets or aquarium plants into the environment. If a pet or plant is no longer wanted, or can no longer be cared for, choose from one of the following alternatives:

- Contact a local retailer for proper handling advice or for possible returns.
- Give/trade with another aquarist, pond owner, or water gardener.
- Donate to a local aquarium society, school, or aquatic business.
- Seal aquatic plants in plastic bags and dispose in trash.
- Contact a local pet store, humane society, veterinarian, or other expert for guidance on appropriate and humane disposal options.

In addition, never dump live plants and/or aquatic animals into storm drains. Storm drains lead to rivers, lakes, or wetlands, which are all integral components of a bigger watershed.

For more information, visit habitattitude.net.

Aquatic biologists, monitors, and those working in Pennsylvania's waterways and wetlands

To reduce potential AIS spread, field workers should take the following precautionary measures during activities such as monitoring, collecting, surveying, and fish stocking:

- Inspect and remove aquatic plants, animals, seeds, and mud from boat, trailer, anchors, waders, boots, nets, and all equipment, paying particular attention to cracks and crevices.
- Drain lake or river water from motor or jet drive, bilge, live well, tubs, tanks, and sampling equipment before leaving water access.
- Dispose of unwanted plants, fish, worms, crayfish, snails, or clams in the trash.
- Wash boat, motor, trailer, and personal gear (waders, boots, scuba gear) and field sampling equipment (nets, bottles, ropes, tubs) with high pressure, hot tap water*, OR
- Dry boat, motor, and trailer in the sun for at least five days and equipment for at least 10 days, or freeze for at least two days before reuse.

Visit protectyourwaters.net for more information on AIS prevention.

Reporting & Collecting

Reporting a Sighting

Take the following steps to ensure proper early detection and response for potential new AIS discoveries:

Carry documentation tools to accurately document your finding in the field:

- Digital camera
- A way to identify the latitude/longitude, such as a map of the area or GPS unit
- Notebook and pen for taking notes
- The Pennsylvania AIS Field Guide for assistance in species identification

Gather and document information accurately:

- Note the exact location of the discovery, including latitude and longitude, if possible.
- Make notes about the location, habitat, and environmental conditions of the discovery site.
- Take note of species size and the extent of the area it covers.
- Write down a detailed description of unknown specimen(s).
- Take digital photographs of the unknown specimen(s), as well as the immediate environment. Include key landmarks to assist in finding the site.
- Include commonly known items (coins, eyeglasses, or a camera lens cover, etc.) in the photo for a size comparison.
- Use the Pennsylvania AIS Field Guide to help identify the species.

Verify identification and submit report:

- Fill out as much information as possible in the Pennsylvania Fish and Boat Commission AIS Sighting Report Form: (http://www.fish.state.pa.us/ais-reporting.htm).
- For more information and additional guidance on reporting new AIS infestations in Pennsylvania, refer to the Rapid Response Plan and Procedures for Agencies Responding to Aquatic Invasive Species in Pennsylvania document found on the Pennsylvania Sea Grant website.

Collecting a Specimen*

Only collect a specimen if it is requested by the agency with authority over the AIS in question. When a sample specimen is needed to assist in identification, it is important to **keep the specimen secure to avoid spreading the collected species, or any organisms that might be attached to it.** Please keep a record with the specimen of the location and date that it was collected. Beware that animal specimens may carry disease organisms. Use appropriate prophylactic measures (gloves, handling with forceps, etc.).

** Please note: It is currently illegal to possess or transport certain aquatic invasive species in Pennsylvania. Please review the Pennsylvania Fish and Boat Commission's list of regulated species before handling or transporting (http://fishandboat.com/ais.htm).*

Collecting specimens:

Aquatic and terrestrial plants:

- Specimens should include the stem with intact leaves, and if available, intact flowers and/or **fruits** and roots.
- Be very careful when collecting a plant specimen, as **fragmentation** could result in spreading the plant to other areas.
- Wash the plant in clean water to remove all debris; do not allow the plant to dry out, and keep cool if possible.
- Use care when handling, as some plants may cause skin and other ailments.

Invertebrates (shellfish, worms, or insects):

- Store specimens in a closed vial or jar with enough rubbing alcohol to keep the tissues moist.

Vertebrates (fish):

- Seal securely in double plastic bags and freeze.

Mailing specimens:

When an outside source is needed for identification, refer to the following guidelines for mailing:

Plants:

- Place the plant in a water-tight plastic bag (such as a Ziploc bag) with enough water to cushion the plant and keep it wet.
- Place the tightly sealed bag in a small box with newspaper packing. Padded envelopes do not work well.

Invertebrates:

- Package the specimen securely in a small box with plenty of packing materials to ensure the jars are not broken.

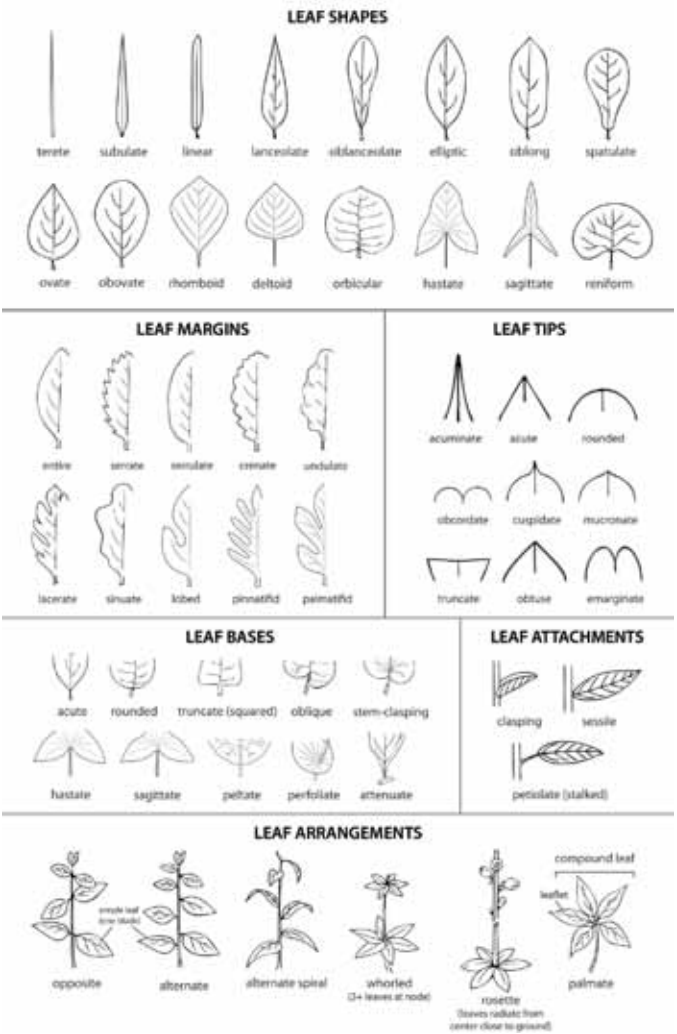
Vertebrates:

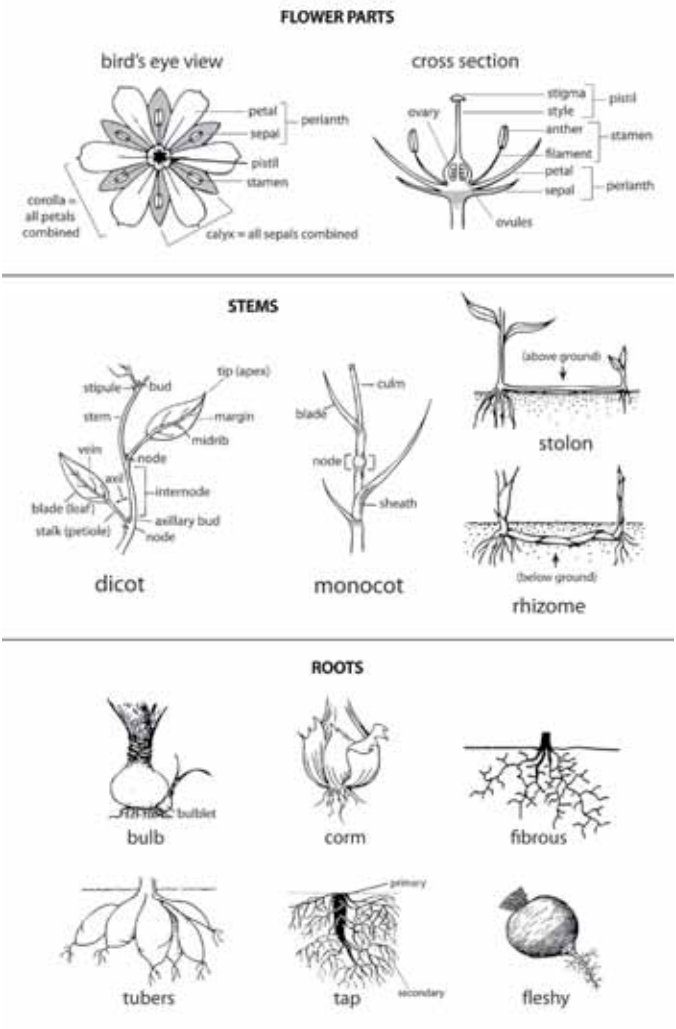
- The United States Postal Service has specific standards and requirements regarding the shipment of hazardous materials such as formalin and dry ice. If shipment to a taxonomic expert is necessary for identification, work with the recipient and the postal service to determine the best and safest method for shipping the specimen.

BE SURE TO PROVIDE CONTACT INFORMATION

Always include a copy of your name, address, E-mail address, telephone number, and a copy of the notes you made when collecting the specimen in the mailed package.

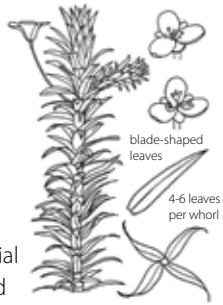
Plant Structure




FLOWER PARTS
bird's eye view
petal
sepal
perianth
pistil
stamen
corolla = all petals combined
calyx = all sepals combined
cross section
stigma
style
pistil
ovary
anther
filament
stamen
petal
sepal
perianth
ovules
STEMS
tip (apex)
stipule
bud
stem
margin
midrib
vein
node
axil
internode
blade (leaf)
axillary bud
stalk (petiole)
node
dicot
culm
blade
node
sheath
monocot
(above ground)
stolon
(below ground)
rhizome
ROOTS
bulb
corm
fibrous
tubers
primary
tap
secondary
fleshy

Brazilian Elodea

Egeria densa



Species at a Glance

Brazilian elodea is a **submerged** aquatic perennial that can reach lengths of 3 m (10 ft) or more, and can survive either rooted or free-floating in depths of up to 6.1 m (20 ft). Because of its showy flowers and oxygen generating capabilities, it is widely used as an aquarium plant and is still sold today under its alias "Anacharis". All introductions in the United States appear to be male plants.

Identification

Leaves: Bright to dark green; densely arranged in **whorls** of 4-6 leaves per **node** (note: some lower leaves may occasionally occur in **opposite** pairs or in **whorls** of three leaves). The leaves are robust and blade shaped, 1-3 cm (0.4-1.2 in) long and 5 mm (0.2 in) wide. Leaf **margins** are very finely toothed (visible only with magnification).

Flowers: Large, showy flowers with three white petals, a yellow center, and three green **sepals** emerge above or at the surface on slender **stalks** projecting from leaf **axils** near the stem tips.

Stems/Roots: Form irregularly along the stems in areas where two **whorls** appear to be joined (known as double **nodes**).

Similar Species

Brazilian elodea may be confused with the invasive plant *Hydrilla verticillata* and the native plant American elodea *(Elodea canadensis)*. Unlike Hydrilla, Brazilian elodea does not have rough teeth on the underside of the leaves and does not produce **tubers**. American elodea has 2-3 leaves per **whorl**, which are smaller; usually less than an inch. They also differ significantly by their flowers, with Brazilian elodea being the only one of these species to produce large, attractive white flowers with three petals.

Habitat

In its native range, Brazilian elodea lives in slow-moving and shallow waters. In its invasive range, it can be found in lakes, ponds, sluggish rivers, and streams. It grows best in enriched, somewhat acidic lakes, and prefers substrates of sand, mud, or stone.

Spread

In the past, spread was mostly by aquarium owner and water gardener releases. Since all plants in the United States are male, they can only reproduce **vegetatively** by plant fragments, which can attach to recreational boats, trailers, and equipment and spread to new water bodies. Once established, it has the ability to cover 100 acres of water per year.

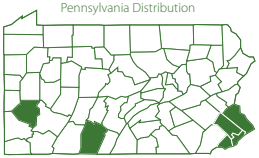
Distribution

Brazilian elodea is native to South America, specifically Brazil and coastal regions of Argentina and Uruguay. It is found to be invasive in several states in the U.S., and in Pennsylvania can be found in the southeast region in Bucks, Montgomery, Delaware, and Philadelphia counties as well as in Allegheny and Bedford counties.

Environmental Impacts

Brazilian elodea grows rapidly (up to 30 cm [11.8 in] in length per day in ideal conditions) and forms mats at the water's surface. These mats crowd out native species, impede aquatic recreational activities such as boating and fishing, destroy water quality, and make poor habitat for fish. Fragmented pieces can also clog water intake pipes.

Pennsylvania Distribution



United States Distribution

Curly-leaf Pondweed

Potamogeton crispus

Species at a Glance

Curly-leaf pondweed is an invasive aquatic perennial that can grow off-shore in depths of up to 4.6 m (15 ft). It has a unique ability to form new plants under the ice in winter, making it one of the first nuisance plants to emerge in the spring.

Identification

Leaves: Submerged, oblong, slightly translucent, olive-green to reddish-brown leaves have rounded tips, narrowing towards the base. They are **alternately** arranged and directly attached to the stem. They are 4-10 cm (1.6-4 in) long and 5-10 mm (0.2-0.4 in) wide, with distinct wavy and finely toothed edges that resemble lasagna noodles.

Flowers: Small and tightly arranged flowers at the end of a slender, sometimes curved **stalk** appear above the water's surface from June through September.

Fruit/Seeds: Have a prominent cone-shaped beak and a bumpy crown-like ridge.

Stems/Roots: Slightly flat, reddish-brown stems grow from 0.3-0.9 m (1-3 ft) long and emerge from slender **rhizomes**, often branching as they grow, giving it a bushy appearance.

Similar Species

This species may be confused with other pondweeds; many of which have both **emergent** and **submerged** leaves. Curly-leaf pondweed has only **submerged** leaves. Other pondweeds also lack the tiny but visible serrations along the edges of the leaves.

Habitat

Curly-leaf pondweed prefers soft substrates and shallow water depths in alkaline and high nutrient waters. It tolerates still or flowing water, and is able to survive in low light conditions and water temperatures. It can grow in shaded, polluted, disturbed, or **turbid** waters where many native plants cannot.

Spread

Burr-like winter buds called **turions**, which move around with water flow, spread this plant **vegetatively**. Plants can also reproduce by seeds and can be spread by waterfowl that ingest them. Recreational activities such as boating and fishing, and intentional plantings for wildlife habitat also aid in its spread.

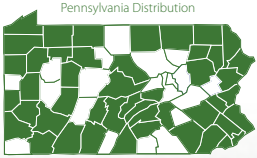
Distribution

Native to Eurasia, Africa and Australia, curly-leaf pondweed was introduced into U.S. waters by hobbyists who used it as an aquarium plant. It has since spread to all states and is widespread in Pennsylvania.

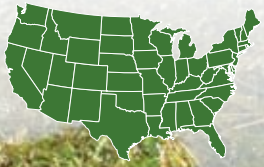
Environmental Impacts

Curly-leaf pondweed's tolerance of low light and temperature conditions allows it to grow sooner than native plants in the spring. It forms dense surface mats that can impede recreational activities such as boating, swimming, and fishing. When it dies off in mid-summer, it may create anoxic conditions, and increase nutrient content that can cause harmful algal blooms.

Pennsylvania Distribution



United States Distribution



Eurasian Watermilfoil

Myriophyllum spicatum

Species at a Glance

Eurasian watermilfoil is a feathery **submerged** aquatic plant that was once commonly sold as an aquarium plant. Generally found in water less than 6.1 m (20 ft) deep, it quickly forms thick, damaging mats that are causing harm in shallow areas of rivers and lakes throughout North America.

Identification

Leaves: Feathery **whorls** of 3-6 leaves (four leaves per **whorl** is common) are openly spaced along the stem, with 1-3 cm (0.3-1.2 in) between **nodes**. Leaves are threadlike, uniform in diameter, and have 12-24 pairs of **leaflets**. They are aggregated into a **submersed terminal spike**, and tips of leaves often have a blunt, snipped-off appearance. Note that the occasional Eurasian watermilfoil leaf may have as few as five **leaflet** pairs. For this reason it is always advised to count **leaflet** pairs on several leaves, taken from various points along the stem.

Flowers: Tiny **whorls** of flowers are located on floral **bracts** atop slender **spikes** that rise above the water's surface. Flowers either have four petals or are without petals.

Fruit/Seeds: Hard segmented capsules contain four seeds.

Stems/Roots: Slender stems, which often curve to lie on top of the water's surface, begin to thicken before blooming and double their width further down.

Similar Species

Without **fruits** or flowers, Eurasian watermilfoil may be confused with the native northern milfoil *(Myriophyllum sibiricum)* and coontail *(Ceratophyllum demersum)*. It may also be confused with other leafy aquatic species including bladderworts, hornworts, mermaid weeds, and water crowfoots, which generally have fewer than 14 **leaflet** pairs. Counting **leaflets** can provide helpful identification clues.

Habitat

This extremely adaptable plant can thrive in a variety of conditions. It grows in a wide temperature range in still to flowing waters, and even survives under ice. It grows best in fertile, fine-textured sediments and high light conditions, and prefers nutrient-rich lakes, but readily inhabits disturbed lakebeds.

Spread

Does not rely on seeds for reproduction, but instead reproduces by **fragmentation**. Plant fragments break off and float via water currents, allowing it to disperse long distances and hitchhike on boats, boat trailers, motors, and fishing equipment.

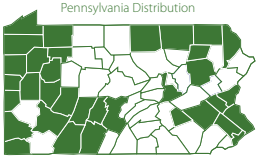
Distribution

Native to Europe, Asia, and northern Africa, Eurasian watermilfoil was first discovered in the eastern United States in the 1940s, but may have arrived as early as the late 1800s. It is now established in nearly every U.S. state and at least three Canadian provinces. It is common in lakes, ponds, and rivers in all regions of Pennsylvania.

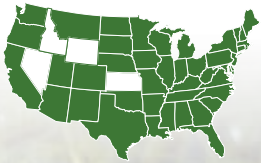
Environmental Impacts

Eurasian watermilfoil forms thick mats that can interfere with swimming, fishing, waterfowl hunting, and boating, as plant fragments become wrapped around propellers. Fish and wildlife are also impacted because nutrient-rich native plants are displaced, and the economy is impacted as these infestations reduce local property values.

Pennsylvania Distribution

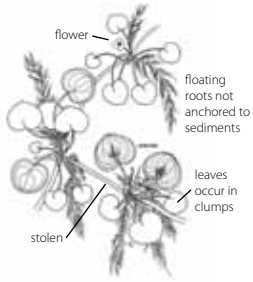


United States Distribution



European Frog-bit

Hydrocharis morsus-ranae



Species at a Glance

European frog-bit is an herbaceous aquatic plant that resembles a miniature water lily. It has been found in the Great Lakes since the 1930s, but is now spreading inland into streams and lakes within the basin.

Identification

Leaves: Small, thick, heart-shaped, and leathery leaves 1.5-6.5 cm (0.6-2.6 in) long occur in clumps and are not anchored to the bottom sediment. They have smooth edges resembling those of a miniature water lily. A dark purplish-red spongy coating is present on the underside of the leaves, allowing it to float on the water's surface.

Flowers: Small, white, and showy flowers are about 1 cm (0.4 in) in length. Each flower has three petals and a yellow center which show up in early summer. Plants are unisexual and therefore seldom produce seeds.

Stems/Roots: Stem-like extensions called **stolons** run from the center of the plant to produce juvenile plants. These **stolons** also produce **turions** (vegetative winter buds) that break free and sink to the water bottom to lie dormant for the winter. Numerous free-floating, unbranched roots grow up to 30.5 cm (12 in) in length. Plants form thick mats with tangled roots and **runners**.

Similar Species

While it is often mistaken for water lily species, European frog-bit leaves are distinctly heart-shaped, leathery, and usually smaller. Water lily flowers are much larger, with more than three petals. It may also be confused with American frog-bit, little floating heart, spatterdock, and watershield.

Habitat

Prefers quiet, still, calcium-rich areas such as marshes, fens, swamps, backwaters, bays, sheltered coves, slow-moving shorelines of rivers, streams and lakes, and poorly drained ditches.

Spread

European frog-bit can spread to new areas by plant fragments, or by **turions**, which float to the surface and begin to grow in the spring. A single plant can produce 100 to 150 **turions** in one season. It can also hitchhike on boats, trailers, waterfowl, and flowing currents, and may also be spread deliberately by humans that purchase it as an aquarium plant for water gardens.

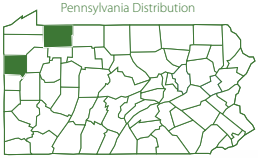
Distribution

Native to Europe and northern Asia, but introduced intentionally in the United States as a commercial ornamental, European frog-bit escaped cultivation and spread to the Canadian shorelines of Lake Erie, Lake Ontario, the St. Lawrence River in New York, and Lake Champlain in Vermont. Populations are also present in Michigan, New Jersey, and Washington. This species was first confirmed in Pennsylvania in Warren county in 2013, but has also been found in Mercer county.

Environmental Impacts

European frog-bit populations increase rapidly, forming dense mats that decrease the amount of nutrients, dissolved oxygen, and light penetration into the water, limiting the growth of any native vegetation beneath. These mats can also inhibit the movement of waterfowl and fish, and limit recreational activities; however, it can serve as a food source for some types of water birds, fish, and insects.

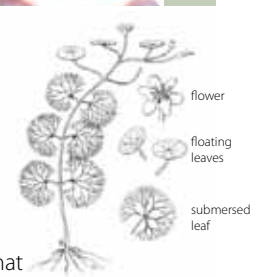
Pennsylvania Distribution



United States Distribution

Fanwort

Cabomba caroliniana



Species at a Glance

Fanwort is a **submersed** freshwater perennial that can often be found rooted or floating. Stems may reach lengths of up to 6m (20 ft). It is persistent, aggressive, and competitive, bringing with it the potential to take over Pennsylvania's waterways.

Identification

Leaves: Two types of leaves include **submersed** and floating. **Submersed** leaves are delicate, fan-shaped, and usually green in color, averaging 5 cm (2 in) in diameter. They are finely divided and arranged in **opposite** pairs along the stem. Floating leaves, which are not always present, are narrow, small (less than 1.3 cm [0.5 in]), oval to diamond in shape, and arranged in an **alternating** pattern.

Flowers: Small white, pink, or purple flowers with a diameter less than 1.3 cm (0.5 in) grow from the tips of the stems and float on the water's surface.

Stems/Roots: Usually green in color ranging from grass to olive green and sometimes reddish brown. Shoots are upturned extensions of the horizontal **rhizomes** and may reach lengths of up to 6m (20 ft).

Similar Species

Fanwort is often confused with other leafy milfoils, Beck's water-marigold *(Megalodonta beckii)*, some bladderworts, hornworts, mermaid weeds, and water crowfoots. The leaves of watermilfoils are **whorled**, and the plants have small flowers growing from where the leaves meet the stem. Beck's water-marigold has yellow, **composite flowers** and **sessile** leaves, while fanwort has white flowers and slender leaves. Water marigold also has **opposite** leaves that attach directly to the stem with no **petiole** between the leaf and stem.

Habitat

This very hardy plant is usually found rooted in muddy areas of slow moving waters such as streams, small rivers, lakes, and ponds. It can establish in a wide variety of environments and tolerate a wide range of temperatures, allowing it to overwinter in frozen lakes.

Spread

Fanwort is thought to have spread from intentional and unintentional release in the aquarium trade. Its fragile stems break off easily, and most pieces can re-sprout and grow into new plants.

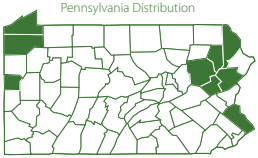
Distribution

Native to the sub-tropic areas of North and South America, and Gulf of Mexico regions of the United States, fanwort has been introduced to regions in the Northeast and the Pacific Northwest. It is present in both the eastern and western counties of Pennsylvania.

Environmental Impacts

Fanwort is highly competitive and persistent, forming dense mats at the water's surface that block sunlight into the water column, negatively impacting native plant species, biodiversity, and water quality. It can also clog waterways, impacting recreational activities such as boating, fishing, and swimming.

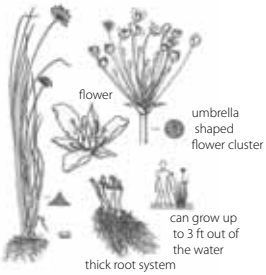
Pennsylvania Distribution



United States Distribution

Flowering Rush

Butomus umbellatus



Species at a Glance

Flowering rush is a perennial aquatic herb that can grow both as an **emergent** plant along shorelines and a **submersed** plant in lakes and rivers. It often goes fairly unnoticed among other wetland plants until it blooms a distinctive spray of attractive flowers in late summer and early fall.

Identification

Leaves: Emergent leaves are stiff, narrow, green, and can grow up to 0.9 m (3 ft) above the water's surface. Leaf tips may be spirally twisted. **Submersed** leaves are limp under water and do not flower.

Flowers: Grow in umbrella-shaped clusters on a long **stalk,** with each flower made up of three petals, three **sepals,** and red **anthers**. Flowers are approximately 2.5 cm (1 in) across and are typically white, pink, or purple in color. Flowering occurs in late summer to early fall, and only occurs on **emergent** plants.

Fruit/Seeds: Pistils ripen into a dark brown **fruit** filled with tiny seeds.

Stems/Roots: Green stems are triangular in cross section. The extensive root system is a thick, **creeping rhizome**. **Bulblets** that form on the **rhizome** can easily break off when disturbed and form a new plant.

Similar Species

Leaves of flowering rush resemble bur-reed *(Sparganium spp)*, another shallow water plant; however the leaves of the bur-reed are V-shaped, and its female flowers appear as small spiked balls. Bur-reed grows 0.3-1.2 m (1-4 ft) tall.

Habitat

Flowering rush prefers shallow and slow moving waters but will inhabit deeper waters. It grows well in riparian zones, watercourses, and wetlands such as ditches, marshes, lakes, or streams. It cannot grow in shade and requires wet soil.

Spread

Once in a watershed, flowering rush spreads locally by underground **rhizomes**, root pieces, and seeds. Wildlife, water movement (water or ice), anglers, and boaters can carry this plant to new areas. Its use as a water garden plant could have also contributed to its spread over long distances.

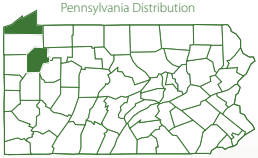
Distribution

Native to Europe and Asia, flowering rush was brought to North America as a garden plant. It is present in states along the U.S./Canadian border, extending north to the tip of Quebec, and south to Illinois. In Pennsylvania, the flowering rush is present in Erie and Venango counties.

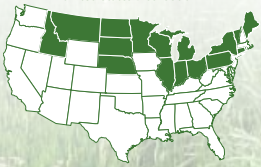
Environmental Impacts

Flowering rush can easily crowd out native species. The large amount of underground **rhizomes** can harm fish and other wildlife by destroying food sources and habitats. It can also interfere with recreational activities such as swimming and boating.

Pennsylvania Distribution



United States Distribution



Hydrilla

Hydrilla verticillata

Species at a Glance

Hydrilla is a **submerged** aquatic perennial that could be considered nature's "perfect weed." It comes in two forms, **dioecious** and **monoecious**. Both forms grow and spread at a very fast rate, covering the surface of water bodies and restricting boating, fishing, swimming, and other recreational uses.

Identification

Leaves: While morphological characteristics can vary, leaves are typically strap-like and pointed, with small sharp teeth on the edges that are difficult to see with the naked eye. Spines or conical bumps are sometimes found on the **mid-rib** on the underside of the leaf; however, these are not always present. The underside of the **mid-rib** can also be red. They are generally 2-4 mm (0.08-0.2 in) wide, 6-20 mm (0.2-0.8 in) long, and occur in **whorls** of 3-8.

Flowers: Small (10-50 mm [0.4-2 in] long), white flowers which float on the water's surface are attached at the leaf **axils** and are clustered towards the tips of the stems.

Stems/Roots: Long and branching stems form intertwined mats at the water's surface. Plants are usually rooted to the lake bottom, growing upward from the substrate in water up to 3.7 m (12 ft) deep. During the late growing season, small white **tubers**, which are used for food storage, are formed on the plants root's, allowing it to overwinter.

Similar Species

Hydrilla closely resembles Brazilian elodea *(Egeria densa)* and North American elodea *(Elodea canadensis)*. Brazilian elodea typically has **whorls** of 3-6 leaves, is usually 2-3 cm (0.8-1.2 in) long, and has minute teeth on the **margins** with no conical bumps on the **mid-rib** below. The native North American elodea has leaves that occur in **whorls** of three and is usually a much smaller plant. Neither North American nor Brazilian elodea produces the **tubers** or **turions** found on Hydrilla.

Habitat

Hydrilla grows in a wide variety of still and flowing water, including freshwater lakes, ponds, rivers, impoundments and canals. It tolerates a wide range of pH, nutrient, and light levels and is somewhat winter-hardy, but optimum temperature for growth is 20-27°C (68-81°F).

Spread

Because Hydrilla reproduces primarily **vegetatively**, even the smallest living plant fragment can float downstream and form a new plant. While it was imported to the United States as an aquarium plant, recreational activities now help it spread.

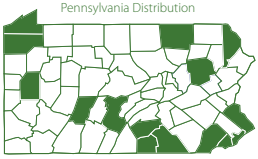
Distribution

While it is unknown where Hydrilla originated, possible native ranges include Asia, Africa, and Australia. It continues to spread and is listed as a federal noxious weed in the United States. While the **dioecious** form appears to spread from South Carolina south, the **monoecious** form is spreading both north and south and is typically the form found north of North Carolina. In Pennsylvania, it was first reported in Adams and Bradford counties, but has since spread to several other areas including the Schuylkill River in Philadelphia, Highland Lake in Bradford County, Pymatuning Reservoir in Crawford County, and Lake Nockamixon in Bucks County among others.

Environmental Impacts

Hydrilla's dense thick mats interfere with commercial activities by clogging water intake pipes and filters and hindering irrigation. It also restricts recreational uses and prevents sunlight from reaching other species growing beneath it. As the mats die and decay, bacteria deplete oxygen from the water, impacting fish and other aquatic organisms.

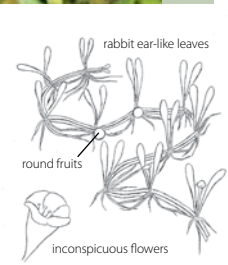
Pennsylvania Distribution



United States Distribution

Mudmat

Glossostigma cleistanthum



Species at a Glance

Mudmat is a low-growing, mat-forming, aquatic invasive plant that has remained largely under the radar due to its small size and the public's lack of familiarity with it. The plant itself is usually less than 2 cm (0.8 in) high and can be found **submerged** in the water or emerging above the water's surface.

Identification

Leaves: Bright green paired leaves resemble tiny rabbit ears. They are narrow, about 1- 4 cm (0.4-1.6 in) in length and are slightly expanded at the tip; they taper to the base and may be **sessile** or **stalked**. Leaf **margins** are smooth.

Flowers: Small, 1-3 mm (0.04-0.1 in) wide flowers are inconspicuous in leaf **axils** at the base of the plant. They emerge when the water recedes in the summer months. Color ranges from mauve, lilac, blue, and bluish-white to white, although Pennsylvania populations are usually pinkish. Closed, self- fertilizing flowers called **cleistogams** are also produced underwater in the soil among the roots.

Fruit/Seeds: Round, thin-walled capsules are divided into two cavities that contain many small, dark brown seeds.

Stems/Roots: Creep horizontally just below the soil surface and root along the **nodes**.

Similar Species

Native mudwort species *(Limosella spp.)* closely resemble mudmat. It may also be confused with **emergent** leaf forms of some members of the bladderworts *(Utricularia spp.)*.

Habitat

Mudmat prefers conditions with low pH, conductivity, and phosphorous in shallow waters, swamps, and periodically flooded areas with little wave action.

Spread

Initial introduction of mudmat probably occurred by aquarium release, and its subsequent spread may have been mediated by both human activities, such as recreational boating, and by natural means, such as hitchhiking on migrating geese or other waterfowl.

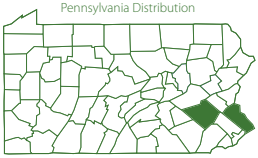
Distribution

Native to Australia, New Zealand, India, and east Africa, mudmat was discovered in the United States in 1992 at a single location in southern Connecticut. In Pennsylvania, mudmat has been found only in Bucks and Berks counties; however, because of its small size, it may have a wider distribution than what is currently known.

Environmental Impacts

Mudmat forms thick carpet-like mats that smother the lake bottom from the shoreline to depths of greater than 2 m (6.6 ft). It spreads very rapidly, covering prime shoreline habitat, reducing biodiversity, and threatening native plant and animal communities.

Pennsylvania Distribution



United States Distribution

Narrowleaf & Hybrid Cattails

Typha angustifolia, Typha x glauca

Species at a Glance

Cattails are aquatic perennials that grow in wetland areas and produce distinct velvety brown **spikes** of flowers. The two most widespread species in the United States are the native common cattail, also called the broadleaf cattail *(Typha latifolia)* and the non-native narrowleaf cattail *(Typha angustifolia)*. The hybrid cattail is produced when these two species cross, giving it characteristics of both species.

Identification

Leaves: Long, narrow (5-15 mm [0.2-0.6 in]), flat leaves originate at the base of the stem from each shoot and spread outward as they rise into the air, reaching 0.9-1.8 m (3-6 ft) in height.

Flowers: Dense, fuzzy, cylindrical **spikes** are located at the end of the stem. The flower is divided into two distinct male and female flowers, separated by a 3-10 cm (1.2-3.9 in) gap. Lighter brown male flowers (**staminate**) are located above the female (**pistillate**) flowers, which are often green during bloom, turning dark brown during seed maturation.

Fruit/Seeds: Cigar-shaped **fruits** about 5-15 cm (2-5.9 in) long contain soft, downy seeds about 1 mm (0.04 in) in size.

Stems/Roots: The flowering **stalks** are light green, stiff, round in cross-section, and grow up to 3 m (10 ft) tall.

Similar Species

Both the narrowleaf and hybrid cattails can be easily confused with the native common cattail. However, the common cattail has both male and female flower types directly next to each other, whereas the invasive cattails have a clear separation of male and female flowers, and the leaves are narrower, deeper green, and typically extend beyond the **spike**.

Habitat

Stands of non-native cattail can be found in a wide variety of wetland habitats, including marshes, lakeshores, river backwaters, and roadside ditches. This prolific plant can grow in disturbed areas, as well as brackish and polluted waters of depths nearing 0.9 m (3 ft).

Spread

The flower head of the parent plant can produce 250,000 seeds, which can remain viable for up to 100 years, waiting for the right amount of water and sunlight to germinate. Seeds are dispersed by wind, and once established, additional spread occurs through an extensive underground root system.

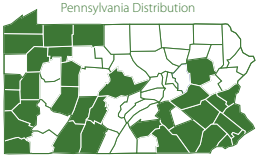
Distribution

Narrowleaf cattails are believed to have originated from the dry ballast of European ships on the Atlantic seaboard. The hybrid cattail may occur wherever both the native and the narrow-leaved species are present. These plants have spread throughout the United States, and all three cattail species are currently found in Pennsylvania.

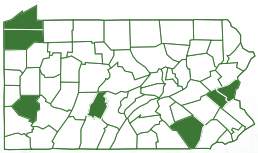
Environmental Impacts

Cattails grow in dense monocultures that can dominate shorelines near open water areas, eliminating habitat and replacing native plants important for waterfowl and wildlife. They are also thought to be **allelopathic**, meaning they produce chemicals which prevent the growth of other plant species.

Pennsylvania Distribution

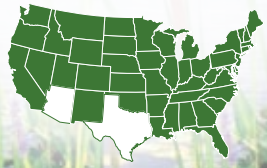


Typha angustifolia



Typha x glauca

United States Distribution



Parrot Feather

Myriophyllum aquaticum

Species at a Glance

Parrot feather, also called Brazilian watermilfoil, is an herbaceous aquatic perennial and member of the watermilfoil family. It gets its name from its bright green feather-like leaves, which are **whorled** around the stem and can form thick suffocating mats.

Identification

Leaves: Emergent leaves are robust, vibrant green, feathery, and covered with a waxy coating. They are arranged around the stem in **whorls** of 4-6 and are 2.5-5 cm (1-2 in) long with 10-18 **leaflet** pairs. Leaves become more closely arranged toward the growing tips of the plant. Limp **submerged** leaves are brownish to reddish, often appearing deteriorated. They are 1.5-3.5 cm (0.6-1.4 in) long with 20-30 divisions per leaf.

Flowers: Small (1.5 mm [0.06 in]), white-pinkish flowers appear between leaf **axils** of female plants in the spring. Only female plants have been found in North America.

Stems/Roots: Long unbranched stems reach heights of 30 cm (12 in) above the water surface. When attached to a bank, they can extend out several yards over the water surface.

Similar Species

A close relative, Eurasian watermilfoil (*Myriophyllum spicatum)*, is easily mistaken for the **submerged** leaves of parrot feather. Other look-a-likes include bladderworts, hornworts, mermaid weeds, water crowfoots, and other leafy milfoils. The **emergent** stems and leaves are the most distinct characteristics of parrot feather, as they can grow up to a foot above the water surface and resemble small fir trees.

Habitat

Parrot feather is hardy but prefers shallow, nutrient-rich, and slow-moving waters. It is most common in shallow water as a rooted plant but can also be found as a floating plant in deeper, nutrient-enriched lakes.

Spread

Since all parrot feather plants in the United States are female, they spread exclusively by **fragmentation**. Therefore, human activities such as water gardening, boating, and fishing, can easily spread fragments to new locations where they can grow into new plants.

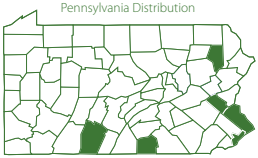
Distribution

Native to South America in the Amazon River, parrot feather was introduced as a garden plant in the 1800s and has since spread throughout the United States. It is found in the south central region of Pennsylvania in Bedford and Adams counties, and in eastern Pennsylvania in Lackawanna, Lehigh, Bucks, Philadelphia, and Delaware counties.

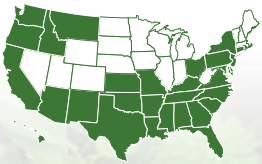
Environmental Impacts

Parrot feather forms thick mats that can shade out native plant and algae species, impact water flow, clog recreational waterways and irrigation canals, and alter the physical and chemical characteristics of lakes and streams.

Pennsylvania Distribution



United States Distribution



Variable-leaf Milfoil

Myriophyllum heterophyllum

Species at a Glance

Variable-leaf milfoil, also called broadleaf watermilfoil or two-leaf milfoil, is a **submerged** perennial aquatic herb that is usually found rooted in up to 1.8 m (6 ft) of water. It gets its name from its two noticeably different forms of **submerged** and **emergent** leaves.

Identification

Leaves: Submerged leaves, usually 2-6 cm (0.8-2.4 in) in length, are finely dissected into 7-11 thread-like **leaflets**, which are arranged in very dense **whorls** of 4-5, giving it a bottlebrush appearance. In general, there is less than 5 mm (0.2 in) between **whorls**. Color ranges from reddish to greenish-brown. **Emergent** leaves that may not appear until late summer are bright green, oval, narrow (0.6 cm [0.2 in] wide), and stand 15-20 cm (6-7.9 in) out of the water.

Flowers: Emergent flower **spikes** are 5-30 cm (2-12 in) long with **whorls** of four flowers each. Petals are small, measuring less than 3 mm (0.1 in), and emerge on green to reddish **stalks** from June to September.

Fruit/Seeds: Small and almost perfectly round **fruits** have four chambers and a rough surface.

Stems/Roots: Stout, usually dark red to reddish-brown stems measure up to 3 mm (0.1 in) in diameter and 100 cm (39 in) in length.

Similar Species

Take caution because all milfoil species display a wide vegetative variability. Variable-leaf milfoil may be confused with parrotfeather *(Myriophyllum aquaticum)* and Eurasian watermilfoil *(Myriophyllum spicatum)*; however, neither species has winter buds and they generally have a greater distance between **whorls** (1 cm [0.4 in] or greater).

Habitat

This extremely well-adapted plant can thrive in freshwater ponds, lakes, ditches, and other still or flowing aquatic systems, and even survives under ice.

Spread

Reproduction is primarily through vegetative fragments, which can hitchhike on boats, trailers, and fishing equipment. It may also reproduce via seed production, but probably to a lesser extent.

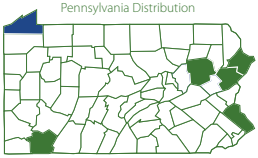
Distribution

While native to the southeastern United States, variable-leaf milfoil has become invasive in most of the northeast. In Pennsylvania, it is considered native and endangered in Erie County, but shows invasive tendencies in lakes and impoundments in Fayette, Monroe, and Bucks counties.

Environmental Impacts

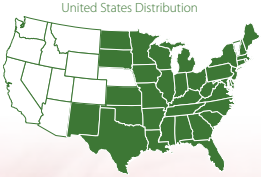
Variable-leaf milfoil can alter ecosystems by forming dense mats that shade out native aquatic plants, inhibit water flow, and impede recreational activities.

Pennsylvania Distribution



Blue - Native Green - Invasive

United States Distribution



Water Chestnut

Trapa natans

Species at a Glance

Water chestnut is a rooted aquatic plant, very different from the one you find in Chinese take-out. It can dominate ponds, shallow lakes, and rivers because it grows in thick, dense colonies and can grow as much as 4.8 m (16 ft) in length.

Identification

Leaves: Come in two distinct forms: floating and **submersed**. Floating leaves are triangular or fan-shaped with noticeably toothed **margins** on the outer edges. They are roughly 1-3 cm (0.4-1.2 in) long and are arranged in large floating **rosettes**. The upper leaf surface is glossy, while the underside is covered with soft hairs. These leaves are kept afloat by spongy, inflated bladders attached to long stems called **petioles** (up to 15 cm [5.9 in]), which connect the leaves to the **submersed** section of the plant. The **submersed** leaves are green and feathery and **whorl** around the cord-like stem.

Flowers: Small flowers, about 1 cm (0.4 in) long, with four white petals are located in the center of the leafy **rosette**, and usually appear in mid to late July.

Fruit/Seeds: Black **nut**-like structures have four spiny projections that are so sharp they are capable of penetrating shoe leather.

Stems/Roots: Numerous finely branched roots develop along the lower stem, which assist in anchoring the plant to the substrate.

Similar Species

None.

Habitat

Water chestnut can grow in any freshwater setting, but prefers nutrient rich waters less than 4.8 m (16 ft) deep in ponds, lakes, slow moving streams, and rivers.

Spread

Water chestnut has a high reproductive rate, with each plant producing up to 15 **nuts** per season. Each **nut** can sink to the bottom and remain viable for up to 12 years. It can also spread **vegetatively** when the **rosettes** of floating leaves break apart and fragments attach to boats and trailers, or float to new locations.

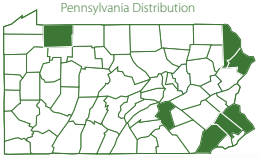
Distribution

Native range includes Europe, Asia, and Africa. When water chestnut was brought to the United States by water gardeners in the 1800s, it quickly established, and was first observed in Massachusetts. It has since spread to the waters of Maryland, New York, and eastern Pennsylvania, where it is most common in the upper Delaware River. Populations are also established in Bucks, Pike, Warren, and Dauphin counties.

Environmental Impacts

The dense floating mats of water chestnut can choke a water body, limiting light and oxygen, and impede boating and other recreational activities. Colonies of this plant can outcompete native organisms for nutrients and space, and they offer little nutritional value for wildlife.

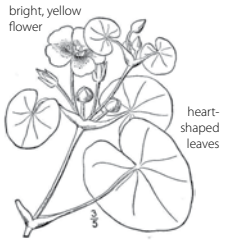
Pennsylvania Distribution



United States Distribution

Yellow Floating Heart

Nymphoides peltata



Species at a Glance

This aggressive aquatic perennial was introduced as a garden ornamental from eastern Asia and has since spread throughout the United States and Canada. It forms dense mats of vegetation in the water that exclude native species and alter the ecology of waterways.

Identification

Leaves: Shiny, green, heart-shaped or nearly circular leaves 5-15 cm (2-6 in) long are set on **stalks** that float at the water's surface. Leaves are frequently seen with reddish-purple blotches and are slightly wavy or rippled. They are **alternately** arranged along the main stem, and **oppositely** arranged on the flower stems.

Flowers: Occur from June to October and are produced on **stalks** just above the water's surface. They can be either solitary or in clusters of up to five, with five yellow petals that have distinctive fringed edges, as well as five **sepals** and five **stamens**.

Seeds: Inch long **fruit** capsules contain numerous flat, oval seeds with "hairy" edges. When ripe, they split open, releasing the seeds to float on the surface of the water.

Roots: Bottom-rooted with long branched stems that reach about 1 m (3 ft) or more.

Similar Species

Yellow floating heart may be confused with the native spatterdock *(Nuphar variegata)* or watershield *(Brasenia schreberi)*. Spatterdock has larger leaves that grow 30 cm (12 in) or more and has yellow flowers in the shape of a ball with six or more petals. Watershield has distinctive olive-shaped leaves, an inconspicuous purple flower, and can be easily recognized by a gelatinous slime that covers the stem and underside of the leaves.

Habitat

Most commonly found in slow moving waters about 0.5-4 m (1.5-13 ft) deep, such as rivers, lakes, reservoirs, ponds, and swamps, and can even grow on damp mud.

Spread

Because of its popularity in the aquarium trade, yellow floating heart can be easily purchased on the internet. Spread can occur when it escapes outdoor water gardens during flooding events, or when it is intentionally discarded into waterways. Since it spreads both by seed and **fragmentation**, pieces of plant and stiff seed hairs can be moved to new areas on water currents, or as they hitchhike on the feathers or fur of waterfowl and other wildlife.

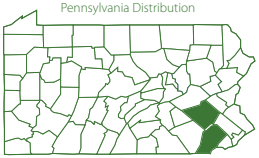
Distribution

Native to Eurasia and the Mediterranean region, yellow floating heart was first recorded in Pennsylvania in Berks County in 1905. It has since become naturalized at additional sites, primarily in the southeastern corner of the state.

Environmental Impacts

Yellow floating heart grows in dense patches that negatively impact wildlife habitats by outcompeting ecologically important native plants, and creating stagnant areas of low oxygen under the mats. These mats also make recreational opportunities such as angling, boating, swimming and padding difficult.

Pennsylvania Distribution



United States Distribution

Yellow Iris

Iris pseudacorus

Species at a Glance

This exotic member of the iris family, also called the yellow flag, is commonly found in wetlands in many regions of the United States. It is an **emergent** aquatic perennial with showy yellow petals that can grow on average 0.3-0.9 m (1- 3 ft) tall, although some can reach up to 2.1 m (7 ft).

Identification

Leaves: Long, broad, flattened, and sword-shaped; usually dark green in color, pointed at the ends and overlapped at the base. Can grow up to 2.5 cm (1 in) wide.

Flowers: There are usually 2-3 flowers on each **stalk** that have bright yellow to cream-colored petals with **sepals** outlined in purple and brown. They are 8 -10 cm (3.1-3.9 in) in diameter and bloom June through August.

Fruit/Seeds: Numerous smooth, flattened seeds grow in small oblong shaped capsules, roughly 5 cm (2 in) long. Capsules grow in clusters at the base of the flower and have the ability to float.

Stems/Roots: Fleshy and form from a single-branched stem. They are 10-30 cm (3.9-12 in) long.

Similar Species

Native look-a-likes include the cattail *(Typha spp.)*, bur-reeds *(Sparganium spp.)*, and the blue flag iris *(Iris versicolor)*. Cattails look similar during spring growth, except that their leaves are arranged in rounded layers rather than flat like the yellow iris. Native irises have thinner leaves and blue-purple flowers instead of yellow.

Habitat

Found mainly in wetland areas like marshes and the shores of lakes, ponds, and streams; however, they have a high tolerance for drought and can survive long periods in dry, acidic, and low-oxygen soils.

Spread

The yellow iris reproduces **vegetatively** through horizontal underground stems called **rhizomes**, which form into roots, allowing it to re-grow new plants.

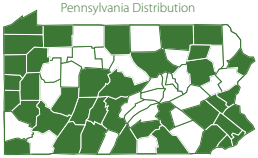
Distribution

Native to Europe, western Asia, northern Africa, and the Mediterranean region, yellow iris was brought to the United States as an ornamental plant that quickly spread to uncultivated areas and is now established in over 40 states, Lake Erie, and several counties throughout Pennsylvania.

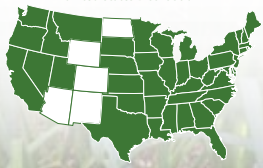
Environmental Impacts

The roots of the yellow iris are sturdy and connect hundreds of flowering plants underground, congesting water flow and leaving no room for native wetland plants to grow. It is also poisonous, harming fish and animals that touch or eat it. It can cause skin irritation when touched, so caution should be used when trying to remove it.

Pennsylvania Distribution



United States Distribution



Common Privet

Ligustrum vulgare

Species at a Glance

Common privet, also called European privet, belongs to the olive family and was introduced from Europe and Asia in the early to mid-1800s as a traditional southern ornamental. It is a semi-evergreen, thicket-forming shrub that grows upright to a height and width of 3.7-4.6 m (12-15 ft), and often has multiple trunks with long leafy branches.

Identification

Leaves: Opposite in two rows at or near right angles to the stem. Oval to elliptical in shape and rounded at the tip (often with little indentations); 2-4 cm (0.8-1.8 in) long and 1-3 cm (0.4-1.2 in) wide. Upper sides of the leaves are a lustrous green, while undersides are pale green with a hairy **mid-vein** beneath.

Flowers: Small white flowers grow in clusters at the end of the stems and bloom from June to July.

Fruit/Seeds: Small, shiny, blue-black berries occur in clusters at the end of the stem and mature from September to October.

Stems/Roots: Slender twigs are straight, rounded, or four-angled below the **nodes** and increase upward, with color ranging from brownish gray to gray-green. Privet bark is whitish tan to gray in color and smooth in texture, and young branches have tiny hairs.

Similar Species

It is difficult to distinguish between the various privet species, including Chinese *(L. sinense)* and Japanese *(L. japonicum)* privets. Common privet also has leaves similar to the native shrub coralberry *(Symphoricarpos orbiculatus)*, but the coralberry has very slender twigs, **deciduous** leaves, and red berries produced in **axillary** clusters, and lacks a **terminal** bud.

Habitat

Common privet is often seen along roadsides, bottomland forests, fencerows, forest fields, and other areas with disturbed soil. It grows well in full sunlight and low nutrient soils, but will tolerate lower light levels if nutrients are increased.

Spread

Common privet easily escapes cultivation to invade adjacent areas, reproducing both **vegetatively** and by seed. Seeds are dispersed by birds and other wildlife that eat the **fruits** and excrete the seeds undamaged into new areas.

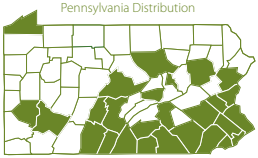
Distribution

Common privet is native to Europe, Northern Africa and Asia. Current range maps show its distribution in several U.S. states, with a wide distribution throughout Pennsylvania.

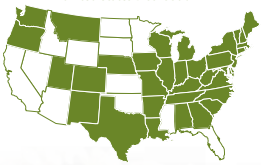
Environmental Impacts

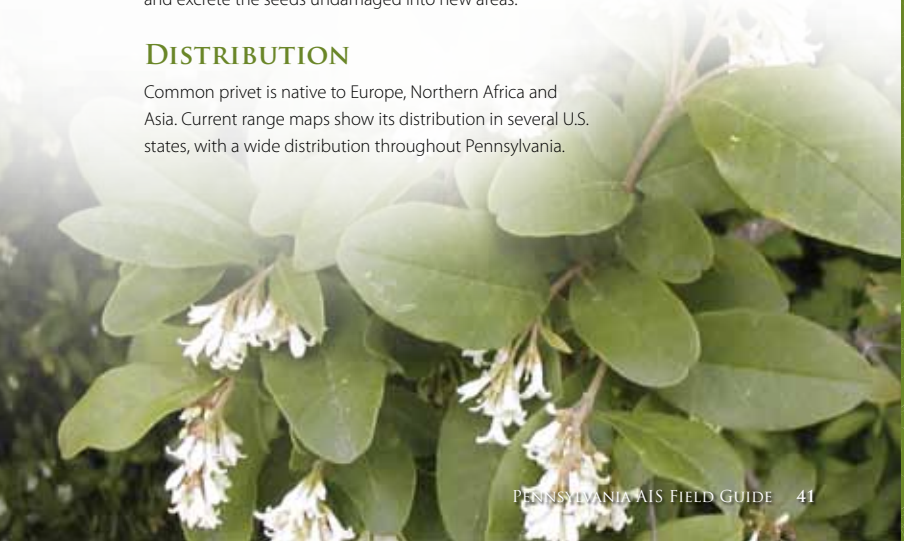
Common privet is aggressive and troublesome. It spreads rapidly to form dense thickets that can easily out-compete native plant species.

Pennsylvania Distribution



United States Distribution





Common Reed (Phragmites)

Phragmites australis

Species at a Glance

Phragmites is a perennial long-lived grass that can grow 1.8-4.6 m (6-15 ft) high in stands that exclude almost all other vegetation. While phragmites is native to North America, the introduction of a non-native strain from Europe rapidly and aggressively expanded throughout the United States, replacing much of the native reed.

Identification

Leaves: Broad, pointed, elongate and typically 20-60 cm (7.9- 24 in) long and 1-5 cm (0.4-2 in) at their widest point. Leaves arise from thick vertical **stalks**. Foliage is gray-green during the growing season.

Flowers: Bushy clusters called **panicles** grow 15-40 cm (5.9-16 in) long in late July and August and are usually purple or golden in color. As seeds mature, the **panicles** begin to look "fluffy" due to hairs on the seeds, and they take on a gray sheen.

Stems/Roots: Rigid stems that feel rough to the touch often reach 4.6 m (15 ft) in height next to dead stems from previous growth. Below ground, phragmites forms a dense network of roots several meters in depth and includes **rhizome runners**, which can grow 3 m (10 ft) or more in a single season.

Similar Species

Reed canary grass *(Phalaris arundinacea)* has a similar appearance to phragmites but is much smaller and has a membranous **ligule**. Giant reed *(Arundo donax)* also has a similar appearance and habitat but has a hairy **lemma** and a hairless **spikelet stalk**.

Habitat

Phragmites is abundant along the borders of lakes, ponds, and rivers, in tidal and non-tidal, brackish, and freshwater marsh communities, roadsides, and disturbed areas. It does not tolerate rapidly moving water.

Spread

Spread occurs mainly through vegetative means such as **rhizome** and **stolon** fragments. **Rhizomes** can break off and be washed downstream, becoming established in new areas. Phragmites also produces an abundance of wind-dispersed seeds, although seed viability is typically low. Heavy machinery may transport phragmites along roadsides between sites.

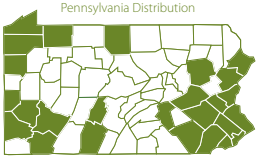
Distribution

Invasive strains of phragmites, which were introduced in the late 1800s, are now widespread throughout the lower 48 states and southern Canada. It can be found in eastern, western, and south-central Pennsylvania counties.

Environmental Impacts

Dense stands of invasive phragmites can crowd out native plant species, alter marsh hydrology, alter wildlife habitat, and increase fire potential. It blocks light to other plants and emits a toxin that allows it to outcompete native species, quickly turning once biologically diverse wetlands into monocultures.

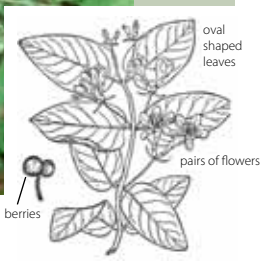
Pennsylvania Distribution



United States Distribution

Exotic Bush Honeysuckles

Lonicera sp.



Species at a Glance

Exotic bush honeysuckles are dense, upright, **deciduous** shrubs, which usually grow 1.8-6 m (6-20 ft) high. The five most problematic species in Pennsylvania include Amur *(L. maacki)*, Morrow's *(L. morrowii)*, Standish *(L. standishii)*, Tatarian *(L. tatarica)*, and Belle honeysuckle, which is a Tatarian-Morrow's hybrid cross.

Identification

Leaves: Oval to oblong or egg-shaped leaves reach 2.5- 6.5 cm (1-2.6 in) in length and are **opposite** along the stem. The significant difference between species is the presence of fine hairs on the leaf. Tatarian honeysuckle has smooth, hairless, bluish-green leaves, and Morrow's has downy leaves. Belle honeysuckle leaves are a combination of the two.

Flowers: Fragrant flowers arranged in pairs less than 2.5 cm (1 in) long occur during May and June. Tatarian flowers are usually pink to crimson in color, while other species are white and become yellow as they age.

Fruit/Seeds: Round berries are usually a deep red, yellow, or orange color. They contain 2-6 seeds and mature in September to October but may remain on the shrub throughout winter.

Stems/Roots: Generally thornless, hairless, and shallow. Older stems have a shaggy-barked appearance and are often hollow.

Similar Species

Exotic bush honeysuckles begin leaf development one to two weeks before other shrubs and native bush honeysuckles, and they also hold their leaves later into the fall. Native honeysuckles also have solid instead of hollow stems.

Habitat

These plants are relatively shade-intolerant and most often occur in forest edges, abandoned fields, pastures, roadsides, and other open, upland habitats and disturbed areas. Morrow's honeysuckle is also capable of invading bogs, fens, lakeshores, sand plains, and other uncommon habitat types.

Spread

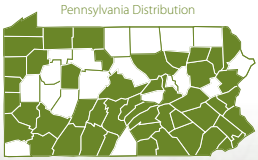
Prolific berries are attractive to deer and over twenty species of birds, which feed on and disseminate the seeds over long distances. Vegetative sprouting also aids in their persistence.

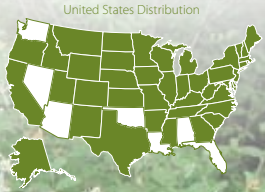
Distribution

Native to Asia and western Europe, exotic bush honeysuckles were introduced to the United States as ornamentals, and for wildlife cover and soil erosion control. Their spread from the central Great Plains to southern New England and south to the Carolinas includes several Pennsylvania counties where all five exotic species are found extensively.

Environmental Impacts

Bush honeysuckle invasions shade out native plant species and alter habitats by decreasing light availability, soil moisture, and nutrients, and possibly by releasing toxins that prevent other plant species from growing nearby. In addition, the **fruits**, while rich in carbohydrates, do not offer migrating birds the nutrient-rich food sources needed for long flights that are supplied by native plant species.





Giant Knotweed

Fallopia sachalinensis

Species at a Glance

Giant knotweed is an herbaceous perennial and member of the buckwheat family. It forms large colonies of erect stems, which are woody in appearance and can reach heights over 3.7 m (12 ft).

Identification

Leaves: Large rounded leaves **alternate** on the stem and reach over 0.3 m (1 ft) in length. They have heart-shaped bases and rounded lobes. Thin, wavy hairs are present on the underside of the leaves in June through mid-September.

Flowers: Small flowers reach about 10 cm (3.9 in) in length and range in color from a creamy white to greenish white. They grow in short, branched clusters from leaf **axils** at the ends of stems and appear from August to October.

Fruit/Seeds: Three-sided seeds are shiny, brown to black, egg-shaped, and have a paper-like texture.

Stems/Roots: Smooth, hollow, jointed stems are swollen at the **nodes**, are light green in color, and resemble bamboo shoots.

Similar Species

Giant knotweed looks similar to the other knotweed species, including Japanese knotweed *(Fallopia japonica)* and Virginia knotweed *(Persicaria virginiana)*. Giant knotweed is generally much larger and can be distinguished by its heart-shaped leaf bases, and the fine hairs on the undersides of the leaves.

Habitat

Giant knotweed grows in various levels of sunlight in moist soils of streams and riverbanks, wet meadows, roadsides, and areas of human disturbance.

Spread

Giant knotweed spreads primarily through **rhizomes** and root fragments that disburse to new areas by natural means such as wind and water, and by man-made disturbances such as roadside clearings and equipment.

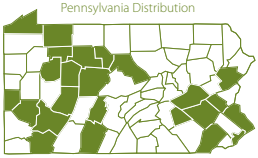
Distribution

Native to the Sakhalin Islands of Japan, it was introduced to the United States around 1900 as an ornamental. It is currently widespread across the United States and is found in several Pennsylvania counties.

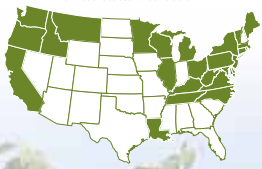
Environmental Impacts

Once established, giant knotweed is very difficult to eradicate. It quickly forms dense strands that crowd out native vegetation, clog waterways, and displace streamside vegetation, causing erosion along stream banks and degrading fish and wildlife habitat.

Pennsylvania Distribution

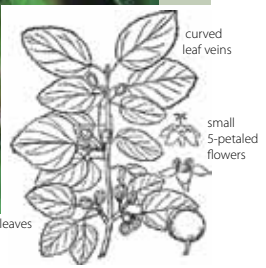


United States Distribution



Glossy Buckthorn

Rhamnus frangula



Species at a Glance

Also known as European alder or smooth buckthorn, glossy buckthorn is a large shrub to small tree that can grow as high as 5.5 m (18 ft) but is usually closer to 3-3.7 m (10-12 ft) tall, 2.4-3.7 m (8-12 ft) wide, and 25 cm (9.8 in) in diameter.

Identification

Leaves: Thin, glossy, dark green, oblong leaves **alternate** on the stem. Size is 2.5-8 cm (1-3.1 in) in length and the leaf **stalk** is one-third the length of the blade. The upper leaf surface is shiny, while the lower surface can be hairy or smooth, and leaf **margins** are smooth instead of **serrated**. A diagnostic characteristic of buckthorns, which is shared only with dogwoods, is the lateral veins that curve to follow the leaf **margins** as they approach the edges. Buckthorns leaf out early in the spring and retain their leaves (which do not change color) into late fall.

Flowers: Small flowers with five petals are arranged in creamy green clusters that bloom in May or early June.

Fruit/Seeds: Small berries, about 1 cm (0.4 in) in diameter, are arranged in large clusters. **Fruit** is red-brown in color, changing to black when it ripens and falls in July through September. Each **fruit** contains 2-4 smooth, ungrooved seeds.

Stems/Roots: Warty-looking or bumpy branches have naked hairy buds. A cut branch reveals yellow sapwood and a pink to orange colored **heartwood**.

Similar Species

This plant is often confused with other buckthorn species, including the invasive common buckthorn *(Rhamnus cathartica)*, the native alder buckthorn *(Rhamnus alnifolia)*, and the lance-leafed buckthorn *(Rhamnus lanceolata)*. Unlike glossy buckthorn, common buckthorn flowers have four petals, twigs are tipped with short spines, and leaves are smooth on both surfaces, with **serrated** edges. Native buckthorns are also much smaller, with alder buckthorn reaching only 0.9 m (3 ft) high and lance-leafed buckthorn reaching 1.8 m (6 ft) high.

Habitat

Aggressively invades moist wetlands and disturbed areas like swamps, bogs, fens, and wet meadows; however, is not confined to wet soils and can also invade upland sites such as old fields and roadsides.

Spread

Glossy buckthorn propagates mainly by seed, so dispersal occurs as the **fruits** are consumed by birds and mice and are distributed over long distances.

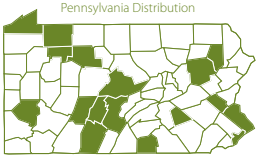
Distribution

Native to Eurasia, it was introduced as an ornamental shrub because of its hardiness and ability to thrive in varying light and soil conditions. It is now widespread in many areas and can be found throughout Pennsylvania, where it is still cultivated under the alias 'tallhedge'.

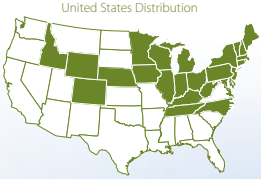
Environmental Impacts

Once established, glossy buckthorn can spread aggressively, forming dense thickets that shade out native shrubs and herbs, often completely eliminating them. The dense buckthorn seedlings also inhibit the growth of native shrub and tree seedlings.

Pennsylvania Distribution



United States Distribution



Japanese Hop

Humulus japonicus

Species at a Glance

Japanese hop is a fast-growing, herbaceous, annual climbing vine and member of the hemp family. It can climb to heights of 3 m (10 ft) or more with the help of many small hooked prickles that cover the stem and can cause irritation to bare skin.

Identification

Leaves: Opposite, **palmate** leaves are approximately 5-10 cm (2-3.9 in) in length and have rough, **serrated** edges. They are divided into 5-9 lobes with downward pointed prickles and down-curved **bracts** at their base. The down curved **bracts** and sharp prickles are distinguishing characteristics of this plant.

Flowers: Because they lack petals and are green in color, the flowers can be inconspicuous. They bloom in clusters about 5 cm (2 in) in length in early to mid-summer.

Fruit/Seeds: Green hops produced by female plants contain oval, yellowish-brown seeds, which can remain viable for up to three years.

Stems/Roots: Rough stems, which are covered in tiny hooked hairs, can reach 2.4-11 m (8-35 ft) in length and help the plant climb.

Similar Species

May be confused with common hop *(Humulus lupulus)*, which typically has three-lobed leaves, with upper leaves occasionally lacking lobes altogether. Unlike Japanese hop, the leaf stems of common hop are shorter than the leaves.

Habitat

Japanese hop grows dense, nearly continuous stands in floodplain areas along river and stream banks; along roadsides, open fields, and woodlands; or wherever soil is moist. It can grow in full sun or shade and in sandy, clay, acidic, or neutral soil.

Spread

Along with spread from intentional introductions, seeds dispersed by wind and moving water can help Japanese hop multiply.

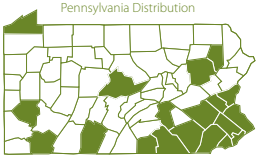
Distribution

Native to Japan and eastern China, Japanese hop was introduced to the United States as an ornamental garden plant and is now growing in the Great Lakes area and surrounding states. In Pennsylvania, it is found in many counties spanning the state.

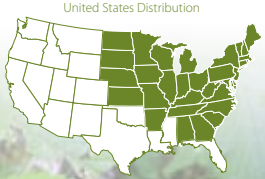
Environmental Impacts

Japanese hop can form dense, almost solid stands that outcompete native vegetation. It can be removed by hand pulling before the seeds ripen (August through September), but protection is needed (gloves, etc.) as irritation and blistering can occur from the hooked hairs covering the vines.

Pennsylvania Distribution

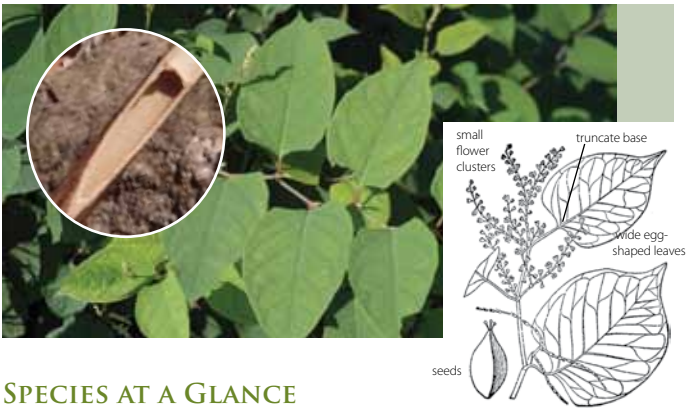


United States Distribution



Japanese Knotweed

Fallopia japonica



Species at a Glance

Japanese knotweed is a shrub-like herbaceous perennial that is nicknamed elephant ear bamboo because it has stems that resemble bamboo when mature. It can reach upright heights of over 4 m (13 ft).

Identification

Leaves: Wide, triangular to egg-shaped leaves are pointed at the tip and arranged **alternately** along the stem. Size may vary, but average is about 15 cm (5.9 in) long by 8-10 cm (3.1-3.9 in) wide. Leaf stems are often a reddish color, and leaf bases are essentially straight across (**truncate**).

Flowers: Small, attractive, greenish to white flowers occur in branched clusters about 10-13 cm (3.9-5.1 in) long in the summer.

Fruit/Seeds: Soon after flowering, small winged **fruits** called **nutlets** are produced. Triangular seeds are shiny and small, about 0.3 cm (0.1 in) long.

Stems/Roots: Smooth, stout, hollow stems are swollen at the leaf joints and resemble bamboo, especially in older plants. Like all members of this family, the base of the stem above each joint is surrounded by a thin membranous **sheath** called an **ocrea**.

Similar Species

Giant knotweed *(Fallopia sachalinensis)* occurs in some of the same areas as Japanese knotweed but can be distinguished by its larger leaves with heart-shaped bases instead of the characteristic **truncate** leaf base. It also lacks egg-shaped leaves and the stems that resemble bamboo.

Habitat

Found in moist, open, partially shaded habitats, Japanese knotweed has been reported along riverbanks, wetlands, roadways, hillsides, and disturbed areas in a variety of soil types and pH's. It also tolerates adverse conditions such as high temperatures, high salinity, drought, and floods.

Spread

Long stout **rhizomes**, which are capable of rapidly producing new plants, result in thick colonies. Plant fragments, seeds, and **rhizomes** can be spread naturally by water and wind, but also by human interactions.

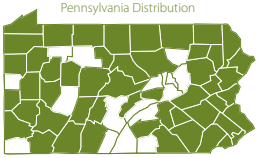
Distribution

Native to Japan, China, and parts of Korea and Taiwan, Japanese knotweed was introduced to the United States probably in the late 1800s as an ornamental plant and for erosion control and landscape screening. It is now found throughout the United States and is widespread throughout Pennsylvania.

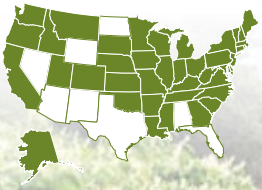
Environmental Impacts

Japanese knotweed emerges early in the spring and grows quickly and aggressively. It forms dense mats that crowd and shade out native plants and grasses along creeks, making riverbanks less stable and more likely to shear off during flooding.

Pennsylvania Distribution



United States Distribution



Japanese Stilt Grass

Microstegium vimineum

Species at a Glance

Japanese stilt grass is an annual, herbaceous, sprawling grass that resembles miniature bamboo. It germinates in the spring and grows slowly through the summer months, reaching a canopy height of 30-61 cm (12-24 in).

Identification

Leaves: Pale green leaf blades are 3-8 cm (1.2-3.1 in) in length; they are narrow, asymmetrical, taper at both ends, and are lightly hairy, **alternating** along a branched **stalk**. A distinguishing characteristic is a pale silvery strip of reflective hairs along the **mid-rib** of the upper surface.

Flowers: Flattened, trapezoid-shaped flowers grow in **spikes** on slender **stalks** about 3-8 cm (1.2-3.1 in) long in late August to September.

Fruit/Seeds: Dry **fruits** called **achenes** are produced soon after flowering, usually in early October.

Stems/Roots: The weak, somewhat reclining stems are hairless and branched, rooting at the lower **nodes**.

Similar Species

The native perennial whitegrass *(Leersia virginica)* is similar but lacks the silver stripe along the **mid-rib**, and flowers earlier in August. The **nodes** of stilt grass are also smooth, while whitegrass has hairy **nodes**. In the fall, stilt grass turns yellow to pale purple, while whitegrass stays green.

Habitat

Japanese stilt grass occurs in a wide variety of habitats, including moist soils of open woods, floodplain forests, wetlands, fields, roadsides, ditches, utility corridors, and gardens. It readily invades areas subject to disturbances such as mowing, tilling, foot traffic, and flooding.

Spread

This colonial species spreads by roots that grow from **nodes** along the stems that come in contact with the ground. It also spreads through a high production of seeds that disperse by water currents during floods, or by contaminated materials, such as hay, soil, and potted plants, or on footwear. Seeds can remain viable for five or more years before they germinate.

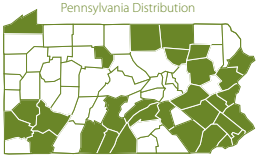
Distribution

Native to Japan, Korea, China, Malaysia, and India, Japanese stilt grass was introduced into the United States in 1919, when it was thought to have escaped from its use as packing material for porcelain. It is now invasive in several states, and is found throughout Pennsylvania.

Environmental Impacts

Japanese stilt grass rapidly spreads to form extensive mats that displace native plant species that are unable to compete. It can alter natural habitats by changing soil chemistry and creating low light conditions that shade out other species.

Pennsylvania Distribution



United States Distribution

Lesser Celandine

Ficaria verna

Species at a Glance

Lesser celandine, also known as fig buttercup and pilewart, is a low-growing, perennial, flowering herb that completes its life cycle during the winter and spring. When in bloom, large infestations appear as a thick green carpet with yellow dots spread across the forest floor.

Identification

Leaves: Kidney to heart-shaped leaves with both smooth and coarse toothed edges form a **rosette**. Leaves are tender, **stalked**, and a shiny, almost lustrous, dark green color.

Flowers: A single flower with 8-12 symmetrical petals blooms in the center of each **rosette** in March and April. They are buttery yellow with slightly darker centers and grow to be about 2.5 cm (1 in) wide.

Stems/Roots: Tiny cream-colored **bulblets** are produced in the stem **axils** and become apparent later in the flowering period. Roots produce numerous finger-like **tubers** that are easily visible when the plant is pulled up and are used to store energy for early growth in the spring.

Similar Species

Native marsh marigold *(Caltha palustris)* also has kidney-shaped leaves and yellow flowers but does not produce **tubers** or form a continuous carpet of growth. Other look-a-likes include celandine *(Chelidonium majus)* and celandine poppy *(Stylophorum diphyllum)*, both of which belong to the poppy family and have flowers with only four petals.

Habitat

Although found mostly in moist, forested floodplains with sandy soils, lesser celandine can also occur in drier upland areas.

Spread

Lesser celandine spreads using an abundant network of **tubers** and **bulblets**, which easily separate from the parent plant to form a new independent plant. **Tubers** can be unearthed and scattered around by animal and human activity, allowing them to spread to new locations on equipment, animal fur, or by flooding events.

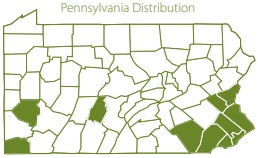
Distribution

Native to Eurasia, including Europe, northern Africa, western Asia, Caucasus, and Siberia, lesser celandine was introduced to the United States as an ornamental plant, and many colorful varieties are still available commercially. It is reported as an invasive in at least seventeen states in the northeastern United States, including the southern half of Pennsylvania.

Environmental Impacts

Lesser celandine emerges before most native species in the spring, giving it a competitive advantage and allowing it to form a thick blanket of leaves across the forest floor, preventing native species from penetrating.

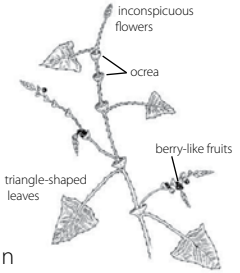
Pennsylvania Distribution



United States Distribution

Mile-a-minute

Persicaria perfoliata



Species at a Glance

Mile-a-minute, also called Asiatic tearthumb, is an herbaceous, annual, trailing vine that can reach lengths of up to 6 m (20 ft). It survives using its recurved barbs to climb to areas of high light intensity and attach to any other plants that get in its way.

Identification

Leaves: Light green and shaped like distinctive equilateral triangles. They are 3-8 cm (1.2-3.1 in) in length, **alternate** along a thin delicate stem, and have barbs on the undersides. Circular, cup-shaped leafy structures called **ocrea** surround the stem at each **node**, where flower buds, late flowers, and **fruits** emerge.

Flowers: Small, white, and generally inconspicuous.

Fruit/Seeds: Attractive, deep metallic blue, berry-like **fruits** are arranged in clusters with each **fruit** containing a single, glossy black or reddish-black hard seed.

Stems/Roots: Delicate, thin, reddish stems have curved downward pointing barbs.

Similar Species

Some native vine species, including native tearthumbs, may be confused with mile-a-minute; however, they lack the equilateral triangle-shaped leaves and the blue berry-like **fruits**.

Habitat

Mile-a-minute generally colonizes open and disturbed areas along the edges of woods, wetlands, stream banks, roadsides, and uncultivated open fields. It prefers extremely wet environments with poor soil structure and full sunlight, although it will tolerate shade for part of the day.

Spread

This self-pollinator produces a large number of seeds that can persist in the soil for up to six years. Birds, ants, small mammals, and water are the primary dispersal methods. **Fruits** can remain buoyant in streams or rivers for 7-9 days, allowing it to disburse over long distances.

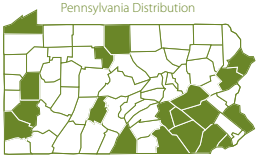
Distribution

Native to India and eastern Asia, the first successful population of the vine in the United States was in York, Pennsylvania in the late 1930s. Today, mile-a-minute has spread to several counties in Pennsylvania.

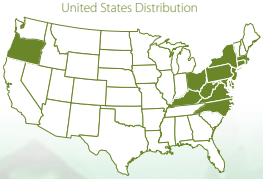
Environmental Impacts

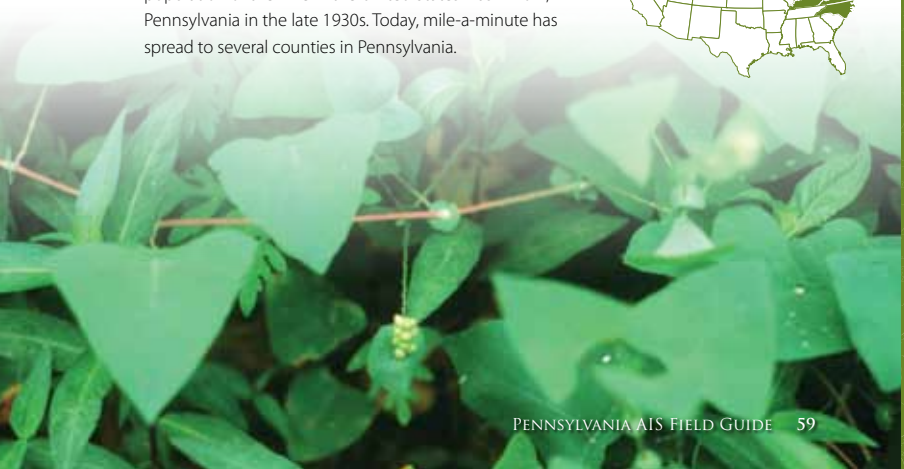
Mile-a-minute grows rapidly, overtaking shrubs and other native vegetation by reducing their access to sunlight and destroying their stems and branches by its added weight and pressure. It also poses problems to nursery and horticulture crops, Christmas tree farms, and forestry operations.

Pennsylvania Distribution



United States Distribution





Oriental Bittersweet

Celastrus orbiculatus

Species at a Glance

Oriental bittersweet, also called Asian bittersweet, is an aggressive, **deciduous**, woody vine that was introduced into the United States in the 1860s as an ornamental plant. Because of its colorful yellow and orange berries, it is still widely used as an ornamental vine, further promoting its spread.

Identification

Leaves: Glossy, rounded, elliptical or ovate, with finely toothed **margins** and an abruptly pointed tip. They are typically 5-13 cm (2-5.1 in) long and grow **alternately** and evenly around the stem.

Flowers: Female plants produce small clusters of greenish flowers along the stems in May and early June.

Fruit/Seeds: Globular capsules produced from July to October change from green to yellow as they ripen. At maturity the yellow capsules split open to reveal three red-orange, fleshy seed coatings, each containing 3-6 seeds. Male plants are non-**fruiting**.

Stems/Roots: Usually light brown, reaching 5-10 cm (2-3.9 in) in diameter and may be up to 18 m (60 ft) long.

Similar Species

American bittersweet *(Celastrus scandens)*, a native species, can be distinguished from Oriental bittersweet because the flowers and **fruits** of the native plant grow only at the tips of small clusters of branches, rather than along long stretches of the stems. In addition, the **fruit** capsules ripen to a dark orange color.

Habitat

Oriental bittersweet infests forest edges, riparian corridors, woodlands, fields, hedge rows, coastal areas, and salt marsh edges, particularly those suffering from land disturbance. It prefers open, sunny sites but tolerates shade enough to invade forested areas. It will grow over anything it comes upon.

Spread

Oriental bittersweet reproduces prolifically by seeds, which are readily dispersed to new areas by birds. It also spreads through root suckering, which is when the plant forms a new growth-shoot from an existing exposed or buried root. **Fruits** can also float downstream to new areas. Vines with **fruit** have also been used ornamentally in wreaths and decorations.

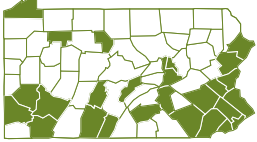
Distribution

Native to Eastern Asia in Korea, China, and Japan, Oriental bittersweet has been reported as an invasive in 21 U.S. states including Pennsylvania, where it has been found in several counties spanning the state.

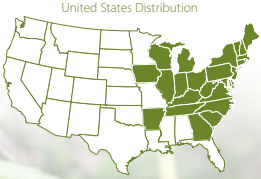
Environmental Impacts

Oriental bittersweet grows vigorously, climbing over and smothering native vegetation and preventing sunlight from reaching native plants. Its weight on trees can lead to uprooting and blow-over during high winds and heavy snowfalls. In addition, Oriental bittersweet is displacing the native American bittersweet through competition and **hybridization**.

Pennsylvania Distribution

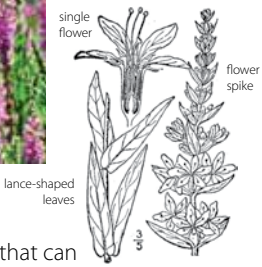


United States Distribution



Purple Loosestrife

Lythrum salicaria



Species at a Glance

Purple loosestrife is an upright perennial herb that can grow 0.9-3 m (3-10 ft) high, depending on environmental conditions. While gardeners might enjoy the brilliant purple display, its attractiveness doesn't outweigh the serious threat it poses to Pennsylvania.

Identification

Leaves: The body of the leaf is lance-shaped or oblong, while the base is usually heart-shaped or rounded. Leaves are **stalkless** with smooth edges and are sometimes covered in fine, downy hairs. They reach 4-10 cm (1.6-3.9 in) in length and are usually paired and **opposite** each other down the stem, but can also be **whorled** in groups of three.

Flowers: Paired, or clustered into 10-40 cm (3.9-16 in) long magenta colored **spikes**. Each flower is complete, containing five to seven petals that can range in color from pink to purple-red, and blooms from June to September.

Fruit/Seeds Two-valved shaped capsules that burst at maturity release seeds usually in late July or August.

Stems/Roots: Mature plants can have 1-50 square, woody stems arising from a large central taproot. Stems are 4-6 sided, green to purple in color, and are often branching, giving the plant a bushy or woody appearance.

Similar Species

It's best to identify purple loosestrife during its long period of bloom when the characteristic reddish-purple flower masses can be easily seen. It is often confused with blue vervain *(Verbena hastata)*, which has toothed instead of smooth leaves; blazing stars *(Liatris spp.)*, which only have one flowering **stalk**; and other species of loosestrifes.

Habitat

Purple loosestrife occurs in freshwater and brackish wetlands, riparian corridors, ditches, and other moist soil areas. It is a successful colonizer and potential invader of any wet, disturbed site in North America.

Spread

A long flowering season allows purple loosestrife to produce an estimated two to three million seeds per year from its 30-50 flowering stems. It can also reproduce **vegetatively** through underground stems at a rate of about one foot per year.

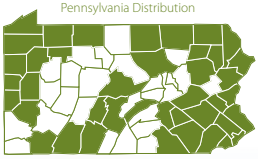
Distribution

Native to areas of Europe and Asia, purple loosestrife was brought to North America in the early 1800s for ornamental and medicinal uses. It has since spread to every state in the U.S. except Florida and is widespread in Pennsylvania.

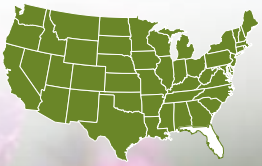
Environmental Impacts

Purple loosestrife quickly establishes and spreads, outcompeting and replacing native grasses and other flowering plants that provide high quality food and habitat sources for wildlife. It forms dense stands that restrict native wetland plants and alter the structural and ecological values of wetlands.

Pennsylvania Distribution



United States Distribution



Reed Canary Grass

Phalaris arundinacea

Species at a Glance

Reed canary grass is a large, cool-season perennial that grows 0.6-2.7 m (2-9 ft) in height and forms large **monotypic** stands that can dominate an area. Two virtually indistinguishable ecotypes are thought to exist in the United States, including a native ecotype and a more aggressive Eurasian one.

Identification

Leaves: Long, gradually tapering leaves with flat blades have a rough texture on both the upper and lower surfaces. Size ranges are 9-25 cm (3.5-9.8 in) long and 0.5-2 cm (0.2-0.8 in) wide. Coloration can be light green to a straw color. A transparent, thin, membranous outgrowth called a **ligule** is also present at the junction of the leaf and **stalk**.

Flowers: Densely packed clusters called **panicles** are generally 7.5-15 cm (3-5.9 in) in length and arise from the stem high above the leaves from May to mid-June. At first, they appear a green to purple color, but gradually change to beige over time.

Stems/Roots: Sturdy, often hollow, hairless stems are 1 cm (0.4 in) in diameter and have some reddish coloration near the top.

Similar Species

The highly transparent **ligule** is helpful in distinguishing reed canary grass from the non-native orchard grass *(Dactylis glomerata)*, which has leaves with wider blades, and more narrow and pointed clusters of flowers. Additionally, blue-joint grass *(Calamagrostis canadensis)* may be mistaken for reed canary grass in areas where orchard grass is rare.

Habitat

A wetland plant, this species typically occurs in soils that are saturated for most of the growing season but where standing water does not persist for extended periods. Ideal conditions typically occur in roadside ditches, rights-of-ways, river dikes and levees, shallow marshes, and meadows.

Spread

Seeds and **creeping rhizomes** help reed canary grass spread aggressively. Seeds can be moved from one wetland to another by waterways, animals, humans, or machines.

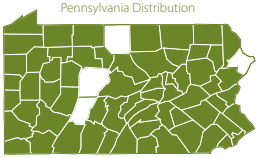
Distribution

Reed canary grass is native to temperate regions of Europe, Asia, and North America. Historically, the Eurasian ecotype was planted throughout the United States for forage and erosion control. It has become naturalized in much of the northern half of the United States and is widespread in Pennsylvania.

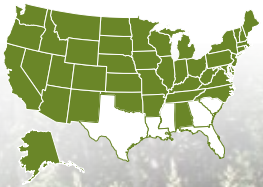
Environmental Impacts

Reed canary grass forms large, **monotypic** stands that harbor few other plant species and are of little use to wildlife. Once established, it dominates an area by building up a seed bank that can eventually erupt, germinate, and recolonize treated sites.

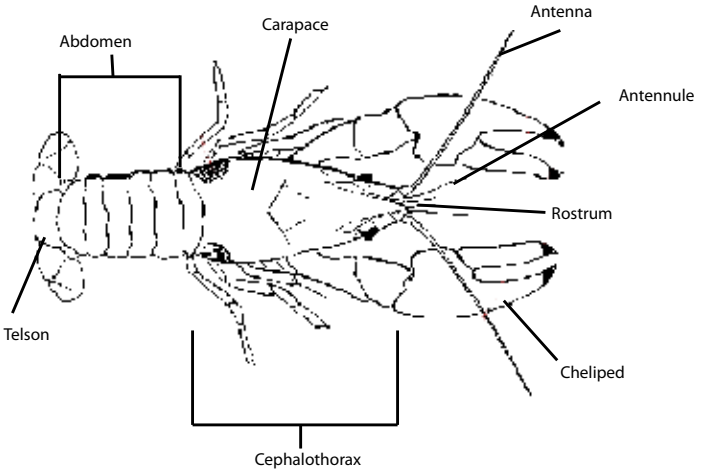
Pennsylvania Distribution

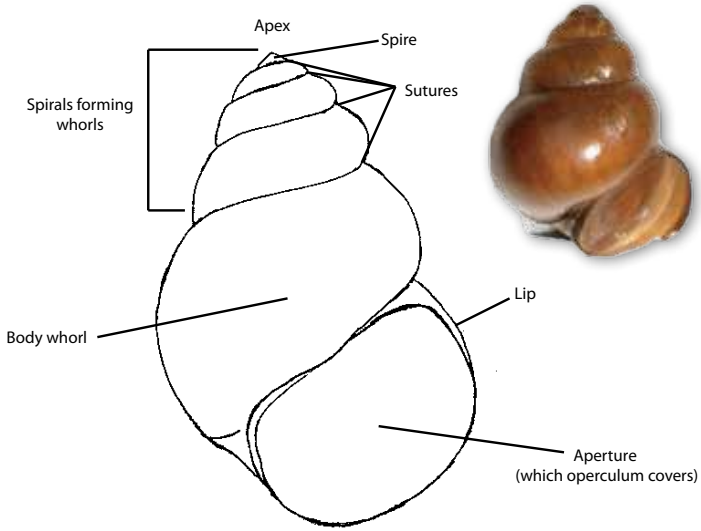


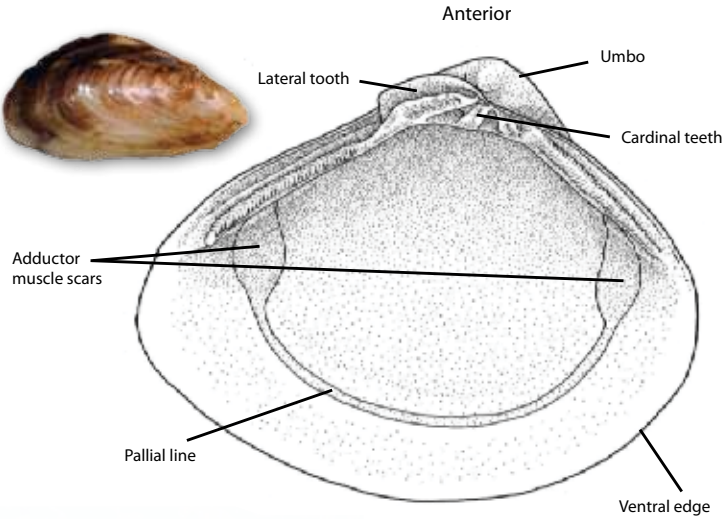
United States Distribution



Invertebrate Anatomy






Anterior
Umbo
Lateral tooth
Cardinal teeth
Adductor
muscle scars
Pallial line
Ventral edge
Posterior

Asian Clam

Corbicula fluminea

Species at a Glance

The Asian clam, also called the Asiatic clam, pygmy clam, or gold clam, is a small freshwater bivalve with two thick-hinged shells that rarely exceed the size of a nickel. It was first introduced to the west coast of the United States in 1924, possibly as a food item. By the 1970s, it occupied most of the Mississippi River Basin, the Gulf Coast, and the eastern United States.

Identification

The shell is typically yellow-green to brown; however, darker **morphs** exist, usually in the southwestern United States. While the small shell averages 2.5 cm (1 in), it can reach up to 6.5 cm (2.6 in) long. The shell is thick, triangular in shape, and displays course, concentric growth rings. The inside of the shell is layered with light purple polished **nacre** and the teeth are finely **serrated**. Microscopic juveniles called **veligers** appear under a microscope in a "D" shape less than 1 mm (0.04 in) in length.

Similar Species

Fingernail and pea clams have smooth, instead of **serrated**, teeth and are generally smaller, with thinner shells and less prominent growth rings than the Asian clam.

Habitat

Because it prefers running water with a sand or gravel substrate bottom, Asian clams can be found in streams, rivers, ponds, lakes, and man-made canals. Although it is a freshwater species, it can withstand slightly brackish waters and is also tolerant of degraded waters.

Spread

Because it is **hermaphroditic**, the Asian clam is capable of self-fertilization. In warmer waters it can spawn year round, and a single clam can release hundreds to thousands of free-floating, microscopic **veligers** per day. These juveniles are then spread by water currents and human activity. Asian clams attach to boating, fishing, and scuba diving equipment, and **veligers** can be transferred in bait buckets or live wells.

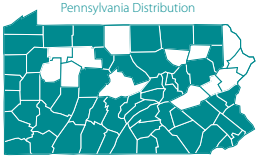
Distribution

While native to the temperate and tropical regions of Asia and Africa, the Asian clam is widespread in the United States and spans almost the entire state of Pennsylvania.

Environmental Impacts

The Asian clam is a known **biofouler** that blocks water flow to power plants and industrial water systems, and causes problems in irrigation canals and pipes. It also increases clarity in the water column by filtering suspended matter, leading to excessive plant growth and altered nutrient and water quality regimes. This clam may also compete with native mollusks for food and habitat.

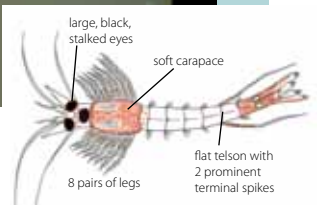
Pennsylvania Distribution



United States Distribution

Bloody Red Shrimp

Hemimysis anomala



Species at a Glance

The bloody red shrimp is a tiny freshwater crustacean in the order "Mysidacea," more commonly referred to as mysids. Mysids are also sometimes called opossum shrimp because females typically carry their eggs in a pouch. The impact of this shrimp on the Great Lakes is unknown, but based on its history of invasion across Europe, significant impacts are possible.

Identification

Bloody red shrimp are very small; males reach only 8-10 mm (0.3-0.4 in) and females reach 11-16 mm (0.4-0.6 in). They are ivory or translucent, but pigmentation can appear bright red to orange. Their eyes are large, black, and stalked, and they have 8 pairs of legs. A soft **carapace** covers the head and thorax. Under a microscope, the **telson** (tail) will be flat with two prominent **terminal** spikes. While these animals bear live young, juveniles are not easily visible to the naked eye. Its unique swarming behavior is unlikely to be confused with anything else in the Great Lakes. During daylight hours, especially in late summer, it may be observed forming reddish swarms in the shadows of piers, boats, or break walls. At night swarms disperse, but in clear, calm waters, they may be detected by shining a bright light on the water–the shrimp will rapidly swim away from the light.

Similar Species

The native Great Lakes opossum shrimp *(Mysis diluviana)* also has stalked eyes and overlapping size ranges. The best way to tell these species apart is by the shape of the tail (using a microscope or hand lens). The native opossum shrimp will have a deeply forked tail instead of a distinct flat tail.

Habitat

This species typically aggregates and hides in rocky crevasses and shadowed areas during the day and disperses to deeper water at night. It typically avoids soft bottoms and vegetation, but can be found in fresh or brackish water over hard bottom surfaces such as rocks and shells.

Spread

It was most likely introduced into the Great Lakes through ballast water discharges from transoceanic ships. Inter-basin transfer is most likely facilitated by bait buckets, live wells, bilges, boat motors/trailers/hulls, or other equipment used in the water.

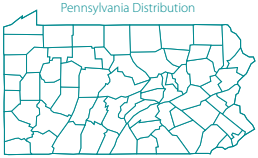
Distribution

While native to the Ponto-Caspian region of eastern Europe, the bloody red shrimp was first reported in 2006 in Lake Michigan waters. The shrimp's current distribution includes lakes Michigan, Ontario, and Erie. The closest report to Pennsylvania's shoreline has been 60 miles north in Dunkirk, New York.

Environmental Impacts

The bloody red shrimp is considered "high risk" for invasion of inland lakes in the Great Lakes region. Its history of invading canals, streams, lakes, and reservoirs throughout Europe also indicate the potential for significant impacts to our inland lake systems.

Pennsylvania Distribution



United States Distribution

Chinese Mitten Crab

Eriocheir sinensis

Species at a Glance

The Chinese mitten crab is a medium-sized burrowing crab that ranges in size from 30-100 mm (1.2-4 in), and has legs about double the length of the torso. It has made its way to the United States in parts of San Francisco as well as the Great Lakes region.

Identification

The "mitten" claws are the best way to identify this crab. Dense patches of bristly hairs are found on the claws of males and occasionally females, although juveniles may not have any hair. The tips of the claws are typically white. They have four pairs of spines located on the side edges of the **carapace**. Mitten crabs range from a light brownish-orange to a greenish-brown. They also have a small notch between the eyes.

Similar Species

None.

Habitat

While the mitten crab is the only crab found in the fresh waters of the United States, it can also tolerate saltwater. These crabs are very skillful at walking on land, especially during upstream migration, allowing them to bypass dams and other natural obstructions.

Spread

The Chinese mitten crab is spreading across the world in ballast water transfers. Mitten crabs are also becoming popular in seafood markets, especially in New York. These crabs are often illegally released by purchasers in nonnative areas. They have also been known to cling to ship barges and hulls during transport.

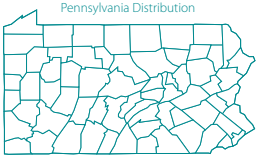
Distribution

This species was first identified in eastern Asia and quickly spread throughout Europe. Currently, California (in particular San Francisco) is the only confirmed U.S. state with a mitten crab population. While there is no evidence they are established in the Great Lakes, specimens have been collected in the Detroit River, Lake Erie, and the Mississippi River Delta. While not yet confirmed in Pennsylvania waters, several of the crabs have been collected in the lower Delaware River and Delaware Bay.

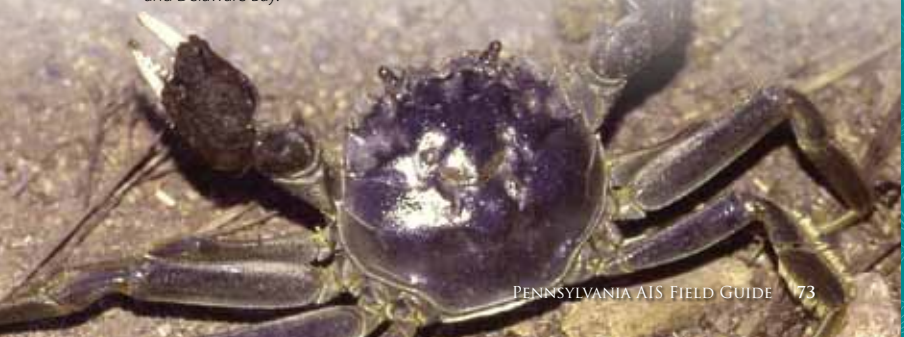
Environmental Impacts

The burrowing behavior of mitten crabs causes erosion of stream banks and damage to embankments, as well as clogged drainage systems. They are also becoming a nuisance for recreational and commercial anglers when they become tangled up in nets. One positive aspect of the mitten crab is that it is a prime food source for predatory fish.

Pennsylvania Distribution



United States Distribution



Chinese Mystery Snail

Cipangopaludina chinensis malleata

Species at a Glance

The Chinese mystery snail is a large freshwater snail commonly sold for use in freshwater aquariums and garden ponds. Its popularity in the aquarium industry has contributed highly to its spread across the United States.

Identification

The shell reaches 6.5 cm (2.6 in) in height. It is smooth, strong, and spherical with 6-7 convex **whorls** separated by prominent **sutures**, and fine vertical and horizontal lines that are slightly indented. Color is usually dark olive-green for adults and lighter for juveniles. Some adults are greenish-brown, brown, or reddish-brown. The outer lip of the shell is round or oval-shaped and black. An oblong-shaped **operculum** (or "trap door") displays concentric growth rings and allows the snail to close the opening of the shell when water conditions are unfavorable or when predators attack.

Similar Species

The native brown mystery snail *(Campeloma decisum)* has a width to height ratio smaller than the Chinese mystery snail, making it much smaller and narrower with less convex **whorls**. The introduced banded mystery snail *(Viviparus georgianus)* is generally smaller (up to 3.5 cm [1.4 in] in height) and has prominent dark horizontal bands. The Chinese mystery snail is also often misidentified as the Japanese mystery snail *(Cipangopaludina japonica)*, which many consider the same species.

Habitat

The Chinese mystery snail inhabits shallow, quiet waters of lakes, ponds, marshes, irrigation ditches, and slower portions of streams with some vegetation and muddy or sandy substrate.

Spread

Introduction of the Chinese mystery snail probably occurred through the aquarium industry and importation for Asian food markets. Once in a body of water, it can be spread by recreational activities via bait buckets and water holding areas on boats.

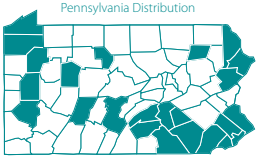
Distribution

While native to southeastern Asia and eastern Russia, the Chinese mystery snail was introduced to the United States in the 1890s and into the Great Lakes basin in the 1930-40s. It now occurs widely in the United States and Pennsylvania, including Lake Erie and the Schuylkill and Susquehanna Rivers.

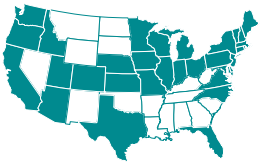
Environmental Impacts

Chinese mystery snails can serve as vectors for transmitting parasites and diseases, and are a known host for some parasites that can infect humans. They can also clog water intake pipes and compete with native snails for food and resources.

Pennsylvania Distribution

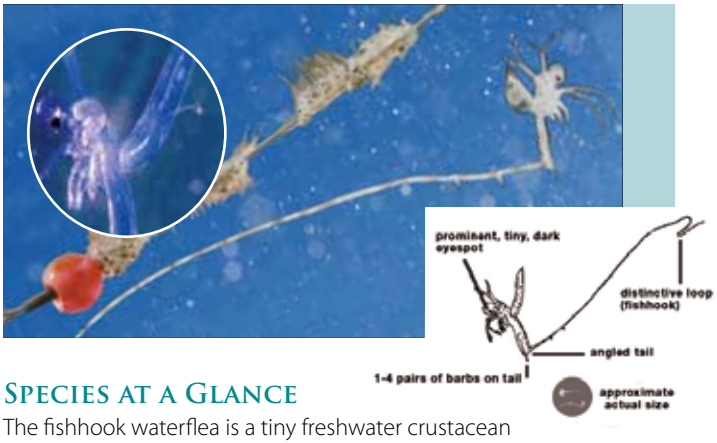


United States Distribution



Fishhook Waterflea

Cercopagis pengoi



Species at a Glance

The fishhook waterflea is a tiny freshwater crustacean that threatens aquatic ecosystems and fishing. It is not actually a flea, but rather a predatory **cladoceran** that consumes native plankton and collects in cotton-like masses on fishing lines and downrigger cables.

Identification

Clumps of waterfleas look and feel like gelatin dotted with tiny black spots. Magnification is needed to see the transparent body, which is about 10 mm (0.4 in) in length, with the tail making up 80 percent of the total length. The tail spine is strongly angled at 90° away from the body, with 1-3 widely spaced pairs of barbs and a unique loop or "hook" at the tip. The head is composed primarily of a single large **compound eye**. The dorsal egg pouch is elongated and pointed.

Note: This species does have another **morph**, which usually occurs earlier in the spring season, but has a much shorter tail that lacks the loop at the end and has up to four paired barbs.

Similar Species

The spiny waterflea *(Bythotrephes cederstroemi)* is larger, with a similar delicate spine; however, it lacks the distinctive looped hook at the end of the tail. In addition, it has a bulbous "balloon-shaped" brood pouch, which is more elongated and pointed in the fishhook waterflea. The two species are difficult to identify without magnification.

Habitat

While it can tolerate a wide range of temperatures, from 8-30°C (46-86°F), it prefers open, deep waters and is typically found in the upper, warmer water layer.

Spread

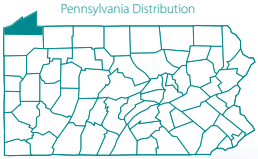
Fishing, boating, and other recreational equipment can transport fishhook water fleas and their eggs to new waters. In the absence of males, the females reproduce by a process called parthenogenesis, which requires no fertilization, and the offspring are clones of the mother.

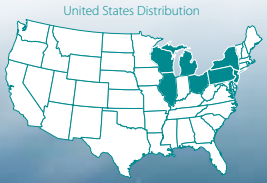
Distribution

Originally native to the Ponto-Caspian region of Europe and Asia, the fishhook waterflea arrived in the ballast water of ships. It has been found in lakes Ontario, Erie, and Michigan, and the Finger Lakes Region of New York. In Pennsylvania, the fishhook waterflea is present in Lake Erie.

Environmental Impacts

Introduction of the fishhook waterflea into the Great Lakes continues to decrease populations of native zooplankton species. It competes directly with juvenile and small fish for food and is considered a nuisance to fishermen because the barbed tail can hook onto and clog fishing lines, nets, trawls, and other equipment used for recreational and commercial fishing.





New Zealand Mudsnail

Potamopyrgus antipodarum

Species at a Glance

The New Zealand mudsnail is a tiny aquatic snail whose population in Pennsylvania consists of only female clones. Since these mudsnails reproduce **asexually**, it takes only one snail to start a new population.

Identification

The shell is long, narrow, and coiled to the right in up to 8 **whorls** that come to a pointed tip at the top of the shell and are separated by deep grooves. Some **morphs**, such as those in the Great Lakes, can have either smooth shells or shells with a **keel** in the middle of each **whorl**. Average adult size is only 3-6 mm (0.1-0.2 in) in invasive populations. Color varies from gray to light and dark shades of brown. An ear-shaped **operculum** covers the opening of the shell when the animal withdraws.

Similar Species

While it resembles many species of native snail, New Zeland mudsnails are usually narrower, longer, and have more **whorls** than most native snails in the same genus.

Habitat

They are known to inhabit freshwater ponds, streams, rivers, lagoons, lakes, ditches, and reservoirs. Because they can tolerate slightly brackish water, they have a wide range of tolerances for substrate, temperature, and salinity.

Spread

The **operculum**, which is a small cover that can be used to close the opening of the shell, allows the New Zealand mudsnail to survive out of water and hitchhike on recreational boating or fishing equipment, the feet of wildlife, or even fur. They can also pass through the digestive system of predators alive and undigested.

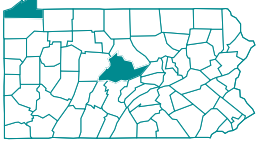
Distribution

While native to New Zealand, this mudsnail was accidently introduced into the United States in the 1980s, possibly with the transfer of fish eggs and live game fish, or in the ballast water of transoceanic ships. In Pennsylvania, these snails have been found in Lake Erie, and in Spring Creek in Center County.

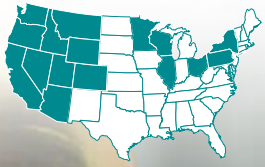
Environmental Impacts

New Zealand mudsnails reproduce rapidly, displacing native species of mollusks and invertebrates, altering the food web, and impacting food sources for native trout and other fish, while offering them little nutritional value in return. They also impact water quality, as they alter ecosystem structure and natural cycles, such as the nitrogen cycle.

Pennsylvania Distribution



United States Distribution



Quagga Mussel

Dreissena bugensis

Species at a Glance

The quagga mussel, which some consider even more dangerous than its close relative the zebra mussel *(Dreissena polymorpha)*, is a small, fingernail-sized, freshwater mollusk and is one of the most intrusive, prolific, and costly aquatic invaders in North America.

Identification

The shells are rounded, fan-shaped, and attached by a hinge. While they are usually 3 cm (1.2 in) long, they can reach up to 5 cm (2 in). The shell is smooth and lacks ridges, although it typically has dark concentric rings that fade to a pale coloration near the hinge. The sticky thread-like projections called **byssal threads** are located toward the anterior end of the shell and help them attach to other objects. Eggs hatch into round, microscopic larvae called **veligers** that free-float in the water column for up to five weeks before settling.

Similar Species

While the zebra mussel is similar, it is more "D"-shaped, with a prominent ridge on its **ventral** side that allows it to sit upright. Quagga mussels are rounded and would simply topple over if placed on their sides. The mid**ventral** line is also straight in zebra mussels and curved in quaggas. The location of their **byssal threads** also differs; in zebra mussels they are located in the middle of the shell.

Habitat

Quagga mussels are found in both shallow, warm waters and deep, cool waters of freshwater lakes, reservoirs, ponds, quarries, and slow-moving or sluggish rivers. Their **byssal threads** attach to rocks, docks, cement, wood, and vegetation, but unlike zebra mussels they can also live and thrive directly on muddy or sandy bottoms. Quagga mussel reproduction can occur at low water temperatures, as cold as 4-9°C (39-48°F).

Spread

One female can produce up to one million eggs in a breeding season. The free-floating **veligers** can be scooped up undetected and transferred in bait buckets, bilge water, and live wells. Because mussels can survive out of water for up to five days, they are easily transported to other waterways on recreational boating and fishing gear.

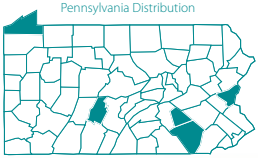
Distribution

While native to the Black, Azov, and Caspian sea drainages, quagga mussels first appeared in the Great Lakes in Lake Erie in 1989 in contaminated ballast water. They have since spread through all of the Great Lakes, the Mississippi River drainage, and many inland lakes. In Pennsylvania, they have been found in Lake Erie, the lower Susquehanna River, and diving quarries in Northampton and Blair counties.

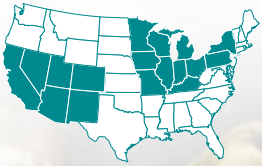
Environmental Impacts

Like the zebra mussel, quagga mussels clog water intake pipes and damage equipment at power and water facilities. They also harm fisheries, alter water quality, and increase the growth of harmful algae. They decrease food sources for native species by filtering large amounts of microscopic plants and animals from the water, and they accumulate contaminants in their tissues. Economic impact is in the billions of dollars.

Pennsylvania Distribution



United States Distribution



Red Swamp Crayfish

Procambarus clarkii

Species at a Glance

The red swamp crayfish, also known as the Louisiana crawfish, or mudbug, is a large and aggressive crayfish whose native range extends from northern Mexico to Florida and north to southern Illinois and Ohio. Often used in classrooms and as a popular food item, this highly adaptable crayfish has escaped to invade the Great Lakes and beyond, impacting aquatic ecosystems by chewing up vegetation, outcompeting native species, and altering water quality.

Identification

Adult red swamp crayfish are a dark red color with raised bright red, white, or black spots (**tubercles**) covering the body and claws. A black wedge-shaped stripe is visible on the top of the abdomen. Juveniles are a uniform gray, sometimes overlain with dark wavy lines. Occasionally, a genetic mutation may turn the body and/or claws blue. A distinctive characteristic of this species is that the **areola** is linear to **obliterate**. The pincers are narrow and long and the rostrum has lateral spines or notches near its tip. Size is typically 5-13 cm (2-5 in).

Similar Species

The red swamp crayfish most closely resembles the white river crayfish *(Procambarus acutus acutus)*, and the southern white river crayfish *(Procambarus zonangulus)*. They differ from the red swamp crayfish in the **areola**, which is narrow but never **obliterated**, and the juveniles typically have spots on the **carapace**. White river crayfish can also be found in streams and ditches with a stronger flow than what's preferred by the red swamp crayfish.

Habitat

The red swamp crayfish is tolerant of a wide range of habitats, including low oxygen levels, extreme temperatures, pollution, and areas with large water level fluctuations. It prefers marshes, swamps, ponds, and slow moving rivers and streams where there is plenty of organic debris like logs, sticks, or water-soaked leaves. In times of drought or cold, the red swamp crayfish can burrow into the sediment until conditions are more favorable.

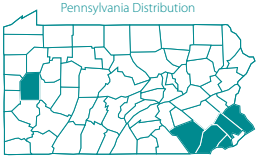
Spread

Because this species is widely available through the seafood industry and aquarium trade, it is most likely spread when it is intentionally and unintentionally released. Aquarists who keep them as pets, teachers and students who use them as live study specimens, and consumers who purchased them from live food markets often release them into the wild. While they usually spread along connected waterways, they can crawl out of water for several miles at night and during wet weather.

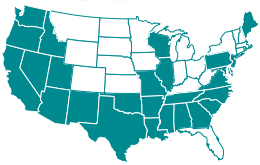
Environmental Impacts

Red swamp crayfish can quickly dominate lakes, ponds, rivers and wetlands. They feed heavily on plants, snails, fish, and amphibians, aggressively competing with native crayfish and other species for food and habitat. They can carry crayfish fungus plague which can lead to declines in native crayfish. In addition, their burrowing behavior can be problematic to levees, dams, and irrigation systems.

Pennsylvania Distribution



United States Distribution



Distribution

Native to the Gulf Coast and the Mississippi River drainage up to Illinois, this species has spread widely throughout the United States. It is found in Pennsylvania in Bucks, Chester, Delaware and Montgomery counties as well as on the campuses of Slippery Rock and Millersville Universities in Butler and Lancaster Counties.

Rusty Crayfish

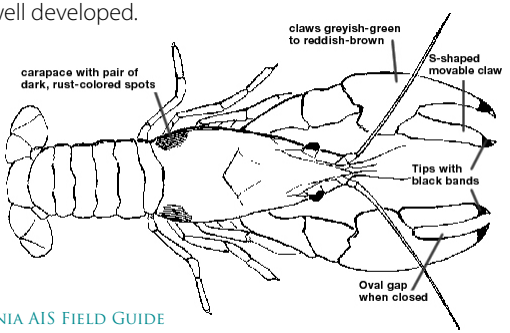
Orconectes rusticus

Species at a Glance

The rusty crayfish is a large, aggressive crustacean that can outcompete native crayfish for food and shelter, and devastate aquatic ecosystems with its huge appetite.

Identification

Adult rusty crayfish are typically 8-13 cm (3-5 in) long, with large, black tipped claws, and smooth mouthparts. They are typically grayish-green to reddish-brown in color, with a set of dark rusty orange spots on each side of the **carapace**; which is the most distinguishing feature. Due to the **hybridization** of male rusty crayfish with female native crayfish, these spots may not always be present or well developed.



Similar Species

May be confused with other native and invasive crayfish, including the calico crayfish *(Orconectes immunis)*, virile crayfish *(O.virilis)*, and northern clearwater crayfish *(O. propinquus)*. However, these crayfish generally have smaller claws and lack the rusty orange spots present on the **carapace**.

Habitat

Rusty crayfish are often found in silt, clay, or gravel substrates, and prefer areas with adequate rock, log, and debris cover; however, they can survive in a variety of habitats, including lakes, rivers, ponds, and streams. They are most active at temperatures above 8° C (46°F).

Spread

Anglers using rusty crayfish as bait are one of the most common ways they have spread to new regions. It is not necessary to have both males and females to establish a new invasion; a female carrying viable sperm could begin a new population if released into a suitable environment.

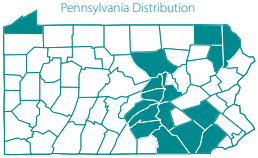
Distribution

While their native range extends throughout the Ohio River basin in Ohio, Kentucky, Tennessee, Illinois, and Indiana, rusty crayfish have become invasive in Michigan, Missouri, Iowa, New Mexico, New York, New Jersey, Pennsylvania, the New England states, and areas of Ontario, Canada. In Pennsylvania, they were first discovered in 1976 in the lower Susquehanna River, but they have since spread to both eastern and western regions of the state.

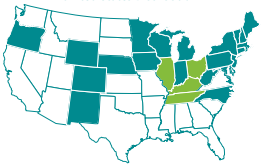
Environmental Impacts

Rusty crayfish reduce native crayfish populations by competing for food and daytime hiding locations. They are very aggressive and voracious eaters, destroying aquatic plant beds and reducing food, shelter, and spawning sites for other organisms, including valued sport fish.

Pennsylvania Distribution



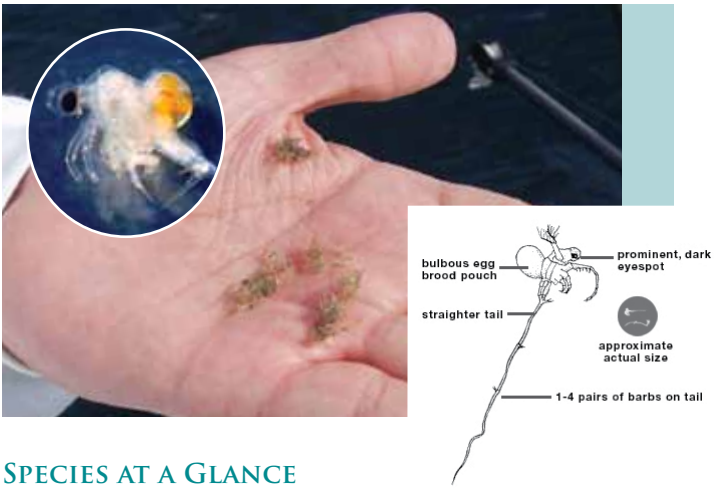
United States Distribution



Green - Native Blue - Invasive

Spiny Waterflea

Bythotrephes longimanus



Species at a Glance

The spiny waterflea is a tiny freshwater crustacean that consumes native plankton and collects in cotton-like masses on fishing lines and cables. It has the potential to outcompete native fish and can threaten a lake's entire ecosystem.

Identification

This species is not actually a flea, but rather a transparent crustacean or **cladoceran** that sticks on fishing lines and forms clumps that look and feel like gelatin, with tiny black spots (eyes). Magnification is needed to see the transparent body, which ranges from 6-16 mm (0.2-0.6 in) long. The single long, straight tail, which makes up to 70 percent of its length, has several spikes or barbs. The ball-shaped head with large eyes is clearly separated from the body.

Similar Species

The fishhook waterflea *(Cercopagis pengoi)*, which is smaller, also has a similar delicate spine; however, its tail has a distinctive looped hook at the end. It also has a more elongated and pointed brood pouch, in contrast with the spiny waterflea's bulbous, "balloon-shaped" brood pouch. The two may be difficult to identify without magnification.

Habitat

Prefers large, deep, clear lakes with summer bottom temperatures of 10-24°C (50-75°F), but can also be found in wetlands, estuaries, and marinas. Spiny waterfleas do not tolerate warm lake temperatures.

Spread

Enacting stricter ballast water regulations, avoiding the release of bait, rinsing boats and equipment with hot water sprayed at high pressure, and drying boats and equipment for five days before reentering the water could help prevent further invasion of this species.

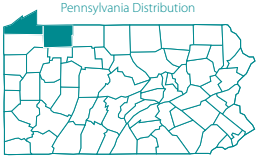
Distribution

While native to Europe and Asia, the spiny waterflea was most likely brought to the Great Lakes in the ballast water of ships traveling internationally. It was first found in 1984 in Lake Huron but is now found in all of the Great Lakes, including the Pennsylvania portion of Lake Erie. Spiny waterfleas were also collected in the Allegheny Reservoir in Warren County.

Environmental Impacts

The spiny waterflea decreases populations of native zooplankton and competes directly with juvenile and small fish for food although it can be a food source for several freshwater fish. Anglers consider it a nuisance because the tail spines hook onto and clog fishing lines and downrigger cables.

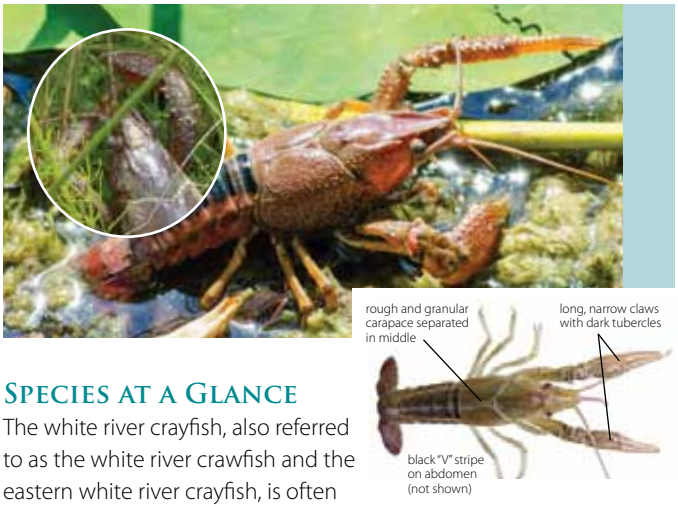
Pennsylvania Distribution



United States Distribution

White River Crayfish

Procambarus acutus acutus



Species at a Glance

The white river crayfish, also referred to as the white river crawfish and the eastern white river crayfish, is often confused with its southern counterpart, the southern white river crayfish *(Procambarus zonangulus)*. The eastern white river crayfish occurs naturally in the United States and is cultured eastwards from Louisiana to the Atlantic coast northward to Maine, but has established select non-native populations in locations throughout the east coast and in California.

Identification

Adult white river crayfish are usually a dark burgundy red but can range in color from pinkish tan to brownish olive with a black "V" stripe on the abdomen. The **carapace** is rough and granular and is separated in the middle by a narrow space called the **areola**. Juveniles are gray with dark spots scattered over the **carapace**. The claws are long and narrow, delicate in appearance, and have small dark **tubercles**. White river crayfish reach about 6-13 cm (2.5-5 in) in length.

Similar Species

The white river crayfish most closely resembles the southern white river crayfish *(P. zonangulus)*, which is nearly impossible to distinguish without looking at the **gonopods** of a **first-form male**, and the red swamp crayfish *(P. clarkii)*. Red swamp crayfish have a linear or **obliterate areola**, and a black "V-shaped" stripe on the abdomen, and the juveniles are typically plain or striped on the **carapace** instead of spotted. White river crayfish can also be found in streams and ditches with a stronger flow than what's preferred by the red swamp crayfish.

Habitat

The white river crayfish is typically found in open waters of sloughs, swampy areas, sluggish lowland streams and ditches, or in small streams and lakes along the floodplains of streams. It will frequently burrow into sediments to escape drying or freezing.

Spread

Because this species is used in bait and aquaculture, it is most likely spread intentionally and unintentionally when they are released by anglers using them as bait, aquarists who keep them as pets, landowners who stock them in ponds, and by consumers who purchased them from live food markets.

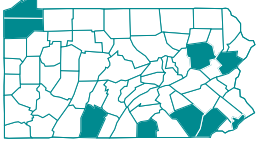
Distribution

The native range for this species extends from the Southern Atlantic coast drainage from Georgia to Maine, from the Florida panhandle to Mexico, and from the Central Mississippi Valley to the upper Great Lakes Drainages. It was introduced intentionally into California and New England for aquaculture and bait, and has been found in Pennsylvania in Adams, Bedford, Chester, Crawford, Erie, Luzerne, Monroe, and Philadelphia Counties.

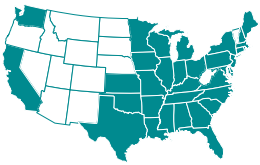
Environmental Impacts

While the impacts of this species are relatively unknown, the white river crayfish has been classified as a high-risk species by individual invasiveness assessments. Because it is an opportunistic feeder, it is expected to outcompete native crayfish for resources like shelter and food. It could also act as a vector for parasites and disease.

Pennsylvania Distribution



United States Distribution



Zebra Mussel

Dreissena polymorpha

Species at a Glance

The zebra mussel is a small, fingernail-sized, freshwater mollusk that attaches to hard objects and has cost billions of dollars to control and remove. Since its discovery in the Great Lakes, it has quickly spread to become one of the most intrusive, prolific, and costly aquatic invaders in North America.

Identification

Although the zebra mussel is named for the alternating light and dark bands present on the shell, color patterns can vary between black, brown, beige, and tan, with white to yellow stripes or zigzagged patterns. The shell is "D"-shaped, with a straight mid**ventral** line and a prominent ridge that allows it to sit flat on its **ventral** side. While size is typically 2-2.5 cm (0.8-1 in) in length, some mussels can reach up to 5 cm (2 in). The sticky, thread-like projections called **byssal threads** are located toward the middle of the shell and help them attach to hard substrates. Eggs develop into round, microscopic larvae called **veligers** that free-float in the water column for up to five weeks before settling. Under polarized light, **veligers** appear to be marked with a dark "X".

Similar Species

A close relative, the quagga mussel *(Dreissena bugensis)* is also fingernail-sized but more rounded in shape, lacking the prominent ridge that allows zebra mussels to sit upright; quagga mussels would simply topple over if placed on their sides. In quagga mussels, the mid**ventral** line is also curved, and the location of the **byssal threads** is more towards the anterior end of the shell.

Habitat

Zebra mussels can be found in lakes, rivers, reservoirs, ponds, and quarries, but they require calcium for shell production, and water temperatures over 10°C (50°F) for reproduction. They can be found attached to hard surfaces such as rocks, wood, concrete, steel, and even other organisms.

Spread

One female can produce up to one million eggs in a breeding season. The free-floating **veligers** can be scooped up undetected and transferred in bait buckets, bilge water, and live wells. Because mussels can survive out of water for up to five days, they are easily transported to other waterways on recreational boating and fishing gear.

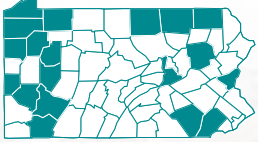
Distribution

While native to the Black, Azov, and Caspian sea drainages, zebra mussels first appeared in the Great Lakes in Lake St. Clair in 1988, probably imported in contaminated ballast water. They have since spread throughout all of the Great Lakes, the Mississippi River drainage, and many inland lakes. In Pennsylvania, they have been found in numerous inland lakes, creeks, rivers, and diving quarries throughout the state.

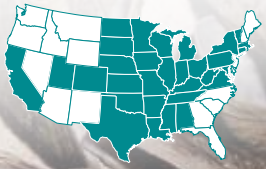
Environmental Impacts

The clustering behavior of zebra mussels causes them to clog water intake pipes and damage equipment at power and water facilities, making them very expensive to remove and control. They also harm fisheries, alter water quality, and increase the growth of harmful algae. They decrease food sources for native species by filtering large amounts of microscopic plants and animals from the water, and they accumulate contaminants in their tissues. Economic impact is in the billions of dollars.

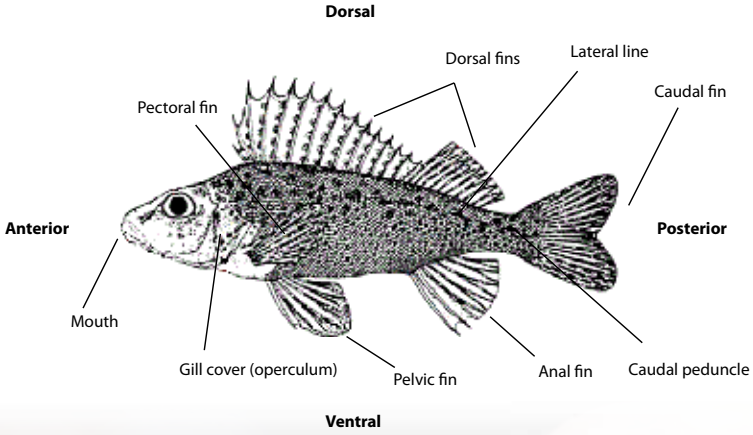
Pennsylvania Distribution

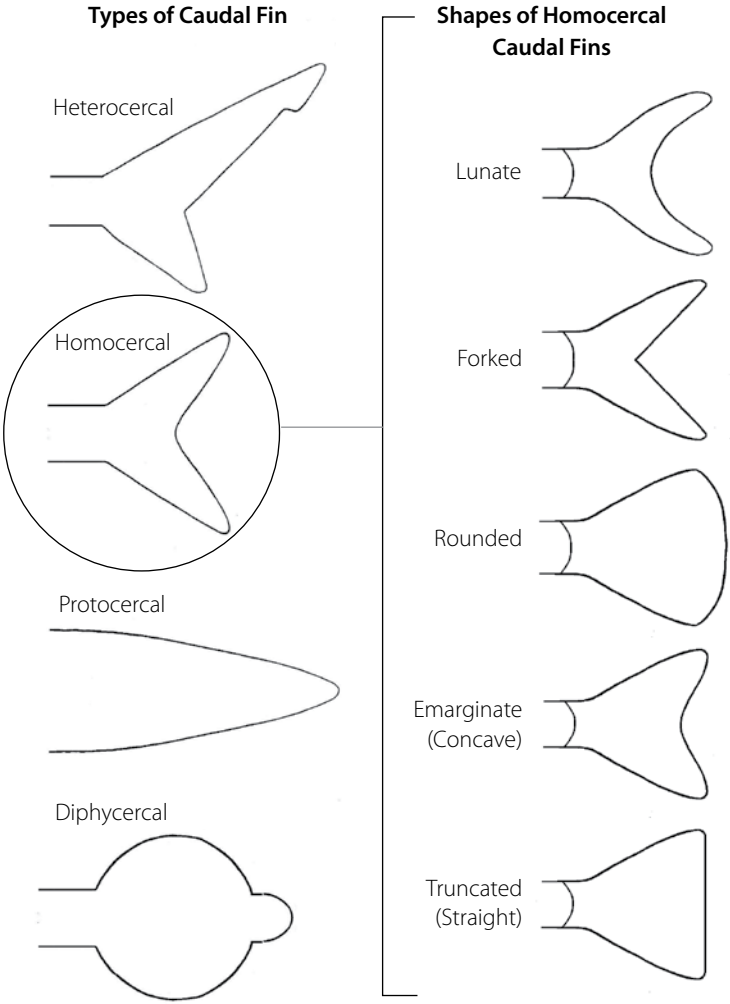


United States Distribution



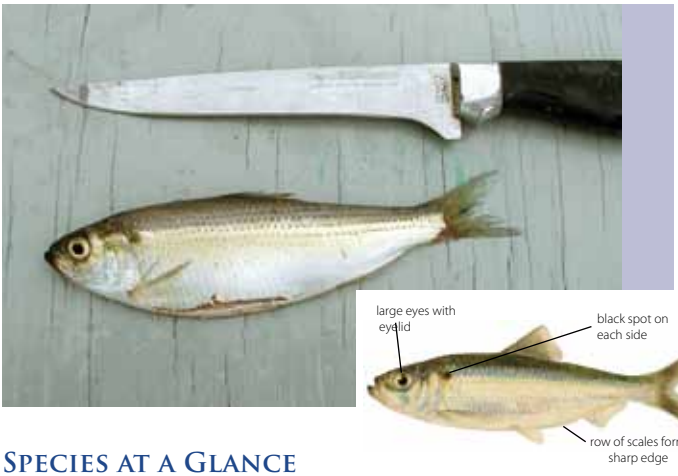
Fish Anatomy




Types of Caudal Fin
Heterocercal
Homocercal
Protocercal
Diphycercal
Shapes of Homocercal Caudal Fins
Lunate
Forked
Rounded
Emarginate (Concave)
Truncated (Straight)

Alewife

Alosa pseudoharengus



Species at a Glance

The alewife is a small forage fish that belongs to the herring family. It migrates long distances from the ocean to fresh water to reproduce in the spring and returns to the ocean in the fall; however, some populations have become landlocked and are restricted to inland waters.

Identification

Alewife size can range from up to 38 cm (15 in) in coastal populations to less than 25 cm (10 in) in inland populations. Their typically silver body is small, slender, and **laterally compressed**, but individuals entering freshwater often have a copper-sheen color. Eyes are relatively large, with an obvious eyelid. A single black spot is present on each side just behind the head. A row of scales, called **scutes**, which form a sharp edge along the mid-line of the belly, are responsible for its nickname "sawback".

Similar Species

The alewife is closely related to the blueback herring *(Alosa aestivalis)*, which is native in parts of the lower Susquehanna River. Alewives are lighter in color than bluebacks, and their body is more strongly compressed and less elongated. The most distinguishing characteristic between these species is the color of their **peritoneum**, or the lining of the abdominal cavity. An alewife's **peritoneum** is pale with dusky spots, while the blueback herring's is black to dusky in color.

Habitat

This **pelagic** species is found in marine waters or open lake waters, except during the breeding season, when they can be found in large rivers, small streams, ponds, and large lakes over a wide range of substrates, including gravel, sand, **detritus**, and **submerged** vegetation. Because alewives are sensitive to the osmotic stresses of freshwater, disturbances such as severe changes in water temperature can cause the fish to die, with large numbers washing up on beaches.

Spread

The Welland Canal most likely gave the alewife access to the Great Lakes and it has continued to spread through waterway connections. Because it looks very similar to native members of the herring family, accidental transfer is possible through fish stockings or release of live bait. It has also been intentionally introduced by some state agencies into inland lakes to increase the forage base for popular sport fish.

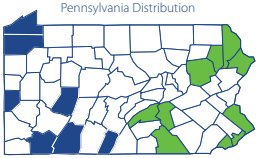
Distribution

Native to the Atlantic coast and its tributaries from South Carolina northward, alewives are found from Nova Scotia to the Carolinas, with landlocked populations in the Great Lakes and in lakes and ponds along the East Coast. In Pennsylvania, introduced populations of alewives can be found in Lake Erie, as well as many inland lakes and reservoirs across the state–in addition to its native range in the Delaware and Susquehanna rivers.

Environmental Impacts

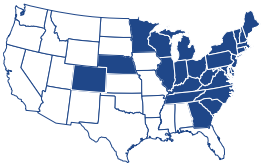
Alewives feed primarily on zooplankton, which puts them in direct competition with native fish and invertebrates for limited food resources. Large densities of alewife in Lake Erie have been blamed for the disappearance of native salmonid species.

Pennsylvania Distribution



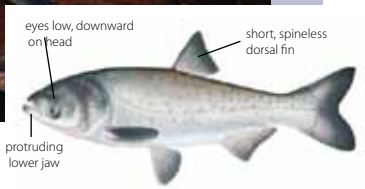
Green - Native Blue - Invasive

United States Distribution



Bighead Carp

Hypophthalmichthys nobilis



Species at a Glance

The bighead carp is a member of the Asian carp complex, which also includes silver, black, and grass carp. As of 2015, its presence in Pennsylvania has not been confirmed; however, its large size and voracious appetite make it an enormous threat to the Commonwealth. Any potential sightings should be reported immediately.

Identification

The body of the bighead carp is large, reaching 1-1.5 m (3.3-4.9 ft) in length and weighing over 100 pounds. It is broad, **fusiform**, and **laterally compressed** with a solid dark gray top blending to white underneath. It has many irregular gray-black blotches on its sides. Its large head lacks scales and its big **terminal** mouth lacks barbels and teeth. The lower jaw also protrudes out farther than the upper jaw. The eyes are situated low on the head and are positioned downward. The short **dorsal fin** lacks spines, and contains 7-10 rays. Scales are very small and resemble those of a trout.

Similar Species

The bighead carp most closely resembles the invasive silver carp *(Hypophthalmichthys molitrix)*. However, the **keel** of the bighead carp runs from the **pelvic fins** to the **anal fins**, while the silver carp has a mid-**ventral keel** that is more extensive and runs from the **anal fins** up to the base of the gills. Silver carp also lack the dark blotches characteristic of bighead carp. Bighead carp may also resemble the common carp *(Cyprinus carpio)*, which has barbels on either side of the mouth, or species of suckers *(Catostomidae)*, which have thick lips containing small nipple-like bumps.

Habitat

Bighead carp are exclusively freshwater fish that prefer large river systems with flowing water, which they need for spawning; however, they will inhabit lakes and ponds.

Spread

Once introduced to open waters, bighead carp readily spawn and disperse themselves. Because the juveniles resemble some common baitfish species, they may be unintentionally spread through the use of live bait. Spread can also occur as they are sold through the Asian food market.

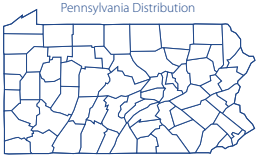
Distribution

Native to eastern Asia, the bighead carp was intentionally introduced into the United States to control algae growth in aquaculture ponds. During flooding in the early 1980s, it escaped into the Mississippi River and has since moved upstream towards the Great Lakes. There is evidence of reproducing populations in the middle and lower Mississippi and Missouri Rivers and in the Ohio River. Bighead are in the Illinois River, which is connected to the Great Lakes via the Chicago Sanitary and Ship Canal. Currently, no established populations have been recorded in the Great Lakes or Pennsylvania.

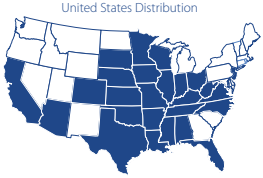
Environmental Impacts

The bighead carp can consume up to 40 percent of its body weight in plankton and **detritus** per day, competing with native filter feeders and juvenile fish for food. This impact on the food web and trophic structure of an ecosystem could result in large population declines, impacting biodiversity as well as commercial and recreational fishing.

Pennsylvania Distribution



United States Distribution



Black Carp

Mylopharyngodon piceus

Species at a Glance

The black carp is a member of the Asian carp complex, which also includes silver, bighead, and grass carp. This molluscivore has powerful teeth that allow it to crack open mussels, snails, and other hard-shelled organisms.

Identification

The elongate, **fusiform**, slightly compressed body of the black carp averages 1-1.5 m (3.3-4.9 ft) in length. Color can vary but is usually dark brown to black on the back and sides, with some white on the underside, with dark fins. The mouth is small, **terminal**, and lacks barbels. Teeth are strong, flat and molar-like, and are arranged in rows of 4-5 on each side. The scales are very large and have black tips, giving it the appearance of cross-hatching. Fins lack spines. The **anal fin** is set far back on the body, and the **caudal fin** is large and forked. Average weight is about 33 lbs, but some black carp can reach up to 150 lbs.

Similar Species

The best way to distinguish the black carp from the grass carp *(Ctenopharyngodon idella)* is by looking at the **pharyngeal** teeth. Black carp teeth appear molar-like, whereas the grass carp's teeth have deep parallel grooves. Black carp may also resemble the common carp *(Cyprinus carpio)*, which has barbels on either side of the mouth, and species of suckers *(Catostomidae)*, which have thick lips containing small nipple-like bumps.

Habitat

Black carp are exclusively freshwater and prefer large river systems and embayments in temperate to subtropical climates.

Spread

The availability of black carp in the live fish market may have created a risk for accidental or unlawful release. Additional introduction and spread occurs as fish escape from holding facilities and naturally disperse to new areas.

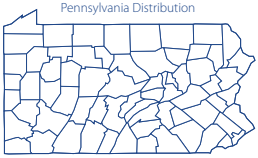
Distribution

The black carp is native to eastern Asia from southern Russia to northern China. They were brought to the United States to control snail populations in aquaculture facilities and escaped from holding ponds during flooding in 1994. Individuals have since been found in the lower part of the Mississippi River basin, although it is unknown whether these individuals have established populations. There are no reports of black carp in Pennsylvania.

Environmental Impacts

Black carp pose a considerable threat to native mussel and snail populations. They can live up to 15 years, consuming several pounds of mollusks each day, competing with native fish, turtles, birds, and some mammals for food. Black carp may also be a vector for parasites and disease affecting native species.

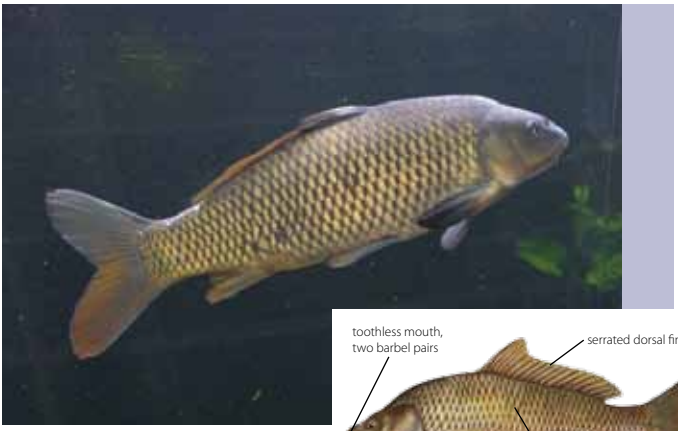
Pennsylvania Distribution



United States Distribution

Common Carp

Cyprinus carpio



Species at a Glance

The common carp, which can live up to 50 years, is omnivorous, has a voracious appetite, and is one of the largest members of the minnow family. Varieties of common carp include mirror carp, leather carp, and koi, which is a type of common carp popular in small ponds and water gardens.

Identification

These bronze, brassy, or yellow fish have spine-like rays at the front of the dorsal and **anal fins**, and are easily identified by two pairs of barbells on each side of the upper jaw. The body is heavy and stout, with large scales usually outlined in black. The head is short, with a rounded snout and a toothless, sucker-like mouth. Their average length is 25 -55 cm (10-22 in) and they typically weigh 1-10 lbs, although some can reach up to 122 cm (48 in) long and weigh up to 80 lbs.

Similar Species

Common carp resemble the smallmouth buffalo *(Ictiobus bubalus)*, bigmouth buffalo *(I. cyprinellus)*, grass carp *(Ctenopharyngodon idella)*, and other species of carp. The best way to identify common carp is the two barbels on each side of the mouth, and the long **dorsal fin**.

Habitat

This species generally inhabits lakes, ponds, and the lower sections of rivers (usually with moderately flowing or standing water). It is also found in brackish-water estuaries, backwaters, and bays, and is often seen in the spring in shallow water during spawning.

Spread

Once established in a body of water, common carp can escape from the point of introduction and move to other connected bodies of water. Transfer of the species to different water bodies can also occur by anglers using juvenile carp as bait.

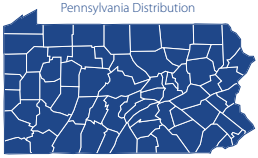
Distribution

Native to Europe and Asia, common carp were intentionally introduced into United States waters as a game fish in the 1880s. They are now very prevalent throughout the United States including Pennsylvania.

Environmental Impacts

The common carp's tendency to destroy vegetation and increase water **turbidity** by dislodging plants impacts native species spawning sites and decreases water quality. They also release phosphorus that increases algae abundance and production.

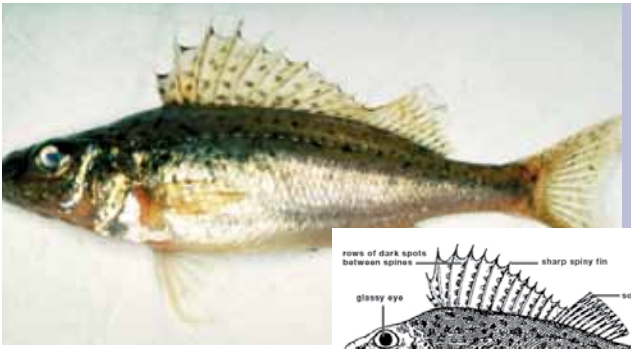
Pennsylvania Distribution

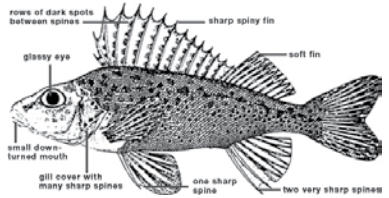


United States Distribution

Eurasian Ruffe

Gymnocephalus cernuus





Species at a Glance

The Eurasian ruffe is an aggressive member of the perch family that was brought to the United States in the ballast water of ocean-going ships. Its high growth rate, adaptability, and high reproductive success make it a serious threat to commercial and sport fishing.

Identification

This small fish has a fairly deep and compressed body reaching 11-15 cm (4.3-5.9 in) in length. The body, which is very slimy when handled, is greenish-brown above, with dark patches on lighter brown sides. The yellowish belly has rows of prominent dark spots on the dorsal and **caudal fins**. The **dorsal fin** is made up of a spiny fin and a soft fin that are connected. Sharp spines on their gill covers, dorsal and **anal fins** make them undesirable to predators. Their head lacks scales and their small downturned mouth resembles a frown.

Similar Species

While it may be confused with native yellow perch *(Perca flavescens)*, the native trout perch *(Percopsis omiscomaycus)*, and the invasive white perch *(Morone americana)*, the Eurasian ruffe can be distinguished by the lack of scales on its head, and its downturned mouth. The yellow perch also has two separate **dorsal fins** and a body pattern with dark vertical bars, and the trout perch has a short, single-lobed **dorsal fin** and an **adipose fin**; these are lacking in the ruffe.

Habitat

The Eurasian ruffe is highly adaptable and will exploit a wide range of depths and conditions in lakes and rivers. However, it prefers **turbid** lakes with soft bottoms with little or no vegetation, and rivers with slow moving waters.

Spread

Once introduced into Lake Superior, ballast water exchange within the Great Lakes may have facilitated further spread. It may also spread unintentionally through the use of live bait.

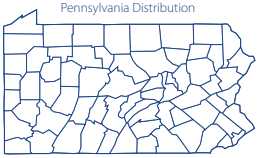
Distribution

Native to fresh and brackish water areas of Eurasia, the ruffe was introduced into Lake Superior in the mid-1980s. Since its introduction, it has spread throughout the upper Great Lakes. It is not currently present in Lake Erie or Pennsylvania waters.

Environmental Impacts

Explosive growth of the Eurasian ruffe population means less food and space in the ecosystem for other fish with similar diets and feeding habits. Because of this, walleye, perch, and a number of small forage fish species are seriously threatened by continued expansion of this pest species.

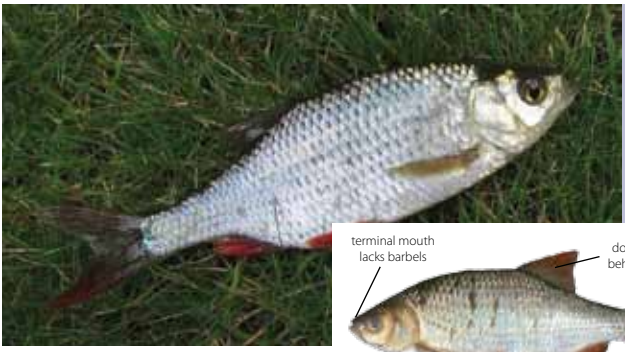
Pennsylvania Distribution



United States Distribution

European Rudd

Scardinius erythrophthalmus



Species at a Glance

The European rudd is a medium-sized fish belonging to the carp and minnow family. It is largely carnivorous when young, feeding on snails, insects, and small crustaceans, but prefers aquatic vegetation as it gets older.

Identification

The body of the rudd is somewhat stocky, robust, and elliptical in shape, with large scales and a forked tail. It has a scaled, **keel**-like belly that runs from the pelvic to the **anal fins**. Coloration is brownish-green above and brassy yellow to rosy on the sides, fading to silvery underneath. The pectoral, pelvic, and **anal fins** are a distinctive bright reddish-orange color. The mouth is **terminal** and lacks barbels, and the lower lip is sharply angled, with a protruding lower jaw. The iris of the eye is yellow to orange, often with a red spot that can cover the pupil. Another identifying feature of the rudd is the beginning of its **dorsal fin** set well behind the front of the **pelvic fin**. Maximum size is up to 48 cm (19 in) in length.

Similar Species

While young rudd often resemble golden shiners *(Notemigonus crysoleucas)*, adults reach larger sizes. Rudd have 6-9 scales on the belly, whereas the golden shiner has a naked, scale-less belly. In addition, the fins of the golden shiner are clear to pale orange, not bright orange or red, and it lacks the red spot on the iris above the pupil.

Habitat

The European rudd prefers still and sluggish waters and weedy shoreline areas of lakes and rivers, but it can adapt to a wide range of environmental conditions, including poor water quality.

Spread

Bait bucket release is the primary mechanism by which the rudd has gained access into open waters. Because of the rudd's similarity to golden shiners, they can become mixed in with shiner shipments to bait dealers and become introduced into new environments by anglers.

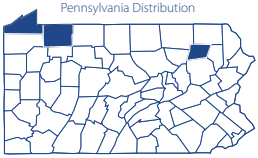
Distribution

Native to Europe and western Asia, the European rudd was probably introduced to the United States as a game and food fish. Since its introduction, it has spread throughout much of the country and has been collected in 21 states. In Pennsylvania, the rudd has been collected in Lake Erie and its tributaries, the Allegheny Reservoir, and Lake Winola in Wyoming County.

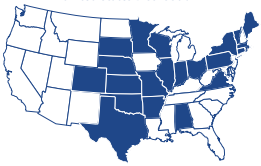
Environmental Impacts

Although the rudd's impacts are mostly unknown, it may compete with native fish for invertebrate food sources and influence the population dynamics of various ecosystems.

Pennsylvania Distribution

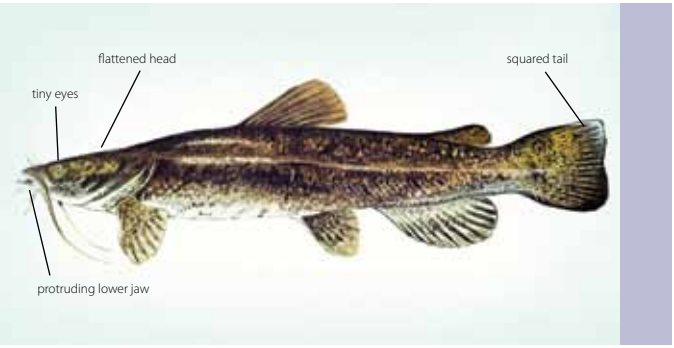


United States Distribution



Flathead Catfish

Pylodictis olivaris



*Note: The flathead catfish has specific management and policy challenges. It is native to the western part of Pennsylvania in the Ohio, Allegheny, and Monongahela river watersheds; however, it is considered invasive in eastern Pennsylvania.

Species at a Glance

The flathead catfish is one of the largest species in the catfish family. It voraciously feeds on other fish, making it an extreme threat to native ecosystems. It has many nicknames, including pied cat, mud cat, Mississippi cat, shovelhead cat, yellow cat, and Opelousa cat.

Identification

Key characteristics of the flathead catfish are its flattened head, tiny eyes, squared tail, and protruding lower jaw. It can grow up to 152 cm (60 in) long and weigh on average 30 pounds, although some have been known to reach over 100 lbs. Coloration is usually brownish-yellow with mottled speckles on the back and a cream-colored white to yellow belly.

Similar Species

Unlike other catfish, which prey on dead organisms, the flathead feeds on live fish, eating mostly sunfish, carp, and even other catfish. Flathead catfish are nearly double the weight of the channel catfish *(Ictalurus punctatus)*. The lower jawbone of the flathead extends outward from the rest of the face, like an under-bite, whereas the channel catfish's upper jaw extends over the lower. The channel catfish also has a forked tail instead of a squared tail.

Habitat

Thriving in reservoirs, lakes, rivers, and large streams, flathead catfish prefer deep, still, muddy waters with logs and other debris to use as shelters.

Spread

The most likely vector of spread is intentional stocking and release by anglers for game and food fishing.

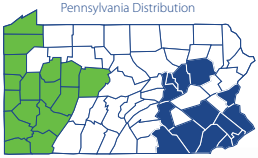
Distribution

Native to North America, including areas of the Mississippi River Basin and the Ohio River drainage in western Pennsylvania, flathead catfish are invasive in several parts of eastern Pennsylvania.

Environmental Impacts

The flathead catfish poses an enormous threat to native fish populations because it feeds on other fish. Young flathead catfish also feed on crayfish, darters, shad, and possibly crabs and young American eel. Species such as sunfish and native catfishes have declined heavily in some areas where flathead catfish are present.

Pennsylvania Distribution

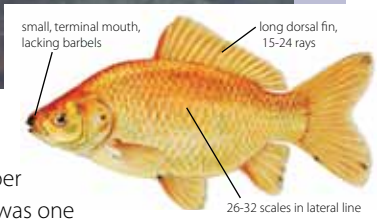


Green - Native Blue - Invasive

United States Distribution

Goldfish

Carassius auratus



Species at a Glance

The goldfish is a freshwater member of the carp and minnow family. It was one of the first aquatic invasive species to reach North America, arriving in the 1600s as ornamental fish for aquariums and water gardens. It is now one of the world's most widespread invasive species.

Identification

It has an elongated, stout body, which is typically 10-20 cm (4-8 in) in length and weighs 100-300 g (3.5-10.5 oz), although it can reach a maximum length of 59 cm (23 in) and maximum weight of 6.6 lbs. It has a long **dorsal fin** with 15-24 rays, and a hard **serrate** spine at the origin of both the dorsal and **anal fins**. There are normally 26-32 scales in the **lateral line**. The mouth is small, **terminal**, and lacks barbels. While goldfish were mostly golden in color one thousand years ago, they now come in a variety of colors, including orange, yellow, white, black, silver, olive-green or greenish-brown and combinations of these colors. When found in nature, goldfish are most often a shade of green, brown, or gray.

Similar Species

Goldfish can be distinguished from common carp *(Cyprinus carpio)* by the carp's two pairs of barbels on the upper jaw, a non-**serrate** spine, and typically more than 32 scales in the **lateral line**. However, they can also **hybridize** with the common carp, producing individuals with both characteristics.

Habitat

While goldfish prefer a habitat with a muddy bottom and thick vegetation, they can tolerate pollution, temperature fluctuations and high levels of **turbidity**. They naturally live in freshwater ponds and slow-moving or still waters in depths of up to 19.8 m (65 ft) and prefer temperatures of 4-41°C (40-106°F), although they cannot live for long at high temperatures.

Spread

Goldfish have been intentionally introduced for ornamental purposes to ponds, fountains, and small lakes to which they may disperse through connecting waters. Many introductions of goldfish were also due to their use as live bait. In addition, goldfish are often released into the wild by pet owners not realizing the environmental repercussions of setting the fish free.

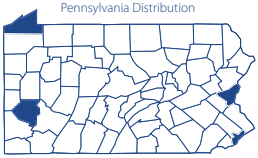
Distribution

Native to eastern Asia, goldfish have been reported invasive in the United States by every state except for Alaska. They are established in all of the Great Lakes, and in Erie, Northampton, and Philadelphia counties in Pennsylvania. Individual specimens have also been collected in several drainages throughout Pennsylvania; however, it is unknown whether these represent established populations.

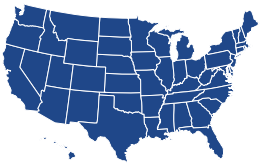
Environmental Impacts

Goldfish are believed to be responsible for population declines in many native fish, invertebrate, and plant species. They also uproot plants and create enormous **turbidity** due to their aggressive bottom feeding behavior.

Pennsylvania Distribution

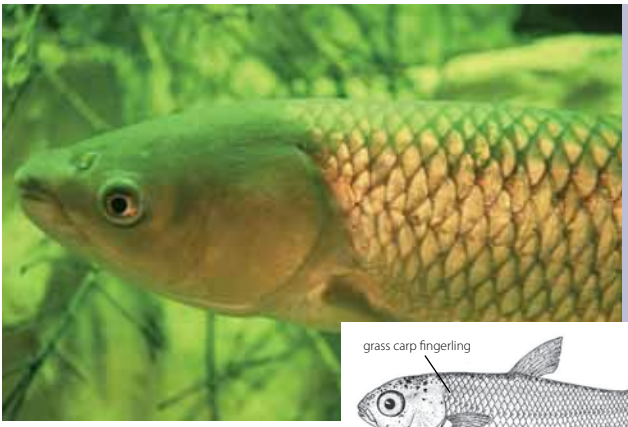


United States Distribution



Grass Carp

Ctenopharyngodon idella



Species at a Glance

The grass carp, also known as the white amur or the waan ue, is one of the largest minnows in the family Cyprinidae. It is also a member of the Asian carp complex, which includes the black, bighead, and silver carp. They were introduced into the United States to help control the growth of aquatic weeds in aquaculture facilities, but escaped into natural systems and are now widespread throughout the U.S.

Identification

The body of the grass carp is oblong in shape but considered slender for most carp. They typically reach between 65 and 80 lbs. Scales are large, with dark edges and a black spot at the base. The scaleless head lacks barbels. Overall color is olive to silvery-white, while the fins are a clear to gray-brown. The **dorsal fin** is composed of three simple rays and seven branched rays.

Similar Species

Grass carp may be confused with the common carp *(Cyprinus carpio)*, which can be distinguished by the presence of barbels around the mouth. Common carp are also more golden in color and have spiny modified rays on the dorsal and **anal fins**.

Habitat

Grass carp prefer shallow and quiet waters, typically 0.91-3 m (3-10 ft) deep, such as ponds, lakes, pools and backwaters of large rivers.

Spread

Once introduced, grass carp can spread to distant water bodies by tributaries, waterways, river systems, canals, and dams. This carp is also still intentionally stocked in aquaculture facilities; however, it must be stocked in the triploid form, which means it is sterile and unable to reproduce. A permit is required to stock the carp in Pennsylvania, and stocking is only permitted in ponds to prevent the spread through waterways and river systems.

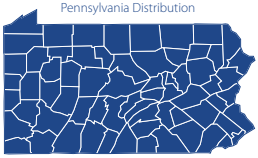
Distribution

Native to eastern Asia, including China and Russia, grass carp were introduced in many countries for aquaculture plant control. They are now widespread in 45 states in the U.S., including Pennsylvania. In Pennsylvania, triploid carp, which are reproductively sterile, can be stocked with a permit.

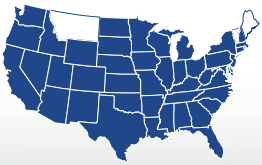
Environmental Impacts

While grass carp do help to reduce unwanted aquatic vegetation, they alter the food web because they also voraciously feed on desirable plant species, reducing the amount of food available to native invertebrates and fish. Excreted plant material can also increase nutrient levels in the water that cause harmful algal blooms and affect water quality.

Pennsylvania Distribution

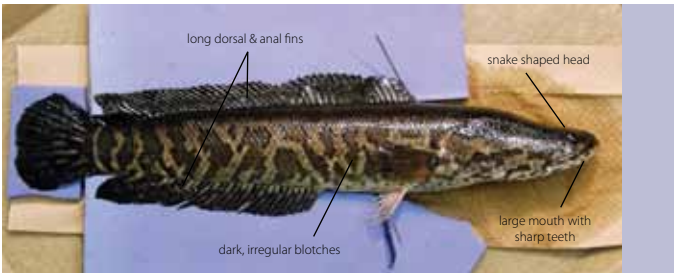


United States Distribution



Northern Snakehead

Channa argus



Species at a Glance

The northern snakehead is a freshwater fish nicknamed "Frankenfish" because of its intimidating appearance and voracious appetite. An air bladder that works like a primitive lung lets this species survive out of the water in moist locations and wriggle over land to new bodies of water. These adaptations give the snakehead a competitive edge in securing habitat and expanding its range.

Identification

These cylindrical fish can grow over 84 cm (33 in) long. As the name implies, the scaled head of the fish looks like a snake. They have a large mouth with sharp teeth, a **truncate**, not rounded tail, and are easily identified by dark irregular blotches along their sides. Snakeheads also possess relatively long dorsal and **anal fins**.

Similar Species

The native bowfin *(Amia calva)* is often mistaken for the northern snakehead. Bowfin are distinguished by their rounded tail, scaleless head, and an eyespot near the tail in males. The burbot *(Lota lota)* looks somewhat similar but can be distinguished by its split **dorsal fin** and a single barbel on the lower jaw. The dorsal and **anal fins** of the bowfin and burbot are also very short in comparison to snakeheads.

Habitat

These fish prefer stagnant shallow ponds, swamps, and slow streams with mud or vegetated substrate. Temperature range is from 0-30°C (32-86°F), and they can survive in waters that are covered in ice. As juveniles, northern snakeheads eat zooplankton, insect larvae, small crustaceans, and young fish. As adults, they become voracious predators, feeding on other fish, crustaceans, frogs, small reptiles, and even birds and mammals.

Spread

Before their threat was fully appreciated, live snakeheads were sold in the United States in pet shops and live fish markets. Uninformed pet owners may have released them into the wild when they grew too big for aquarium tanks, or as part of religious or cultural practices. In 2002, the import and interstate transport of the northern snakehead was banned without a permit from the U.S. Fish and Wildlife Service.

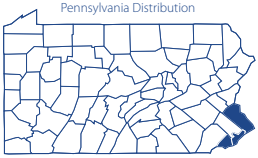
Distribution

Native to China, Russia, and Korea, the first reported breeding population in the United States was discovered in a pond in Crofton, Maryland in May 2002. In July 2004, northern snakeheads were found in a lake in FDR Park in Philadelphia, Pennsylvania. About a year later, another was caught in the nearby Delaware River. In 2008, snakeheads were discovered in the Schuylkill River below Fairmount Dam in Philadelphia County, and in 2012 a discovery was made in the John Heinz National Wildlife Refuge in Delaware County.

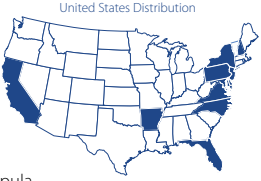
Environmental Impacts

With no natural enemies, northern snakeheads can devastate populations of native fish and wildlife. They compete directly with native fish, altering feeding habits, food availability, and behaviors of other members of the ecosystem.

Pennsylvania Distribution

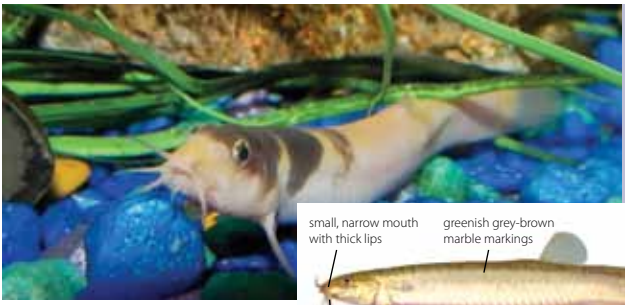


United States Distribution



Oriental Weatherfish

Misgurnus anguillicaudatus



Species at a Glance

The oriental weatherfish, also called the dojo and Chinese loach, is a small eel-like fish that gets its name from its ability to forecast the weather. It is sensitive to changes in barometric pressure, so increases in activity and swimming in fast circles can indicate that major weather changes are imminent. This species is also popular in the aquarium trade because it is hardy and has a voracious appetite that can help keep tanks clean. Unfortunately, the release of this species into natural waterways has caused negative impacts to water quality, native species, and the food web.

Identification

The oriental weatherfish has a long, cylindrical, eel-like body with greenish grey-brown marble markings on the dorsal side, and pale silver sides and underbelly. Many specimens have a large pigmented spot located above the base of the **caudal fin**. The mouth is small and narrow with thick, fleshy lips surrounded by ten barbels. The **lateral line** is short and doesn't extend past the pectoral fin. The pectoral fin has a stout spine, and the **caudal fin** is rounded. Average size is up to 28 cm (11 in) long. This species exhibits sexual size **dimorphism**, with the average length of the female being considerably larger than that of the males.

Similar Species

Because of its eel-like body, the oriental weatherfish may be confused with species of lamprey; however, lamprey are typically thinner and don't have the characteristic barbels on the mouth.

Habitat

This species is very hardy and can survive a wide range of temperatures and environmental conditions. It is typically found in slow or still waters with muddy or silty bottoms abundant with aquatic plants. It feeds on bottom-dwelling animals, insect larvae, snails, and worms. The oriental weatherfish can breathe atmospheric oxygen by using its intestine as an accessory respiratory organ, allowing it to live in oxygen-poor waters and to bury itself in soft substrates to survive long droughts.

Spread

Used as bait, and commonly sold in the aquarium trade, the oriental weatherfish can be released when aquariums are dumped, or when bait buckets are emptied. Their use as a food fish is also linked with their purposeful introduction into the wild to create harvestable populations.

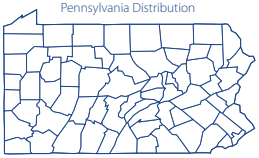
Distribution

Native to Eastern Asia, the Oriental weatherfish was most likely introduced to natural waters of the United States by fish farm and aquarium escapes. It has not yet been introduced into Pennsylvania, but is established in drainages in New York and New Jersey.

Environmental Impacts

Oriental weatherfish can negatively impact native species by predation and competition for food, habitat, and spawning sites. They can also increase **turbidity** and nitrogen levels in standing water, which can negatively impact water quality.

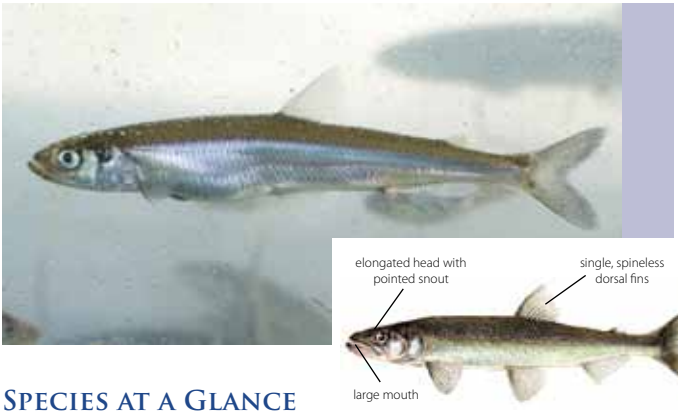
Pennsylvania Distribution



United States Distribution

Rainbow Smelt

Osmerus mordax



Species at a Glance

The rainbow smelt is a small fish that is eagerly pursued by anglers because of its fine flavor. Its Latin name *Osmerus*, which comes from the Greek word meaning "odor", is fitting because when removed from the water, they give off an odor which smells like freshly cut cucumbers.

Identification

The rainbow smelt has a small, slender body that typically ranges from 18-23 cm (7-9 in) long and weighs around 85 g (3 oz). Smelt are mostly silver, with pale olive-green backs and iridescent purple, blue, and pink sides. A conspicuous silvery streak runs lengthwise along each side. In the water, rainbow smelt shimmer colorfully, but when removed, they quickly fade to a silver white. In freshwater they are darker, becoming almost black on the back. The head is elongated, with a relatively large mouth and pointed snout. The lower jaw protrudes, and prominent teeth can be seen on the tongue and both jaws. Scales are thin and easily detached. A single **dorsal fin** and a single **adipose fin** lack spines. Spawning males are covered on the head, body, and fins with tiny bumps called **nuptial tubercles**.

Similar Species

While they may be confused with many minnow species, rainbow smelt have an **adipose fin** and prominent teeth that minnows lack.

Habitat

Historically, rainbow smelt have been strictly **anadromous** (residing in saltwater, but entering freshwater to reproduce). However, since the early 1900s the smelt has been successfully introduced into freshwater systems. It prefers deeper, cooler waters during the warmer seasons but will favor shallower coastal areas for feeding as winter approaches.

Spread

Rainbow smelt spread naturally through waterway connections. Other potential vectors include ballast water, bait bucket transfers, improper disposal of fish remains containing gametes, and intentional introduction as forage and bait fish.

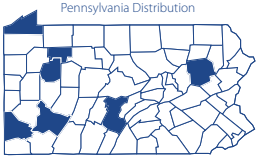
Distribution

The rainbow smelt is native to the Atlantic Coastal drainages of North America and the Pacific drainages of North America and Asia. It was introduced into Michigan's Crystal Lake as a food for stocked salmon and soon escaped into Lake Michigan. It can now be found in all of the Great Lakes, the Mississippi River, and other inland waters. In Pennsylvania, rainbow smelt populations are established in Lake Erie, the Allegheny and Monongahela river drainages, and Harvey's Lake in Luzerne County.

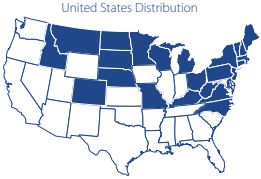
Environmental Impacts

Rainbow smelt could impact sport fishing and native fish populations because they compete directly with sport fish such as perch, walleye, and lake trout for food. Smelt also feed on early or larval stages of other fish.

Pennsylvania Distribution

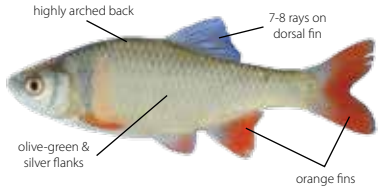


United States Distribution



Red Shiner

Cyprinella lutrensis



Species at a Glance

The red shiner is in the genus *Cyprinella*, which is Greek for "small carp". This hardy, widespread shiner is native to the Midwest, but through its use as a baitfish has been introduced to habitats outside of its native range.

Identification

The red shiner is a deep-bodied species with a highly arched back. Its **flanks** are mixed olive-green and silver, with bright orange fins and a large orange spot that sits between the eyes on its blunt, sloped brow. Spawning males become bluish on the sides and the fins redden. There are 7-8 rays on the **dorsal fin** and 8-10 (usually 9) rays in the **anal fin**. Maximum size is only 9 cm (3.5 in) in length. The red shiner can crossbreed with other minnow species, such as the blacktail shiner *(Cyprinella venusta)* and the endangered blue shiner *(Cyprinella caerulea)*, producing hybrids that may also have a faint **caudal** spot.

Similar Species

While easily confused with most other minnows, including the golden shiner *(Notemigonus crysoleucas)*, the rudd *(Scardinius erythrophthalmus)*, and the roach *(Rutilus rutilus)*, the outstanding characteristics of red shiners are the vibrant orange fins and the orange spot between the eyes.

Habitat

Although found in a variety of habitats, the red shiner prefers silt disturbed streams and muddy riverbeds where it doesn't have to compete with other minnows for prey.

Spread

The red shiner has infiltrated Lake Michigan through its use as bait for recreational fishing and, more recently, through the aquarium trade. Its extended mating season, coupled with the versatile nature of the eggs, ensures the species will spread quickly throughout habitats.

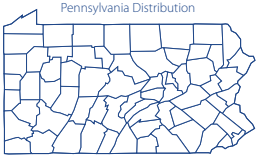
Distribution

The red shiner is native to a large portion of the U.S. Midwest, reaching from central North Dakota to the southernmost point of Texas along the Mississippi River and its tributaries. Currently, the red shiner is only present in the Great Lakes region in Lake Michigan and is not yet found in Pennsylvania.

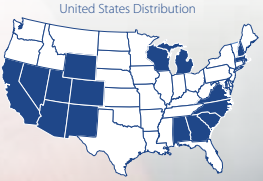
Environmental Impacts

Known to eat small invertebrates, the red shiner is in direct competition with native fish and invertebrates for food. The red shiner also has adaptive advantages over other Cyprinids because it not only can lay eggs in tight crevices, but it can attach adhesive eggs to rocks and plant life.

Pennsylvania Distribution



United States Distribution



Round Goby

Neogobius melanostomus

Species at a Glance

The round goby is a small, aggressive, bottom-dwelling fish that has dramatically altered the Great Lakes food web since it was first discovered in Lake St. Clair in 1990. It grows rapidly and reproduces several times in one season. Avian botulism outbreaks appear directly related to the round goby due to its heavy feeding on invasive zebra and quagga mussels.

Identification

The two most distinguishing features of the round goby are the black spot on the **dorsal fin**, and the fused **pelvic fin** that forms one suction cup shaped fin. Young round gobies are a solid slate gray, whereas older gobies are mottled, with olive green, black, gray, and brown spots. Spawning males turn almost solid black. Their soft body and large round head have very distinctive frog-like raised eyes. On average, they grow 10 -25 cm (3.9-9.8 in) in length.

Similar Species

While round gobies look very similar to the native mottled sculpin *(Cottus bairdi)*, the sculpin has two separated **pelvic fins** and lacks the black spot on the **dorsal fin**. The round goby may also resemble the much smaller, invasive tubenose goby *(Proterorhinus marmoratus)*, but the tubenose has tubular shaped nostril extensions and lacks protruding eyes and the black spot on the first **dorsal fin**.

Habitat

This freshwater fish prefers shallow water with rocky and sandy bottoms where it likes to perch on top of rocks and hide in crevices. Round gobies can occupy a variety of depths, can tolerate a wide range of temperatures, water quality, and oxygen concentrations, and can survive in brackish water.

Spread

The round goby was most likely introduced to the Great Lakes through the ballast water of ocean-going cargo ships. Because they resemble small baitfish, boaters and fishermen can accidentally carry them from one body of water to another through bait buckets, bilge water, and plant debris.

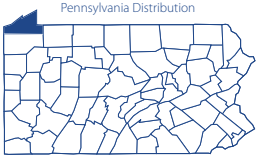
Distribution

Native to Eurasia, including the Black, Caspian, and Azov seas and tributaries, round gobies were first sighted in the St. Clair River in 1990 and since have spread to all of the Great Lakes. They are now working their way inland through rivers and canal systems. In Pennsylvania, the round goby is abundant in Lake Erie and its tributaries. The first Pennsylvania inland occurrence was confirmed in 2010 at the Gravel Pits quarry in Erie County.

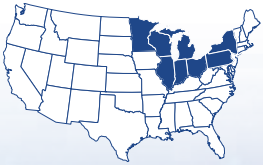
Environmental Impacts

The round goby is thriving at the expense of native populations, many of which are important sport fish. It outcompetes native species including sculpin, logperch, lake trout, and darters for food sources, habitat, and spawning sites. It also spawns more frequently and feeds on their eggs and young.

Pennsylvania Distribution



United States Distribution



Sea Lamprey

Petromyzon marinus

Species at a Glance

Sea lampreys are primitive, jawless fish that resemble eels. These aggressive parasites affect Great Lakes fish populations such as lake trout, rainbow trout, whitefish, and walleye because they can latch onto their victims for up to several weeks and feed on their blood and body fluids.

Identification

Sea lampreys have long, flexible, cylindrical, scaleless bodies with a deeply notched **dorsal fin**, separating it into two distinct parts. The body is 30-51 cm (12-20 in) long and weight can range from 227-369 g (8-13 oz). Adults have a disc-like mouth that contains circular rows of over 100 sharp, hooked teeth. Larval lampreys, called **ammocoetes**, have a very small, undeveloped mouth hidden between folds of skin. Juveniles have white undersides and uniformly colored blackish blue or silver backs. Adults can be olive-brown, yellow-brown, green, red, or blue mottled with a darker shade of the same color; or sometimes nearly black. The underside is typically white or gray.

Similar Species

Non-parasitic native lamprey species such as the Ohio lamprey *(Ichthyomyzon bdellium)*, the American brook lamprey, *(Lampetra appendix)* and the northern brook lamprey *(Ichthyomyzon fossor)* are much smaller, lack the dark blotches on the body, and have a single, continuous **dorsal fin**.

Habitat

Sea lampreys require three distinctly different habitats connected by free-flowing stretches of stream. Spawning adults are found in late May or early June in shallow pits near the upper end of gravel riffles. After hatching, the **ammocoetes** drift down to larger, slower moving streams and burrow into the sediment. After several years, they transform into parasitic adults in spring, and migrate into large bodies of water. They migrate back to tributary streams the following spring to spawn and then die shortly after.

Spread

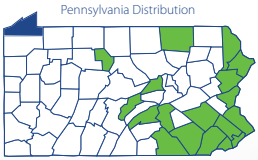
In 1921, the sea lamprey appeared in Lake Erie, arriving via the Welland Canal. It took just 25 years for it to spread to the remaining Great Lakes.

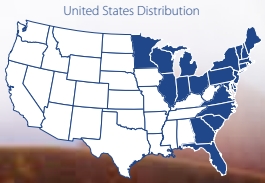
Distribution

Sea lampreys are native to the Atlantic Ocean, where natural populations moved into the freshwater areas of Lake Ontario and the St. Lawrence River to spawn. Now landlocked in the Great Lakes, the sea lamprey has distributed itself into the tributaries of those lakes. In Pennsylvania, sea lampreys are native to the Delaware and Susquehanna river basins in the eastern part of the state, and invasive in Lake Erie and Walnut Creek in Erie County.

Environmental Impacts

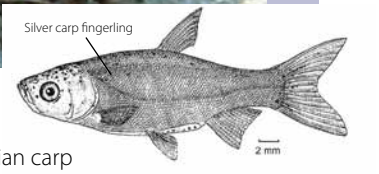
A single sea lamprey can destroy up to 40 pounds of fish during its adult lifetime. Under some conditions, only one out of seven fish attacked will survive. The sea lamprey population explosion in the 1940s and 1950s contributed significantly to the collapse of economically important Great Lakes fish species such as lake trout.





Silver Carp

Hypophthalmichthys molitrix



Species at a Glance

The silver carp is a member of the Asian carp complex, which also includes bighead, black, and grass carp. Although it is not yet found in Pennsylvania, its large size, voracious appetite, and ability to leap out of the water make it an enormous threat to the Commonwealth's fishery and recreational economies.

Identification

This very large filter feeder averages 40-70 cm (16-28 in) but can reach up to 130 cm (51 in) in length and weigh up to 80 lbs. Its deep body is **laterally compressed,** with a **ventral keel** that extends forward from the anus almost to the base of the gills. Large eyes are located low and forward on the head. The mouth is large and **terminal**, and the lower jaw is slightly longer than the upper jaw. No barbels are present on the mouth. The short **dorsal fin**, which lacks spines, contains 7-10 rays. Scales are very small. Coloration is olive to grayish-black on the back, with silvery sides blending to white below, with darker pigmentation on the fins.

Similar Species

While it most closely resembles the invasive bighead carp *(Hypophthalmichthys nobilis)*, the silver carp is fairly uniform in color, whereas the bighead has irregular dark blotches on its back and sides. The bighead also has a less extensive **keel**, spanning from the **pelvic fin** to the **anal fin**. Silver carp may also resemble the common carp *(Cyprinus carpio)*, which has barbels on either side of the mouth, and species of suckers *(Catostomidae)*, which have thick lips containing small nipple-like bumps.

Habitat

Silver carp are exclusively freshwater fish, preferring large river systems, lakes, or impoundments with flowing water, which they need to spawn. They can feed in temperatures as low as 2.5°C (36.5°F) and can withstand low levels of oxygen.

Spread

Once introduced to open waters, silver carp readily spawn and disperse. Because the juveniles resemble some common baitfish species, they may be unintentionally spread through the use of live bait. They can also spread in illegal shipments of live Asian carp, which is popular in the Asian food market.

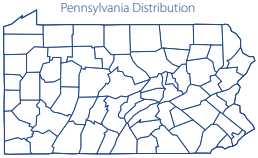
Distribution

Native to eastern Asia, silver carp were intentionally introduced into the United States to control algae growth in aquaculture ponds. During flooding in the early 1980s, they escaped into the Mississippi River and have since moved upstream towards the Great Lakes. In an effort to prevent the dispersal of Asian carp species between the Mississippi and Great Lakes watersheds, an electronic barrier is being used in the Chicago Sanitary and Ship Canal.

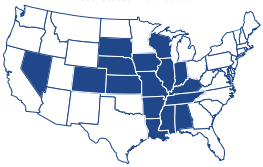
Environmental Impacts

The silver carp consumes vast amounts of plankton and **detritus** each day, competing with native filter feeders and juvenile fish for food. In addition, when startled by boat motors or other equipment, the silver carp can leap up to 3 m (10 ft) out of the water, posing a risk of injury to boaters and watersport enthusiasts.

Pennsylvania Distribution

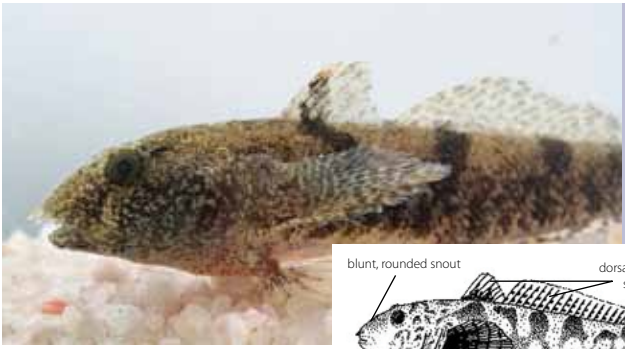


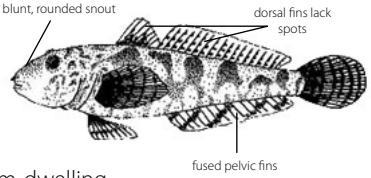
United States Distribution



Tubenose Goby

Proterorhinus semilunaris





Species at a Glance

The tubenose goby is a small, bottom-dwelling fish that gets its name from its tubular-shaped nostrils. It feeds mainly on aquatic insects, and although females can live for up to five years, males die immediately after spawning.

Identification

Its cylindrical body has small scales and a somewhat flattened underside, measuring 6-11 cm (2.4-4.3 in) in length. It has a blunt and rounded snout with a wide mouth and large lips. Tubular shaped nostrils extend just beyond the tip of the snout. Two **pelvic fins** are fused into a single suction cup shaped fin, and two **dorsal fins** lack spots. The body is light brown, with darker brown blotches that can form vertical bars on the rear half of the sides. A triangular black spot is present at the base of the **caudal fin**, followed by two white spots.

Similar Species

While it may be confused with the round goby *(Neogobius melanostomus)*, the tubenose goby is much smaller, has tubular shaped nostril extensions, lacks a spot on the first **dorsal fin**, and has eyes that do not protrude from the top of the head. In addition, tubenose gobies do not feed on zebra mussels, and their mouths are too small to be caught on fishing lines like round gobies. Tubenose gobies may also be confused with native sculpins; however, sculpins do not have scales or **pelvic fins** that form a suction cup.

Habitat

The tubenose goby lives in slightly brackish to fresh water and defends nest sites created under rocks, logs, and shells in shallow areas of lakes and rivers with plenty of plant cover.

Spread

The tubenose goby was most likely introduced to the Great Lakes in the ballast water of ocean-going ships. Since they often resemble small bait fish, they can also be spread by boaters and fishermen who accidentally carry them from one body of water to another through bait buckets, bilge water, and plant debris.

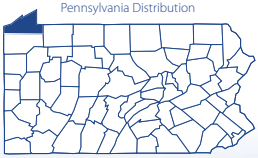
Distribution

Native to the Black and Caspian seas in Europe, the tubenose goby was first found in Lake Erie around 1990 and can now be found in lakes St. Clair, Erie, and Superior.

Environmental Impacts

While their impacts are not yet known, tubenose gobies may compete with and prey upon benthic species in a manner similar to the larger round goby. However, because it is small and not as aggressive, the tubenose goby may not be as detrimental as the round goby.

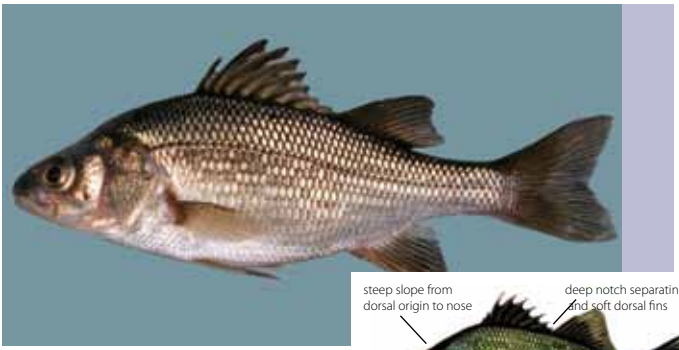
Pennsylvania Distribution

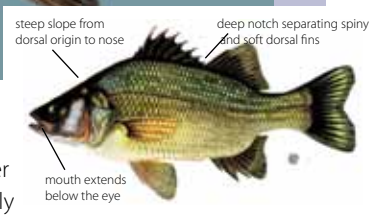


United States Distribution

White Perch

Morone americana





Species at a Glance

The white perch, also called the silver perch and the stiffback, is not actually a perch but rather a member of the temperate bass family. It is a prolific competitor of native fish species and is believed to have the potential to cause declines of Great Lakes walleye populations.

Identification

Its deep, **laterally compressed** body, which averages in length from 13-18 cm (5.1-7 in), is steeply sloped from the dorsal origin to the nose. The mouth is large and extends just below the eye, and the tongue lacks teeth. The **dorsal fin** is made up of a spiny and soft portion separated by a deep notch and a small membrane. Color is silvery-gray to greenish-brown above, fading to silvery-white below and paler on the sides, with no **lateral line**.

Similar Species

The white perch is most similar to the white bass *(Morone chrysops)*, which grows larger, is more uniformly silver with prominent dark horizontal stripes, and lacks the connected membrane between the first and second **dorsal fins**. **Hybridization** between the two species has been documented in Lake Erie, which has resulted in mixed characteristics.

Habitat

This predacious and opportunistic feeder thrives in brackish and freshwater rivers, streams, and lakes. It exploits shallow and deep water, and can overpopulate quickly.

Spread

Spread has occurred through natural dispersal, unauthorized stockings, and recreational activities. Additional spread may occur as the white perch is stocked as a sport fish in many areas of the Mississippi River Watershed.

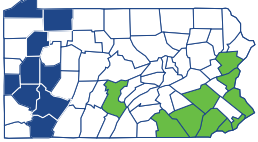
Distribution

The white perch is native to the Atlantic coastal regions of the United States, including the Lower St. Lawrence River south to South Carolina. It invaded the Great Lakes through the Erie and Welland canals in 1950 and is now found in all of the Great Lakes. In Pennsylvania it is established in Lake Erie, the Monongahela and Allegheny rivers, and has been found in several inland lakes throughout the state. This species is native in the lower Delaware and lower Susquehanna rivers.

Environmental Impacts

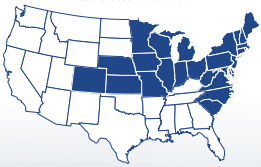
The diet of the white perch, which includes zooplankton, insect larvae, and other fishes, puts it in direct competition with native game and forage species for food. In the spring, white perch feed heavily on the eggs of other fish species such as walleye and white bass, limiting recruitment and causing declines in species numbers.

Pennsylvania Distribution



Green - Native Blue - Invasive

United States Distribution



Pathogens

Fish are vulnerable to a variety of diseases caused by organisms (pathogens) such as bacteria, viruses, and fungi that are a normal part of their environment.

These pathogens can be present at low levels, yet fish can remain healthy if their immune system is strong.

Hemorrhaging caused by viral hemorrhagic septicemia (VHS) virus

Disease outbreaks occur when fish are stressed by poor diet or sudden environmental changes that weaken their immune system, allowing the pathogens to be more active. Outbreaks also occur when fish are exposed to new pathogens to which the fish has limited immunity.

Like human diseases, fish diseases are infectious: Once a few fish get sick, the pathogens can spread rapidly in water, from fish to fish, causing large die-offs in the population.

Only a fish disease expert can identify with certainty which pathogen is causing a disease. Diseases may affect fish in different ways and many of them have similar and overlapping symptoms.

Common warning signs of a fish disease outbreak include:

- Abnormal swimming: swimming in circles or upside down
- Gasping, rapid gill movement; bleeding, eroded, or pale gills
- Skinny body, hollow belly
- Pale body colors
- External cysts, sores, bloodstains; bloody or bulging eyes
- Fungus, often resembling white or yellow fuzz, on body

Bulging eyes, a symptom of fish disease

If you see fish exhibiting any of these symptoms, contact state and federal authorities immediately. See the "REPORTING AQUATIC INVASIVE SPECIES" section for more information on reporting suspected cases.

Spring Viremia of Carp (SVC)

Rhabdovirus carpio

Species at a Glance

The spring viremia of carp (SVC) virus is a highly contagious pathogen found to impact mainly common carp and related species. While fish can carry SVC with or without symptoms, outbreaks can cause high rates of death and substantial economic losses.

Identification

SVC is caused by a bullet-shaped RNA virus that can cause external symptoms including bulging eyes; hemorrhaging of the skin, gills, and eyes; a bloated appearance; darkening of the skin; and vent protrusion. Internally, fluids can build up in the organs and body cavity, and hemorrhaging and inflammation can occur in the swim bladder and intestines. Diseased fish may appear lethargic, swim and breathe more slowly than normal, and tend to gather at the water inlet or sides of ponds. Loss of equilibrium with resting and leaning can also be seen in later stages. Other members of the Family Cyprinidae (minnow family) and possibly northern pike *(Esox lucius)* are also susceptible to this disease.

Similar Species

The symptoms of SVC have characteristics similar to those of other fish diseases, so lab testing is necessary to confirm that a fish is infected with SVC.

Habitat

SVC usually occurs in the spring, when water temperatures are less than 18°C (64°F); however, the virus can persist in 10°C (50° F) water for more than four weeks, and in 4° C (39° F) mud for at least six weeks. Mortality rates vary with stress factors, population density, age, and condition of the fish.

Spread

SVC is highly contagious and can be spread through contact with the environment and through parasitic invertebrates such as the carp louse or leeches. Infected fish shed the virus through feces, urine, and gill and skin mucous. When fish come into contact with infected water, the virus enters most often through the gills.

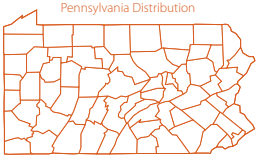
Distribution

SVC has been identified in Europe, Russia, and the Middle East, and was first diagnosed in Yugoslavia. The first report of this disease in the United States was in 2002 in North Carolina. It has since been found in Wisconsin, Illinois, Missouri, Washington, Lake Michigan, and in areas of the upper Mississippi River.

Environmental Impacts

SVC mortality rates, which can reach up to 70 percent in young carp, can have serious economic impacts on aquaculture. No vaccines exist for the virus, so prevention by proper disinfection of equipment and gear is the best method for fighting this disease. There is currently no indication that SVC is any threat to human health.

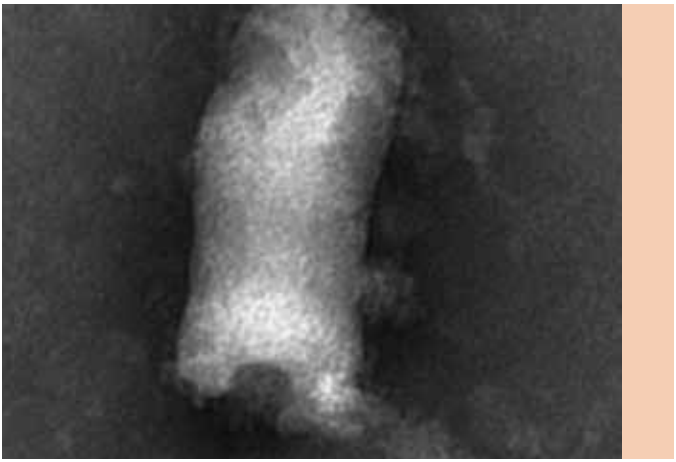
Pennsylvania Distribution



United States Distribution

Viral Hemorrhagic Septicemia (VHS)

Novirhabdovirus sp.



Species at a Glance

Viral hemorrhagic septicemia (VHS) virus is a highly contagious fish pathogen that has caused significant fish kills in the Great Lakes region of the United States and Canada. Once a fish is infected with VHS, there is no known cure. REPORT SUSPECTED CASES TO STATE AND FEDERAL AUTHORITIES IMMEDIATELY.

Identification

VHS is a bullet-shaped virus of the genus *Novirhabdovirus*. Symptoms of the disease may include bulging eyes, bloated abdomens, darker coloration, unusual behavior, and hemorrhaging in the eyes, muscle tissue, skin, gills, and at the base of the fins. Some species, such as the bluntnose minnow *(Pimephales notatus)* and the emerald shiner *(Notropis atherinoides)*, show no obvious symptoms.

Similar Species

The symptoms of VHS have characteristics similar to those of other fish diseases, so lab testing is necessary to confirm that a fish is infected with VHS.

Habitat

Fish mortality from VHS infection is highest at water temperatures between 9-12°C (48-54°F), and deaths rarely occur at temperatures above 15°C (59°F). Outbreaks often occur during stressful environmental changes, such as rising water temperatures in the spring, or during spawning.

Spread

VHS is highly contagious and easily transmissible, spreading through contact with the infected water or from fish to fish. Survivors can become lifelong carriers. Transfer to new water bodies is thought to be primarily through fish stockings and baitfish transfer. Natural fish migrations, recreational boating and angling, ballast water discharge, and aquarium and live fish releases could also help spread this virus.

Distribution

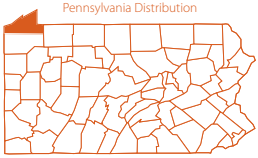
Since its initial discovery in Europe in the mid-1900s, four VHS strains, including freshwater and marine, have been identified. Introduction into the Great Lakes is believed to have been as early as 2003. VHS is present in the waters of lakes Michigan, Huron, St. Clair, Erie, and Ontario, as well as the Detroit, Niagara, and St. Lawrence rivers and in some of the Finger Lakes in New York.

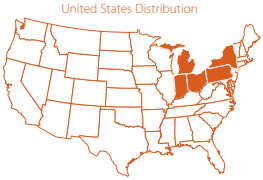
Note

In Pennsylvania, live fish transport out of the Lake Erie and Genesee River drainage basin is prohibited. It is also unlawful to transport, sell, or introduce VHS susceptible species, dead or alive, into the Commonwealth unless laboratory tested and certified as negative for the virus. It is also unlawful in Pennsylvania to use the eggs of VHS-susceptible species as bait.

Environmental Impacts

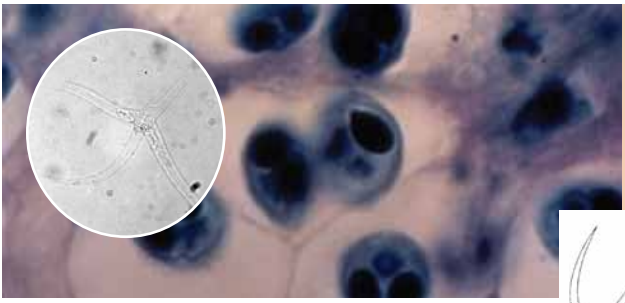
At least 50 species of marine and freshwater fish carry the virus, including muskellunge, smallmouth bass, northern pike, and yellow perch. The full list of VHS susceptible species can be found online at http://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/. The long-term risks of VHS on the Great Lakes' 4 billion dollar fishery are unclear; however, large fish kills of certain species have been reported. There is no indication that VHS is a threat to human health.

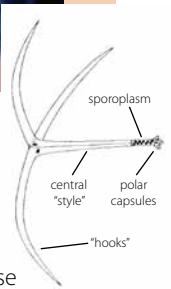




Whirling Disease

Myxobolus cerebralis





Species at a Glance

Whirling disease is an infection caused by the microscopic parasite *Myxobolus cerebralis*, which impacts members of the salmonid family, such as trout, salmon, and whitefish. This parasite is an exotic species from Europe that can cause fish to swim in a characteristic "whirl" pattern. It is a significant threat to hatcheries and wild cold-water fisheries in North America.

Identification

This parasitic organism has a complex life cycle requiring two hosts, tubifex worms and the Salmonidae family of fish. Its life begins when tubifex worms consume spores found in the sediment of river bottoms. The worms become infected and the spores develop into a free-swimming form called **triactinomyxon** (TAM). When the host cell bursts it releases TAM spores into the water. These spores can attach to a fish's skin, penetrate through secretory openings and settle in its head and cartilage. The TAM then multiplies rapidly and eventually invades the spinal cord and the brain and it puts pressure on the organ of equilibrium, causing the fish to swim erratically (whirl). This makes it difficult for the fish to feed and avoid predators. Other physical symptoms include blackened tail and deformities of the head and spine. Infected fish release mature spores into the water, and the cycle begins again.

Similar Species

The symptoms can have characteristics similar to those of other fish diseases, so lab testing is necessary to confirm that a fish is infected.

Habitat

Because spores are released from the tubifex worm almost exclusively when the temperature is 10°-15°C (50-59°F), fish in warmer or cooler waters are less likely to be infected. The spores can withstand freezing, drying, and passing through the digestive tracts of predators. They can also survive in the stream for 20-30 years. Once in the short-lived TAM stage, infection of fish hosts is dependent upon temperature as well as other environmental factors.

Spread

When an infected fish dies, many thousands to millions of the parasite spores are released to the water. The parasite can spread naturally through a watershed, or by humans moving infected fish and fish parts, or moving mud or water from one watershed to another.

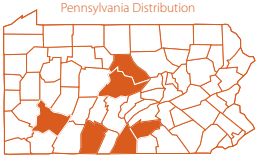
Distribution

The parasite, which is native to Europe, was first identified in the Benner Springs fish hatchery in Pennsylvania in the late 1950s, presumably arriving with frozen fish shipments. It has spread to more than 25 states. In Pennsylvania, outbreaks have only occurred in fish hatchery operations, and although the parasite has been detected in wild streams, it has not led to outbreaks in wild trout populations.

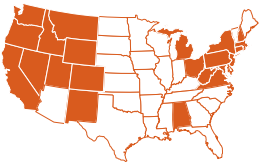
Environmental Impacts

All species of trout and salmon may be susceptible to whirling disease, although rainbow and cutthroat trout appear to be the most vulnerable. Brown trout appear to have immunity to the infection and have not been as greatly impacted. Young fish are also more susceptible because their skeletons have not ossified and they are more prone to deformities. Whirling disease cannot infect humans, mammals, or fish that are not members of the salmonid family.

Pennsylvania Distribution



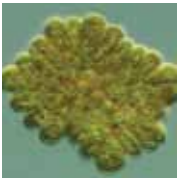
United States Distribution



Algae Group Descriptions

Green algae *(chlorophyta)*: This large and diverse group of algae can range from small, single-celled organisms to large, multicellular organisms and colonies. They are considered the closest ancestors to the land plants because they share common features, including the photosynthetic pigments chlorophyll a, chlorophyll b, beta carotene, and cellulose-rich cell walls. They are also the only algal group to produce starch for food stores.

Blue-green algae *(cyanobacteria)*: Notorious for forming blooms (some of which are toxic), these organisms are not really algae, but rather aquatic bacteria that obtain their energy through photosynthesis. Like other bacteria, the cells are prokaryotic and therefore lack nuclei, **chloroplasts**, mitochondria, and **flagella**. Cyanobacteria may be single-celled or colonial, with colonies forming filaments, sheets, or even hollow balls.



Golden-brown algae *(chrysophyta)*: Mostly abundant in freshwater, this large group of algae is typically found in waters with a neutral or slightly acidic pH, low conductivity and nutrient levels, and colder temperatures. They are particularly important in lakes, where they may be a primary source of food for zooplankton. In many species, the cell walls are composed of cellulose with large quantities of silica, similar to the diatoms.

Dinoflagellates: These typically unicellular **flagellates** have armored cell walls made of thick plates that fit tightly together to form a continuous covering for the cell. Half the dinoflagellates are colorless predators that consume their food. The other, pigmented half are usually a golden brown in color. Out of the several thousand species of dinoflagellates, only a couple hundred are found in freshwater habitats.

Diatoms: These single-celled organisms are characterized by beautiful and intricate shapes. Most diatoms exist singly, although some join to form colonies. Diatoms can be fresh or salt-water and appear in the greatest abundance early in the year in the phenomenon called the "spring bloom," when both light and nutrients are highly available. The cell walls are made up of silica, which persists in the environment after the cells have died, creating an extensive fossil record.

Euglenoids: This small phylum consists of mostly freshwater, unicellular aquatic algae. Some euglenoids contain **chloroplast** with photosynthetic pigments, and others are heterotrophic, meaning they can ingest or absorb their food. The most characteristic genus is Euglena, common in ponds and pools, especially when the water has been polluted by runoff from fields or fertilized lawns.

Didymo

Didymosphenia geminata

Species at a Glance

Didymo, also called "rock snot," is a single-celled alga found in the cool waters of northern Europe and North America. Since the mid-1980s, it has begun to take on the characteristics of an invasive species, forming massive blooms that blanket stream and river bottoms, threatening a variety of aquatic systems.

Identification

Beginning as small circular brown blotches on rocks and other substrates, didymo can grow in two stalked forms – short stalked and long stalked. The short form generally appears as a coating on hard substrates, while the long stalked form can take on the appearance of wet fiberglass or toilet paper. Didymo has also been mistaken for raw sewage. The extracellular stalk material can form thick nuisance mats that can be over 20 cm (8 in) thick. While it appears slimy, it is actually rough to the touch, like wet wool, and is very difficult to pull apart and detach from rocks. When determining if a suspect specimen is didymo, squeeze out as much water as possible and rub between the fingers.

Similar Species

Unlike other species of algae, didymo does not break apart when rubbed between your fingers, nor does it feel slimy to the touch.

Habitat

Didymo is both **epilithic** (attaching to stones) and **epiphytic** (attaching to plants) and can thrive in a wide range of physical and chemical conditions within lakes and rivers. It prefers relatively shallow, clear, moderately-flowing and nutrient-poor waters with rocky substrates and plenty of sunshine. Nuisance blooms are only known to occur in flowing water.

Spread

Anglers, kayakers, canoeists, and boaters can accidently spread this microscopic hitchhiker, which can cling to fishing gear, waders, boots, and boats. Felt-soled waders are especially good at transporting didymo because they can stay wet for longer periods of time, and didymo can survive outside of a stream in a cool, damp environment for at least 40 days. Only one cell is needed for it to spread.

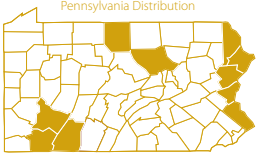
Distribution

Historically, didymo was found in cooler waters in the northern hemisphere and was considered a rare alga in the United States. However, in recent years it has exhibited a much greater tolerance for different water chemistry conditions and has expanded to diverse areas, including parts of Canada, New Zealand, and scattered areas in the United States, including New England, the Mid-Atlantic Region, and the western United States. In October 2007, didymo was first discovered where the east and west branches of the upper Delaware River meet along the New York and Pennsylvania border. Since then, didymo has spread as far south as Bucks County in the Delaware River, and the entire length of the Youghiogheny River, in several other counties throughout Pennsylvania.

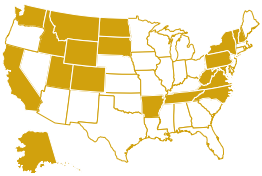
Environmental Impacts

Didymo cells can create large amounts of stalk material that form thick mats that are capable of completely engulfing a stream bottom, covering substrates, smothering aquatic organisms, and ultimately reducing fish habitat and food. Didymo does not appear to affect the safety of drinking water, does not produce an odor, and while aesthetically unappealing, does not appear to be a threat to human health.

Pennsylvania Distribution



United States Distribution



Golden Alga

Prymnesium parvum

Species at a Glance

Golden alga is a naturally occurring, one-celled, microscopic organism that can be found worldwide on every continent except for Antarctica. Toxins produced by the alga have caused extensive kills of aquatic animals, resulting in severe ecological and economic harm.

Identification

Golden alga is a tiny organism about the size of a human blood cell. It is very mobile and uses its two "tails," called **flagella**, to move through the water. A short, stiff, hair-like structure called a **haptonema** is used to attach the cell to other cells or objects. A yellow-green, C-shaped **chloroplast** wraps around the middle of the cell and can be seen under a microscope. During a typical bloom, the water turns yellowish, yellowish-copper, or a brownish tea color. Foaming at the surface of the water in areas where there is a lot of wave action is another sign. Exposed fish may swim slow or erratically just below the surface, lie inactively along the bottom in shallow areas, or show no avoidance to human presence. Other visible signs include redness or hemorrhaging at the base of the fins, around the mouth area, under the chin, and along the belly.

Similar Species

The conditions typical of a golden alga bloom may come from other sources and do not always indicate a golden alga bloom.

Habitat

Generally found in brackish waters, golden alga cells can thrive in a variety of environmental conditions, including a salinity range of 1-40 PSU (Practical Salinity Unit) and a temperature range of 5-35°C (41-95°F). Other factors that affect its growth include phosphorus (P) and nitrogen (N) levels, **cationic** substance levels, and pH. Toxic blooms typically occur at salinity levels of 1-12 PSU, temperatures of 10-25°C (50-77°F), and at fairly high P and N levels.

Spread

A single drop of water may contain over 2,000 golden alga cells. Unintentional spread may occur by water currents or as cells stick to the feathers or fur of waterfowl and other animals. Under stressful conditions, golden alga is able to form into dormant cysts that can hitchhike to new areas in live wells, bait buckets, recreational boating and fishing equipment, or equipment used during water withdrawals.

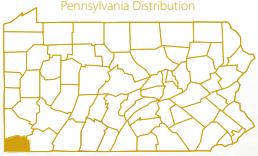
Distribution

First identified in the United States in Texas in 1985, golden alga has since spread to 18 states. In Pennsylvania the first known occurrence was in 2009, when it contributed to a massive kill spanning nearly 30 miles of Dunkard Creek in Greene County along the Pennsylvania-West Virginia border.

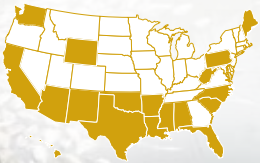
Environmental Impacts

Golden alga is fast growing, resilient, and uses nutrients more effectively than other kinds of algae. Bloom situations can cause extreme die-offs of native threatened and endangered species. Serious economic consequences for affected communities have also been well documented. At-risk waters can include those with high salinities and those being affected by mineral resource extraction, such as natural gas. There is currently no evidence that golden alga has toxic effects on non-gill breathing organisms or humans.

Pennsylvania Distribution



United States Distribution



Starry Stonewort

Nitellopsis obtusa

Species at a Glance

While starry stonewort resembles a true plant, it is actually a rooted alga descended from some of the earliest life forms on earth and thought by scientists to have been the ancestors to all plants. Its ability to degrade ecologically sensitive areas and proliferate rapidly makes it a highly invasive species.

Identification

This robust alga grows more than 2 m (7 ft) long. It is a light green color when actively growing. One way to distinguish starry stonewort is by the tiny, star-shaped, tan-colored reproductive structures called **bulbils** that are firm to the touch when compared to its soft branches. Its long, relatively straight branches are arranged in **whorls** of 4-6, which are attached at angles to the stem **nodes**. Stems can reach up to 80 cm (31 in) long and will "pop" when squeezed. Dark-red to orange reproductive structures called **oogonia** (female) and **antheridia** (male), can occur in the **nodes** of the branches although all North American colonies appear to be male plants. Colorless hair-like filaments called **rhizoids**, which act as roots, absorb nutrients and provide stability. Instead of forming uniform mats, this alga forms irregularly spaced "pillows" of dense vegetation in various heights. When growth declines, usually in summer, circular openings may appear in the mat that resembles a "Swiss cheese" pattern.

Similar Species

While it may be confused with native species of chara, like muskgrass *(Chara spp.)*, starry stonewort's light green color when growing distinguishes it from other charoid species. It can also be distinguished by the "squeeze test", where the contents of the cell will "pop" out when squeezed. In addition, starry stonewort can grow to remarkable heights and depths. Its branching pattern is more irregular; giving the plant a characteristic ragged or "disheveled" appearance. Most charoid algae have a musky or garlic odor that's not as pronounced in the starry stonewort. Star-shaped **bulbils** are a key characteristic and are best observed from late fall through winter.

Habitat

Stoneworts live in fresh or brackish water and tolerate low nutrient and light levels. They are found at depths from 1 m (3 ft) to greater than 6 m (20 ft) in lakes or slow moving rivers, and prefer alkaline waters. They can grow on organic and inorganic substrates and have the ability to absorb nutrients through all surfaces, not just the **rhizoids**.

Spread

Starry stonewort was likely introduced to North America in the ballast water of ocean-going ships. It spreads rapidly by fragments and **bulbils** that are easily transported by boats, trailers, and water currents.

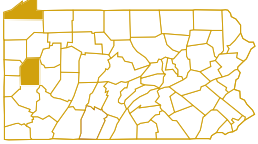
Distribution

Native to Europe and western Asia, and classified as endangered in Great Britain, this alga was first reported in the St. Lawrence River in 1978 and the St. Clair River in 1983. In 2005, starry stonewort was reported in Oneida Lake in New York, and in 2006 it began to rapidly expand its range throughout inland lakes in Michigan. It has since spread to Wisconsin, Vermont, and Pennsylvania where it can be found in Lake Arthur in Butler County and Presque Isle Bay in Erie County.

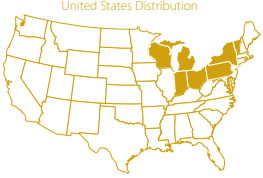
Environmental Impacts

Dense mats of starry stonewort can completely cover the lake bottom and greatly reduce the diversity of aquatic plants. These mats can be up to 2 m (7 ft) thick, and can impede the movement of fish and other animals, decrease available habitat for successful spawning activities, reduce water flow, and prevent recreational activities.

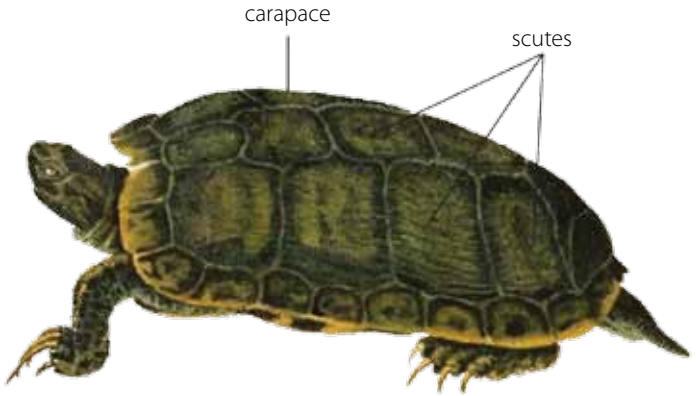
Pennsylvania Distribution

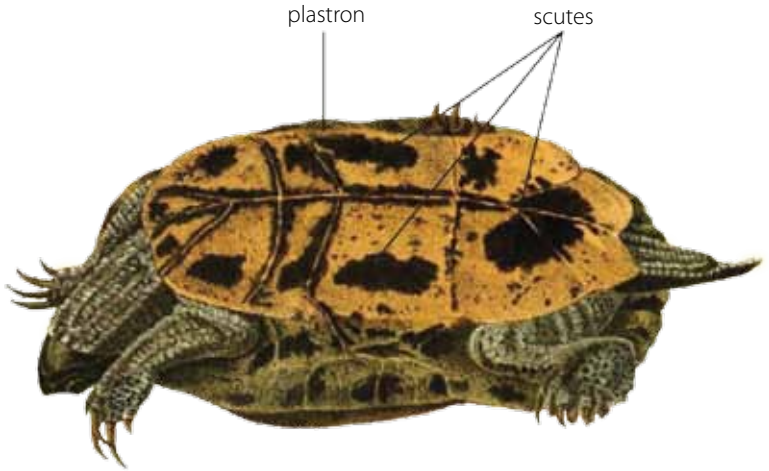


United States Distribution



Turtle Shell Anatomy





INVASIVE REPTILES

Red-eared Slider

Trachemys scripta elegans

Species at a Glance

The red-eared slider, which gets its name from the red, oblong streaks present behind each eye, has been listed as one of the "100 World's Worst Invaders." It has a voracious appetite and outcompetes native turtles, and its popularity in the pet trade has helped account for its numerous introductions worldwide.

Identification

The unique, broad, reddish-orange patch behind the eyes grazes the left and right **flanks** of the skull. The shell is a dark green with black or off-white stripes. The skin is olive to brown with yellow stripes or spots. Females typically reach 25-33 cm (10-13 in) in length, whereas males are considerably smaller, reaching 18-23 cm (7-9 in), and have a long, thick tail. Young individuals have numerous dark, eye-like spots on the yellow **plastron**, or under part of the shell.

Similar Species

This average-sized, common-looking turtle can be easily confused with many other turtle species, especially those in the *Trachemys* genus. The most notable look-a-like is the yellow-bellied slider *(Trachemys scripta scripta)*, which has a yellow patch behind the eye instead of red. The red-bellied turtle *(Pseudemys rubriventris)*, which is a Pennsylvania threatened species, has almost identical foraging, nesting, and food requirements as the red-eared slider, but it can be distinguished by a distinctive orange to reddish color on the underside of the shell.

Habitat

The red-eared slider is a hardy, freshwater turtle that flourishes in many kinds of habitat and is frequently seen basking on rocks, logs, vegetation masses, and banks. It prefers quiet waters such as ponds and wetlands but will also inhabit slow-moving waterways, brackish waters, or even fairly polluted waters and can survive the cold by hibernating in the winter.

Spread

Despite a 1975 ban by the U.S. Food and Drug Administration on the sale of red-eared sliders fewer than four inches, small hatchlings are still available for Internet or mail order. When they grow into large adults, unprepared pet owners release them into the natural environment, where they can reproduce and spread.

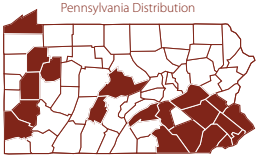
Distribution

While the native range includes Midwestern states within the Gulf Coast basin and Mississippi Valley area, this turtle has invaded most of the world with human help. In Pennsylvania, the first recorded red-eared slider was in 1996 in Lehigh County. Today, this turtle can be found in many counties in southeastern Pennsylvania and is thought to be widespread in the Delaware River basin.

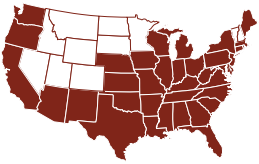
Environmental Impacts

The red-eared slider has infiltrated the ecosystems of nearly every continent. As aggressive omnivores feeding on fish, plants, insects, amphibians, and other aquatic organisms and their eggs, they directly compete with many native aquatic and terrestrial turtles for food, basking areas, and nesting sites. Their ability to survive and reproduce in polluted waters makes them prone to contracting and spreading diseases.

Pennsylvania Distribution



United States Distribution



Yellow-bellied Slider

Trachemys scripta scripta

Species at a Glance

The yellow-bellied slider is a semi-aquatic basking turtle that can be found resting on logs, stumps, or rocks when the weather is mild and the sun is out. This species can mate with the red-eared slider *(Trachemys scripta elegans),* producing hybrids that are often sold as pets.

Identification

A vertical yellow blotch that runs behind the eye is most evident in juveniles and females. Narrow yellow stripes mark the neck, legs, and arms. The upper shell (**carapace**) is oval in shape and tends to be **serrated**, with olive to brownish-yellow vertical bands. Older turtles can be completely black. The lower shell (**plastron**) is typically yellow with dusky smudge-like markings and often has two solid black spots towards the rear. Males range from 13-20 cm (5-8 in), while females range from 20-33 cm (8-13 in).

Similar Species

Both the yellow-bellied slider and the eastern river cooter *(Pseudemys concinna concinna)* have yellow stripes down the neck and underside, but the eastern river cooter tends to have green spots along the edge of the belly.

Habitat

The yellow-bellied slider inhabits lakes, ponds, streams, rivers, ditches, marshes, bays, and swamps, preferring areas with aquatic vegetation. They can also survive in saltwater.

Spread

Because the yellow-bellied slider is popular in the pet industry, intentional pet releases, as well as escapes into the natural environment, are the mostly likely vectors for its spread.

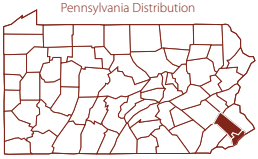
Distribution

Although the yellow-bellied slider is native to the United States in parts of Virginia and the Carolinas, it has been collected (but is not yet established) in New York, Wisconsin, Colorado, New Mexico, California, Arizona, and Mexico. In Pennsylvania, the yellow-bellied slider has been reported in Philadelphia and Montgomery counties.

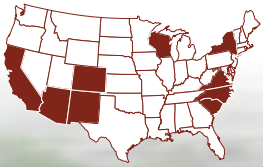
Environmental Impacts

Little is known about the ecological impact of sliders, although they compete with other native species of turtles for food and basking sites. These turtles have also been linked with salmonella when farmed and sold as pets, increasing the spread of disease to humans and other turtles.

Pennsylvania Distribution



United States Distribution



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Glossary

Achene: Dry, one-seeded fruit that splits to release the seed

Adipose fin: A small, rayless, fleshy dorsal fin present in certain fishes

Allelopathic (Allelopathy): The process by which a plant releases chemicals that can inhibit or benefit other plant species

Alternate: Leaves spaced singly along a stem, one at each node

Ammocoete: The larval stage of primitive jawless vertebrates, such as the sea lamprey

Anadromous: Migrating between freshwater and saltwater to breed

Anal fin: An unpaired fin located on the underside of a fish, posterior to the anus

Anther: Plant structure located in the stamen (male organ) of the flower that contains the pollen

Antheridia: The male sex organ of algae, mosses, ferns, fungi, and other nonflowering plants

Areola: A small circular area; small space that separates the carapace in crayfish

Asexual reproduction: Mode of reproduction that does not involve meiosis; offspring arise from a single parent and inherit genes only from that parent

Axillary: In an axil; growing in an axil, as buds

Axil: The angle formed between two structures on a plant, such as a leaf and a stem

Biofouler: A living organism whose growth or activity results in the impairment or degradation of something, such as a ship's hull or mechanical equipment

Bracts: Small, specialized, leaf-like structures at the base of a flower or leaf

Bulblet: A small bulb, or bulb-shaped growth arising from the leaf axil or replacing the flowers; capable of producing a new plant when separated from the parent plant

Byssal threads: Strong, silky fibers made from proteins that are used by mussels or other bivalves to attach to rocks, pilings, or other substrates

Carapace: A hard, bony or chitinous case or shield covering the dorsal (upper) part of an animal, such as a turtle or crab

Caudal: Directed towards the hind part of the body

Caudal fin: The tail fin; located at the end of the caudal peduncle and used for propulsion

Chloroplast: Specialized organelles found in plant cells and other eukaryotic organisms where photosynthesis occurs

Cladoceran: Small crustaceans in the order Cladocera which are commonly found in most freshwater habitats

Cleistogam (cleistogamy): Small, inconspicuous, self-pollinating flowers, often more fruitful than showier ones on the same plant

Composite flowers: Large family of flowering plants with individual flowers forming clusters or groups of flowers arranged on a steam, which gives it the appearance of a single flower

Compound eye: The eye of most insects and some crustaceans, consisting of multiple light-sensitive parts, each serving to focus light on the retina to form a portion of an image

Creeping: Growing by spreading out and staying close to the ground

Deciduous: Falling off or shedding at a particular season or stage of growth, such as trees shedding their leaves annually

Detritus: Non-living, particulate organic material; any disintegrated material or debris

Dimorphism: The difference in appearance between males and females of the same species

Dioecious: Having male and female reproductive organs on separate individuals of the same species

Diphycercal: Caudal tail shape; vertebrae extend to the tip of the tail and the tail is symmetrical and epanded

Dorsal fins: Are located on the back of a fish and serve to protect against rolling and assist in sudden turns and stops; can have up to three

Emarginate: Caudal fin with a slight inward curve

Emergent: Plants with leaves that extend above the water surface, usually found in shallow water

Epilithic: Growing on the surface of a rock

Epiphytic: Growing on another plant

First-form male: The breeding form of male crayfishes

Flagellum (flagella): Long, slender, whip-like extensions of certain cells or unicellular organisms, used mainly for movements

Flanks: The side of the body between the ribs and the hips

Fragmentation: A form of asexual reproduction where an organism is split into fragments that develop into mature, fully grown individuals that are clones of the original organism

Fruit: The seed bearing portion of a plant

Fusiform: Elongated and spindle-shaped at both ends; fish with this body shape are capable of swimming very fast

Gonopods: Specialized appendages of various arthropods used in reproduction or egg-laying

Haptonema: A stiff, hair-like organelle attached near the flagella in a group of algae called haptophytes; may function in attachment, feeding, or avoidance

Heartwood: The dense inner part of a tree trunk

Hermaphroditic: Organism that has reproductive organs associated with both male and female sexes

Heterocercal: Caudal tail shape; vertebrae extend into the upper lobe of the tail, making it longer (as in sharks)

Homocercal: Caudal tail shape; fin appears superficially symmetric but in fact the vertebrae extend for a very short distance into the upper lobe of the fin

Hybridization: The mixing of different species or varieties of animals or plants to produce hybrids of those species

Inflorescence: A cluster or arrangement of flowers on an axis

Keel: A lateral ridge found on the caudal peduncle of many fast-swimming fishes that provides stability and support to the caudal fin

Lateral line: A series of sensory pores along the head and sides of a fish and some amphibians by which water currents, vibrations, and pressure changes are detected

Laterally compressed: Flattened from side to side; fish with this body shape usually do not swim rapidly but have exceptional maneuverability

Leaflet: Individual blades found in a compound leaf

Lemma: A larger, outer bract which, along with the palea, serves to contain the floret(s) held within and provides a protective covering for the developing floret as well as for the seed after ripening

Ligule: Thin, membranous extension of the leaf sheath on the upper surface of the leaf; may be hairy or bristly, hard or soft

Lunate: Caudal fin shaped like a crescent moon

Margin: The edge of a leaf

Mid-vein (Mid-rib): The central vein of a leaf that runs from the tip to the base of the leaf

Monoecious: Having male and female reproductive structures on the same plant

Monotypic: Having only one type or representative; such as a genus containing only one species

Morphs: One of several variant forms of an animal or plant

Nacre (Mother of pearl): The hard, pearly, iridescent substance forming the inner layer of a mollusk shell

Nodes: A knob, or joint of a stem from which leaves, roots, shoots, or flowers may arise

Nut/Nutlet: Dry fruit having a hard shell which usually contains only one seed; nutlets are very small nuts

Nuptial tubercles: Usually small, raised structures on regions of the head, body or fin rays where two individuals come in contact to breed; may function to maintain body contact between the sexes during spawning

Obliterate: invisible or indistinct

Ocrea: A sheath around a stem or node formed by two or more **stipules**

Oogonia: The female sex organ of certain algae and fungi; typically a rounded cell or sac containing oospheres

Operculum: A structure that acts as a lid or covering to close the aperture of a mollusk's shell when the animal is retracted

Opposite: Two leaves emerging from one node directly across from one another; leaves occurring in pairs

Palmate: Having several lobes (typically 5-7) whose mid-ribs all radiate from one common point

Panicles: A many branched **inflorescence**

Pelagic: Relating to the open sea

Pelvic fin: Each pair of fins on the underside of a fish's body, attached to pelvic girdle and helping to control direction

Peritoneum: The membrane that lines the abdominal cavity and covers most of the abdominal organs

Petiole: A leaf stalk

Pharyngeal: Relating to the pharynx, which is the membrane-lined cavity behind the nose and mouth that connects them to the esophagus

Pistils: The female fertilizing organs of a flower

Pistillate: Having **pistils** (female flowers) but no **stamens** (male flowers)

Plastron: The ventral surface of a turtle shell

Protocercal: Caudal tail shape; vertebrae extend to the tip of the tail and the tail is symmetrical but not expanded

Rhizoid: A filamentous outgrowth on the underside of some plants, especially mosses, serving to anchor the plant and conduct water

Rhizomes: A creeping underground stem

Rosette: Leaves arranged in a radiating pattern at the base or top of the plant

Runner: A slender, creeping stem that puts forth roots from nodes, spaced at intervals along its length; new plants eventually grow from the nodes and can become detached from the parent plant

Scute: A thickened horny or bony plate or large scale; such as on the shell of a turtle, underside of a snake, back of a crocodile, etc.

Sepals: Part of the outer floral leaves; usually green

Serrate/Serrated: A sharply toothed leaf margin

Sessile: Sitting directly on a main stem or branch without the support of a leaf stalk

Sheath: The extension of the leaf that surrounds the stem

Spike/Spikelet: A flower or fruit bearing stalk

Stalk: A stem or similar structure that supports a plant part such as a flower, flower cluster, or leaf

Stamen: The male fertilizing organ of a flower

Staminate: Having stemens (male flowers) but no pistils (female flowers)

Stipule: A small, paired, leaf-like appendage at the base of a leaf stalk in certain plants, such as roses and beans

Stolon: A horizontally creeping stem on the surface of the soil

Submersed (submerged): Plants growing with their root, steams, and leaves completely under the surface of the water

Sutures: A line or junction of adjacent animal or plant parts such as the juncture between whorls of a mollusk shell, or the junction between the valves of a bivalve shell

Telson: The last segment in the abdomen, or terminal appendage in crustaceans, chelicerates, and embryonic insects

Terminal: Situated at the end or extremity

Triactinomyxon: Spores that live in tubifex worms and can infect other fish with whirling disease

Truncate: Appearing to end abruptly, shortened, cut off at the end

Tuber: The short, thickened, fleshy, food-storing portion of an underground stem with many surface buds; shaped like a tiny potato

Tubercle: A small rounded projection, especially on the bone or on the surface of a plant or animal

Turbidity (turbid): Muddiness created by stirring up sediment or having foreign particles suspended

Turion: A young scaly shoot budded off from underground stems; detachable winter bud used for survival when conditions are unfavorable

Vegetatively: A form of asexual reproduction of a plant where new plants grow from parts of the parent plant

Veliger: The free-swimming, planktonic larva of certain aquatic mollusks such as zebra mussels

Ventral: Relating to the underside of an animal or plant

Whorl/Whorled: A pattern of spirals or concentric circles; In plants: an arrangement of three or more leaves, flowers, or bracts radiating from a common node, spread at intervals along the stem.

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Measurement Conversion

1 centimeter = 0.39 inches

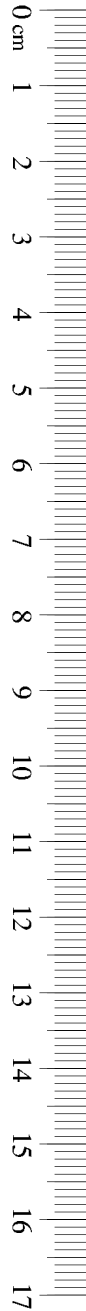
2.5 centimeters = 1 inch

25.4 millimeters = 1 inch

30.5 centimeters = 1 foot

1 meter = 3.28 feet

0.914 meters = 1 yard



Centimeter Specimen Ruler

Sea Grant
Pennsylvania