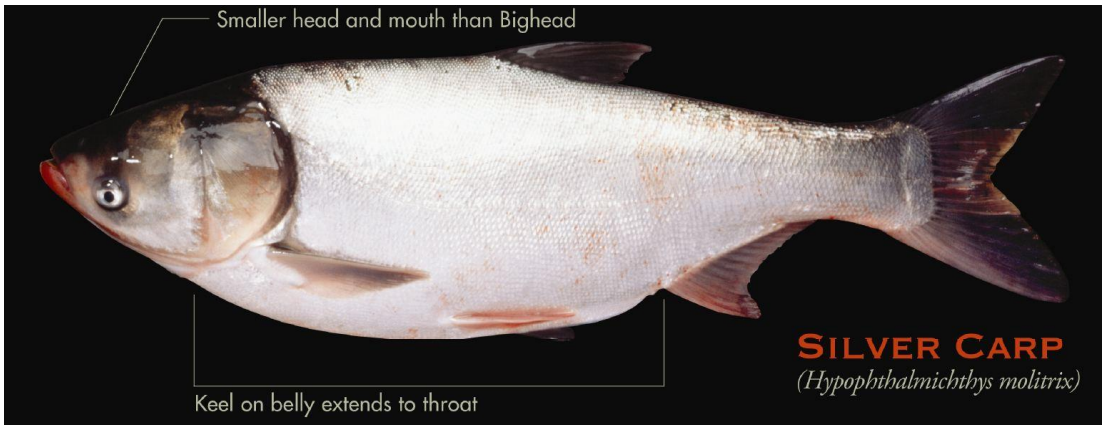
Aquatic Animals

Asian Carp

Bighead (*Hypophthalmichthys nobilis*) / Silver carp (*Hypophthalmic molitrix*)



Life History *See reproduction*

Distribution

Bighead: Mississippi River basin and Lake Erie

Silver: Mississippi River basin only (ish)

Reproduction

Silver: After 3 years they are mature enough to breed and will breed until their maximum age of 10 years old. Spawning occurs anytime between April and September when the temperature is between 18-20 degrees Celsius. They migrate up stream to breed in groups of 15 to 20. They need water with some current so the eggs and larvae can float downstream.

Big head: Spawning occurs after spring rains have flooded the rivers and when the temperature of the water reaches 77 F. External fertilization takes place and the eggs float downstream.

Habitat Characteristics

Aquatic Animals

Silver: Freshwaters that are standing or slow flowing.

Bighead: Freshwater; prefer large rivers and will not spawn in still water or small streams but do inhabit lakes and ponds.

Ecology

As most native fish feed on plankton during their larval and juvenile life stages (and some native fish remain planktivorous for life), this high level of feeding on plankton by Asian carp can have serious impacts on the stability of the food web, with bighead carp potentially outcompeting native fish while eliminating the main source of food for larval fish and native planktivorous fish. Native fish considered most at risk include ciscos, bloaters, and yellow perch, which serve as prey to important predatory sportfish including lake trout and walleye.

Diet

Silver and bighead carp are filter-feeders which feed on plankton (drifting animal, plant, or bacteria organisms that inhabit the open waters of waterbodies), with an apparent preference for bluegreen algae). When not feeding on plankton, Asian carp have been known to feed on detritus and root in the bottom of protected embayments and wetlands. This disturbance could have significant impacts on Great Lakes wetlands and shoreline vegetation which provide spawning habitat for native fish and breeding areas for native waterfowl.

History

Bighead introduction: 1972 / Silver introduction: 1973

Originally imported into the southern United States to provide an inexpensive, fast-growing addition to fresh fish markets. They also served to help keep aquaculture facilities clean. By 1980 the carp were found in natural waters in the Mississippi River Basin. As they have moved north through the Basin they have overwhelmed the Mississippi and Illinois River systems where Asian carp now make up more than 95% of the biomass in some areas.

Control Methods *See below.*

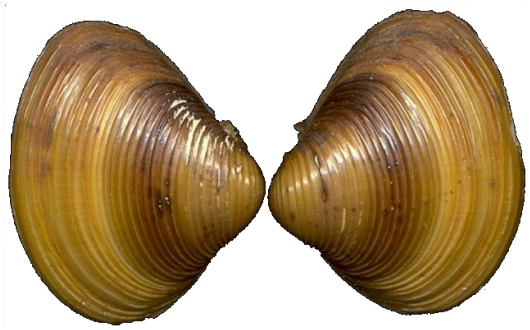
Laws and Regulation

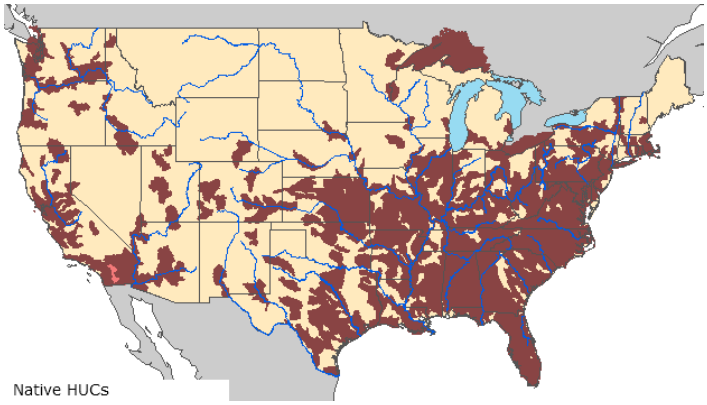
To reduce the spread of **silver carp** the U.S. Fish and Wildlife Service has proposed including the species on the federal list of injurious species. The fear that these fish could make their way into the Great Lakes and interrupt the $4 billion fishing industry has prompted the U.S. Army Corps of Engineers and the state of Illinois to build an electric barrier in the Chicago Sanitary and Ship Canal to stop the carp from moving from the Mississippi River watershed into the Great Lakes watershed. Some states prohibit the importation, possession, or release of silver carp into public or private waters. If a silver carp is caught in Indiana, it must be killed immediately and not returned to the water. An aquaculture permit may be provided for medical, educational or scientific research purposes.

In March 2011 the U.S. Fish and Wildlife Service included **bighead carp** on the list of injurious fish species. This law prohibits importation into the United States and interstate transport of the fish.

Aquatic Animals

Asian Clam (Corbicula fluminea)





Anatomy and Physiology

This freshwater **bivalve mollusk** with distinct concentric rows of elevated ridges on the shells. The shell is rounded to slightly triangular. The exterior is usually brown in color but can vary to a yellowish-gold. The nacre, or interior of the shell, is usually white to light purple. The average adult size is rarely larger than 1.5 inches

Reproduction

This species of clam is hermaphroditic, meaning that an individual produces both eggs and sperm, and is capable of self-fertilization. While self-fertilization occurs, they will also release sperm into the water that can be captured by other clams for fertilization of eggs. One small clam can produce as many as 400 larvae per day or up to 70,000 per year! The Asian clam can reach densities of 10,000 to 20,000 clams per square meter in a very short time.

Habitat Characteristics

Prefers sand or gravel substrates in areas with running water. These filter feeders can be found at sediment surface or slightly buried beneath. This species can live in slightly brackish water (salinity up to 13ppt) but is viewed as a freshwater species.

Diet

It uses its siphon to filter feed suspended particles (particularly phytoplankton) from the water and its fleshy foot appendage to pedal feed on detritus in the sediment.

History

Native to: Asia, Africa, Australia. The first record of Corbicula fluminea in the United States was documented in 1924 on the west coast, and it was discovered later in the Columbia River in Washington in 1937. This species was thought to enter the U.S. as a food item by Chinese immigrants. By the 1970s, the Asian clam had found its way into most of the Mississippi Basin, the Gulf Coast and on the east coast. By 1990, this species was recorded in New Jersey, Delaware, New York and Connecticut.

Distribution

Aquatic Animals

The primary means of dispersion of the Asiatic clam is through human transport, by way of water transfer through recreational activities, accidental transfer with imported aquaculture, and intentional introduction to provide a food item. Corbicula is occasionally sold for use in aquariums or water gardens. Passive movement via water currents is also a considerable means of distribution.

Behavior

A tube-like siphon draws water, food, and dissolved oxygen into the body and a second exhalent siphon expels water and wastes. This small clam moves by means of a strong muscular foot. The Asiatic clam has the ability to secrete a mucuous thread from within the gills; this thread performs like a draglin, catching the current which pulls the clam off the bottom to allow it to float downstream.

Ecology

Like most invasive species, this clam competes with native species for limited resources.

Human annoyances

The most significant impact of the Asian clams' introduction has been biofouling. Biofouling is the impairment or degradation of something as a result of the growth or activity of living organisms. Power plants, drinking water treatment systems, and other industries who withdraw water have suffered in areas where the clams reach high densities resulting in the shells clogging and reducing the volume of water withdrawn from a body of water. The Asian clam also has been shown to cause problems in the pipes and canals of irrigation systems.

Control Methods: The use of screens and traps to "filter" out these adult clams from water systems is a means of mechanical control. Hot water can be injected into pipes containing Asian clams to kill the individuals. Chemicals, such as chlorine and bromine, have been proven to effectively kill juveniles and adults, however many environmental agencies have regulations restricting the use of these chemicals.

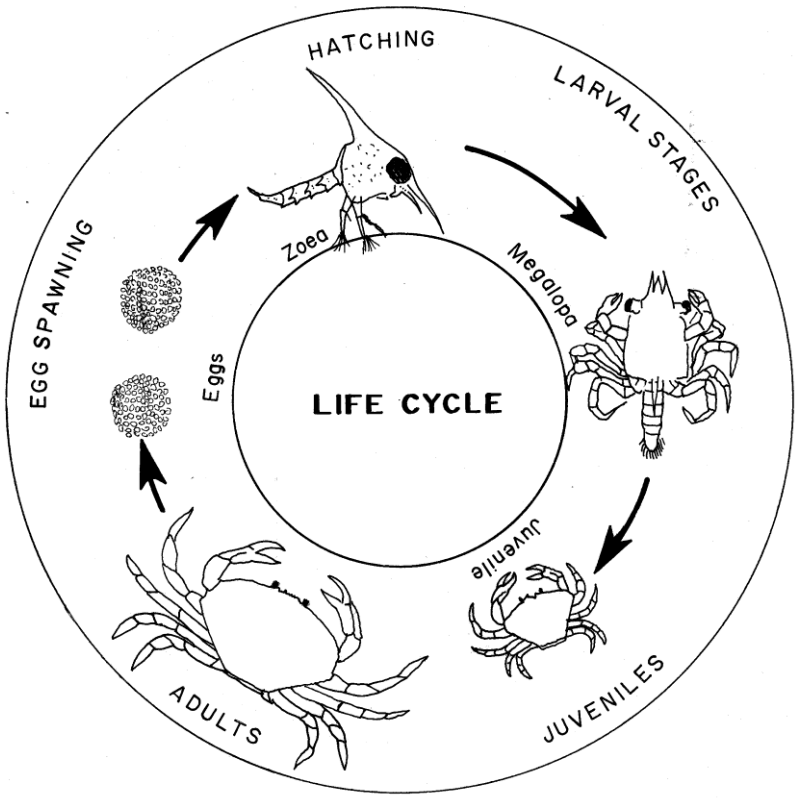
Laws and Regulation

Some states have regulations prohibiting the import, transport or possession of this species in order to attempt to control its numbers and limit the spread.

Aquatic Animals

Asian Shore Crab (Hemigrapsus sanguineus)

Life History



Distribution

Eastern US Coastal region

Anatomy and Physiology

Square-shaped shell with 3 spines on each side of the carapace. Males have a fleshy, bulb-like structure at the base of the moveable claw finger. Carapace colors can be green, red, orangish brown or purple.

Claws have red spots; legs are light and dark banded. Adult carapace width ranges from 1.4 inches to 1.7 inches.

Reproduction

This species is highly reproductive, breeding from May to September, with females capable of producing three to four clutches per season, each containing up to 50,000 eggs. Free-floating larvae can be transported over long distances during the month that it takes them to develop into juveniles and settle out of the water column.

Habitat Characteristics

- Intertidal zones, estuaries/bays
- Established and abundant along Atlantic intertidal coastlines

Ecology

Owing to this crab being an opportunistic omnivore (it feeds on macroalgae, salt marsh grass, larval and juvenile fish, and small invertebrates), it could potentially negatively impact populations of such native species as fish, shellfish and other crabs by predation and by general food web effects. It could also out-compete native mud crabs, blue crabs and lobsters.

Diet

Opportunistic omnivore, feeding on macroalgae, salt marsh grass, larval and juvenile fish, and small invertebrates such as amphipods, gastropods, bivalves, barnacles, and polychaetes.

Behavior

Tolerant to many habitat conditions

History

Native to: western Pacific Ocean from Russia, along the Korean and Chinese coasts to Hong Kong, and the Japanese archipelago. *Hemigrapsus* was first recorded in the United States at Townsend Inlet, Cape May County, New Jersey in 1988. Many speculate that adults or larvae were brought by incoming ships of global trade via ballast water discharge.

Control Methods

Preliminary evidence shows that rockfish and seagulls may prey upon *Hemigrapsus*.

Scientists are monitoring changes in native species, tracking the shore crab's spread along the coastline, and conducting experiments to increase their knowledge of basic biology and ecology of this species. Ballast water management is also being researched to reduce or eradicate new introductions from occurring.

Laws and Regulation

Aquatic Animals

Chinese Mitten Crab (Rana catesbeiana)

Life History

They are walking crabs that can emerge from the water to move upstream of barriers and are capable of moving several hundred miles upstream from saltwater. They spend most of their lives in freshwater rivers, migrating to brackish or salt water to reproduce. The young move upstream, sometimes spending 2 - 5 years in freshwater.

Distribution

West coast, great lakes, Chesapeake Bay

Anatomy and Physiology

- Claws equal size with white tips and hair
- Carapace (shell) up to 4 inches wide; light brown to olive color
- Eight sharp pointed walking legs; no swimming legs

Reproduction

Females are capable of producing 100,000-1,000,000 eggs per brood.

Habitat Characteristics

These crabs may be found in both freshwater and salt water.

Annoyances

Chinese mitten crabs interfere with operations at water facilities and pumping stations. Entrainment during fish salvage operations results in large losses of fish. Burrowing activities cause damage to dykes, coastal protection systems, harbor installations, and soft sediment banks when populations reach high abundance. Damage to soft sediment banks has the potential to affect flooding events, thus increasing erosion and repair expenses. Feeding on fish in nets has the potential to reduce harvest of fishing industry. The spiny carapace and legs of crabs damage fish catch. Crabs get entangled in gear, increasing handling time and cause damage to fishing nets.

Ecology

Aquatic Animals

Chinese mitten crabs are intermediate hosts of the mammalian lung fluke of the genus Paragonimus and they have the potential to damage rice crops by consuming the young rice shoots. These crabs are aggressive and may compete with our popular native blue crab in the Hudson River. Their burrowing habits may threaten stream bank and earthen dam stability and promote erosion and habitat loss.

Diet

Omnivorous and opportunistic. They consume a wide variety of plant and animal material, including algae, macrophytes, terrestrially derived detritus, invertebrates (both hard and soft-shelled) and will scavenge fish carcasses; also steal a wide range of bait from fishermen. Predation on small invertebrates increases with size.

Behavior

Aggressive

History

Native to: Southeast Asia from southern China to the Korean Peninsula was and was first reported in San Francisco Estuary in 1992 . This species is established in only in California, although it has been reported in the Detroit River, Mississippi River, Great Lakes, and Columbia River near Portland, Oregon. Its presence in North America is of particular concern since its prior introduction to and spread throughout Europe had significant adverse impacts. The probable means of introduction was by transport of larvae and small crabs in ship ballast water, adult crabs clinging to ship hulls and barges (very unlikely means of introduction into California), or by deliberate release to establish a fishery or local food resource.

Control Methods

In Germany, traps placed on the upstream side of dams captured juvenile crabs as they migrated upstream. Installation of traveling screens and trash racks, in conjunction with collection and disposal efforts, has the potential to drastically reduce a large portion of the mitten crab population during migration events; this is most effective if done at a place where the river is entirely contained by a regulatory structure (e.g., dam, fish facility).

Are a potential food source for predators.

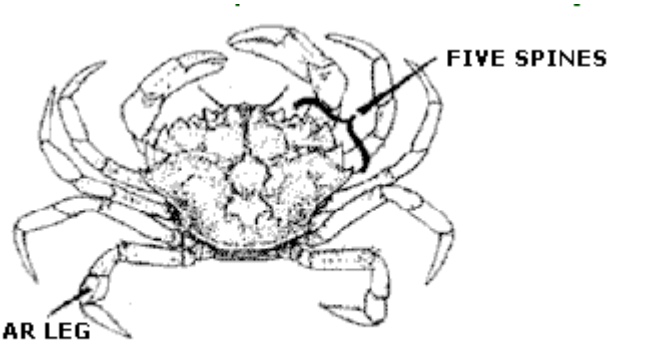
Laws and Regulation

*** NYS Fish and Wildlife regulations (Section 44.10) prohibit releasing Chinese mitten crab into waters of New York State; prohibits possession, importation, transportation, purchase or sale or offer of purchase or sale of Chinese mitten crab whether dead or live. This regulation requires Chinese mitten crab to be destroyed unless lawfully held under a license or permit to collect, possess or sell for propagation, scientific or exhibition purposes issued under section 11-0515 of the Environmental Conservation Law. In addition, the Federal Lacey Act prohibits inter-state transport of Chinese mitten crabs.**

Aquatic Animals

European green Crab (Carcinus maenas)

Aka Shore crab, Joe Rocker



UP TO 3 INCHES WIDE ACROSS THE BACK OF THE SHELL.
COLOUR VARIABLE, DARK, MOTTLED, OFTEN GREEN OR ORANGE

Life History

When the female becomes sexually mature and approaches her annual molt, pheromones are released to attract males. The males attach themselves to the females and defend her from predators and rival males. This is termed pre-molt cradling. Females can spawn up to 185000 eggs at a time. Green crabs have six larval stages: the protozoea hatching stage, four zoea feeding states, and the megalopa or transitional stage between the planktonic larval and the sedentary adult form. Development lasts between one or two months depending on water temperatures. While the larvae are dispersed they can tolerate a wide range of temperatures and salinities. Female crabs can live for approximately 3 years and males up to 5 years.

Distribution

North Atlantic coast; Pacific coast

Method: Given the length of the larval development phase and wide environmental tolerances, it can be expected that local currents, shipping, and recreational boating activities are important pathways in the spread of the species. The green crab is also often used as bait and can escape or be released

Anatomy and Physiology

Reproduction

see *life history*

Habitat Characteristics

abundant in shallow waters from the upper intertidal to the shallow subtidal zone. It has a wide salinity tolerance occurring in estuaries and areas well upstream from river mouths.

Ecology

Aquatic Animals

This is a voracious omnivorous species and will consume many species of shellfish, algae, polychaetes, and crustaceans (**native species**). Intense predation and competition can alter the community structure and ecological balance in an ecosystem.

The green crab is thought to have ruined the soft-shelled clamming industry in the northeast U.S. in the 1950s.

Diet

shellfish, algae, polychaetes, and crustaceans

Behavior

History

Native to: NW Europe, including western Baltic Sea. First recorded in 1817 along the eastern seaboard, it is though to have been introduced through shipping (_____**!)**. In 1961, the crab first appeared on the west coast in Washington; however it did not become established at that time. In 1989 it was again introduced on the west coast, this time in San Francisco Bay and has since been spotted north throughout parts of Oregon, Washington and even British Columbia. The green crab has also successfully invaded parts of South America, Asia, South Africa, and Australia.

Control Methods

Prevention

• Never dump your bait bucket into any water body.

• Good boat hygiene is critical – boats that have been washed with warm, soapy water or mild bleach are less likely to spread non-natives.

• Drain water from boat motors, live wells, bilges, and transom wells while on land before leaving a water area.

- Restrictions on imports from out-of-state, which included requiring one-hour chlorine dips for shellfish seed and broodstock from European green crab infested areas. Commercial shellfish growers and seafood handlers should routinely inspect their products and equipment for European green crab before making transfers to crab-free areas.

Laws and Regulation

Aquatic Animals

Fishhook Water Flea (Cercopagis pengoi)

Life History

During the summer, when surface waters are warm, waterfleas produce new generations through **parthenogenesis** (no fertilization), which results in clones of the mother. Because males are not needed for parthenogenesis, they are rarely found when food is plentiful or when environmental conditions favor rapid population growth. When food becomes limited, or when temperatures cool in the fall, males are produced that mate with females. Eggs are released from the female's brood pouch to sink to the bottom of the lake where they can survive the cold winter.

Distribution

ALL Great Lakes, and the Finger Lakes Region of New York.

Reproduction

As many other cladocerans, Cercopagis pengoi is a **cyclic parthenogen**. It reproduces parthenogenically during the summer and gametogenically later in the year. The parthenogenically-produced young develop in a fluid-filled dorsal brood pouch that ruptures to release the young. In late summer and autumn, parthenogenic females produce eggs that develop into males and gametogenic females, which copulate. Gametogenic reproduction results in resting eggs, which are released when the brood pouch ruptures, and overwinter in the sediment. Hatch in spring-summer, depending on local temperatures, to re-found the population. Sexual females are reproductive only at instars II and III, producing 1-4 resting eggs, while parthenogenic females produce between 1 and 24 embryos.

Lifecycle stages

Female, both parthenogenic and gametogenic, and male Cercopagis pengoi possess 3 life-history stages or instars, which differ by number of spines, or barbs, on the caudal process. At each molt, the animal sheds its exoskeleton to the base of the caudal process. A new pair of proximal barbs and the growth of an intercalary segment are inserted between the existing tail spine and the body. The newborn parthenogenic females (instar I) have one pair of barbs on the caudal process, compact oval embryos in the brood pouch without a pointed apex. The second stage (instar II) has two pairs of barbs and the mature stage (instar III) of the parthenogenic female has a large brood pouch with a pointed apex housing embryos. In males at this stage paired penes behind the last thoracic legs and a toothed hook on the first pair of legs are developed. Parthenogenic females of the first generation of C. pengoi proceed

through 3 moult yielding 4 pairs of proximal barbs on the caudal process unlike the females of following generations that undergo 2 molts to reach adulthood.

Habitat Characteristics Freshwater to brackish lakes

Ecology

These tiny predators have the ability to seriously impact the growth and survival of native species by disrupting the food web. Feed primarily on small planktonic animals called zooplankton which are important in the food web. Their high reproductive rate and ability to build large populations in a short period allows them to deplete the zooplankton population, which small juvenile fish and other aquatic organisms need for food.

Economic Costs

Waterfleas have become a significant nuisance to anglers. They collect on fishing lines and accumulate in high numbers on the tips of fishing rods, making it difficult to reel in the lines. Because they have become such a problem, charter and recreational anglers often stop fishing during periods of peak abundance, impacting the recreational fishing industry. The commercial fishing industry is also impacted as waterfleas collect on commercial fishing nets and downrigger cables.

Diet

Zooplankton (notably, Daphnia).

Behavior

History

Native to: Ponto-Caspian Basin in Southwest Asia., and introduced to the north into the Baltic Sea region.

first discovery in Lake Ontario in August 1998

Control Methods

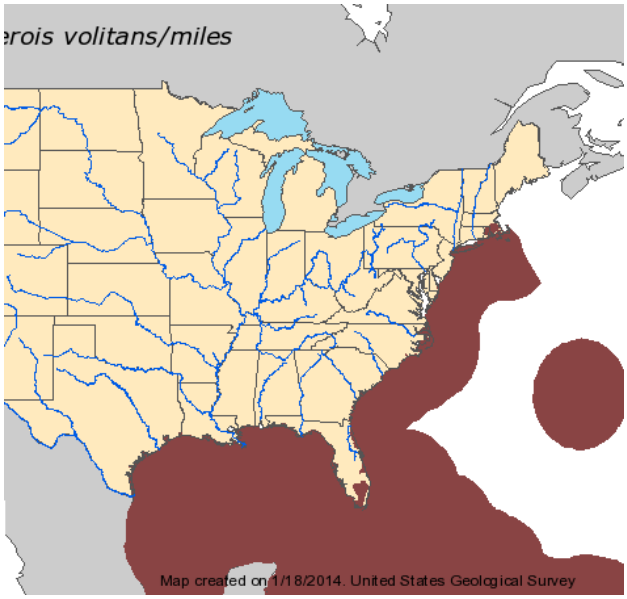
- Enacting stricter ballast water regulations and preventing their spread to new bodies of water are the most realistic strategies in dealing with waterfleas and other invasive species.
- Always check for and remove any plants, mud, and debris from boats, trailers, clothing, fishing lines and equipment before leaving a water body. Drain all water from equipment, bilges, and live wells before transporting to new areas. Since bait buckets can carry microscopic organisms, never transport bait bucket water to another location. Clean all gear and equipment with either hot water, or salt water, OR let boats and equipment dry thoroughly for at least five days before entering a new water body

Aquatic Animals

Lionfish (Pterois volitans)

Life History: See *Reproduction* and *Behavior*

Distribution



Anatomy and Physiology

The dorsal- and anal-fin spines of the lionfish contain a potent venom that can administer a painful sting

Reproduction

Pterois volitans reproduction is sexual and involves external fertilization of eggs and a suite of complex courtship and mating behaviors. The species is generally solitary outside of the reproductive season, but during courtship, males will aggregate with multiple females to form groups of 3-8 fish. Females release a pair of mucus-encapsulated clusters of 2,000-15,000 eggs to the pelagic environment where they are fertilized by the male. Environmental microbiota break down the egg mass mucus to free the eggs and facilitate hatching.

Aquatic Animals

Habitat Characteristics

Lionfishes inhabit natural (e.g., reef) and artifical structure (e.g., wrecks) at depths from just a few inches of water to over 300 m. Reefs, wrecks, bridge pilings, seagrass and natural hardbottom

Ecology

They rely on their unusual finnage to discourage would-be predators. They inject toxin from the hollow bones of the dorsal and pectoral fins, by whipping the fins towards a target. They are likely to affect the population size of their prey and the availability of food sources for larger fish in the Atlantic Ocean.

Diet

The prey of lionfishes includes small fishes and crustaceans (shrimp and small crabs). An increase in piscivory occurs with age

Behavior

Most scorpionfishes (family: **Scorpaenidae)** are colored to camouflage them against their background. However, the lionfish is a notable exception with its greatly extended fin spines and striking coloration.

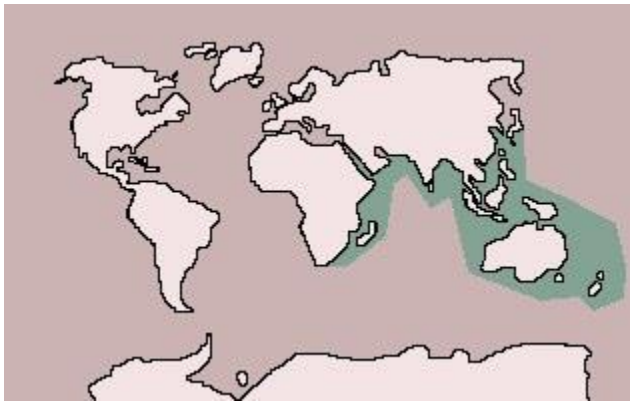
In the native range juveniles live in small groups, but as adults they typically occur alone. Individuals are relatively inactive during the day, typically sheltering in reef crevices.

Lionfish invest most of their energy in growing to a large body size early in life. This allows them to grow big rapidly so they are more likely to avoid attacks from predators and increase their chances of mating successfully.

History:

Native to:

The most probable explanation for the arrival of lionfishes in the Atlantic Ocean is via the aquarium trade. No one will ever know with certainty how lionfishes gained entry to the coastal waters of the U.S.; however, as they are common aquarium fishes, it is possible they were released pets.



Control Methods

- Lionfish are edible and considered a delicacy: Local removal efforts that are sustained can significantly reduce lionfish densities

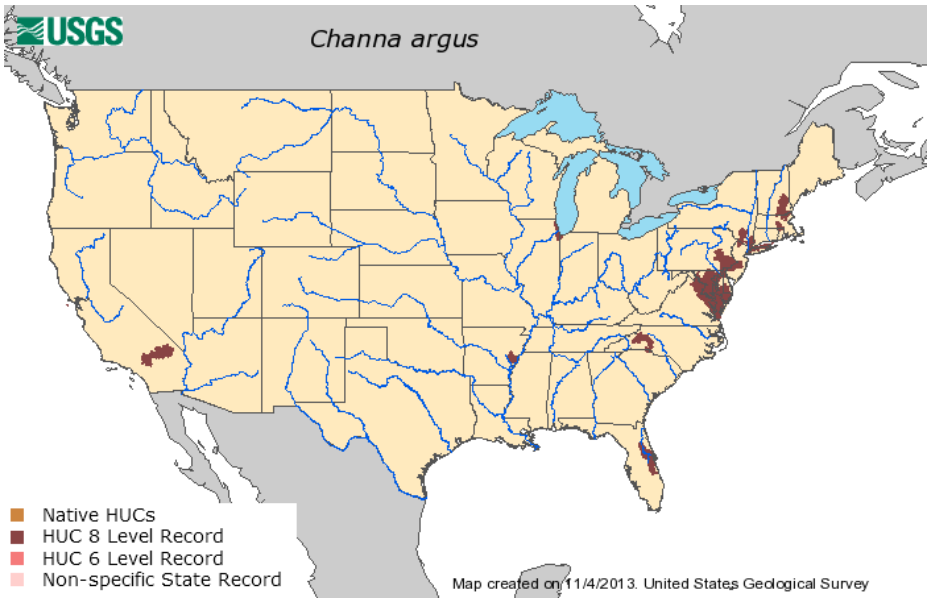
Laws and Regulation

Aquatic Animals

Northern Snakehead (Channa argus)

Life History *See Reproduction*

Distribution



Reproduction

Breeding occurs between June and August. Some species can breed up to five times a year. Snakeheads form monogamous pairs that remain throughout the spawning season. The snakeheads build elaborate nests by clearing an area of vegetation and weaving some vegetation into a column. During spawning the pair move up the column they built and the male wraps his body around the female. The eggs are then released and fertilized and they rise to the surface of the nest column. One or both parents fiercely guard the eggs.

Habitat Characteristics

Snakeheads are an aquatic fish that live in freshwater streams, rivers, wetlands, or ponds. They prefer low moving to stagnant waters. Snakeheads can survive the cold winters and low oxygen

environment. Some snakeheads are capable of breathing atmospheric oxygen and may be able to jump out of the water to be found on terrestrial land near aquatic systems. During the spawning season, northern snakehead fish prefer shallow waters with macrophyte (aquatic plant) cover. Nests are made by first clearing an area and then weaving aquatic vegetation into a column to hold and protect eggs.

Ecology

Preys on and competes with native species

Diet

Small prey, such as zooplankton, larvae, and small fish and crustaceans populations may be threatened by feeding juvenile snakehead fish. Adults devour fish, crustaceans, small amphibians, reptiles, and some birds and mammals.

Behavior

History

Native to: The northern snakehead fish species is native to China and possibly Korea and Russia. In New York, the first documentation was reported in 2005 at Meadow Lake in Queens and then again in 2008 in a stream in Wawayanda, New York.

Released pets. The fish is also an important food source in other countries and could have been intentionally released into waterways to create a local food source for fisherman here in the United States. Even though it is illegal in some states to possess a snakehead fish, they are utilized in some restaurants and are available for purchase online. Northern snakehead fish can spread by swimming underwater and are also capable of breathing out of the water to move short distances on land.

Control Methods

All snakehead fish have been assigned injurious wildlife status.

Waters with snakehead fish presence can be treated using chemicals. Previous control efforts have found that Rotenone has been successful in lakes and ponds. However, chemical control methods should be done by professionals since the chemicals may effect or kill non-target fish species and also may require permits for use. If approved to work with chemicals, always follow the instructions on the label.

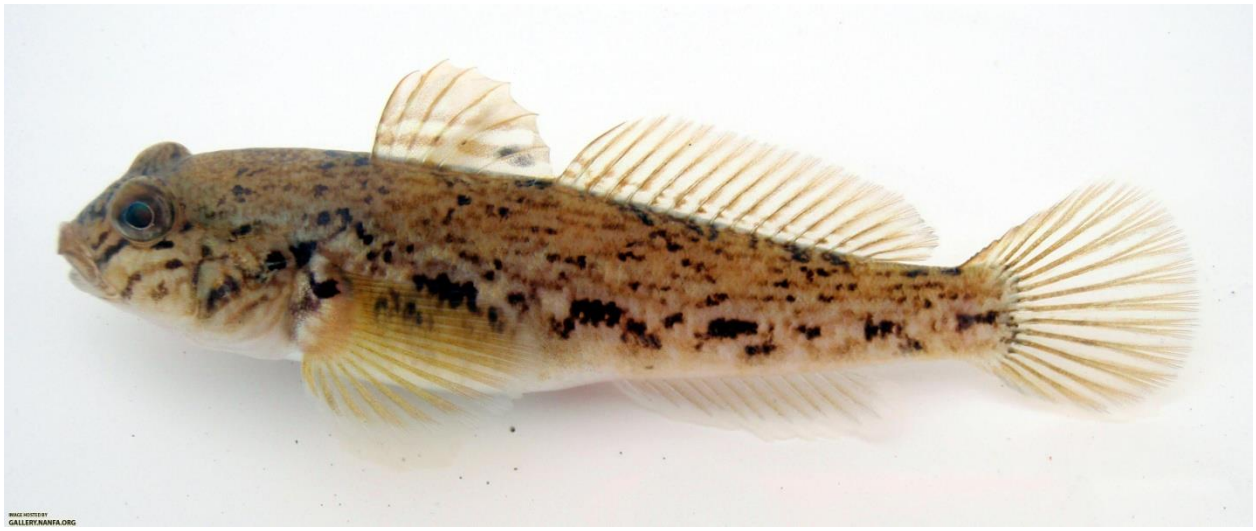
If you catch a snakehead fish, do not release it back into the water. Kill it, freeze it in a double bag and then report the fish and its location to a local natural resource agency for documentation. To prevent more occurrences from happening, it is important to control the current populations and also to educate others on the importance of not releasing or transporting exotic species to new ecosystems.

Laws and Regulation

Listed as injurious wildlife under the Federal Lacey Act, which makes it illegal in the U.S. to import, export, or transport between States without a permit

Aquatic Animals

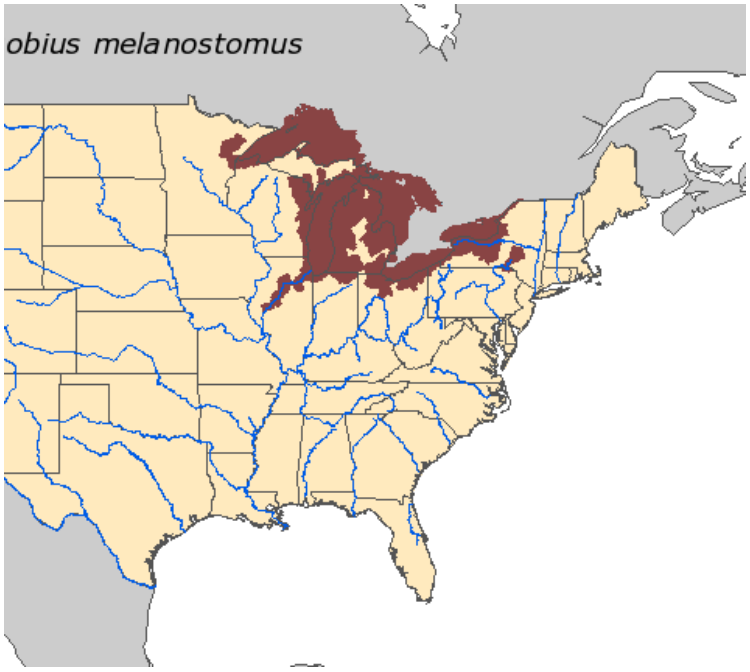
Round Goby (Neogobius melanostomus)



Life History

The maximum age reported for a round goby is 4 years. *See Reproduction.*

Distribution



Anatomy and Physiology

Reproduction

They spawn frequently, about once every 20 days, from April through September. The eggs are laid in nests on rocks, logs or other hard substrates. They forcefully defend their spawning sites. Round gobies have the highest densities in rocky areas and have exceeded densities of more than 20 per square meter.

Aquatic Animals

Habitat Characteristics

Round gobies can live in marine or freshwater environments, preferring brackish water.

Ecology

Adult gobies take over prime nearshore spawning sites and aggressively prevent use by native species. Long-term impacts are expected to include declines in native species populations. *N. melanostomus* has a well-developed lateral line which may give it a competitive advantage over native species feeding in turbid waters. Round gobies are also prolific breeders, spawning every 20 days during the spawning season.

Round gobies are problematic to anglers in that gobies are proficient bait thieves.

A link has been suggested between round gobies and the recent outbreaks of Type E avian botulism on Lakes Erie and Ontario.

Diet

Round gobies may prey on small fish such as darters, as well as lake trout, sculpin, and darter eggs and fry. (*N. melanostomus* has the beneficial impact of consuming large numbers of **zebra mussels**; however, given the contamination found in some populations of zebra mussels, this may result in bioaccumulation of toxics in gobies and biomagnification up the food chain to shorebirds and other species which consume the fish.)

Behavior

- Well-developed sensory system that enables them to detect water movement even in complete darkness.
- Round gobies are resilient and are able to live in depleted oxygen situations for several days.

History

The round goby, **native to Eurasia** (particularly the Black and Caspian Seas and the Sea of Azov), was first observed in the Great Lakes Basin in 1990 when recreational anglers caught a specimen in the St. Clair River. It is believed that the species was introduced via international shipping ballast water discharge. Since that time, the fish has spread to all of the Great Lakes (Lake Erie, 1993; Lake St. Clair, 1994; Lake Michigan, 1994; Lake Superior, 1995; Lake Ontario, 1996; Lake Huron, 1998), where it is undergoing a dramatic population explosion (densities of several dozen per square meter of lakebed have been reported). Spread upstream to Lake Superior is believed to have been a result of interlake ballast water transport; downstream spread is most likely attributable to both ballast discharge and natural migration.

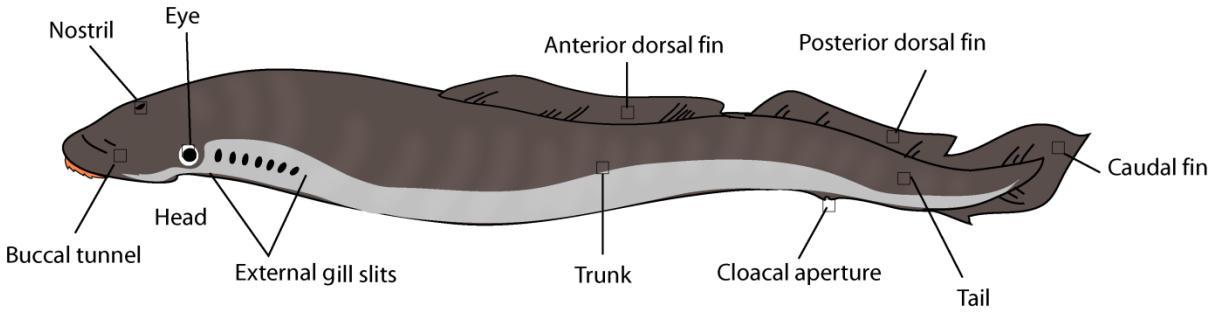
Control Methods

Better regulations on ballast water transport. Prevent accidental transfer.

Laws and Regulation

Aquatic Animals

Sea Lamprey (Petromyzon marinus)



Life History

As larvae, the sea lamprey lives in freshwater rivers. Larval sea lampreys will remain in the streams for usually 4 to 6 years. As adults they move out into a marine environment, or in the case of the landlocked form, they move into the open water of the Great Lakes. The adult sea lamprey is parasitic, feeding off of other fish. After spending 12 to 20 months in the open water of the Great Lakes, the sea lamprey will return to a tributary stream to spawn. There will be a large congregation of lampreys all intertwined in a large ball during spawning. Adult sea lampreys die following spawning.

Distribution

Now landlocked in the Great Lakes, the sea lamprey has distributed itself into the tributaries of those lakes. Manmade canals appear to be the pathway sea lampreys invaded at least four of the five Great Lakes.

Reproduction See *Life history*

Habitat Characteristics

Freshwater

Ecology

Adult sea lampreys often kill their prey due to their **parasitic feeding**, either by direct loss of blood and tissue or because of an infection in the open wound caused by the lamprey. There was a decline of several large native fishes in the Great Lakes due in part to the introduction of the sea lamprey. Lampreys appeared to have the most devastating effect on a variety of cisco species, lake trout, and walleye.

Another negative impact of the establishment of sea lamprey in the Great Lakes is **economic**. At the height of the sea lamprey population, various sport fish populations were suppressed which resulted in reduced recreational and commercial fishing activities. Methods used to lessen the lamprey population are also an economic drain. And finally, a large amount of money continues to be spent in restoring the sport fish populations that have been damaged by sea lampreys.

Aquatic Animals

Diet

As larvae: microorganisms and detritus

Use their teeth to scrape and the skin of their host and suck out its blood and body fluids. Produces an anticoagulant in saliva, which prevents the prey's blood from clotting.

Behavior

History

Lampreys were first discovered in Lake Ontario in 1835, Lake Erie in 1921, Lake Michigan in 1936, Lake Huron in 1937, and Lake Superior in 1946. There is controversy over whether or not the lamprey is native to Lake Ontario. Those who do believe that it is native say that the current sea lampreys are descendants of populations from the Pleistocene. Those who oppose this view say that lampreys were allowed to enter Lake Ontario through manmade locks and shipping canals. The Welland Canal, which joins Lake Ontario to Lake Erie bypassing Niagara Falls, was in place for nearly nine decades before sea lampreys invaded Lake Erie. Upgrades to the Welland Canal in 1919 appear to have provided an improved avenue for lampreys to invade Lake Erie as they were found just two years after improvements were made. Once in Lake Erie, it took just 25 years to spread to the remaining Great Lakes.

Control Methods

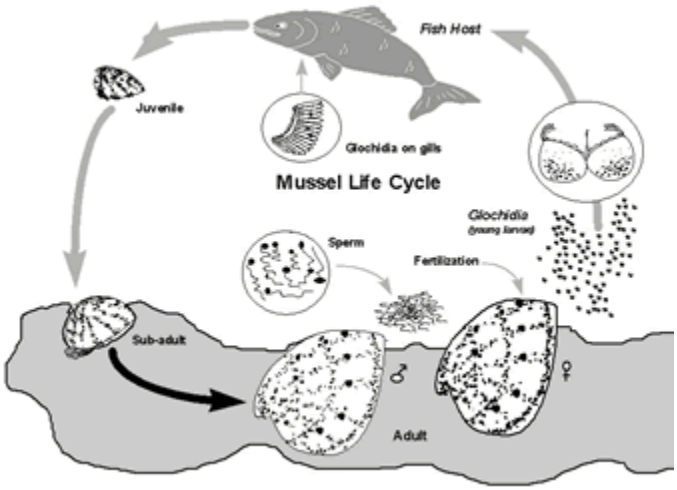
- Lampricides—
- Barriers:
- Release of sterile males

Laws and Regulation

Aquatic Animals

COMMON NAME: Zebra Mussel

SCIENTIFIC NAME: *Dreissena polymorpha*



3-9 year lifespan. Able to reproduce after one year

Diet

- mainly single-cell organisms, such as bacteria, blue-green algae, small green algae, and protozoans. They also consume very fine detritus particles.

History

- Originated from the Black, Caspian, and Azov seas region of the former Soviet Union.
- construction of extensive canal systems enabled the spread of zebra mussels to almost all major drainages of Europe.
- Zebra mussels probably entered the Great Lakes when ships arriving from Europe discharged ballast water containing a variety of aquatic organisms, including zebra mussel larvae.

Habitat

- Slow-moving freshwater

Behavior

- ability to attach to boats.
- Ability to stay alive out of water for several days under moist and reasonably cool conditions.
- Can survive brackish waters

Ecology

- Out-compete and grow on top of native mussels

Aquatic Animals

- filter an enormous amount of plankton out of the water. This changes the flow of energy in the foodweb -- the energy in the phytoplankton goes to the bottom, to the mussels and the animals that eat them, instead of swimming plankton predators like zooplankton and fish.

- Also, if zebra mussels clear the water, sunlight can penetrate deeper into the water, allowing more aquatic plants to grow. These plants provide food and hiding places for fish and invertebrates.

Human Impacts

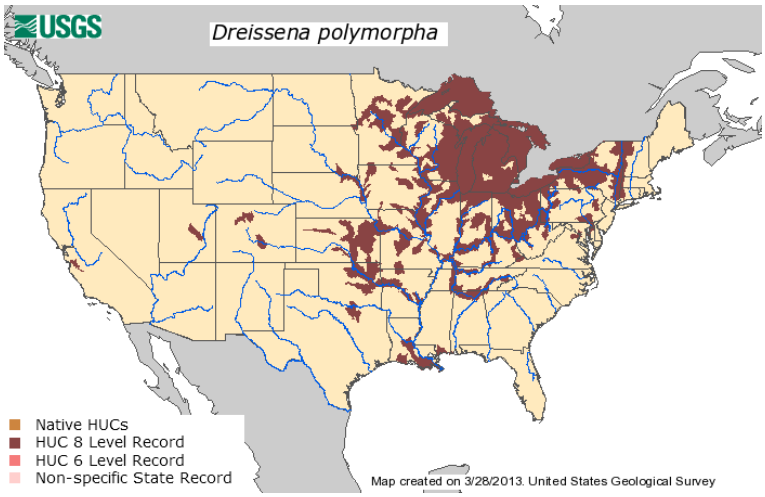
- Sharp enough to cut through skin
- Clogs power plants, industrial and public drinking water intakes
- Smother boat hulls
- Impact fisheries

Remediation

- Water recreationists, like boaters, are encouraged to inspect boats for hitchhiking mussels (in some states it is illegal to transport harmful exotic species).

Now found in:

- Most of the major drainages of Europe.
- All of the Great Lakes
- Many states on the East side of the United States.



Laws and Regulation

Listed as injurious wildlife under the **Federal Lacey Act**, which makes it illegal in the U.S. to import, export, or transport between States without a permit (DOI,Fish and Wildlife Service*)*