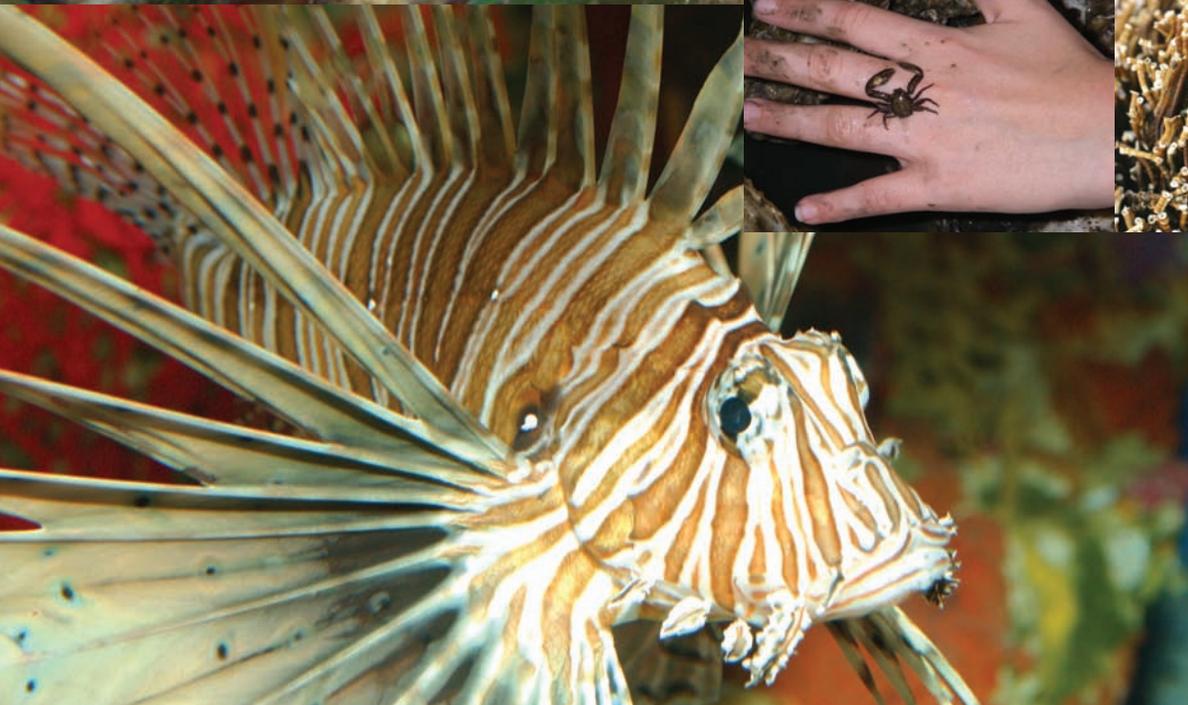




Aquatic Invasive Species

Species

A Guide to Non-native Species in Coastal Georgia



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Coastal Georgia Habitats

Georgia has a relatively short coastline, but contains a significant proportion of the remaining salt marsh habitat on the East Coast. The salt marsh is characterized by expansive grasslands, mudflats, and meandering tidal creeks fringed with dense oyster reefs. These provide important ecological services including pollution, flooding, and erosion control and are essential habitat for a myriad of commercially important fish and shellfish species. There are thirteen major barrier islands which contain approximately 90 miles of sandy beaches that are being continually shaped and changed by ocean currents, waves, and wind. Sand dunes, beaches, sandbars, and shoals comprise a vital natural resource system that protects the coastline from the damaging effects of floods, winds, tides, and erosion.



Important Native Species

Salt Marsh Plants: smooth cordgrass, glasswort, saltwort, salt grass, needle rush, sea oxeye daisy, marsh elder, and eastern red cedar

Salt Marsh Animals: oyster, fiddler crab, mud snail, periwinkle, blue crab, shrimp, clam, mussel, whelk, killifish, wading birds, waterfowl, and shore birds

Beach Plants: sea oats, pennywort, yucca, camphorweed, and dune primrose

Beach Animals: dolphin, sea turtle, ghost crab, sand dollar, horseshoe crab, sponge, bass, trout, stingray, shark, catfish, gulls, hermit crab, jellyfish, sea whip, olive shell, and moon snail



Aquatic Invasive Species



An aquatic invasive species (AIS) is any freshwater or marine species that is not native to an ecosystem and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Many successful invasive species share one or more of the following traits: high reproductive rates, broad diet, long-lived, high dispersal rates, broad native range, associated with humans, occur in groups, and wide tolerance range for environmental conditions.

Aquatic invasive species can spread with even more ease than terrestrial species due to the fact that many waterways are interconnected in some way.



Impacts



The southeastern United States has the largest number of aquatic invasive species in the nation and the rate of new introductions is increasing. Problems associated with these species include: costs associated with maintenance of fouling organisms on boats, docks, and water intake pipes; interference with navigation; increased competition with and predation of native species; decreased biodiversity; and habitat degradation including reduced water quality.

- Invading species cost the U.S. \$120 billion per year in environmental damage and loss.
- Almost half of the species on the Federal Threatened or Endangered species lists are at risk primarily because of invasive species.
- Human health impacts associated with invasive species include water-borne diseases, parasites, drownings, and stings.

Pathways

Often the introduction of non-native aquatic species is accidental or unintentional (e.g. shipping ballast water and hull fouling). Members of the public can also unknowingly introduce or spread non-native species:

Boating Hitchhikers: People moving boats and trailers from one water body to another can carry aquatic hitchhikers in bait wells and bilge water and also on the boat hull or trailer.

Ornamental Pond Releases: Plants and animals can be intentionally released by people or escape from backyard ponds or water gardens.

Home and Classroom Aquarium Releases: Well-meaning people sometimes dump aquarium pets and associated plants into local waters.

Live Bait Releases: Anglers can introduce species into local waters when live bait is used and either escapes from the hook or the bait well, or is accidentally released or intentionally dumped.



Prevention: The Best Control

BOATERS

Avoid chopping vegetation with motor propellers.
Remove plants and animals from boats, trailers, and equipment.
Eliminate all water from motors, live wells, and bilges.
Flush water through motor's cooling system and clean sea strainers.

AQUARISTS/GARDENERS

Never dispose of unwanted plants or animals into local waterways.
Use native plants and animals, especially in areas prone to flooding.
Seal plants in plastic bags, freeze for 24 hours, and dispose in trash.
Return unwanted pets to the pet store, or give to another person.
Familiarize yourself with problem species and do not purchase these.
Check plants that you purchase for unwanted hitchhikers.
Contact your veterinarian for guidance about humane disposal of animals.

ANGLERS

Never release live bait into the water.
Share leftover live bait with other anglers.
Use native bait, cut bait, or artificial lures.
Empty your bait bucket in the trash before leaving the fishing area.
In some waters it is illegal to use live bait.

Green Porcelain Crab (*Petrolisthes armatus*)

Habitat: Rock rubble or oyster reefs in shallow intertidal or subtidal areas

Origin: Historic range includes both Pacific and Atlantic: eastern Pacific from the Gulf of California to Peru; western Atlantic from Florida through the Gulf of Mexico to Brazil, including Bermuda, the West Indies, and the Caribbean; eastern Atlantic in tropical western Africa

Suspected Pathway of Introduction: Native transplant, possibly from ballast water and/or cultured shellfish transport

Description and Similar Species:

These crabs are extremely flat and small (max 11-15 mm carapace width). The chelae (claws) are also flattened. Adults are typically orange-brown to dark brown, while the juveniles have a somewhat lighter, speckled appearance. While they superficially resemble other porcelain crabs; mature specimens of both sexes have bright blue coloration on their mouthparts.

Facts and Potential Impact:

Green porcelain crabs are filter feeders, using feathery arm-like structures to sweep plankton into their mouths. The flattened bodies of these crabs make it ideal for them to hide between the oyster shells on an oyster reef. While camouflage and body shape are their most useful form of protection, they can also readily drop an appendage, such as a claw or leg, to distract a predator and escape. The impact of this non-indigenous crab on the local oyster reef ecosystems is inconclusive. Possible threats include feeding on native shellfish and crab larvae, competition with resident crabs and fish for space on the reef, and food competition with other filter feeding natives.



Green Mussel (*Perna viridis*)

Habitat: Coastal waters (less than 10 m), typically attached to hard structures like dock pilings

Origin: Indo-Pacific region of Asia

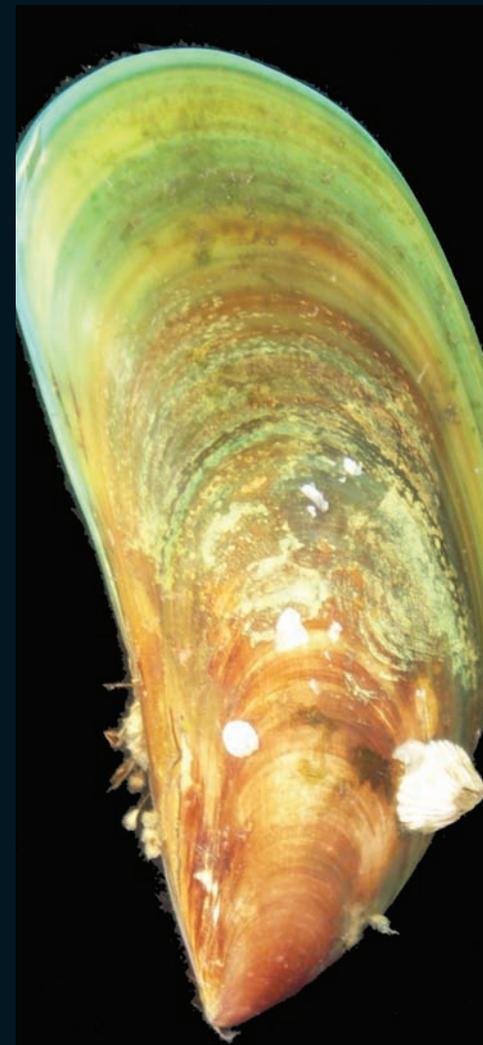
Suspected Pathway of Introduction: Ballast water

Description and Similar Species:

The outer shell layer is bright green, especially in juveniles. The shell may be mostly brown in adults, with green occurring near the shell margins. Adults can reach 150 mm in length. Green mussels are often confused with other members of the *Perna* genus, particularly the green-lipped mussel from New Zealand (*P. canaliculus*). Members of the *Perna* genus lack ribs or ridges and therefore are not easily confused with many of our native mussel species (e.g. ribbed, scorched, hooked).

Facts and Potential Impact:

The optimal salinity and temperature tolerances of the green mussel are 27-33 ppt and 26-32°C. Specimens located in Georgia are predominantly subtidal, with some reports of the mussels occurring on the lower intertidal portion of beach jetties. The green mussel was first introduced to the United States in Tampa Bay in 1999, where it has caused significant fouling resulting in economical and ecological impacts. In Tampa, dense colonies developed on bridge pilings, piers, and navigation structures, and even smothered out intertidal oyster reefs (*Crassostrea virginica*). It is thought that a greater tidal range in Georgia is preventing the mussel from thriving in the intertidal zone here, thereby protecting oyster resources. Mortalities associated with cold winter spells have also helped to keep the mussel populations in inshore waters under control. However, warmer offshore currents help populations on buoys to persist through the winter season and there are concerns that the species will establish populations at Gray's Reef National Marine Sanctuary, one of the largest nearshore sandstone reefs in the southeastern United States.



Charrua Mussel (*Mytella charruana*)

Habitat: Typically mudflats or shallow lagoon areas, attached to submerged hard surfaces

Origin: Eastern coast of South America (Venezuela to Argentina) and the eastern Pacific Ocean (from Mexico to El Salvador, plus the Galapagos Islands)

Suspected Pathway of Introduction: Ballast water

Description and Similar Species:

In shape, this species resembles the edible blue mussel (*Mytilus edulis*). Charrua mussels are brown, light green, yellow, or black in color and can be uniform or banded. This mussel can be distinguished from native mussels because it lacks distinct exterior ribs or ridges and the interior of the shell is normally iridescent purple.

Facts and Potential Impact:

Mytella charruana is a member of the Mytilidae family, one that includes our native ribbed, scorched, hooked, lateral, and horse mussel species, plus another non-indigenous species, the green mussel. Charrua mussels have been reported at maximum lengths of 45 mm, with a salinity tolerance between 14 and 41 ppt. This species was first reported in Jacksonville, Florida in 1986 and in Liberty County, Georgia in 2006. Dense colonies of these mussels have been observed on floating docks and boat hulls, presenting economical costs associated with cleaning and maintenance efforts. These mussels also have the potential to compete with native shellfish species for space and food.



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Titan Acorn Barnacle (*Megabalanus coccopoma*)

Habitat: Shallow water attached to hard substrate, may survive in lowest intertidal range, most likely to be found in high salinity waters

Origin: Native to the eastern Pacific Ocean from Mexico to Ecuador, but reported in Brazil, Texas, Louisiana, as well as a northern expansion of its Pacific range in California

Suspected Pathway of Introduction: Hull fouling

Description and Similar Species:

Megabalanus coccopoma can grow very large (> 5 cm in diameter and height) and has a conspicuous pink color with six triangular plates. It may be distinguished from *M. tintinnabulum (antillensis)* which also occurs occasionally in Georgia by a more rounded conical shell and a circular to ovate opening. Additionally, if the plates are removed the scutum is noted to be wider than higher.



Facts and Potential Impact:

Research on *M. coccopoma* indicates that the planktonic larvae prefer to settle on disturbed or recently cleaned surfaces. The barnacle can also grow rapidly and attain a large size. Significant settlement and growth of the barnacle on structures including boat hulls, buoys, and fishing gear presents economic problems associated with reduced fuel efficiency and increased cleaning and maintenance efforts. Competition with native filter-feeding species for space and food is an environmental concern.



Australian Tubeworm (*Ficopomatus enigmaticus*)

Habitat: Low intertidal to shallow subtidal areas attached to hard surfaces, prefers brackish water

Origin: Native to the southern hemisphere (Indian Ocean), possibly Australia, and has been introduced to many regions including Europe, Japan, and areas of the United States (Hawaii, California, Texas, and the Chesapeake Bay)

Suspected pathway of introduction: Hull fouling

Description and Similar Species:

These polychaete worms build and live in upright white calcareous tubes that have distinctive collar-like rings at irregular intervals and are about 2 mm in diameter. Tubes that are older tend to darken to a gold or brown color; however, the areas around the rings and by the flared opening normally remain white. The worm itself is normally about 2 cm long, including the operculum, which is the “stopper” the worm pulls into the opening of the tube when startled.

Facts and Potential Impact:

Ficopomatus enigmaticus can occur as a single tube or as large, dense reef-like masses. In one Argentinean location, this species forms circular reefs up to 7 m in diameter and 0.5 m deep. Heavy settlement and growth of the species has caused significant economic problems in both the Netherlands and New Zealand, and similar problems are feared if the fouling species were to become established in Georgia. The first sighting of this species in Georgia occurred in Brunswick, where the species was found attached to intertidal oysters on a piling structure. To feed, *F. enigmaticus* sends its branching gill plumes out of its tube. The gill plumes then move around in the water, capturing small food particles to pass down to the mouth. If startled, the worm will pull in its gill plumes and close inside of the tube using the operculum. Competition with native species for food and space is another potential impact.



Island Apple Snail (*Pomacea insularum*)

Habitat: Freshwater

Origin: South America

Suspected Pathway of Introduction: Deliberate and accidental releases by aquarium hobbyists; in the aquarium trade they are sometimes sold as the “Golden Apple Snail” or “Mystery Snail”

Description and Similar Species:

The island apple snail is now the largest non-marine snail in the southeastern United States and is the most common apple snail found in Georgia. It can be distinguished from the native Florida apple snail (*Pomacea paludosa*) by the deep groove (channel) between the whorls of the shell. Shells are 70-100 mm high as adults and are highly variable in color, from olive brown to yellowish brown, often with darker bands and blotches. Gold and albino color forms are popular in the aquarium trade.

Facts and Potential Impact:

This snail feeds aggressively on many types of aquatic and terrestrial plants. Apple snails were introduced to Taiwan and Hawaii for human consumption and have since become a serious rice and taro pest. While not yet a rice pest in the continental US, there is concern that this apple snail may out-compete native snails. In areas where they are eaten, undercooking can lead to parasite infections (e.g. rat lung parasite). Apple snails, in general, have a lung in addition to their gills, allowing them to survive considerable time out of water and to migrate between water bodies. In addition, this species has a lower tolerance for cold temperatures than the Florida apple snail. Apple snails lay their egg clusters on solid objects above the water line. It is normally the presence of these masses that alert individuals to their presence. The island apple snail lays clusters of thousands of eggs that are initially bright pink or red in color. After time, the eggs fade to a lighter pink or even white color. While the native Florida apple snail also lays pale pink to white clusters, the eggs are larger in diameter, and each cluster averages only 30 eggs.



Red Lionfish (*Pterois volitans*)

Habitat: Sand, coral, and live bottom substrates from about 10 to 55 m in depth (some sources indicate a greater maximum depth)

Origin: Indo-Pacific

Suspected Pathway of Introduction: Aquarium trade and human release

Description and Similar Species:

Lionfish are members of the Scorpaenidae family (Scorpionfishes). Therefore, they share some characteristics with other members of this family, such as a large head and long, extravagant fins that contain venomous spines. Their body is typically white or cream with vertical red to reddish-brown stripes. They normally have large tentacles over their eyes and the membranes of their fins (particularly the dorsal, caudal, and anal fins) are often spotted. The red lionfish is very similar and closely related to another member of its genus, the devil firefish (*Pterois miles*). The red lionfish and devil firefish are largely separated by differences in number of fin spines or rays and also coloration.

Facts and Potential Impact:

While the red lionfish is utilized as a food fish in some areas of its native range, in the U.S. it is most commonly known as a valuable aquarium fish. The first documented introduction of red lionfish on the east coast came when Hurricane Andrew swept across Florida in 1992. The hurricane destroyed a large marine aquarium and released six lionfish into the water. These fish were seen alive nearby several days later. Since then, several lionfish have been captured or seen along the east coast, some as far north as New York. Adult red lionfish have no known predators and hunt small fish, shrimp, and crabs. The juvenile stage of this fish swims continuously in open water, which may account for its spread along the coast. As of September 2007, red lionfish have been documented and photographed at Gray's Reef National Marine Sanctuary off the Georgia coast.



Potential Aquatic Invasive Mussels

Asian Date Mussel (*Musculista senhousia*)

Habitat: Found from the intertidal area to 30 m deep on hard and soft substrates with a temperature range of approximately 1-31°C and a salinity tolerance from 18-35 ppt.

Native Distribution: China, Korea, Japan, Siberia, and Singapore.

Introduced Distribution: West coast of Canada, Mexico, and the United States, Mediterranean coast of Egypt, France, Israel, Italy, and Slovenia, and in Australia and New Zealand.

Introduction Vectors: Ballast water and food trade.

Impacts of Introduction: These mussels can decrease populations of native bivalves through food competition and by smothering them with mats of dense threads. They have also affected the growth of eel grass in San Francisco Bay.



Black-striped Mussel (*Mytilopsis sallei*)

Habitat: Typically found in estuarine and inshore areas and tolerate temperatures from 5 - 40°C and salinities from 0 - 50 ppt.

Native Distribution: Central and South America.

Introduced Distribution: Fiji, Hong Kong, India, Japan, and Taiwan.

Introduction Vectors: Ballast water and hull fouling.

Impacts of Introduction: Black-striped mussels can attach to wide range of substrates in high densities and foul pipes, piers, and other structures. They out compete native bivalves by forming dense clusters.



Mediterranean Mussel (*Mytilus galloprovincialis*)

Habitat: Prefers estuarine or marine areas on sandy substrates and exposed rocky areas with high water flow. Temperature and salinity preferences are 10 - 20°C and 34 ppt, respectively.

Native Distribution: Adriatic, Black, and Mediterranean Seas.

Introduced Distribution: Asia, North America, Hawaii, and Southern Africa.

Introduction Vectors: Aquaculture, ballast water, hull fouling, and live food trade.

Impacts of Introduction: This invasive mussel can out compete indigenous mussels due to its rapid growth and ability to survive long periods of air exposure (approximately seven days).



Brown Mussel (*Perna perna*)

Habitat: Prefers rocky shores and artificial substrates and can tolerate temperatures from 7.5 - 30°C and salinities from 15 - 50 ppt.

Native Distribution: Africa, Europe, and South America.

Introduced Distribution: North America in the Gulf of Mexico.

Introduction Vectors: Ballast water.

Impacts of Introduction: These mussels can affect shipping by attaching to shipping buoys and causing them to sink. They also foul pipes and water system in power plants.

Potential Aquatic Invasive Crabs

European Green Crab (*Carcinus maenas*)

Habitat: Can tolerate a wide range of salinity (four to 54 ppt) and temperature (zero to 33°C) and are found on a variety of habitats including cobble beaches, rocky shores, sand flats, and tidal marshes.

Native Distribution: Europe and N. Africa.

Introduced Distribution: Australia, South America, and the United States.

Introduction Vectors: Aquaculture, aquarium and live food trade, ballast water, and hull fouling.

Impacts of Introduction: The European green crab has caused a 40% drop in the Manila clam harvest in Humboldt Bay, CA and has forced shellfish growers to use nets to protect their stocks. It has also been linked to the destruction of soft-shell clam stocks and to declines in scallop and northern quahog stocks in the Northeast U.S. It has the potential to damage the Dungeness crab fishery if populations increase in Washington State.



Chinese Mitten Crab (*Eriocheir sinensis*)

Habitat: Found around vegetation in rivers, estuaries, lagoons, riparian zones, and wetlands; can also tolerate a wide range in temperature and salinity.

Native Distribution: China and Korea.

Introduced Distribution: Europe and North America including Hawaii.

Introduction Vectors: Ballast water, deliberate introduction, hull fouling, and live food trade.

Impacts of Introduction: The Chinese mitten crab causes erosion by burrowing in the banks of rivers, estuaries, and coastal marshes. It reduces native invertebrate populations, damages rice crops, and interferes with the fishing industry by damaging nets, increasing handling time, and eating fish caught in nets. It also is an intermediate host of the oriental mammalian lung fluke (*Paragonimus* sp).

Indo-Pacific Swimming Crab (*Charybdis hellerii*)

Habitat: Found in soft-bottom areas, under rocks and in corals from the intertidal zone to 30 – 51 m.

Native Distribution: Japan, Philippines, New Caledonia, Australia, Hawaii, and throughout the Indian Ocean, including the Red Sea.

Introduced Distribution: Eastern Mediterranean, Cuba, Venezuela, Colombia, Brazil, and the Caribbean and Florida.

Introduction Vectors: Aquaculture, aquarium and live food trade, ballast water, and hull fouling.

Impacts of Introduction: The impacts of *Charybdis hellerii* introductions are currently unknown. In high numbers, it could compete with native commercial species (e.g. *Callinectes sapidus*) for food and habitat. It is itself a commercially important species in Southeast Asia, but no market currently exists for it in the United States.



Potential Invasives Polychaetes

Tubeworm (*Hydroides elegans*)

Habitat: Natural and artificial hard surfaces; exhibits a wide temperature tolerance and preference for salinities between 15 and 20 ppt.

Native distribution: Indo-Pacific.

Introduced Distribution: Europe, Hawaii, and throughout the Gulf of Mexico and East Florida.

Introduction Vectors: Hull fouling.

Impacts of Introduction: This tubeworm produces an irregularly sinuous white or gray calcium carbonate tube which is cemented to the structure it has settled onto. In tropical harbors around the world, *H. elegans* is considered one of the most costly fouling organisms and also has economic impacts on the aquaculture industry in China.



European Fan Worm (*Sabella spallanzanii*)

Habitat: Protected shallow sub-tidal areas (i.e. harbors and bays) on either soft or hard substrate 1-30 meters deep

Native Distribution: Found in the eastern Atlantic, in western Africa, the Canary Islands, Spain, France, and throughout the Mediterranean Sea.

Introduced Distribution: Australia, Jakarta Harbor, Indonesia, and Rio de Janeiro and Ilha Sao Sebastio, Brazil

Introduction Vectors: Ballast water, hull fouling, and as accidental bait

Impacts of Introduction: The European fan worm feeds at a higher rate than the native tube worms and can alter the structure of the habitat by forming a canopy with their filamentous feeding structures. This change in habitat has caused a population increase in the fish *Neodax balteatus* in the Port Phillip Bay, Australia.

IMAGE CREDITS

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The prevention and control of invasive species requires modifying the public's behaviors, values and beliefs, and changing the way decisions are made.

National Invasive Species Council's National Management Plan 2001.

For more information on aquatic invasive species or to report an unusual sighting, please visit www.marex.uga.edu/shellfish

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