3 Problem Definitions

This chapter describes the scope of Louisiana's invasive species problem, in terms of pathways and media (how species arrived here), species and groups of species (which biota prove most problematic), and exacerbating circumstances (what other factors intensify this problem).

3.A Pathways and Media

3.A.1 Shipping

The confluence of waterways in Louisiana and sheer magnitude of waterborne shipping in the state have unintentionally made this vital Louisiana industry the state's premier pathway for accidental species introduction. "Shipping" as a pathway refers not exclusively to hull fouling, ballast water, or packing materials (these phenomena are considered "media;" see page 20), but rather to the network of waterways, shipping trends, and the port infrastructure through which waterborne vessels deliver and obtain cargo (including infested media) — and therefore may spread species into new habitats. Louisiana and its neighbors form the premier gateway of foreign shipping to America, making the state that much more susceptible to accidental species introduction via shipping pathways. In fairness, it should be noted that waterborne shipping offers a multitude of economic and environmental benefits compared to alternatives (particularly trucking). The goal here is simply to minimize one of waterborne shipping's potential environmental costs.

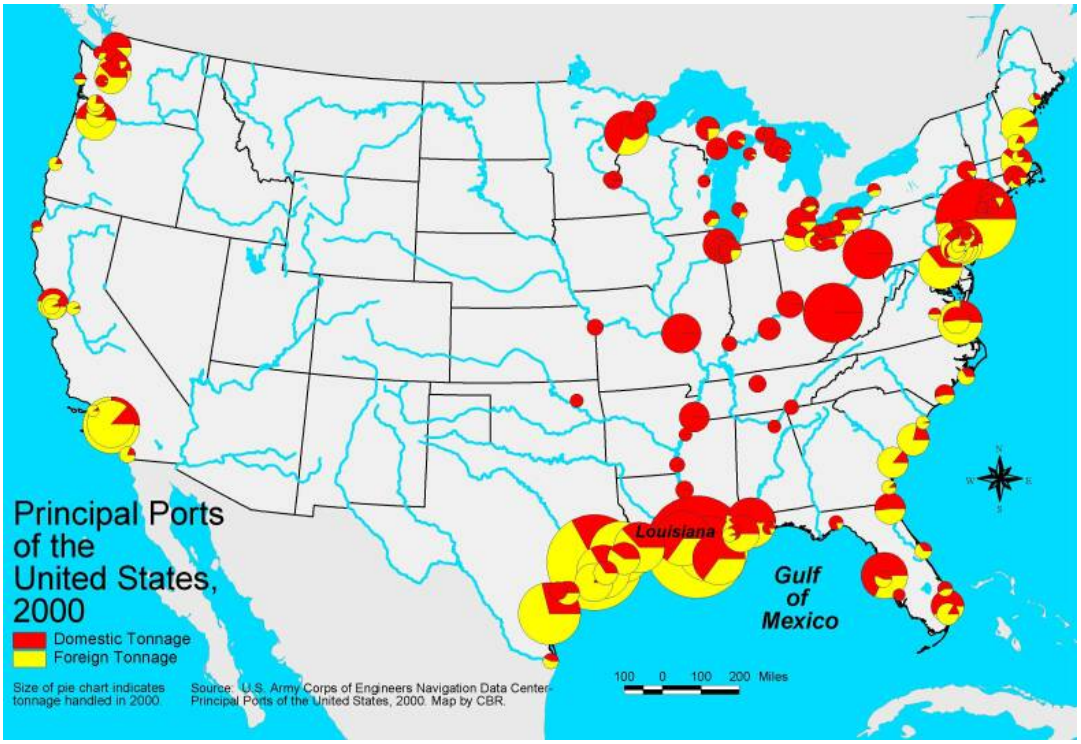
Understanding shipping pathways is critical in invasive species management because they offer preventative opportunities when an accidental introduction is at its most controllable stage. The purpose of this section is to characterize trends in the distribution, content, type, and magnitude of shipping activity occurring along Louisiana's navigable waterways and through its points of ingress and egress, as a first step toward prevention. Five perspectives are offered: (1) shipping and port activity in Louisiana; (2) cargo types and their susceptibility to invasive species; (3) patterns of commodity shipments destined for Louisiana; (4) patterns of commodity shipments originating from Louisiana; and (5) patterns of foreign imports to Louisiana.

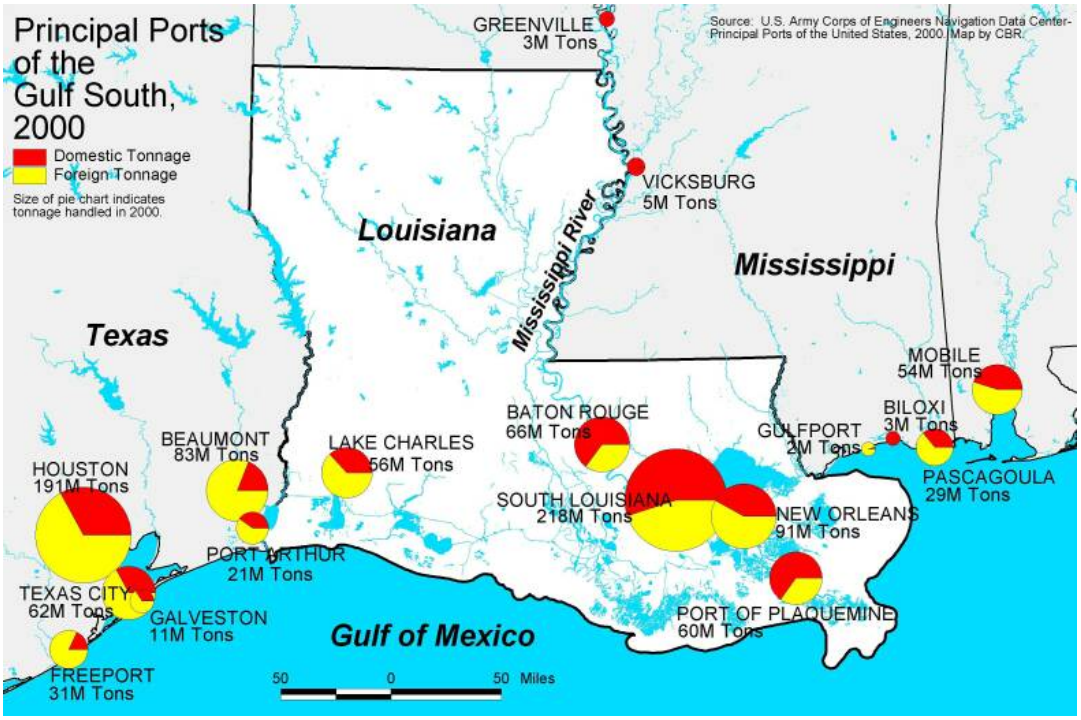
Shipping and Port Activity in Louisiana

Louisiana is home to the busiest port system in the nation as measured by the most reliable gauge of port activity: tonnage. In 2000, over a half-billion cargo tons — about one-fifth the national total — were imported or exported through Louisiana, a state in which one in every eight jobs can be traced to port activity.[1] According to the U.S. Army Corps of Engineers' *Port and Waterway Facilities*, 882 separate port-infrastructure entities — docks, wharves, terminals, piers, turning basins, facilities, landings — dot the Bayou State, most of which are categorized into five principal intermodal ports: Port of South Louisiana, Port of New Orleans, Port of Baton Rouge, Port of Plaquemines, and Port of Lake Charles. These five major ports (which are not single, specific locations but agglomerations lining miles of waterways) are described below. However, from an invasive species perspective, the hundreds of smaller port-infrastructure entities each represent potential portals and pathways for foreign species introduction. Contact information (including names and telephone numbers for responsible individuals) for each entity is listed in the U.S. Army Corps of Engineers' *Port and Waterway Facilities* documents, published by the Institute for Water Resources-Navigation Data Center and may be downloaded from http://www.iwr.usace.army.mil/ndc/data/datapwd.htm.

Port of South Louisiana comprises eight facilities (123 total docks, wharves, terminals, and other entities) of general cargo, bulk docks, grain elevators, and petroleum infrastructure along the 54 miles of the lower Mississippi River that pass through St. James, St. John the Baptist, and St. Charles parishes. These eight facilities are leased to operating companies. Additionally, the Globalplex Intermodal Terminal is expanding to become a major complex to handle dry bulk and break-bulk cargo. Together, this port system "is the largest tonnage port in the Western Hemisphere and ranks

[1] U.S. Army Corps of Engineers Water Resources Support Center 2002.





Louisiana is home to the busiest port system in the nation in terms of tonnage. In 2000, over one half-billion cargo tons — about one-fifth the national total — passed through Louisiana, where one in every eight jobs can be traced to port activity. The Gulf South region is the nation's premier handler of foreign tonnage, potentially putting it at greater risk for species introductions. Louisiana's five principal ports, shown above, all ranked among the top 15 busiest in the U.S.; the Port of South Louisiana ranked first and Port of New Orleans ranked fourth. *Maps by CBR, 2004.*

third in the world. It handled over 245 million tons of cargo in 2000, brought to its terminals by vessel, barge, rail, and truck."[2]

Port of New Orleans, historically one of the world's great ports and the *raison d'etre* for the city of New Orleans, comprises 315 docks, wharves, terminals, and facilities of all types along the Mississippi River, Industrial Canal, Gulf Intracoastal Waterway (GIWW), Mississippi River-Gulf Outlet (MR-GO) Canal, Harvey Canal, and adjacent waterways in the urbanized area of Orleans, Jefferson, and St. Bernard parishes. The Port of New Orleans accommodates roughly 2,200 vessel calls per year, and more than 6,000 vessels move through New Orleans via the Mississippi River each year. On the import side, it is a major through-port for steel and rubber, and a major destination port for coffee and petroleum products. Poultry and grain comprise the largest exports that originate upriver

Louisiana's port infrastructure (docks, wharves, terminals, piers, turning basins, etc.) comprises 882 separate facilities, most of which are categorized into five principal intermodal ports: South Louisiana, New Orleans, Baton Rouge, Plaquemines, and Lake Charles. Ports represent a potential portal and pathway for species introductions. *Map by CBR, 2004.*

and pass through the Port of New Orleans, while plywood and petroleum products are the largest exports that originate locally. Port facilities were concentrated along the Mississippi River until the mid-20th century, when many facilities were relocated to the eastern Industrial Canal and Mississippi River-Gulf Outlet Canal. Recent limitations in wharf space and access have resulted in major new containerized facilities along the Mississippi River in uptown New Orleans and the return of port activity to its historical riverside location. The entire port infrastructure supports over 107,000 jobs, spends $13 billion per year, and contributes $231 million in state taxes annually.[3]

Port of Baton Rouge, seventh in the nation in total tonnage, connects the Mississippi River with the thousand-mile GIWW with 107 docks, wharves, terminals, and facilities of all types along 50 river miles below Louisiana's capital city. The river / GIWW junction is occupied by the port's 60-acre

[2] Port of South Louisiana (no date).
[3] The Port of New Orleans 2001.

Inland Rivers Marine Terminal. In addition, the Port of Baton Rouge features general cargo docks and transit sheds along 3,000 contiguous feet of wharf space for paper and forest products, steel, bagged goods, heavy lifts, and other general cargo; expansive grain elevators serving farmers in 31 parishes and exporting 1.4 million tons of grain worldwide; liquid commodity storage for a wide range of petroleum products and chemicals; and the largest molasses terminals in the world.[4]

Port of Plaquemines, headquartered in Braithwaite on the 82nd mile of the lower Mississippi River, is the first major Louisiana port facility for incoming ocean-going vessels. It imports steel, crude oil, and iron ore and exports coal, coke, soybeans, corn, and wheat. Most of the Port of Plaquemines' tonnage comes in the form of dry bulk cargo (19 million tons annually), followed by liquid (13 million) and general cargo (700,000 tons).[5]

Port of Lake Charles currently offers the most direct access to the Gulf of Mexico of all major Louisiana ports, by means of the Calcasieu River. "The Port of Lake Charles is the 12th largest seaport in the U.S., 4th largest liner service seaport in the U.S. Gulf and a major West Gulf container load center."[6] The port's district covers 203 square miles and features three marine terminals, docks, a bulk terminal, a three-mile-long Industrial Canal, two industrial parks, and access to the Gulf Intracoastal Waterway—a total of 155 facilities of all types spanning 42 miles. In all, the Port of Lake Charles handles five million cargo tons annually at its public facilities, including rice, flour, food, paper, wood products including woodchips, petroleum products, barites, and rutile.

Cargo Types and Their Susceptibility to Invasive Species

Three types of cargo flow through Louisiana's ports, each with an invasive species implication.[7]

Bulk cargo is unpackaged cargo that is piled or pumped into a vessel's hold and handled in non-unitized mass, such as coal, petroleum, gravel, and grain. It may be solid, granular, pulverized, liquid, semi-liquid, or gaseous in form. Bulk cargo *per se* sometimes serves as media for species introduction—wood chips and plant matter may harbor insects, snails, slugs, and plant pathogens; gravel, grain, and fibers may harbor seeds and weeds[8]—but a more serious impact comes from heavy bulk cargo's need for more ballast water, which is one of the most problematic media of invasive species in shipping pathways.

Break-bulk cargo is loose cargo unitized into crates, cartons, boxes, bags, or staked palettes, which are stored in the hold and handled in a piece-by-piece manner. Examples may include textiles, retail merchandise, rubber, lumber, equipment, and any other unitized goods that are not containerized. Break-bulk cargo is often associated with species introduction because the varied nature of their unitization makes them permeable and penetrable by insects, seeds, etc and the dunnage in which they are packed is susceptible to infestations. Dunnage is any packing material used to protect cargo from movement, moisture, contamination, or other damage. It includes wood, straw, plastic, Styrofoam, jute and other fibers, rice matting, tarpaulins, or bags. Organic dunnage on the wet floors and sweating walls of ship holds is a likely media for species introduction on shipping pathways, more so than the cargo itself. Crates used for break-bulk cargo also serve as media: 11 percent of the mollusks intercepted by inspectors in the late 1980s arrived in crates.[9] Locally, Formosan termites and cogongrass arrived by means of break-bulk cargo, the former in wooden shipping palettes and the latter as dunnage. Tropical plywood piled high in riverside warehouses awaiting shipment may also offer infestation opportunities.

Containerized cargo is packaged into boxcar-like containers, available in two standardized sizes, which are handled in a mass-production mode, regardless of contents. Starting in the 1960s, ports started a revolutionary movement toward this standardization at the expense of traditional ship-hold storage of break-bulk and bulk cargo. Even liquid and gas cargo may be containerized in special tank-fit units. While containerization of ships and port facilities requires massive changes of costly equipment, the savings in labor and increase in efficiency has more than offset the costs. After years

[4] Port of Baton Rouge (no date).
[5] Louisiana Economic Development 1998.
[6] Port of Lake Charles (no date).
[7] Cargo information gathered from a number of government sources on the Internet, and Wallace 1975.
[8] Office of Technology Assessment 1993, page 79.
[9] Office of Technology Assessment 1993, page 80.

of falling behind in containerization, the Port of New Orleans recently completed a vast new containerized facility along its uptown Napoleon Avenue wharves. From an invasive species standpoint, containerization offers some benefits, because (1) the container itself often serves to contain not only its contents but hitchhiking organisms as well, preventing their release into the local environment, and (2) containers use fewer wooden crates, burlap, grass, and other dunnage compared to equivalent quantities of traditional break-bulk cargo. For example, coffee used to be stored in burlap sacks piled in holds or containers, but now is more often blown into containers lined with plastic, a material less likely to harbor organisms than burlap. Additionally, a manifest is prepared for all contents of all containers no matter what their stage of shipment; this document may be used to identify those containers more likely to harbor introduced organisms. However, containers present the following problems:

- Containers are difficult to inspect because cargo must be fully unloaded and reloaded. It is the responsibility of the U.S. Bureau of Customs and Border Protection, formerly the U.S. Customs Service, to inspect containers. (Effective March 1, 2003, all border agencies in the United States Government, including the U.S. Customs Service, were unified into one agency — the U.S. Bureau of Customs and Border Protection (CBP). The CBP is housed within the Department of Homeland Security.)
- Containers are usually not cleaned after each unloading.
- Full containers often sit idle for long periods of time on wharves near species-rich water bodies, during which time organisms may enter, settle, and reproduce.
- Because containerized cargo (unlike break bulk cargo) is usually unloaded at destination ports rather than at entry ports, containers can release introduced species at numerous small interior points rather than at major entry points such as New Orleans. In essence, containerization has partially reversed the geography of species introduction.

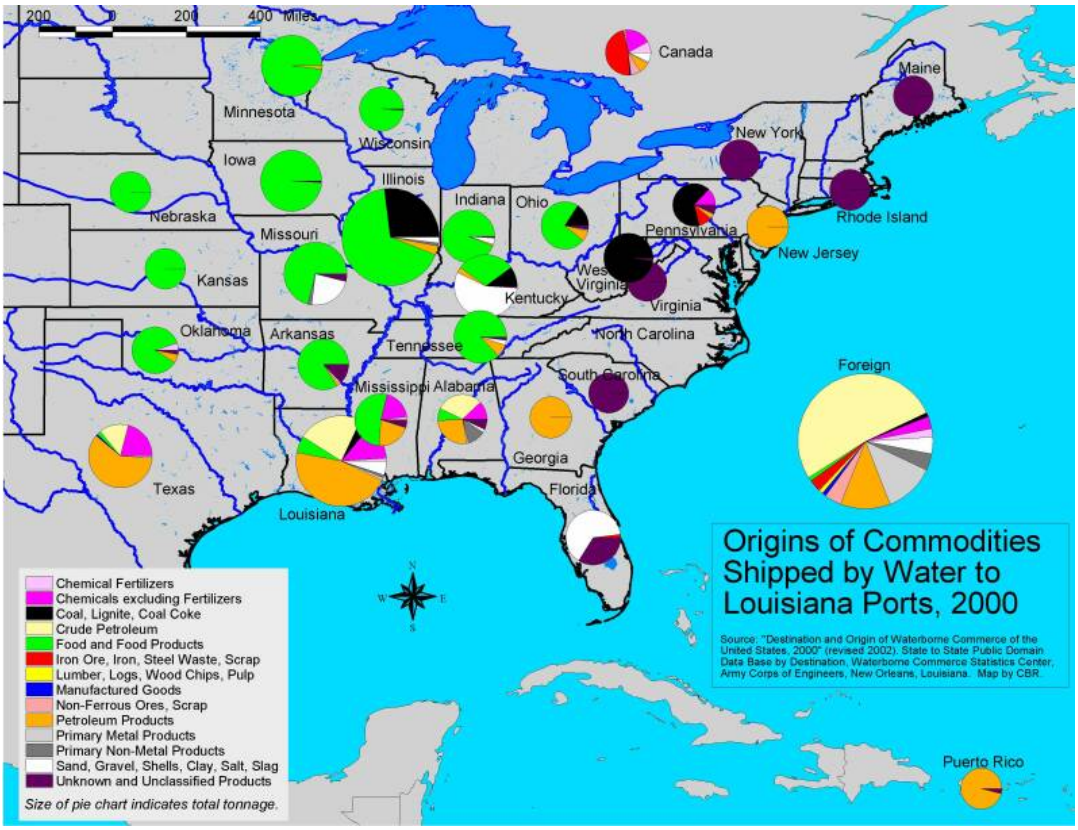
Containerized shipments of used tires were the origin of the Asian tiger mosquito introduction in the late 1980s. Additionally, “at least 15 percent of the snails and slugs intercepted by Federal agriculture inspectors between 1984 and 1991 were in freight containers.”[10]

Patterns of Commodity Shipments Destined for Louisiana

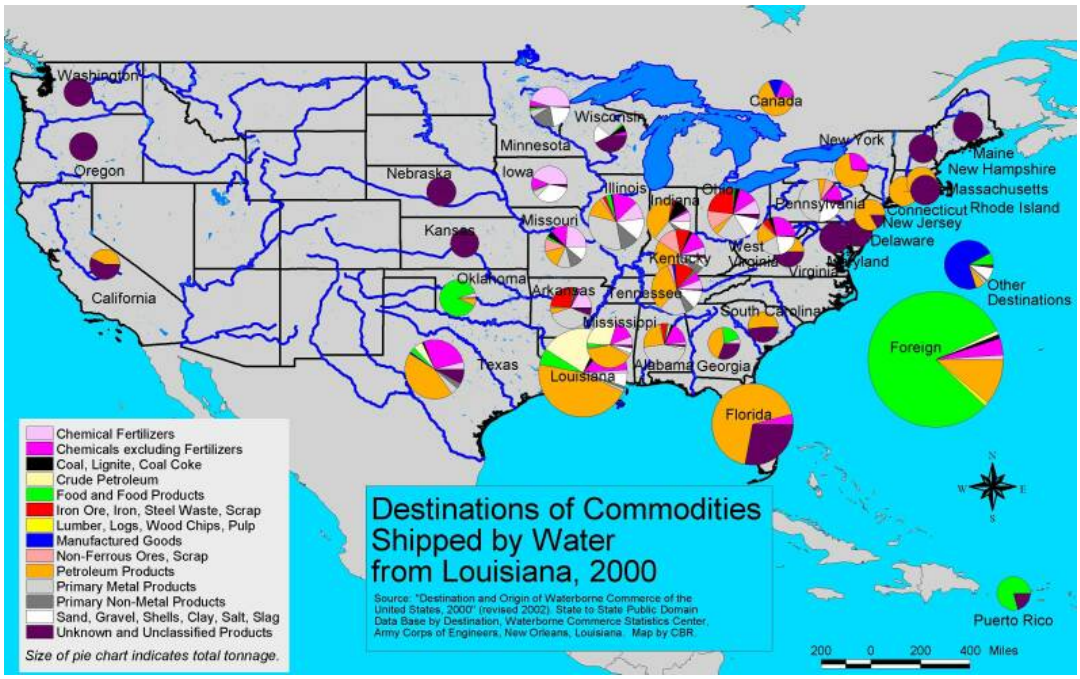
Waterborne commodities destined for Louisiana originate from the states of the Mississippi River basin and the Eastern Seaboard. (See map.) The following patterns in the origins of commodity shipments to Louisiana in 2000 are offered (these data do not include commodities shipped *through* Louisiana destined for other ports):[11]

- As a wood-producing state, relatively little lumber, logs, wood chips, and pulp are shipped to Louisiana. Those that do, originate mostly from foreign sources, often in the form of tropical plywood. Louisiana itself ships wood products to other ports within the state — a potential pathway for the spread or introduction of tropical pests, particularly termites.
- Most food shipments (agricultural commodities as well as processed food) come from the Mid-western states, particularly Illinois. Potential introductions associated with grains, such as any grain mite or other insect that inhabits stored dry grain, may use this pathway.
- Most chemicals come from the Gulf South; most coal-related commodities come from the northern Appalachian region west to Illinois; and most iron ore comes from Canada. While these bulk commodities per se are rarely associated with species introduction, their transport vessels may carry media that are.
- Most petroleum products (such as gasoline) come from the Gulf South and foreign sources; most crude petroleum comes from foreign sources.
- Sand, gravel, shells, clay, salt, and slag come primarily from Florida, Kentucky, Missouri, and Louisiana itself, as well as foreign sources.
- Unknown and unclassified products generally come from the Eastern Seaboard and Northeast.
- In addition to these bulk commodities, manufactured goods and other high-value shipments may also introduce new species through the dunnage or packing crates used to store such break-bulk or containerized cargo.

[10] Office of Technology Assessment 1993, page 80.
[11] U.S. Army Corps of Engineers 2002.



Among the multitude of commodities handled in Louisiana ports (above), imports such as wood products and fill material may harbor species from other environs. Other commodities or merchandise may be packed in materials vulnerable to infestations. Likewise, Louisiana ships various commodities to ports worldwide (below), in which species both native or introduced to the state could be transported to other environs. *Maps by CBR, 2004.*



The original source of these data (*Destination and Origin of Waterborne Commerce of the United States, 2000* from the Waterborne Commerce Statistics Center at the Army Corps of Engineers in New Orleans) breaks these commodity categories down to the commodity itself (sugar, fish, corn, wood chips, etc.). This information should be consulted to target origins of commodities highly correlated with potential species introductions or spreads.

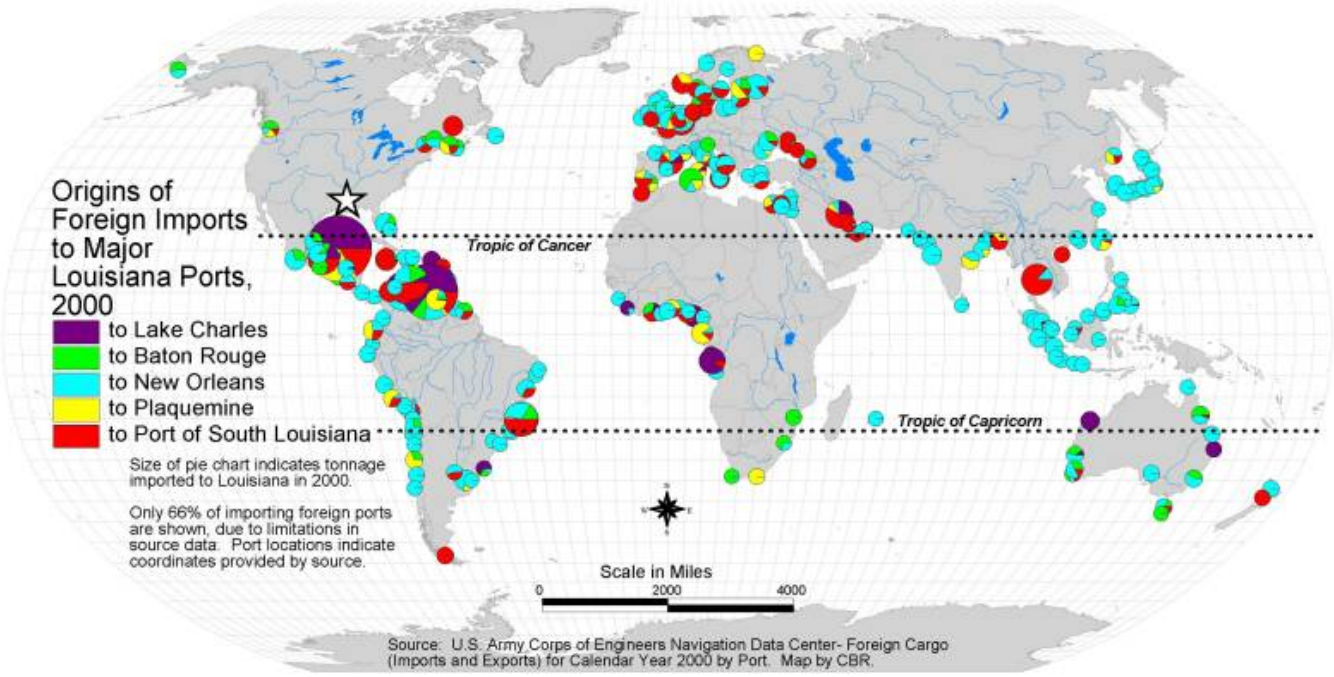
Patterns of Commodity Shipments Originating from Louisiana

Commodities originating in Louisiana destined for other states not only illustrate potential pathways by which Louisiana's species (introduced or native) may spread elsewhere, but pathways by which media such as ballast water, potentially carrying exotic organisms, may arrive here. The following trends in shipments from Louisiana are observed: [12]

- By far, most of Louisiana's food products are shipped to foreign ports. A smaller portion is destined for Illinois, Oklahoma, Puerto Rico, and Louisiana itself.
- Most chemicals go to the agricultural and industrial regions of the Midwest.
- Most petroleum goes to Florida, throughout the Mississippi Valley, and to the Northeast.
- Metal products are shipped throughout the Mississippi Valley, as are Louisiana's exports of sand, gravel, shells, clay, salt, and slag.
- Manufactured goods go mostly to "other" destinations. This category is not explained in the original dataset, but may include the delivery of offshore oil rigs to the Gulf of Mexico. Louisiana has a relatively small manufacturing sector.
- Unknown and unclassified products generally were shipped to the Eastern Seaboard and Northeast, just as those areas were shipping similarly unknown commodities to Louisiana.

Patterns of Foreign Imports to Louisiana

Patterns of foreign cargo by origin imported to Louisiana help identify potential pathways by which species may arrive. Import trends involving Louisiana's five principal ports in 2000 reveal the following information relevant to introduced species:[13]



A significant portion of cargo shipped from foreign ports to Louisiana originates in tropical or subtropical regions, particularly Central and South America. These regions have similar climates as Louisiana, increasing the chance that an introduced species may become established. *Map by CBR, 2004.*

[12] U.S. Army Corps of Engineers 2002.
[13] U.S. Army Corps of Engineers Institute for Water Resources Navigation Data Center 2002.

- **Caribbean Basin Shipping Lanes** — Mexican ports and sites in the Gulf of Mexico, importing mostly petroleum products, shipped more tonnage to Louisiana than any other origins. Venezuelan ports were second, again reflecting petroleum imports. This trend generally remained true for each individual Louisiana port, although it is clear that the petroleum refineries associated with the Port of South Louisiana along the lower Mississippi River made them a major importer of cargo from Gulf of Mexico origins. The shipping of petroleum products is generally less vulnerable to accidental species introductions, except to the extent that ballast water media or hull fouling may be involved. (See Section 3.A.5 for more information.) To the extent that these pathways may usher in unwanted species regardless of the type of cargo, researchers may consider focusing on circum-Caribbean ports to maximize the effectiveness of prevention efforts or to foresee future introductions.
- **Worldwide Susceptibility** — The importance of Louisiana ports is by no means limited to the Caribbean Basin. Countries or regions importing more than one million tons to Louisiana ports in 2000 are dispersed worldwide: Mexico / Gulf of Mexico, Venezuela, Colombia, China, Aruba, Brazil, Angola, Thailand, Qatar, Brazil, South Africa, Russia, Belgium, Trinidad-Tobago, Kuwait, and Gabon.

These fives aspects of waterborne shipping are but a few of the perspectives that may be studied to reduce the risk of species introduction by this pathway.

3.A.2 Boating

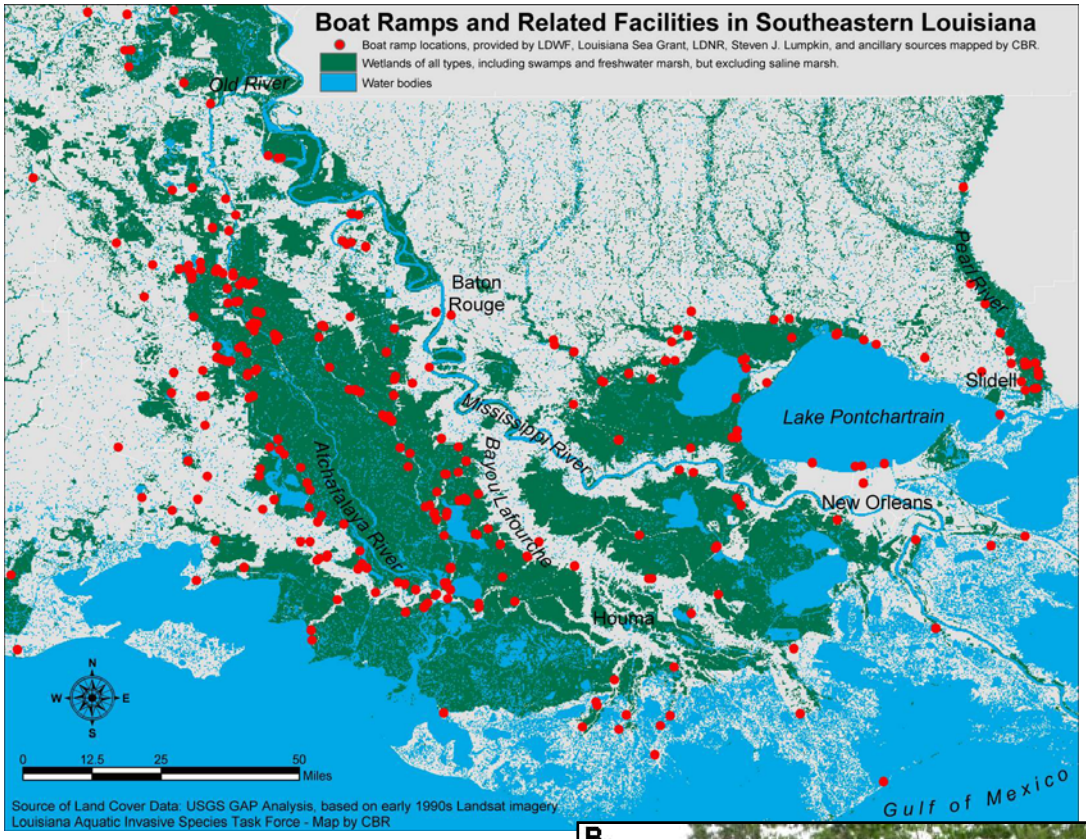
Recreational boating is a primary pathway by which invasive species spread throughout Louisiana's waterways. In 2002, more than 1.7 million boaters, fishermen, and hunters registered with the Louisiana Department of Wildlife and Fisheries (LDWF). By not thoroughly washing or rinsing boats and boat trailers, boaters can easily transport an aquatic weed from one water body to another. Louisiana is also at risk for invasive species introductions from neighboring states with similar ecosystems and climates, since the "Sportsman's Paradise" attracts fishermen from Texas, Mississippi, Florida, and Alabama. The Gulf of Mexico Regional Aquatic Nuisance Species Panel is in the process of devising a strategy to address this problem.

Louisiana is home to some of the most productive fisheries in North America. In 2001, Louisiana water provided recreational opportunities to about 970,000 total anglers, of whom 68% were freshwater fishermen. The total economic impact of sportfishing to Louisiana in 2001 was estimated at over $1.5 billion, providing almost 16,000 jobs, and generating over $9 million and $57 million in state and federal income taxes, respectively.[14]

Strictly with regard to fishing licenses, commercial fishing license sales alone generated more than $4.2 million in revenue in 2002. Combined with sport fishing, hunting, and recreational boating from both in-state and out of state, the total revenue generated by license sales in 2002 was more than $20 million. In most years, commercial fishermen from Mississippi, Texas, Florida, and Alabama are the primary source of out-of-state commercial fishing license sales.[15] Similarly to recreational boating and fishing, the attraction of commercial fishermen to Louisiana from neighboring states increases the potential for an invasive species to become established in Louisiana waters.

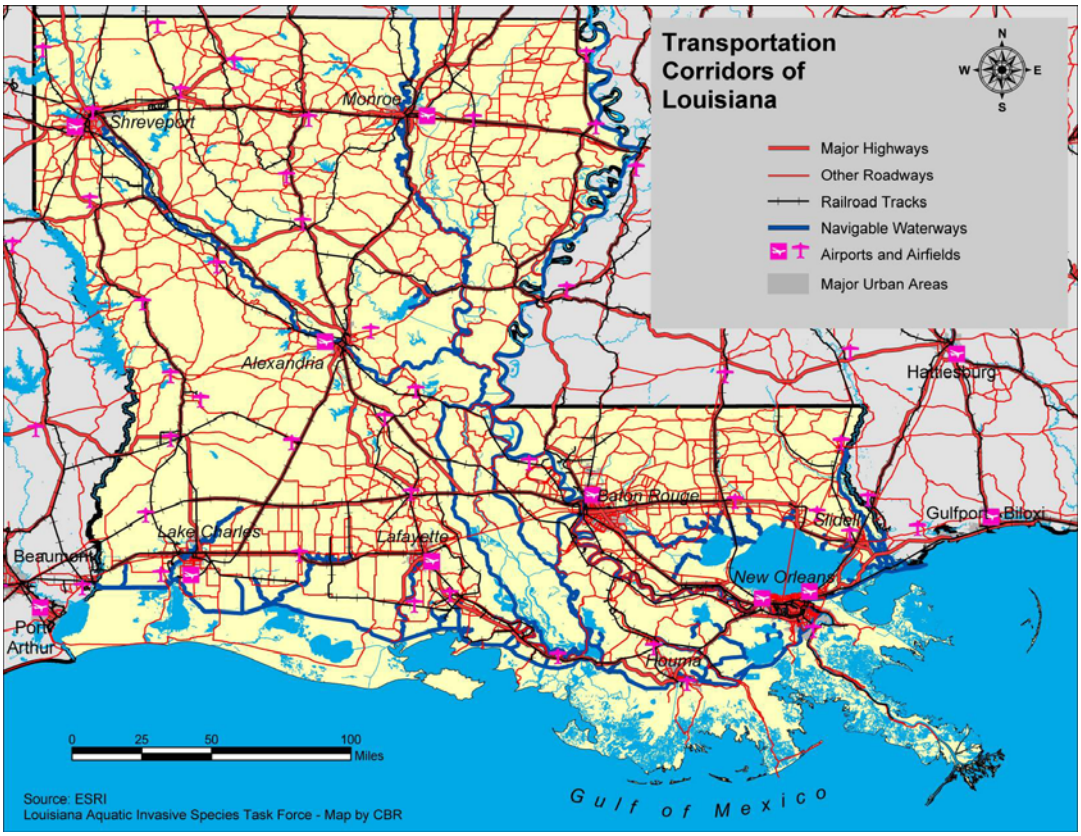
LDWF maintains annual reports detailing the total number of active motorboats per parish (more than 330,000 active motorboats are registered in the state); the total number of hunting, fishing, and boating licenses sold in the state; and the total revenue generated from the license sales. These publicly available statistics are kept by LDWF's Fiscal Section, and could be used to focus invasive species control efforts.[16]

[14] American Sportfishing Association 2002
[15] LDWF 2002a; LDWF 2002c; LDWF 2002b.
[16] LDWF 2002e; LDWF 2002d.



Boating

Boat ramps sometimes serve to spread invasive species, as aquatic plant debris cling to recreational watercraft and trailers (A) and are transported to new water bodies. Most ramps in Louisiana provide access to prime invasive species habitat (map, top), making such introductions more likely to become established. Field signage (B) provides an opportunity to educate outdoor recreationists about invasive species. Ironically, an invasive Chinese tallow tree grows a few feet behind this sign. *Map and photos by CBR, 2004.*



Transportation Corridors

Transportation corridors such as highways, railroads, and waterways, serve as pathways for the spread of invasive species, by the vehicles traveling on them and by the disturbed habitats that often parallel them. Chinese tallow trees, cogon grass, and privet thrive in these sunlight-rich areas. Note the water hyacinth growing at this dock (bottom right) in St. John the Baptist Parish. *Map and photos by CBR, 2004; river photo courtesy SouthWings and The Nature Conservancy.*

3.A.3 Transportation Corridors

Invasive species may be introduced or spread through transportation corridors such as highways railroads, and navigable waterways, and their associated rights-of-way. Cogongrass is an example of an aquatic invasive species that spreads along highway rights-of-way, migrating from Mississippi to Louisiana by exploiting the disturbed soils shouldering the Interstate 10 corridor. Its continued range expansion is partially due to the transport of dirt and soil containing cogongrass tubers to new, uninfested locations. Cogongrass infestations are primarily concentrated in the Florida parishes of Louisiana. (See section 3.B.1.b.ii on cogongrass for more information.)

Formosan termites have expanded their range through railroads and railroad ties by infesting one tie to the next. Instances of termite range expansion also have been documented when old, infested railroad ties were transported to a new, uninfested location, frequently for use in gardening and landscaping. In these examples, the railroads served both as the pathway and as the media for invasive species introductions. (See section 3.B.5.a.ii on Formosan termites for more information.)

3.A.4 River Diversions

The diversion of Mississippi River water into adjacent wetlands reestablishes salinity gradients within the ecosystem. An added benefit is the reintroduction of deprived nutrients and sediments to the wetlands, slowing down coastal erosion in Louisiana. One unintended consequence of river diversions may be the spread of invasive species from the river into wetlands.

South Louisiana risks eroding into the Gulf of Mexico due to the gradual loss of important wetland ecosystems. Every year, Louisiana loses 25-30 square miles of land area, and it is estimated that over 1,500 square miles of marsh have been lost since 1930.[17] The land loss can be attributed to many factors, among them the levee system, canal construction, and the invasive nutria (*Myocastor coypus*), a rodent-like mammal introduced from Argentina.

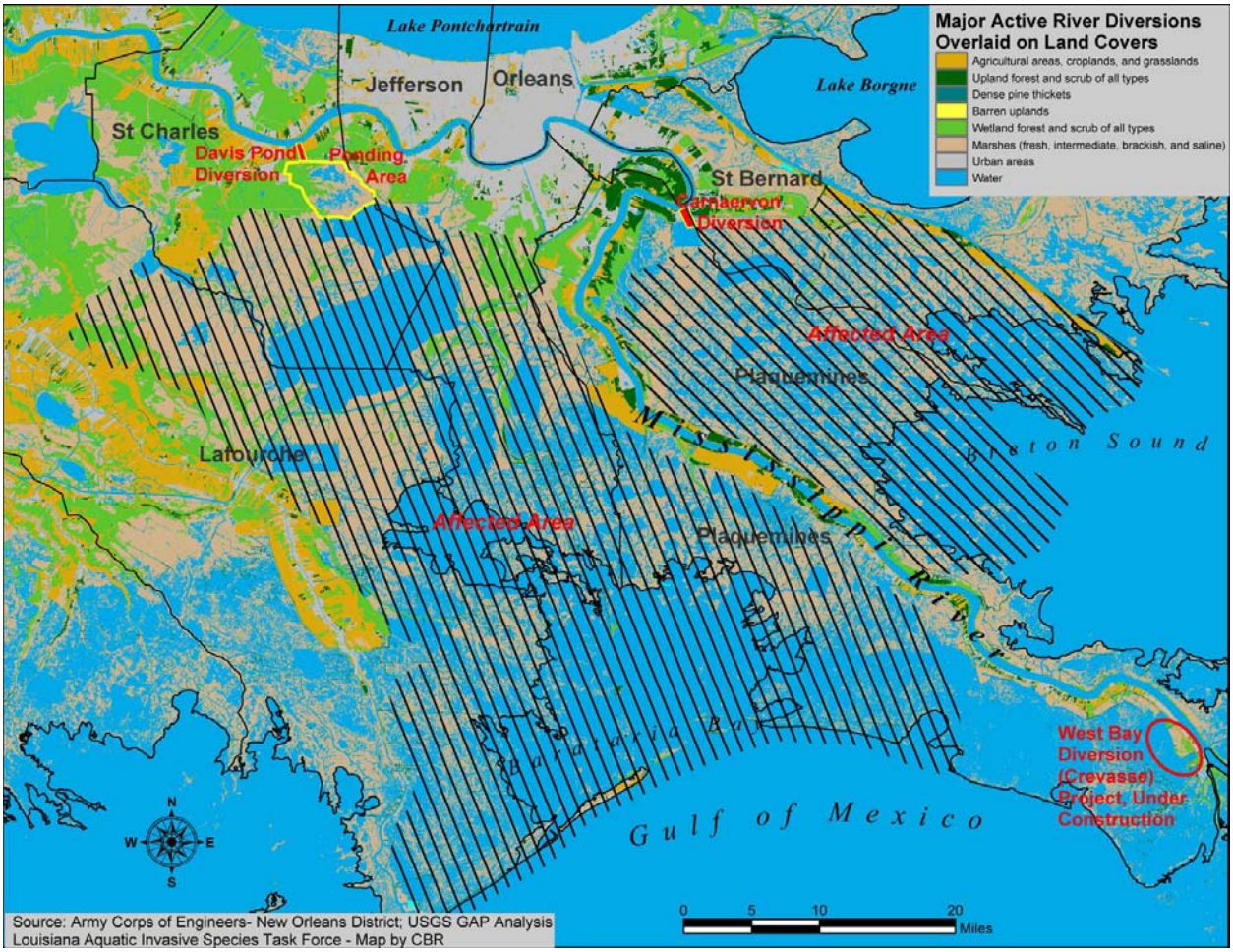
Mississippi River levees sustain the city of New Orleans and southeastern Louisiana by preventing floods. However, levees deprive the wetlands and marshes of essential freshwater, nutrients, and sediments that traditionally would arrive during historic river overflows in the spring.[18] Without the continuing sediment supply, the existing land and soils subside and become open water.

The U.S. Army Corps of Engineers (USACE) is planning and constructing controlled diversion structures on the Mississippi River to divert nutrients and sediments from the river into coastal wetland areas. USACE predicts that diversions will help (1) restore proper salinities to the marshes, thereby counteracting vegetation loss through saltwater intrusion; (2) restore freshwater species of plants and animals to the marsh; and (3) rebuild land through the deposition of sediments and nutrients. Dozens of diversions, crevasses, pipelines, and other devices are currently planned as part of Louisiana's coastal restoration plan; the two currently operational large-scale freshwater diversion structures are the Caernarvon and Davis Pond diversions.

The Caernarvon Freshwater Diversion was opened in 1991 and is operated by the Louisiana Department of Natural Resources (LDNR). It is located on the east bank of the Mississippi River on the St. Bernard-Plaquemines parish line and discharges up to 8,000 cubic feet per second (cfs) from the Mississippi River toward the Breton Sound. The diversion is working: freshwater marsh plants have increased seven-fold since 1991, while the amount of salt marsh vegetation has decreased by 50 percent. In 1998, surveys showed marshland increased by 406 acres in the sampling area.[19]

Located approximately 15 miles upriver from New Orleans on the west bank of St. Charles Parish, the Davis Pond Freshwater Diversion can divert up to 10,650 cfs of Mississippi River water into the

[17] Coalition to Restore Coastal Louisiana 2002.
[18] Addison 1999a.
[19] Naomi 1998.



Wetlands and marshes affected by the freshwater diversions at Davis Pond and Caernarvon. Diversions slow saltwater intrusion and coastal erosion by transferring sediment-laden freshwater to wetlands and mashes. They could also introduce river-borne invasive species to adjacent wetlands and water bodies. *Map by CBR, 2004.*

Barataria Bay estuary.[20] The structure opened in stages starting in March 2002 and has been described as the largest coastal restoration project in the world.

The Bonnet Carré Spillway, located in St. Charles Parish upriver from the New Orleans metropolitan area, is designed not to restore wetlands but to prevent flooding by diverting water from the Mississippi River into Lake Pontchartrain in times of high river flow. The spillway, which can divert up to 250,000 cfs into the lake, has been opened eight times between 1937 and 1997.[21] Recent plans include new diversionary structures paralleling the Bonnet Carré Spillway designed to restore marshes along the south shore of Lake Pontchartrain.

As the Caernarvon and Davis Pond freshwater diversions continue to operate, the Breton Sound and Barataria Bay marshes and estuaries will become increasingly fresh, thus providing more suitable habitat for freshwater plants and animals, including invasives. The diversions themselves pose a minor risk of introducing invasive river species to the freshwater marsh, possibly including grass carp, bighead carp, silver carp, black carp, Asian clams, and zebra mussels. Water monitoring by USACE and LDNR provide data on salinity, nutrient load, sediment load, and some species composition, but little monitoring for invasive species occurs at the diversion structures, despite complaints by fishermen that water hyacinth, Eurasian watermilfoil, and other invasive aquatic plants frequently clog canals and impede boat traffic around the Caernarvon Diversion.[22] The state currently does not

[20] Addison 1999a.
[21] Addison 1999b.
[22] Grandy 2002; Villarrubia 2003.

regularly monitor for invasive species at the diversion structures or in the receiving waterbodies when these structures are open.

Despite the invasive species implications of diversions as a pathway, the river diversions are vitally important to coastal restoration efforts, and the benefits they provide likely outweigh potential invasive species introductions.

3.A.5 Media

3.A.5.a Ballast Water

Ballast is weight stored in the hold of a ship to prevent capsizing when its cargo load is light. Sea water is often used as ballast for large ocean-going vessels, which discharge it in anticipation of new cargo. Discharging ballast water into new maritime environments has been shown to introduce new species, some of which have become invasive. Because of invasive species concerns, some regions require mandatory ballast water exchange, in which ships must discharge their ballast in the open ocean and take on new ocean water ballast before coming to port. Although no known introductions of invasive species have occurred directly to Louisiana via ballast water discharges, it may only be a matter of time before such an introduction.

According to the National Invasive Species Act (NISA) of 1996, ships entering U.S. waters from outside the Exclusive Economic Zone (EEZ) are not required to perform ballast water exchange, though reporting is mandatory. NISA, however, currently designates the Gulf of Mexico as a "sea" instead of an "ocean," thus exempting the Gulf from ballast water reporting regulations.[23] Because of this exemption, ballast water reporting for ships entering Louisiana ports has generally been low. The National Ballast Information Clearinghouse shows that from July 1999 to July 2001, ships entering the Port of Baton Rouge submitted only 59 ballast water reports. From July 1999 to September 2001, only 859 vessels (roughly 20 percent of traffic) entering the Port of New Orleans submitted ballast water reports. The Port of South Louisiana has similarly low numbers: from October 1999 to August 2000, only 10 vessels submitted ballast water reporting forms.[24] Lack of reporting data makes it difficult to estimate ballast discharge into Louisiana waters, and the invasive species implications of those discharges.

The U.S. Coast Guard (USCG) has recently tightened ballast water regulations, by imposing monetary penalties for reporting violations and requiring ballast water management practices, some of which were formerly voluntary. Effective September 27, 2004, all ships entering U.S. waters from outside the EEZ must either:

- perform complete ballast water exchange;
- retain ballast water onboard; or
- utilize an alternative, USCG-approved method of ballast water treatment, before entering U.S. waters.

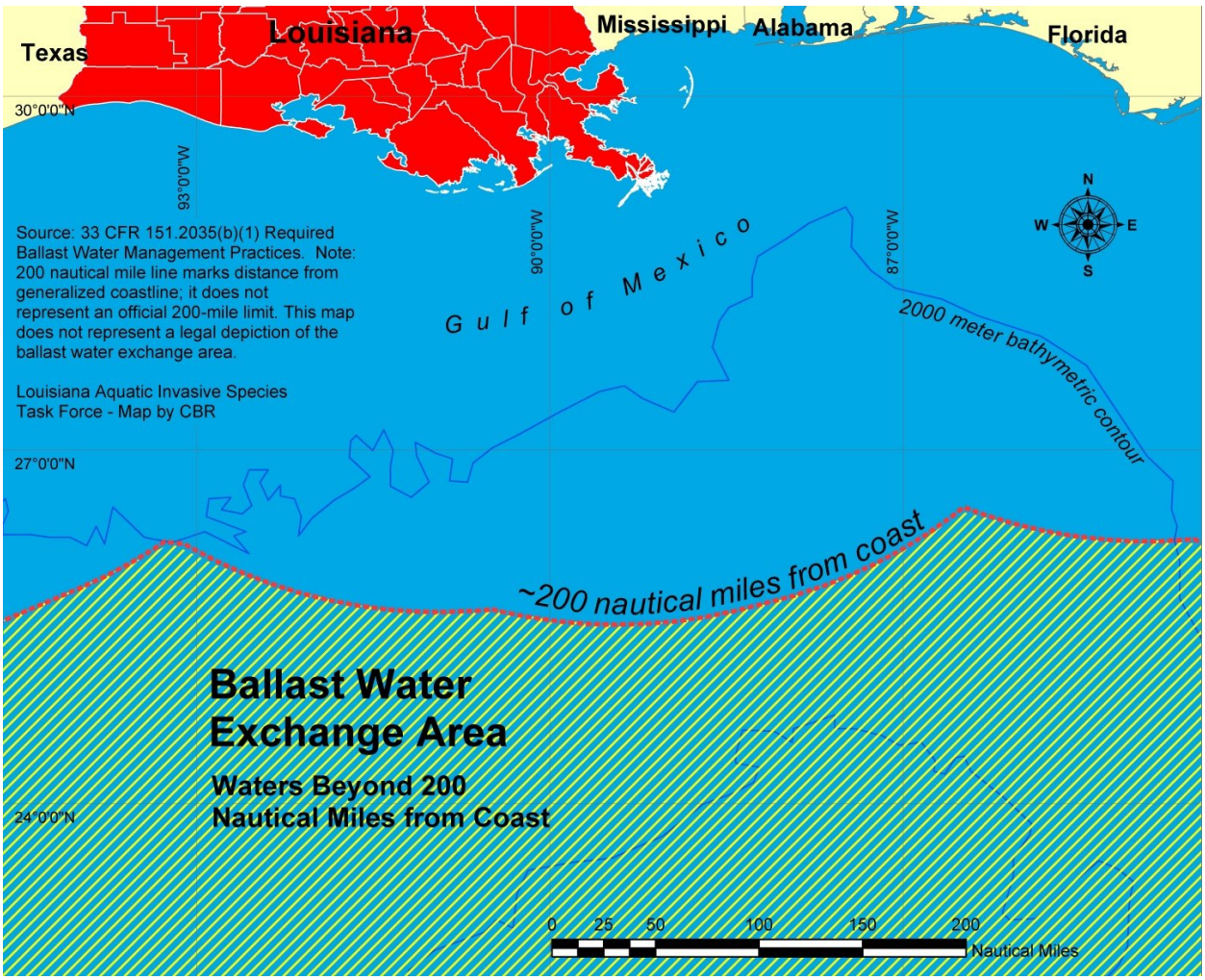
The USCG believes "defining mid-ocean ballast water exchange as taking place at least 200 [nautical miles] from shore allows more vessels to conduct exchange and simplifies enforceability."[25] This rule supercedes earlier regulations which restricted exchange to areas that were at least 200 nm offshore *and* deeper than 2,000 meters (6,562 feet).[26] Despite the NISA exemption for the Gulf of Mexico, the new USCG rule applies to all ships entering U.S. waters, including the Gulf of Mexico, from outside the EEZ.[27]

Despite these new regulations, risk remains for species introduction through ballast water exchange. Oil tankers, which comprise almost 25 percent of Louisiana shipping, are exempt from the above rules, as are military vessels and passenger ships with ballast water treatment systems.[28] Also, the new exchange requirement does not include coastwise trade, meaning that

[23] Meyers 2002; Barrett-O'Leary 2003.
[24] National Ballast Information Clearinghouse (no date); Port of New Orleans 2001.
[25] United States Coast Guard 2004.
[26] Meyers 2002; United States Coast Guard (no date).
[27] United States Coast Guard 2004.
[28] Gulf of Mexico Program 1998; United States Coast Guard (no date).

vessels traveling from the Caribbean to Gulf ports along continental coastlines will not be required to perform ballast exchange.

Carlton (2001) estimates that at least 7,000 species of marine life are transported around the world everyday, and ballast water arrives in the United States at a rate of 2 million gallons per hour.[29] Not enough data currently exist to evaluate fully the risk posed by ballast water discharges to Louisiana.



Ballast water, taken on by ships for stability, often incorporates species that are thence transported to new environs when the load is discharged. To minimize the risk of such introductions, ballast water should be "exchanged" in environs that will most likely kill the hitchhiking species. New U.S. Coast Guard guidelines restrict ballast water exchange to areas beyond 200 nautical miles offshore, superceding earlier regulations that required exchange in areas that were also at least 2000 meters deep. Removing the depth requirement significantly enlarged the area in the Gulf where exchange can occur. *Map by CBR, 2004.*

Marilyn Barrett-O'Leary, invasive species coordinator for Louisiana Sea Grant and a member of the Louisiana Aquatic Invasive Species Task Force, states "we have no idea how many or what species come into this region every day."[30]

One of the few regional studies on this issue was conducted in 1998 by Battelle for EPA's Gulf of Mexico Program. Battelle attempted to approximate the volume of ballast water discharged at five major ports in the Gulf of Mexico: Houston, Lower Mississippi, Gulfport, Mobile, and Tampa. The Port of Lower Mississippi was defined as the ports of New Orleans, Greater Baton Rouge, and

[29] Carlton 2001, page 12.
[30] Barrett-O'Leary 2003.

South Louisiana.[31] Battelle reported that "[t]he total ballast water released from ocean-going vessels in the three ports during 1996 [was] estimated at 26.6 million metric tons. This equates to 7.0 billion gallons per year, or approximately 13,400 gallons per minute."[32]

3.A.5.b Fouling of Ships, Dry Docks, and Drilling Platforms

Fouling organisms, such as barnacles, mussels, sponges, coelenterates, annelids, and seaweeds, can attach to vessels, dry docks, and drilling platforms. The worldwide transportation of vessels and infrastructure sometimes carries fouling species across oceans, a trip they normally would not survive if drifting on their own. The potentially high biological diversity of fouling organisms on ships led Godwin to describe ocean vessels as "biological islands" for organisms living in ports and estuaries.[33]

In 1999, Louisiana had 130 active drilling rigs, 4,489 producing oil wells, and 3,813 producing gas wells.[34] Though there are no species known to have been introduced via hull fouling, Louisiana's shipping economy and off-shore infrastructure offer ideal circumstances for this to occur.

3.A.5.c Dunnage

Dunnage is any loose material used to support and protect cargo from movement, moisture, contamination, or other damage. *Floor dunnage* protects moisture-sensitive cargo such as coffee, tea, and tobacco from water that may accumulate in the cargo hold. *Lateral dunnage* fills gaps between cargo. *Interlayer dunnage* is placed between cargo layers to prevent contamination of underlying cargo from top cargo. *Top dunnage* protects cargo against moisture, condensation, and contamination at the top of the cargo hold.[35]

Dunnage may serve as media for invasive species, or may itself be an invasive species. Some problematic dunnage materials include:

- wooden palettes
- jute coverings
- paper
- straw
- matting
- squared lumber
- planks or boards

Several invasive species in Louisiana arrived via dunnage. The premier example is the Formosan termite, which was introduced through infested wooden palettes (floor dunnage) during World War II. Another example is cogongrass, accidentally introduced to Mobile, Alabama, when it was used as a packing material in shipping crates. Now spreading across the Gulf South, cogongrass can be found in at least seven parishes in Louisiana. The imported red fire ant, known for its painful bite and aggressive behavior, was introduced in dunnage and ballast soil to Mobile in the 1930s, and quickly spread throughout the southern United States by transport of nursery stock and relocation of construction and landscaping equipment.[36]

(For more information on these invasive species, see the Species Section, 3.B.)

3.A.6 Deliberate Introductions

Species are introduced to new environs either accidentally or deliberately. Accidental introductions arrive through pathways such as those listed in the previous sections. Deliberate (or intentional) introductions are purposely brought in by humans, usually for economic gain and with little consideration for how the species may affect natural ecosystems. Deliberate introductions occur in

[31] Battelle grouped these three ports together because of their "location[s] and similar geographical attributes, as well as similar ship traffic and cargo."
[32] Gulf of Mexico Program 1998, page 14.
[33] Carlton 2001, page 12; Godwin 2001.
[34] Addison 1999c, page 4.
[35] Transport Information Service 2000.
[36] Agricultural Research Service 2002a; Johnson and Shilling 1998; Morisawa 2000.

the context of the aquaculture, agriculture, and fishing industries; aquarium and pet industries; gardening and landscaping; and others.

3.A.6.a Aquaculture Industry

Louisiana's flat terrain, abundant water supply, and productive wetlands foster a large aquaculture industry. If privately managed oyster leases are included, Louisiana devotes more total acreage to aquaculture than any other state. The Louisiana State University Agricultural Center (LSU AgCenter) estimates the total economic benefit to Louisiana from cultured aquatic species exceeded $203 million in 2001.[37] Major aquaculture commodities include crawfish, catfish, minnows, alligators, soft shell crabs, and fish species such as redfish, grass carp, and tilapia.[38] While many of these species are native to Louisiana and provide tremendous economic benefit, some species, including tilapia, grass carp, and black carp, pose a threat to natural resources when the species escape cultivation. These fish outcompete native fish for food and habitat and can alter ecosystems and food chains.

Tilapia are typically farm-raised for human consumption, but triploid grass carp are usually cultivated for the biocontrol of aquatic plants. Black carp are used as a form of biocontrol for snails and yellow grub (*Clinostomum margaritumin*) in aquaculture ponds.[39] To curb deliberate stocking of ponds and reservoirs with grass carp and tilapia, the state has made it illegal to "import, export, transport, culture, possess, dispose, transfer or sell" live tilapia and triploid grass carp without a permit from the Department of Wildlife and Fisheries.[40]

3.A.6.b Fishing and Fisheries

Freshwater sportfish are the fisheries most at risk from invasive species introductions, therefore commercial fisheries and marine sportfish will not be included in this section of the management plan. It is acknowledged, though, that some of the same concepts apply to these sectors.

Deliberate Fish Stocking for Sportfishing — According to the American Sportfishing Association, in 2001, the total economic impact of freshwater sportfishing to Louisiana was $759 million.[41] This figure is down from $1.03 billion in 1996.[42] Louisiana is known as "Sportsman's Paradise" because its waters and wetlands are rich in nutrients and biodiversity of species that recreational anglers and hunters find desirable. Some popular fish species are deliberately stocked by the Louisiana Department of Wildlife and Fisheries (LDWF) to ensure large numbers for sportfishing. Many stocked species are non-native, but few are considered invasive; on the contrary, most are regarded as beneficial and commercially valuable, such as striped bass (*Morone saxatilis*), which is native to some parts of southeastern Louisiana but has been stocked statewide.

In 2002, LDWF stocked more than 7.1 million fish in Louisiana public waters. The total number of fish stocked annually by LDWF has increased three-fold since 1997, when 2.4 million fish were stocked in public waters. The species stocked in 2002 included Florida largemouth bass, striped bass, hybrid striped bass, channel catfish, flathead catfish, bluegill/redear sunfish, paddlefish, and black crappie.[43]

Some species introduced to Louisiana waters for sportfishing now may be considered invasive. According to the U.S. Geological Survey (USGS), the redbreasted sunfish (*Lepomis auritus*) was intentionally introduced as a sportfish, but now scientists believe it may be displacing the native longear sunfish (*Lepomis megalotis*) through direct competition for resources.[44]

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[37] This figure includes proceeds from private and public leases of oyster beds in oyster production. LDWF has jurisdiction over most aspects of oyster production in Louisiana; however, oysters are regarded as both a commercial fishery and as a form of aquaculture.
[38] LSU AgCenter (no date).
[39] Nico 2000a.
[40] Aquaculture Exotic Species 2000.
[41] American Sportfishing Association 2002.
[42] American Sportfishing Association (no date).
[43] LDWF (no date).
[44] USGS (no date)a.

Accidental introductions could occur through deliberate fish stocking. Though the fish stocks themselves might not be invasive, the water used to transport them could be contaminated with invasive plants, invertebrates, or viruses. Fish stocks should be carefully inspected for such biological contaminants before relocation to a new water body. Fish stocking by unqualified individuals increases the chance of biological contamination. In addition to acting illegally, these individuals are less likely to adhere to regulations and standards regarding transport methods and equipment. Carlton (2001) states that though there are no data to report on the magnitude of illegal attempts to start new fisheries, "these attempts may be a significant source of introductions."[45]

Baitfish Introductions — Live bait also pose an invasive species risk. When anglers discard live bait or the bait's packing material into a water body, they may inadvertently introduce an invasive species to that water body. These actions are sometimes referred to as "bait bucket releases" or "bait bucket dumps." Anecdotal evidence indicates that this ostensibly small pathway may in fact contribute significantly to the invasive species problem. In some parts of the U.S., discarded earthworms intended as baitfish may be causing significant changes in forest plant compositions.[46]

Researchers believe that one fish species, the Rio Grande cichlid, may have been introduced in several locations on the south shore of Lake Pontchartrain both through aquarium releases and multiple bait bucket releases. University of New Orleans ichthyologist Martin O'Connell, Ph.D., states that bait bucket releases are a big problem on the south shore of Lake Pontchartrain and probably the rest of Louisiana as well.[47] The fathead minnow, a common baitfish species, is not generally regarded as invasive, but its widespread range in Louisiana and the rest of the United States is most likely due to numerous bait bucket dumps.[48]

3.A.6.c Nursery Industry and Water Gardens

A recent increase in interest has made water gardening one of the fastest growing sectors of the gardening and nursery industry, and sales of aquatic plants are greater than ever. This also means that the sale of aquatic invasive plants is on the rise. Since there is no specific data on invasive plant sales at nurseries and watergarden stores in Louisiana, we conducted an informal survey of selected nurseries in the New Orleans metropolitan area. The surveyed businesses included two national home improvement stores, a national pet and aquarium store, and two locally owned nurseries, one of which specializes in aquatic plants and water gardens.

Although some invasive plant species were found at the nurseries, such as parrot feather, Japanese and Chinese privet, and Brazilian waterweed, several common plant species we expected to find were not available. Some merchants expressed willingness to order the plants. We also found discrepancies in the naming of plants, which could confuse buyers who prefer native species.

University of Minnesota Researchers investigated the long-range transport of aquatic invasive plants through the water garden trade. In their experiment, Maki and Galatowitsch (2003) placed 40 aquatic plant orders for 681 plant individuals from catalogs and the Internet. Federally listed noxious plants, as well as plants banned or regulated by the state of Minnesota, were deliberately ordered to determine if state and federal regulations are followed. Once received, the plants were allowed to grow in a greenhouse for five weeks. The results were as follows:

- Federally listed noxious weeds and Minnesota-regulated plants were obtained in 92 percent of the orders requesting those species, including purple loosestrife and curly pondweed.
- Only one of 13 vendors informed the customer that he could not sell the plants because of regulations.

[45] Carlton 2001, page 13.
[46] Holdsworth, Hale, and Frelich 2003.
[47] O'Connell 2003.
[48] USGS (no date)a.

- Ninety percent of all purchases contained a plant species that was not specifically ordered, some of which (10 percent) contained banned or regulated plants, such as hydrilla, purple loosestrife, giant salvinia, or curly pondweed.

Every plant in this photograph, taken at a commercial aquatic nursery, is non-native to Louisiana and possibly to the United States. Water gardens and nurseries are an increasingly problematic pathway for invasive species in Louisiana. *Photo by CBR, 2003*.

- Forty-one percent of the orders contained seeds of both ordered and unordered plants.
- Fifteen percent of the orders contained misidentified plants.
- Other unintended organisms received were several invertebrates (snails) and some vertebrates, including two fish.[49]

LDWF maintains a list of noxious plants, however, the law behind it is inconsistent. The law states that the listed species cannot be transported into Louisiana, but it is not illegal to sell the plants or transport them within the state once they are already here.[50] Because of this loophole, invasive plants such as water hyacinth, giant salvinia, and water lettuce can be found at some Louisiana nurseries and water garden stores.

3.A.6.d Agriculture Industry

In general, agricultural commodities in Louisiana are non-native but not invasive. Many of Louisiana's most commercially important agricultural products are non-native plants and animals

[49] Maki and Galatowitsch 2003.
[50] Dugas 2003.

including cotton, soybeans, corn, cattle, rice, and sugarcane.[51] For 2002, the gross farm value of these and other agricultural commodities (both plant and animal) was approximately $3.04 billion. Once the agricultural products were processed, transported, and/or marketed, the value added for these commodities was about $3.72 billion, producing a total economic impact of $6.76 billion in 2002.[52]

Insects are the invasive pests most commonly associated with non-native agricultural crops. Some examples include:

- The Mexican boll weevil, a cotton pest that has caused an estimated $14 billion in damage to the cotton industry since its accidental introduction from Mexico in the 1890s[53]
- The sugarcane borer, a moth whose larvae bore into the sugarcane stalks causing plants to weaken or die. The invasive red imported fire ant is a predator of the sugarcane borer and, therefore, is favored by sugarcane farmers
- The sweetpotato weevil, an insect whose larvae bore into and tunnel through sweet potatoes, damaging the crop and rendering it unusable[54]

Although these insects are not aquatic and are thus beyond the scope of this management plan, it should be recognized that they cause extensive damage to important Louisiana crops. The U.S. Department of Agriculture (USDA) and the Louisiana Department of Agriculture and Forestry (LDAF) have extensive resources to control or eradicate these agricultural pests. Regarding the spread of invasive insect pests, such as the Asian long-horned beetle expanding its U.S. range, the USDA has rapid response plans already in place.

3.A.6.e Aquarium and Pet Industry

Aquarium Release — The majority of plant and animal species sold in aquarium and pet stores are non-native. These sales of non-native species represent a "deliberate pathway," by which more than 2000 fish species are introduced to the United States every year, primarily from Central and South America, Africa, and Southeast Asia.[55] To become invasive, the species must escape, establish itself in the wild, reproduce and spread, and exert a negative impact or economic or ecological effect. Aquarium releases usually occur when an aquarium or pet owner no longer wishes to care for his or her pet; the owner chooses to be "humane" and releases the pet into a water body. This is sometimes referred to as "aquarium dumping."

Many non-native fish and plants have been introduced to the United States through suspected aquarium dumping. According to the USGS, "at least 185 different species of exotic fishes have been caught in open waters of the United States, and 75 of these are known to have established breeding populations. Over half of these introductions are due to the release or escape of aquarium fishes."[56] Some examples of suspected aquaria releases in Louisiana include the Rio Grande cichlid, giant salvinia, Brazilian waterweed, hydrilla, and koi / common carp. (For more information on any of these species, see the Species Section, 3.B.)

Misidentified Aquarium and Pet Store Species — In March 2000, the Louisiana Department of Agriculture and Forestry (LDAF) discovered that the East Baton Rouge Science Resource Center, a public school entity, was using "golden apple snails" as part of an elementary school ecology project. The snails were obtained from a local pet store that sold them under the name *Pomacea bridgesi*, sometimes known as the spiketop apple snail, the Brazilian apple snail, or the albino mystery snail. However, APHIS Plant Protection and Quarantine National Identifier David Robinson, Ph.D., confirmed the species to be *Pomacea canaliculata*, the channeled apple snail, an invasive species and a potential threat to the rice industry. After that discovery, LDAF surveyed 32 pet stores in Louisiana and found that 31 percent carried *Pomacea canaliculata* or a closely related

[51] Evers and Barrett-O'Leary 2002.
[52] LSU AgCenter 2003, page 19.
[53] Center for Bioenvironmental Research 2002.
[54] Capinera 2001; Capinera 1998.
[55] USGS (no date)b.
[56] USGS (no date)b.

species under generic common names such as “golden apple snail”, “apple snail”, or “mystery snail.” Only one store used scientific names, but used an incorrect one for the snail species.[57] This case study illustrates the potential pathway of invasive species introductions through aquarium and pet stores, a problem exacerbated by the frequent misidentification of species by vendors. (For more information, see Channeled Apple Snail, section number 3.B.3.c.iii.)

Live aquatic plant sales are problematic as well. Hundreds of online aquarium supply websites sell thousands of non-native plant and animal species. One example is www.LiveAquaria.com, an aquarium supplies vendor that delivers aquatic plants “Direct to Your Door.”[58] Many of these plants are exotics known to be invasive. A common example is the oxygenating plant “Anacharis”, otherwise known as Brazilian waterweed. (See section 3.B.1.a.vi for more information.) Despite the establishment of this invasive plant in 33 states,[59] LiveAquaria.com praises this plant as “an ideal aquatic plant for beginners” and “an excellent oxygen producer for all types of freshwater aquariums.”[60] LiveAquaria.com’s “Anacharis” sales page states that the plant cannot be shipped to New Hampshire, Vermont, or Washington but does not explain why.

Other invasive species for sale on LiveAquaria.com include water hyacinth, parrot feather, various apple snails only identified to the Genus *Pomacea*, and koi / common carp. The website also offers a fish identified as the Texas cichlid, *“Herichthys cynoguttatus”* [sic], also called the Rio Grande Perch or Rio Grande cichlid.[61] Ichthyologist and Rio Grande cichlid expert Martin O’Connell, Ph.D., confirmed that the fish on the LivaAquaria.com website is the Rio Grande cichlid and noted that although there is some debate over whether this species belongs in the Genus *Herichthys* or *Cichlasoma*, the misspelled species name on the website could lead to further confusion.[62] The Rio Grande cichlid is established and becoming invasive in Lake Pontchartrain and the connected New Orleans drainage canals. (For more information on any of these species, see the Species Section, 3.B.)

Solutions to these problems include education (such as signage at marinas and piers warning against aquarium dumping), internal pet industry education and self-regulation, and, as last resort, state regulation.

3.A.6.f Fur Industry

Historically, native mammals, including muskrat, beaver, wild mink, fox, and bobcat, have been trapped for fur in Louisiana. In the 1930s, fur interests and others introduced nutria to Louisiana, primarily to offer a new fur resource to the state, and secondarily as a biocontrol for the invasive plant water hyacinth. Although legend says that Tabasco Sauce™ tycoon E.A. McIlhenny was responsible for the escape of 20 nutria held at Avery Island, recently discovered documents indicate that fur trappers or growers deliberately released nutria at several other locations in coastal Louisiana in the 1930s and 1940s.[63]

By the 1950s, the number of nutria harvested every year exceeded 200,000 individuals and did not fall below that level until the late 1980s and early 1990s. In fact, until about 15 years ago, nutria harvesting was so profitable that harvests exceeded 1,000,000 individuals every year between 1961 and 1980, when the price per pelt hovered between $7 and $8. During the late 1970s and early 1980s, nutria fur harvests were a $15 million per year industry. In 1988, a few years after the price of nutria fur peaked and the number of animals harvested annually fell, landowners began noticing an increase in the nutria population and in damage to vegetation occurring on their properties.[64]

[57] Hardy 2001.
[58] LiveAquaria.com (no date)a.
[59] USGS (no date)c.
[60] LiveAquaria.com (no date)a.
[61] LiveAquaria.com (no date)b.
[62] O’Connell 15 May 2003.
[63] Linscombe 2003a.
[64] Linscombe 2003a.

A variety of factors contributed to the decline of the nutria market, including a series of mild winters in Europe and Russia, previously the largest importers of nutria furs; an overproduction of ranch mink, which lowered the price of mink fur; a saturation of the fur market among people most likely to purchase fur coats; and an increased preference for leather coats, particularly for women. Contrary to popular belief, the animal rights movement caused, at most, a minor impact on this decline. Despite concerted efforts to increase demand through advertising under the label BayouNutria™, the demand for nutria never rebounded. The Fur and Alligator Advisory Council of Louisiana, in partnership with the Louisiana Department of Wildlife and Fisheries, recently attempted to create a demand for nutria meat, but these efforts, too, have proven disappointing, despite the support of famous chefs such as Paul Prudhomme. [65]

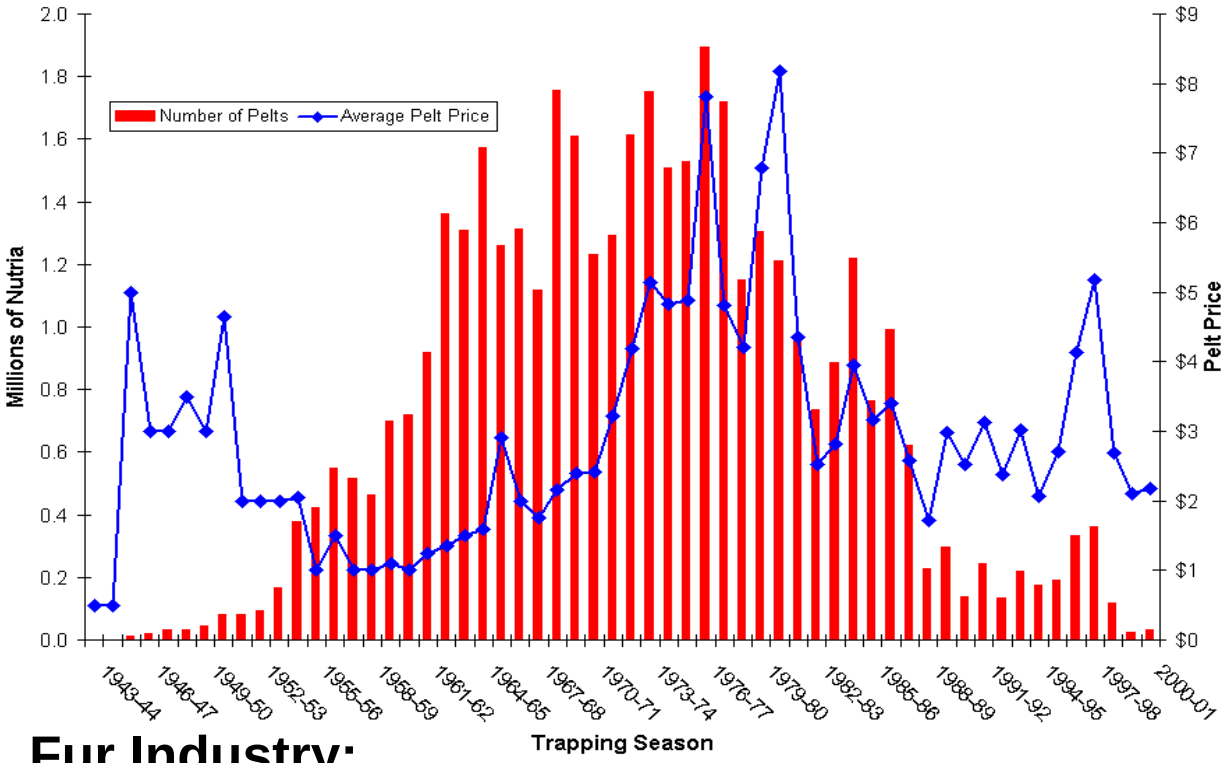
This South American rodent has become one of Louisiana's most notorious invasive species, wreaking ecological havoc on native wetland vegetation and contributing to Louisiana's coastal erosion problems. To help control nutria, a new bounty program, designed to create an economic incentive for trappers to harvest nutria, was implemented in 2002. (For more information on nutria and the nutria bounty program, see section 3.B.4.a.i on "Nutria" in the Species Section of the management plan.)

3.A.6.g Cultural Traditions

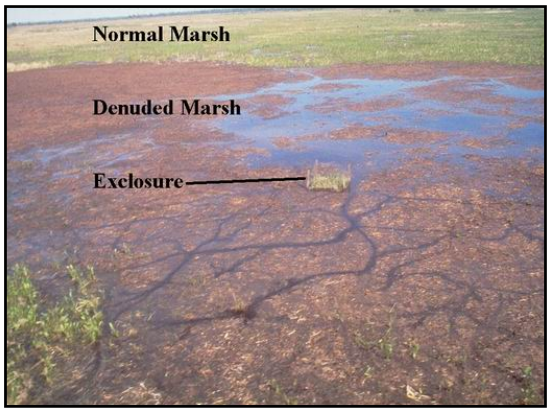
For purposes of this management plan, "cultural traditions" are defined as traits associated with the ethnic or religious identity of a people beyond the influence of economics (which is covered by the sections on agriculture, fishing, shipping, boating, etc). Although Louisiana once ranked as a premier destination for immigrants to the South, few present-day invasive species in the state can be traced back to an original introduction for reasons of cultural tradition. Nationally, there are a number of examples. In 1997, a Buddhist group purchased 2,500 fish from a pet store in New York's Chinatown and released them in a New Jersey pond. Some Buddhists believe that setting animals free is an act of compassion that will be rewarded with good karma.[66] Similar cultural pathways may exist in Louisiana.

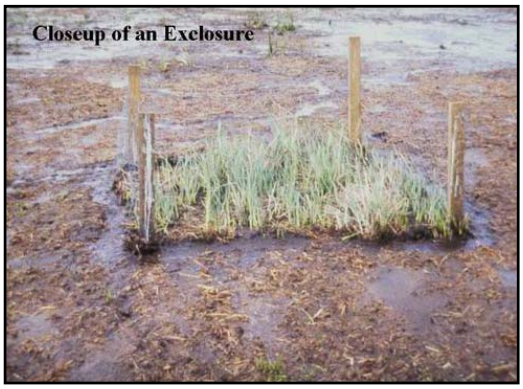
For example, the eastern New Orleans neighborhood known as Versailles is home to an enclave of Vietnamese refugees and their descendents, first established in the mid-to-late 1970s. As is common to many refugee and immigrant communities, the elders of this group re-established cultural traditions practiced in their homeland for generations, including the creation of intensively cultivated backyard vegetable gardens. According to geographer Christopher A. Airriess, "approximately 34 different leafy green vegetables, tubers, cucurbits, condiments and herbs, legumes, and medicinal plants not common to the Western diet are cultivated [in Versailles gardens]. The plants are propagated from seeds or cuttings acquired from enclave stores, sent directly from Vietnam, or acquired from enclave friends and relatives."[67] It is not the intention of the Task Force to condemn such traditions, as they play important roles in the acculturation of recently arrived refugees and immigrants. Indeed, European charter groups indulged liberally in the introduction of species from their homelands upon their initial arrival. Nevertheless, the possibility of a genuinely harmful species arriving and spreading via this pathway cannot be overlooked by agencies charged with the protection of the greater public good. Management actions that assess the risk level of such introductions and propose reasonable and appropriate responses if the risk level is significant would be of interest to Louisiana's invasive species efforts.

[65] Linscombe 2003a.
[66] West 1997.
[67] Airriess 2002.



Fur Industry: Nutria





Fur interests introduced nutria to Louisiana in the 1930s. By the 1950s (graph, top), the number of nutria harvested every year exceeded 200,000 individuals, and until about 15 years ago, nutria pelts were so profitable that harvests resulted in a $15 million per year industry. In 1988, after harvests fell, landowners began noticing increased nutria populations and damaged vegetation. This South American rodent has since wreaked ecological havoc on native wetland vegetation and is contributing to Louisiana's coastal erosion problems. *Graph data and photos by LDWF.*