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A NATURALIST'S DRIVE DOWN BAYOU LAFOURCHE: A BRIEF OVERVIEW OF NATURAL HISTORY, ECONOMIC, AND CULTURAL ASPECTS OF THE DRIVE FROM U.S. 90 TO GRAND ISLE, PORT FOURCHON, AND ELMER'S ISLAND, LOUISIANA

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HOW TO USE THIS GUIDE: This document was written to help participants in the Louisiana Master Naturalists of Greater New Orleans understand the sites, landscapes, structures, and way of life within the culture of those who live along Bayou Lafourche. It should be of interest to all who want to know more about this region of Louisiana, especially those who love natural history. NOTE that the mileages given are from the junction of U.S. 90 and LA 308, heading south. As you turn left off the exit ramp from US 90 onto LA 308, write down your odometer reading – all mileages given here are from that point. It will be best to reset your odometer to 0.00 so you can just read mileages. ALSO NOTE: odometer readings will be off some depending on the make of vehicle and the size of tires, so treat these mileages as approximations.
ENJOY!
Note the hand-drawn map with mileages in Appendix IV.

People with a deep and abiding interest in the natural history of south Louisiana are drawn to the Grand Isle/Fourchon/Elmer's Island region. The habitats are spectacular, very different from New Orleans, and normally full of wonderful and interesting fauna and flora.

Very important is that one will pass through wonderful communities, a "development corridor," brackish and salt marshes, and barrier islands, including seeing the chéniers splayed out north of Grand Isle.

If you are somewhere else in Louisiana (or elsewhere, for that matter), this region is fondly referred to in south Louisiana as "down da bayou." Q: "Where you from?" A: "Down da bayou!" In Lafourche Parish, that means this is the region I'm from – this is home, and I may live in Lockport, Larose, Cut Off, Côte Blanche, Galliano, Golden Meadow, or nearby. In Terrebone Parish, "down da bayou" means south of Houma.

Always factor in where you are at the moment. If you are "down da bayou," and you want to refer to another region along Bayou Lafourche, the words may change. If you are in Galliano and you refer to Larose, you say "up da bayou." If in Larose and you refer to Golden Meadow, then you use "down da bayou" (even though technically the entire region is referred to as "down da bayou."

Now, if you are driving down LA 308 and you call your friend who happens to be on LA 1, you would say, "I'm on the *other side* of the bayou." Your friend would say, "Oh, I'm on *this* side of the bayou." Oddly, each knows which side of the bayou the other is on (or, so it is said!). If the two are together on the west side of the bayou and they say something about "the other side of the bayou," they are referring to the east side – and vice versa! The locals are masters of their location!

A sign on LA 1 near U.S. 90 helping locals remember "up da bayou" and "down da bayou." Note the fork = "Lafourche." Photo by the late State Representative Reggie Bagala, 2020.

NOTE: Reference to Moran's Marina and the Conoco Station – closed until further notice. May be another brand of gasoline when it reopens. Clean restrooms and drinks/food (meat pies, chicken, boudin balls, etc.)

FIRST, TIME NOTES FOR DIRECT TRAVEL FROM KENNER TO GRAND ISLE (assumes driving at the speed limit):

- Kenner levee on I-10 to jct with US 90 via I-310 – 13 minutes
- I-310 jct with US 90 West to Exit 215B to the right toward Raceland/Grand Isle. Turn left on LA 308 – 17 minutes
- Jct US 90 West on LA 308 to Bollinger Shipyards in Lockport – 9 minutes
- Bollinger Shipyards to top of bridge over the Gulf Intracoastal Waterway in La Rose – 15 minutes
- Top of GIWW, cross Bayou Lafourche, on LA 657 to jct LA 3235, turn left – 3 minutes
- Jct LA 3235 to Golden Meadow City Limits sign – 11 minutes
- Golden Meadow City Limits to merge with LA 1 – 4 minutes – 50 MPH!!! STRICTLY ENFORCED
- Road merger to Levee – 2 minutes
- Levee to Leeville bridge toll booth – 6 minutes
- Leeville toll booth to exit of the elevated highway (Moran's Marina & Conoco station on right) – 10 minutes
- Moran's Marina & Conoco station to Elmer's Island turn off to right off La 1 – 7 minutes – keep going to Grand Isle
- Elmer's Island turn off to Ludwig Street in Grand Isle – 10 minutes – 25 MPH FOR SOME OF THIS DRIVE – STRICTLY ENFORCED

BAYOU LAFOURCHE – THE MAIN ARTERY OF THE REGION

The centerpiece of this region, and the drive, is Bayou Lafourche, a 106 mile long bayou that originates in Donaldsonville, LA, and ultimately empties into the Gulf of Mexico at Port Fourchon. It was originally called Chetimachas River, or La Fourche des Chetimaches (the fork of the Chitimacha). The "fork" portion of the name refers to the large entrance to the bayou (actually a distributary) from the Mississippi River where the first Acadians settled, thus making Bayou Lafourche central to the evolution of the Cajun culture.

Bayou Lafourche was cut off (dammed) from the Mississippi River in 1904. This changed it from a flowing distributary to a channel that receives its water from runoff from the adjacent countryside. This change concluded its natural role as an artery necessary for helping maintain the wetlands along and at the end of the bayou's path, thus aiding in their demise.

For most of its length, it flows between LA 1 (on the west) and LA 308 (on the east) and is colloquially known as "the longest Main Street in the world." It is a special place with its own mannerisms and customs.

The three main functions of Bayou Lafourche today are 1) movement of boats (especially commerce) beyond Lockport, 2) providing drinking water for 300,000 people in four parishes, and 3) daily traffic at the southern end for boats servicing the Gulf of Mexico oil and gas industry. Its two main challenges are that it is often clogged with vegetation, principally water hyacinths, and is full of discarded appliances and old tires.

There is an ongoing project to reunite Bayou Lafourche with the Mississippi River, but with controls to regulate the amount of water that makes the turn. In 2017, the flow rate is about 1500 cubic feet per second (cfs), and the 2017 Coastal Plan will continue that project which might ultimately deliver up to 2500 cfs from the Mississippi to Bayou Lafourche. Many people support this as an opportunity to move freshwater, nutrients, and sediment back into the starved Lafourche-Terrebonne coastal wetlands.

Many people are deeply concerned with the project for some of the following reasons:

- Concern that dredging will cause bank collapse
- Fear of contamination to their drinking water
- Fear of legal issues of ownership of riparian (water's edge) areas – they think they own up to the bank; in fact, they own to mean low water as of 1903 (most other places it is mean high-water location)
- Potential flooding
- Possible impacts on shipping as it exists today
- Probably impact on distribution of fisheries resources
- In 1993, the state proposed a siphon carrying 2000 cfs that would raise the level of the bayou 6 ft – how would they NOT flood?

GEOLOGIC HISTORY

As in most major flowing bodies of water in the Mississippi River Deltaic area, Bayou Lafourche was once one of the main channels of what we call the Mississippi River today. It built the Lafourche Subdelta between 1500-700 years before present (YBP). Once replaced by the Plaquemines Subdelta (1200-500 YBP) to the east, the Lafourche Subdelta began to diminish in size and structure.

As we turn off of US 90 on the LA 308, we get our first glimpse of Bayou Lafourche. We are soon driving through sugarcane fields until we get to the town of Lockport (and beyond).

Mile 3.7, 6,7 and more: note that on your right, between the highway and the riparian tree line that borders the bayou, the sugarcane farmer has planted his crops in the very

narrow available strip. This demonstrates the value of his crop – that he would use such a small piece of land. This used to lie fallow, thus provided extra habitat for wildlife.

The sequence of towns and townships you will pass through are as follows:

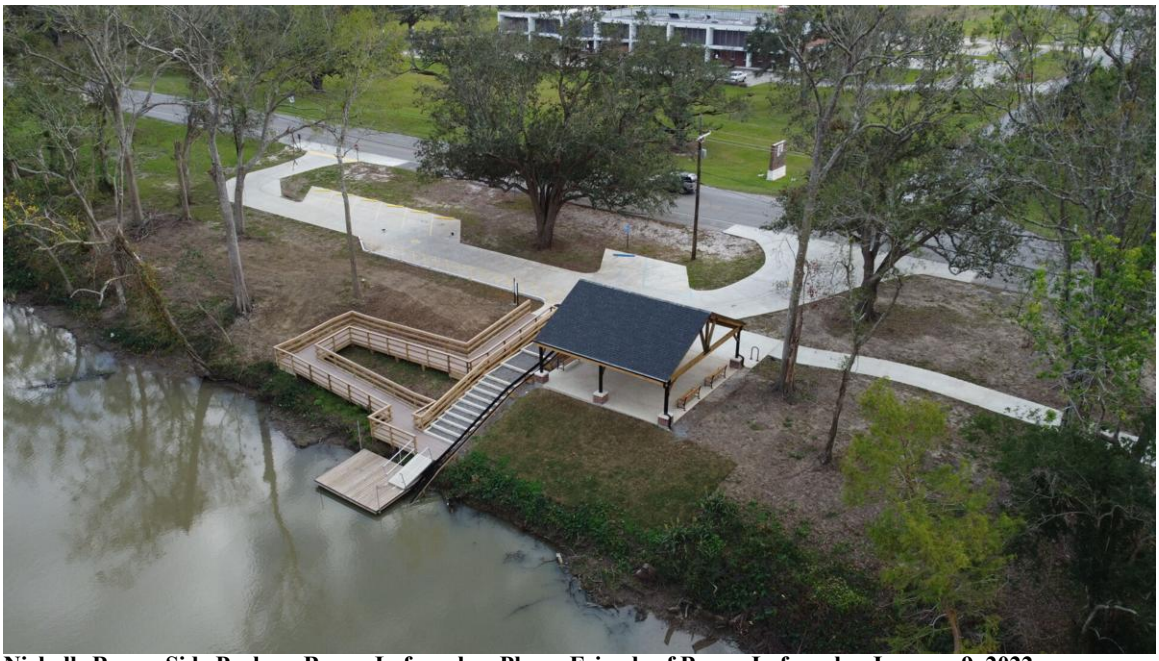
- Lockport – incorporated with their own elected government
- Larose – when you cross over the high-rise bridge, notice that you are crossing the Gulf Intracoastal Waterway (GIWW), a very important waterway to commerce that begins in Carrabelle, Florida, and ends 1050 mi to the west in Brownsville, Texas. You will not only probably see barges moving along the GIWW, but also note the large shipyards that are in Larose. This is also the intersection of the GIWW and Bayou Lafourche – a simple crossing with the bayou having flood gates that can be closed in the event of extreme water conditions.
- Cut Off - this is where Andrew Jackson had a forest chopped down and the logs placed in Bayou Lafourche to keep the British from invading New Orleans from the south; later a canal was constructed from the bayou toward the east to relieve the backed-up water and prevent flooding – hence the name Cut Off.
- Côte Blanche - some people with means settled there after the 1893 Caminada hurricane and moved their cypress houses with them. They then white-washed the houses, thus the name Côte Blanche.
- Galliano – named after an Italian gentleman, Antoine Galliano, who operated a large vegetable and citrus farm in the area in the late 1700s. It was formerly known as Côte Cheramie.
- Golden Meadow (incorporated town; formerly called Canal Yankee; the east bank across the bayou is called Pointe de Saucisse [=sausage], people there were poor and had to eat sausage)
- Leeville – this is where you get on the elevated portion of LA 1. You will pay a $3 toll at the booth going in. LA 1 now bypasses Leeville, so it has had a devastating effect on the local economy. When you cross the high-rise bridge in Leeville, look around and see all the open water. It was covered with healthy marsh just 20 years ago.
- Port Fourchon – This nonresidential, working community exists to support the offshore services associated with oil and gas production in the Gulf of Mexico, as well as the Louisiana Offshore Oil Port (LOOP). Among other services, it is the

epicenter of supply management, ship repair/service, and helicopter/crew boat delivery of personnel offshore.

- Grand Isle – An the only inhabited barrier island in Louisiana with a long history and culture as a base for commercial and sports fisheries, bird watchers, oil field service, a laid-back way of life, and a weekend and vacation get-away for many who love the coastal lifestyle. The maritime forests of Grand Isle are one of the best birdwatching sites in North America during the spring and fall Neotropical bird migrations.
- Elmer's Island – Once privately owned, Elmer's Island is now owned by the state and is a very popular recreational barrier island for residents, nature enthusiasts, and beach lovers. It has been a relatively flat barrier island, and its elevation as lifted significantly in 2016-17 by the state's largest beach nourishment program that moved sand from Ship Shoal offshore.

THERE IS A RENEWAL OF ACCESS TO BAYOU LAFOURCHE FOR RECREATION AND ENJOYMENT.

A partnership among the Bayou Lafourche Fresh Water District, Friends of Bayou Lafourche, and Lafourche Parish Government recognize the value of the bayou as a recreational amenity and are arranging for boat launches along its length that give citizens easy access and rest facilities that will encourage public use and enjoyment.



Nicholls Bayou-Side Park on Bayou Lafourche. Phone Friends of Bayou Lafourche, January 9, 2022.

Canoe launch on Bayou Lafourche. Photo by Chris Granger, nola.com, January 9, 2022.

BOATS – FISHING AND TRANSPORTATION: You should be inquisitive about all the types of boats that are important to the coastal community.

- Lafitte skiff – note the characteristic fan-tail on the aft

- Skimmer rigs – moving or anchored, and on docks; designed for shallow water; triangular frame, net attached on two sides.

Anchored with shrimp in current passively filling the nets.

Skimmer net (often a butterfly net) attached to a dock; used when shrimp are moving through the channel. It is lowered into the water, then periodically lifted and emptied.

- Butterfly rigs for shrimp -

Not as common as they once were, these net systems are rectangular with 4 sides to which nets are attached, and were typically used in shallow situations, not offshore. Capt. Roy is in Bayou Petite Caillou in Chauvin, La.

- Trawlers – they have TEDs (turtle excluder devices) in their trawl nets; their front edges are not attached to a rigid frame. These are the rigs that work the open Gulf of Mexico.

The TED can be seen in the net. Its purpose is to release sea turtles that become entrapped in the trawl. The turtle hits the TED that is tied on

an angle in the trawl, slides upward, and exits via a "door" in the top of the trawl.

- Crabbers – usually a Lafitte skiff. This one is loaded with empty crab traps.

- Oyster luggers – the board "walls" on the sides are removable. Their function when in place is to keep heavy sacks of oysters from rolling off the boat.

- Flats/bateaus ("bateau" is variously defined) – these have many uses for fishing, moving about in the shallower marsh, or rigged for trawling (as is this one).

- Mud boats (the upper photo is a "Go Devil" mud boat, designed to move through shallow water); the lower photo is a "mud buddy" designed to do the same.

- House or lodge boats – service to the oil industry as well as recreational.

- Airboats – specifically designed to move about in marshes

- Bob's favorite boat docked at LA 308 and East 40th street in Cutoff – NOT a "working boat" and not of local design.

- Pirogue – the preferred individual small boat in Louisiana, although canoes and kayaks are now commonly used for recreation.

Pirogue on Bayou des Familles piloted by the late and great Frank Ehret, father of Jean Lafitte National Historical Park and Preserve and much more.

- Tug – one of the workhorses of the Gulf Coast

- Edison Chouest work or supply boat – "18 wheelers of the sea," equipment (usually large) delivery system for the oil and gas industry in the Gulf of Mexico. These boats typically have deeper, rounded bows to allow room for carrying fuel and water to platforms; this shape renders them a bit slower than other boats. Each company servicing offshore oil has a unique color pattern and design for its boats/ships.

- Crew boat – These boats are similar, but smaller, than work/supply boats – they are the "buses of the sea," carrying workers and smaller supplies out to the rigs/platforms. They have shallower, sharper bows that allow them to be very fast as they continually run from land to sea to land.

- Lift boats, (jack boats or jack-up boats or barges) - Very important in the shallow waters of the Gulf of Mexico, these are self-propelled boats that have 3 or more "poles" that can be jacked down to the bottom, thus eventually lifting the boat above the water surface, thus allowing crew to work on a solid surface not bouncing due to turbulence in the water.

BRIDGES OVER BAYOU LAFOURCHE LINKING LA 308 AND LA 1 AND OTHER NOTABLE ITEMS TO SEE – All listed are visible from LA 308 (there are two in Lockport hidden from view of traffic on LA 308), and the last two listed are visible from LA 1 in Galliano and Golden Meadow.

There are two types of bridges: lift bridges that lift straight up to allow boats to pass, and pontoon bridges that float on pontoons on the water and must pivot against the shore to allow boats to pass. Since the pontoon bridges float on the water, they present a problem by trapping floating vegetation. This becomes a problem when there are huge blooms of plants such as water hyacinths, and a wind pushes them against the pontoon bridge. Water hyacinths sometimes gather so densely on the windward side of the pontoon bridge that it may take the operator an hour to maneuver the bridge to the open position, at which point the plants quickly move through the space and float down the bayou.

Mile 2.7: Champagne-Harrelson Memorial Bridge - state lift bridge operated - LA 654 crosses the bridge - 2.7 mi S US 90 on LA 308

Mile 4.9 (in Lockport, on the east side of LA 308) — The Lockport Elevated Boardwalk (Nature Trail) was built in 2015. This very nice, short nature trail is at the end of a shell road, about 200 yards from LA 308. You will see the entrance when you enter the small parking lot on the left at the end of the road. Take a walk and see a beautiful cypress tree, lots of wetland vegetation, and a cypress swamp.
It is 2.2 miles south of the Champagne-Harrelson Memorial Bridge at the jct of LA 308 & LA 654; if driving north, it is 1.3 mi north of the Bollinger, or Bellevue, Bridge, aka Lockport New Span Bridge (just north of the Bollinger Shipyards).

Mile 6.2: Bollinger, or Bellevue, Bridge, aka Lockport New Span Bridge - state pivot bridge - just north of Bollinger Shipyards in Lockport - runs between LA 308 & LA 1, no roads connecting at either end - 6.2 mi S US 90 on LA 308

Mile 8.9: LA 308 passes through the Bollinger Shipyard, and important source of income for many local workers, and the largest area employer. There are often U.S. Coast Guard ships (with the characteristic red diagonal band on the side) on the bayous inside the shipyard.

Lockport is an incorporated municipal town with its own elected government system.

Mile 10.7: Valentine Bridge - parish operated pontoon bridge that pivots down-stream on the LA 308 side of the road - just south of the junction with Valentine Road on LA 308 - 10.7 mi S US 90 on LA 308. It has been inoperable for a few years as of 2022. Across the street is a large sugarcane processing plant.

Mile 11.6 – 12.7: On the east side of LA 308, you will see an extensive manicured area with a beautiful, tall black cast-iron fence. Look closely in the fields and you may see exotic animals like black buck from India and other gazelles, deer grazing in the grass, and even zebras. This property is owned by the Arceneaux family; they have done quite well owning boats that service the oil industry.

Mile 12.9-15.4: You will pass a sugarcane factory on the left, surrounded by sugar cane fields

Mile 15.0: T-Bois Bridge - state operated lift bridge - at the junction of Portuguese Drive on LA 308 - 15.0 mi S US 90 on LA 308. Across the street is a Dollar Store.

Down position

Up position

About Mile 16.4: In Larose, you will cross the Gulf Intracoastal Waterway (GIWW). This is now a 1,050 mi long inland waterway that roughly parallels the Gulf coast and runs from Carrabelle, Florida, to Brownsville, Texas. It is a major thoroughfare for barge traffic across the southeastern states and connects in many places to the Gulf. It has become a hub of commerce, with many businesses opening along its length to serve various industries. A great example is what you see from the bridge in Larose – look right or left and note ship building and repair businesses.

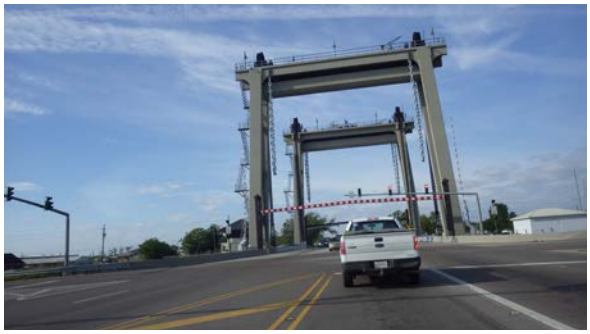
Businesses and residences line the GIWW in Larose, La.

Once the GIWW was built, small communities along its path saw an opportunity to become economic centers by digging waterways from the GIWW to the Gulf. In so doing, they reasoned, they would be accessible to fishing and shipping traffic. For some, it worked. But what happened at every location is that the new waterways allowed saltwater to intrude into largely freshwater areas, thus killing the salt-intolerant vegetation of fresher marshes and allowing tidal flows to lift the organic material, and drain it into the Gulf as the tide dropped. This caused the rapid demise of many of our state's coastal wetland areas. At some point, we must fix this plumbing issue!

GIWW as it crosses Louisiana. Note the vertical channels added to create inland ports. The green zones are freshwater marshes, so you can see how the channels allowed salt water to decimate that type of habitat.

INTERESTING NOTE: The GIWW's original purpose was to allow inland passage of ships to avoid them being sunk by German U-boats as they left the mouth of the Mississippi River. After WWII, people realized that the inland passage was a good idea and would have economic benefits, so it was improved and still works today.

Mile 16.9: Bayou Lafourche Bridge - state operated lift bridge - where LA 308 intersects LA 657 at Larose - 16.9 mi S US 90 on LA 308



NOTE: TWO CHOICES TO PROCEED TOWARD GRAND ISLE FROM LAROSE. FOR FIRST TIME VISITORS, OR THOSE WISHING TO LEARN MORE ABOUT THE STRING OF COMMUNITIES THAT EXTEND FROM

LAROSE TO GALLIANO/GOLDEN MEADOW, WE RECOMMEND USING ROUTE 2 GOING "DOWN DA BAYOU" ON LA 308, AND ROUTE 1 FOLLOWING LA 3235 RETURNING:

Route 1: Shortest route (time): Cross the Bayou Lafourche Bridge and drive 0.5 mi to jct LA 3235 – turn left on LA 3235 and drive south 7.4 mi (you will pass on the left a Walmart and McDonalds where this highway intersects LA 3162 – this is where you will get on LA 3235 if you choose the following Route 2). SKIP TO PAGE 22 just above Option 2.

Route 2: Longer route (time, not distance) to see bridges and other sights described below: Do not cross the Bayou Lafourche Bridge – instead, turn left on LA 308 and continue your trip south. FOLLOW THE DIRECTIONS IMMEDIATELY BELOW.

Mile 19.2: Le Pont D'or Bridge (aka McDonalds and Larose-Cut Off Bridge - a parish operated lift bridge - LA 6459 crosses, between 28th and E 31st Streets - there is a McDonald's restaurant at the foot of the bridge on LA 1 - 19.2 mi S US 90 on LA 308

Mile 21.7: Côte Blanche Bridge - parish operated pontoon bridge - between E 52nd and E 53rd Streets on LA 308 on the east side, meets W 79th Street on LA 1 - 21.7 mi S US 90 on LA 308

Mile 19.7-21.0: Kudzu vine is a large vine with "leaves of three." It grows very fast and dominates the landscape in parts of Mississippi, Alabama, Georgia, and elsewhere in the South. It is rare in southern Louisiana but can be seen in several places along LA 308. The first place it is encountered heading south is between E 35th and E 37th Streets.

Mile 24.9: South Lafourche Lift Bridge - a state operated lift bridge – junction of E 90th Street and LA 308 in Galliano (you can see the bridge as you pass Edison Chouest Offshore headquarters on the left; at the bridge, a shopping center on left contains Dollar Store and South Lafourche Parish Library), cross the bayou and LA 1 onto LA 3162 - 24.9 mi S US 90 on LA 308

2 OPTIONS SOUTH FROM HERE:

Option 1 - Longer and deeper down the bayou – off the beaten track: Continue down LA 308 with Bayou Lafourche on your right:

- Galliano Pontoon Bridge - crossing Bayou Lafourche to LA 1 at the junction of LA 308 and East 123rd Street.

- Golden Meadow, or Pointe-a-Saucisse, Lift Bridge – the oldest bridge on the bayou – crossing Bayou Lafourche on to LA 1 at the junction of LA 308 and East 178th Street.

Cross either of these bridges, turn left on LA 1 and proceed with Bayou Lafourche on your left to the junction with LA 3235, where you turn south and continue to Leeville and points south. CAUTION: Closely observe the speed limits in Golden Meadow – on LA 1 it should be 20 mph! Golden Meadow is a notorious speed trap town and you will be stopped if you go even slightly over 20 mph. To be safe, set your speed control!!!

Option 2 – Shorter time and you will get to the four-lane highway quicker: Turn right and cross the South Lafourche Lift Bridge, cross LA 1 onto LA 3162 for 0.7 mi, then turn left onto the four-lane LA 3235. You are now heading south and there are a number of things to watch for – some regional and some seasonal.

There are a number of pastures along the way (be sure to honk at cows; they are typically lonely and when you honk, wave, and say "Hey, girls!," they often wag their tails in

delight). There are also horses and bulls, but we don't honk at them, but we do look at them with kindness.

In spring and early summer, these fields are often solid yellow with flowering Hairy Buttercup (*Ranunculus sardous*). In fact, fields throughout most of Louisiana look the same, adorned with the very same species. How many of these flowers there must be every year in our state!

It is also common in spring to see the roadside, and often the neutral ground, densely stocked with Spiny Thistle (*Cirisium horridulum*). This common weed is very tasty when young with stalks a couple of feet high. You can safely cut and eat the stalk after scraping off the thistle prickles/needles; the taste is reminiscent of fresh celery. Fun for a naturalist, especially when it is thick, is to stop and walk slowly among the plants and examine the flowers and leaves. They are typically loaded with bees, bugs, spiders, and other denizens – fun to watch and study.

VERY IMPORTANT FOR YOU TO KNOW (HAS NOTHING TO DO WITH NATURAL HISTORY): When you see the Golden Meadow sign in the neutral ground of LA 3235, note that the speed limit drops from 65 to 50 mph. Golden Meadow is a notorious speed trap town and you will be stopped if you go even slightly over 50 mph. To be safe, set your speed control!!!

A visitor not using cruise control set at 50 mph!

You will begin to catch glimpses of the levee in the distance on the right (west), and as you drive farther south the levee comes closer to the highway. The average driver doesn't realize that he/she is moving through a ***development corridor***, a huge loop of levees with human development protected on the inside and unprotected marshes and swamps on the outside. At the southern tip is Golden Meadow, with marshes outside the levees there.

All the land within the levee system qualifies for insurance (note the light green "finger" extending into the darker marsh).

One can also experience development corridors when driving down Plaquemines Parish on LA 23 (Venice at the tip) and going to Cocodrie on LA 56 (Chauvin at the tip).

1.9 mi south of the junction of LA 3235 on LA 1 you will encounter two things:

1. The place where the development corridor ends is where you drive over the levee on LA 1. You will quickly see the stark difference of the inhabited, vegetated with large trees, area inside the development corridor and the expansive almost treeless marshes a few miles to the south.
2. To your left is the Golden Meadow hurricane floodgates and locks. Their purpose is to keep wind-pushed surge waters from flooding the development corridor (Golden Meadow and points north). The locks were added to allow ships to pass through when there is a differential between the heights of the bayou and the water outside the gates.
   When a storm is approaching, there is a race among boats to get behind the protection of the levees. Those who don't make the announced deadline may have to weather a storm outside the protective levee.
   Due to a variety of reasons, including relative sea level rise and related subsidence, the gates are often left closed in the absence of traffic, especially when there is a south or southeast wind.

Gates at the south end of Golden Meadow on Bayou Lafourche.

As you drive between Golden Meadow (at the locks) and Leeville (to the toll gate), a distance of 6.3 mi, you will see the vastness of the saltmarshes that characterize this area. It appears as a monoculture of Oyster Grass (*Spartina alterniflora*), but there are other predictable species there, especially if you look along the edge of the highway, which is basically a natural levee (or "spoil bank") with a road on it extending deeply into saline marshes.

What should catch your eye is the dead or dying live oak trees. The acorns that germinated and became these trees grew on natural ridges that were formed when Bayou Lafourche was a major distributary (before 1906) of the Mississippi River. Over time, due to a combination of sea level rise, subsidence, and erosion, the tree roots have come in contact with increasingly salty water and they have declined. These skeletons of living trees from the past inform naturalists directly about how salt water is creeping north and changing the ecosystem as it goes.

Dead live oak trees that are characteristic of this subsided marsh region.

Note how near the highway is to sea level. You will see places where rip-rap (stones and concrete) has been placed to protect the highway from collapsing. When there are high levels of water, possibly driven by persistent winds from the south and southeast, the roads are flooded. This presents problems for two important constituencies: residents and the approximately 1,300 trucks and heavy equipment that traverse LA 1 each day, each way servicing the oil industry based in Port Fourchon.

"No Wake Zones" are important, as boats traveling too fast will etch away The narrow soil areas that protect LA 1.

YOU WILL NOW DRIVE 8.4 MI FROM THE BEGINNING OF THE ELEVATED LA 1 IN LEEVILLE TO THE BOTTOM OF THE EXIT RAMP AT THE BLINKING LIGHT (FORMER CONOCO STATION ON THE RIGHT; this is the junction of LA 3090 [straight ahead] and continuance on LA 1/3235 if you turn left). Be sure to stop at

Moran's Marina at the Conoco station to get deep fried boudin balls, meat pies, and boneless chickens (boiled eggs) – yum!

To counter-act the chronic flooding across LA 1, caused by subsidence and coastal wetland loss, a not-for-profit group – the LA 1 Coalition – stimulated the construction of the elevated LA 1 that begins here. The Phase I of LA 1, from Leeville to Port Fourchon, cost $371 million ($44.2 million per mile!).

Note that after you turn right, pay your toll, and drive a short distance, there is an awkward 90 degree turn to the left. This seems odd until you recognize that the day will come when the 8.3 mi gap of Phase II of the elevated LA 1 (at a projected cost of $463 million, or $56 million per mile) will be accessed in Golden Meadow and join the highway at Leeville. Construction activity on the link began in 2019. As of the end of 2022, about 200 feet of highway has been finished toward Golden Meadow at the 90 degree turn in Leeville, and the metal infrastructure of the beginning of the road construction has been erected from LA 3235 in Golden Meadow. Presumably, this stretch of highway will progress from Golden Meadow to the connection in Leeville.

As you drive up to the 90 degrees turn, turn left, and then drive toward the high-rise bridge - note the healthy vegetated marsh on the east (to your left). This is the way this entire area appeared 25 years ago. This area looks this way because the construction required mitigation, thus the building of this marsh.

As you scale the high-rise bridge, you will see a vast area of open water with small, vegetated areas. Again, this area was heavily vegetated, dissected by winding bayous and sloughs, until about 25 years ago. The loss is part natural but exacerbated by channelization of Bayou Lafourche and the construction of many keyholes for oil exploration and construction of pipelines to move the product to market.

You are viewing the Barataria Estuary – a high productivity place that salt water from the Gulf of Mexico mixes with freshwater from Bayou Lafourche and, in nearby places, other waterways.

As you leave the elevated LA 1 there is a junction with a blinking traffic light and a Conoco filling station on the right.

Louisiana Offshore Oil Port, LLC (LOOP)

LOOP is a common carrier facility that serves regional, national and international hydrocarbon shippers. The deep-water port complex is considered part of our nation's critical infrastructure and is a 40-year success story in public-private infrastructure development. Located in the Gulf of Mexico on the Outer Continental Shelf (OCS), the LOOP Deepwater Port is the only port is the U.S. capable of handling the largest maritime tankers in the world, which supports efficient global port-to-port transportation. LOOP accommodates a wide range of crude oil marine vessels including Ultra Large

Crude Carriers (ULCC) and Very Large Crude Carriers (VLCC) down to Medium Range (MR) Tankers.

LOOP's Clovelly Hub provides 72 million barrels of interim storage for crude oil before it goes to refineries. LOOP receives and temporarily stores crude oil supplies from three sources: tankers carrying foreign and domestic crude oil, domestic crude oil produced in the Gulf of Mexico Outer Continental Shelf (OCS), and the Zydeco Pipeline moving domestic crude produced in the U.S midcontinent as well as the OCS.

LOOP, Port Fourchon, and beyond

There is a nondescript large metal building across the highway from the Conoco station. No signs, very little visible activity – but this is strategically a very important structure. Twenty miles offshore, in 110 ft of water, is the marine terminal for the Louisiana Offshore Oil Port (LOOP) facility. It consists of what looks like an oil platform, and three single point mooring buoys floating on the surface. This is the place that ocean tankers tie up to one of the mooring buoys and offload oil so it goes ashore via 48 inch pipelines to the refineries and storage facilities. Five percent of the foreign oil imported into the United States (not counting Canada) comes ashore via LOOP. The building you see here is the booster station – it has a pumping system that oil from LOOP enters and gets a strong push to direct it to its next stop at the Clovelly, LA, storage facility 25 mi inland and 45 mi from the marine terminal. From Clovelly it is distributed to refineries. In some cases, that oil is stored and moved back offshore to marine tanker to support customers trading crude oil internationally.

LOOP booster station.

Those assets are under 24-hour surveillance.

You are probably interested in knowing a bit more about LOOP. Here are a few images to give you context on what it entails:

A diagram showing offshore platforms, the actual LOOP station and an offloading ship, the tanks to which the oil is piped, and the refineries that ultimately receive the oil. Loopllc.com.

The LOOP offshore facility that oversees the offloading. Loopllc.com.

An anchored ship near the LOOP facility offloading oil. Loopllc.com.

Here are a few factoids that give you an idea of its operation and value to the nation, and context for rates of national consumption. Energy markets are rather volatile at present due to changes in availability, sources, technology and market trends in general, so they are not as predictable/stable as they once were. The following numbers are for early 2020:

- National U.S. hydrocarbon consumption: 16 million barrels/day

- Imports per day from all sources other than Canada: 2.815 million barrels. LOOP moves 5% of this oil.
- Imports per day from Canada: 3.845 million barrels
- Gulf of Mexico production: 2 million barrels/day
- Total domestic production: >13 million barrels/day
- LOOP moves approximately 1.0 million barrels/day
    - 90% is from the Gulf of Mexico OCS and the U.S Midcontinent, the latter via the Zydeco Pipeline over land)
    - 10% off ships originating from international ports
    - 25% from the Permian Basin
- LOOP moves up to 50% of total Gulf of Mexico production
- LOOP does participate in export of domestically produced energy. U.S. exports are now 3 million barrels/day, including LOOP and (mostly) Houston. South Louisiana currently accounts for 250 thousand barrels/day of this total.
- Rates of oil movement by LOOP are affected by the current trend of regional refineries soaking up as much domestic product as possible.
- About 300 families depend on LOOP
- Almost all employees and contractor support are Louisiana based
- LOOP directly employs almost all its staff in operations, administration, engineering, environmental science, safety, scheduling and vessel traffic control.

Stay tuned! LOOP has high impact on the economy of south Louisiana and the United States.

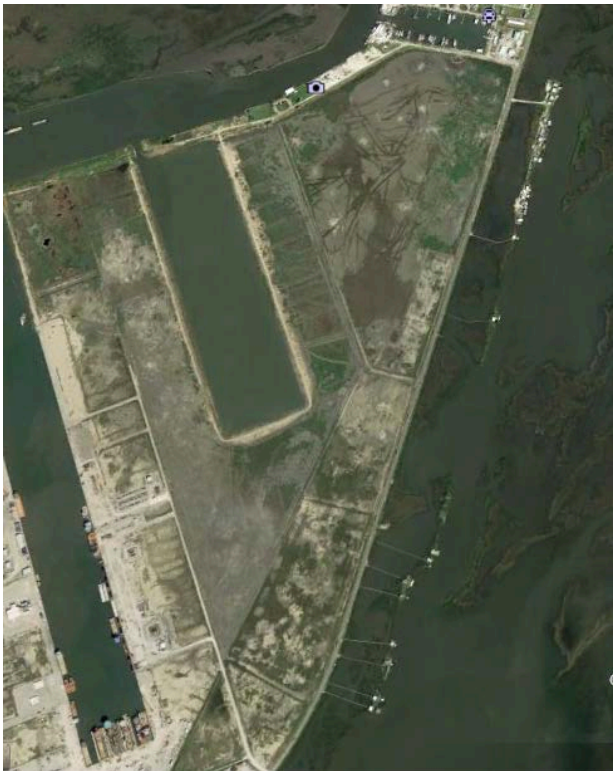
YOU HAVE TWO OPTIONS TO PROCEED EXPLORING THIS REGION:

1. STRAIGHT AHEAD TO PORT FOURCHON AND FOURCHON BEACH.
2. LEFT ON LA 1/3235 TO ELMER'S ISLAND AND GRAND ISLE.

OPTION 1- PORT FOURCHON: Go straight – LA 1 becomes A. O. Rappelet Road (LA 3090): on your right you will see a large open water/wet area locally called Rappelet's Hole. This is an extremely important body of water in the winter when waterfowl are present in huge numbers. It has been a renowned birding site and it has long been common to see birders standing along the road. As of November 2019, it had been filled in and was dry, and is now tidally influenced. It was legally filled in to provide more space for oil and gas related businesses. Port Fourchon gets special help permitting filling wetlands due to the nationally economic importance of the businesses, but they do have to mitigate their filling.

In April 2015, 1 mi west of the blinking light on LA 3090 was the usual open water; 2 mi west had been recently filled in with in situ material dredged from Slip D just west and adjacent to the site. The last section of Rappelet's Hole to be pumped in (late 2014)

included 45 acres of high land to be available for lease and 98 acres of salt marsh mitigation including a 6000-foot tidal slough/creek system dug for tidal flow.



Upper right is Rappelet's Hole, showing tidal sloughs/creeks; lower right are the two rectangular development cells. The large green open water in the center is Slip D, with Slip C to the left. Google Earth, January 17, 2020.

Marsh with tidal sloughs/creeks that was formerly open water called Rappelet's Hole – Port Fourchon is shown to the west and LA 3090 to the left. Photo by Davie Breaux, September 6, 2019.

Earlier fill projects in southwestern areas of Rappelet's Hole to create Slip C and the lease areas surrounding it required the port to mitigate for the loss of these wetlands. The port pumped the dredged material from the slip through a pipe across the Flotation Canal and created hundreds of acres of marsh to the north in an area of degraded marsh and open water. In constructing Slip C to a depth of 24 feet, the port had extra dredge material, and with many partners including the Barataria-Terrebonne National Estuary Program (BTNEP), was able to construct a ridge on the "bones" of the long-gone Bayou Cochon ridge. Almost a mile long, construction of the Fourchon Maritime Forest Ridge was completed in 2008 and provides almost 20 acres of maritime forest ridge habitat. This human-made ridge was reforested through woody plantings carried out by BTNEP and almost 1,000 volunteers from 2008 to 2017. The native trees planted on the ridge provide a place to rest and refuel for resident birds and migrating birds using the Mississippi Flyway on their annual spring and fall migrations. Some of the native trees planted include live oak, red mulberry, hackberry, yaupon, wax myrtle, American beautyberry, honey locust, and persimmon.

The Fourchon Maritime Forest Ridge is the east-west structure near the top of the image in line with the words "Bayou Cochon." The other areas that are partially vegetated, partially open soil, are restored marshes. Bayou Lafourche is to the left, and the Flotation Canal crosses the bottom. Google Earth, January 17, 2020.

This 2013 photo of Port Fourchon shows Rappelet's Hole full of water and the open water and deteriorated marsh north of the Flotation Canal that has been filled in with dredge materials.

Over time, there will be many more mitigation restoration projects in this area to accommodate those developments that are present and some that are yet to come.

Turn right at N. J. Theriot Road. You are entering the heart of the Port Fourchon facilities. The purpose of this port is to support the needs of offshore oil and gas production. Other things happen here (commercial and sport fishing, other outdoor activity support, and the like), but the focus will be obvious.

Layout of Port Fourchon, showing Rappelet's Hole at top right and a very productive wetland area to the left near the center of the port. Google Earth, January 17, 2020.

IMPORTANT ECONOMIC FACTOIDS:

- 80% of Gulf of Mexico oil and gas production comes from deepwater sources

- The Gulf of Mexico oil/gas production amounts to 30% of total domestic production
- Port Fourchon services 90% of Gulf of Mexico deep-water exploration and production
- Port Fourchon plays a strategic role in furnishing 17% of total U.S. oil and gas supply
- And don't forget that 5% of foreign oil (other than from Canada) enters the U.S. through LOOP
- About 250 companies are engaged in Port Fourchon activities
- 15,000 people are flown to offshore work locations each month
- 270 large work vessels use the port's channels each day
- 1,300+ trucks and other heavy equipment travel in and out of Port Fourchon each day

As you drive down N. J. Theriot Road, you will pass the following:

- Large metal buildings that are covered docks. Crew boats (boats that carry materials to and from the platforms and rigs) back into these docks to unload/reload, and the buildings protect them from the weather. Each has an adjacent equipment yard. As the saying goes, to judge the current economy, observe the yards. If full, that means platforms are not fully operational – all those supplies in the yard "should be" on the platforms making money. Under normal conditions, they are constantly receiving fresh supplies that are immediately taken to the work site. The last time the yards were packed with materials was the offshore moratorium after the BP blowout.

Edison Chouest boats in loading/unloading position. Chouest.com.

- Along the same road, you will see stacks of rusted pipe, each section being 30 or so feet long. This is used oil drilling pipe that is waiting to go back to work. There have been problems in the past with these being radioactive (NORM – "naturally occurring radioactive materials") from radon and such contacted during drilling. Each pipe has a threaded end and a receptacle, and the drilling process consists of a team of roustabouts screwing one into the other as the drill bit drills deeper into the sea bottom.

Rusty drilling pipe is often stack in the port area. Its absence is a sign that drilling is underway and people are employed.

- You will also see whitish items, the same length, stacked up. They consist of two halves split longitudinally, and have a larger opening down the center when placed together. These are *Buoyancy modules*, or "buoyancy cakes," and they are wrapped around the drilling pipe (the portion, called *drilling risers*, that run from the rig to the sea bottom (for example, they may attach to a *blowout preventer* - BOP - *stack* that is sitting on the sea floor and the rig that is on the surface. Their purpose is to give near neutral buoyancy to the heavy weight of the multi-mile long drilling riser pipes reaching down to the seafloor.

Buoyancy modules that give neutral buoyancy to head drilling risers that extend from the rig to the blowout preventer on the sea bottom.

- Turn right on Dudley Bernard Road. On the left is ERA Helicopters, characterized by landing pads and a huge parking lot. Offshore workers drive down, park their cars, and are taken to work a very expensive way! Petroleum Helicopters International (PHI) is nearby, and other heliports in the region also service the oil and gas industry.

On the right are more yards, usually for large equipment such as sea anchors. Of note are a couple of very large cranes. The yellow one is the largest land crane in the United States.

- Before you get to the obvious security check station, turn left on the unnamed shell road. You will pass many working crew boats. Note that there are distinctive color combinations, probably on numerous boats. These clearly indicate ownership. As an example, the largest such company is Edison Chouest Offshore (remember reference to their headquarters in Galliano?). Their boats are tan and orange, seem to be of every size you can imagine, and are on all seas of the world. Their ships in Antarctica are blue and white, as required by international maritime law.
- At the end of this road, turn left on Norman Doucet Drive, then left when you reach N. J. Theriot Road again. Look at all the boats and look for similarities and differences. Do you see any that have helipads above the bridge? What other structures do you see on the boats that may indicate something about their jobs in the Gulf?

  Some of the families who own these companies range in wealth from millions of dollars to being at least near billionaires. It is interesting to note that just two generations ago, these families were barely making a living as commercial fishers with small boats. Oilmen came in and hired them (often with great difficulty) to take them around to possible oil sites. As the money began to flow, they bought bigger boats and over time designed what you see today.

  For a great read on this topic, see Woody Falgoux's 2008 book *Rise of the Cajun Mariners: The Race for Big Oil* (Stockard James LLC).

Make note: When the economy is strong, and oil & gas are in high demand, Port Fourchon is a very busy place. During such times, the equipment yards around the boat

docks are either empty (stock is being shipped to the rigs & platforms), the yards are busy receiving delivers to load of the boats, there is a huge amount of traffic on the roadways, and boats are arriving and leaving constantly. Another telltale sign is that ERA Helicopter's parking lot is full of cars, with helicopters coming and going like bees on flowers. When the economy is slow, just the opposite is observed: full equipment yards (unused equipment has been brought in from the Gulf), traffic is sparse, few workers are seen, boat traffic is thin, and the parking lot at ERA Helicopters is empty.

You will notice that much wetland is being filled to accommodate economic endeavors. The port is required to mitigate for such activities, and one significant mitigation project is the Maritime Forest Ridge they are building just north of Port Fourchon that will replace important bird habitat that is otherwise being lost. That said, it is obvious that there is a lot of wildlife using habitats in and around the shipyards. Be sure to notice the resiliency of wildlife even in such a developed area.

NOTE: THE FOLLOWING IS NOT CURRENTLY ACCESSIBLE – DURING 2018 - 2022 THE BRIDGE WAS REMOVED, TO BE REPLACED AT SOME POINT. At the end of N. J. Theriot Road, turn right onto A. O. Rappelet Road. You will soon cross a narrow bridge that crosses a small canal. Notice the *Ligustrum*-like bushes all around you in the salt marsh – these are Black Mangrove (*Avicennia germinans*), a very important plant for holding our precious marsh together. It is the only mangrove that grows this far north, and the most characteristic feature is the many pneumatophores that stick up from the roots that allow the plant (which grows in anaerobic salt marsh soils) to exchange oxygen and carbon dioxide. Continue to the parking site at the end of the road. You are at Fourchon Beach, which may or may not be closed. If closed, enter at your own risk of being asked to leave or worse. If with Bob Thomas, we usually risk being asked to leave but we go to the seashore!

- The purpose of an almost continuous beach building and stabilization program here is to protect the infrastructure of Port Fourchon from the onslaught of the Gulf of Mexico.
- The offshore piles of rocks are breakwaters and function to break the power of incoming waves, thus lessening the scour along the beach.
- The beach has been built up by constructing a rectangular levee, then filling it with sand pumped from offshore.
- Some years ago, an additional step to protect the beach was to line with beach with a double stack of what we called "boudin bags," because they resemble large pieces of boudin. They were strong fabric bags filled with a concrete-like powder that hardened when it got wet. These were effective but were sometimes scattered about in large storms. They also suffered the same problems of any stack of hard materials, such as rocks, placed on a beach – they caused most of the beach between them and the sea to wash away. There is now a very long, black boudin bag on the beach, and it has recently been catching blown sand, causing it to build small dunes. There are also "picket fences" capturing blown sand that parallel the beachfront.

- In the swash zone, where waves wash up and back on the face of the beach, a product named ergomat was once places to keep the swash from removing valuable sand. Ergomat consisted of concrete "bricks" about 10x6 inches that were laced together with cable to form the mat.
- In conjunction with the above, dune plants have been planted to stabilize the dunes.

On leaving Fourchon Beach, backtrack to the Conoco filing station. At the traffic light, turn right on LA1/3235 to drive to Grand Isle and Elmer's Island.

Option 2- ON TOWARD GRAND ISLE: Turn left on LA 1/3235 and head toward Grand Isle.

You will be reminded of, and observe, the tenuous nature of highways and estuaries. People love to fish here (along the road or from a boat), but the marshes are disappearing.

Bridge fishing on LA 1. Photo from internet.

During this portion of the drive, you should be in awe of the vastness of Louisiana's saline marshes, and the fact that they look like unending fields of wheat – seemingly only a single species of grass. There is diversity, but one has to get up close and personal to view it (check out the characterization of Louisiana marshes in the table below). The dominant plant is saltmarsh cordgrass (*Spartina alterniflora*). What is easy to see, and very worthwhile, is the interspersed areas (more commonly seen the closer one gets to Grand Isle) of tall, dark "grasses" – which are actually black needlerush (*Juncus roemerianus*) – not a grass but a rush (remember, rushes are round, sedges have edges, and grasses have joints . . .). In fact, many people refer to Louisiana's salt marshes as "*Spartina-Juncus* marsh."

Salt marsh near Grand Isle. Lighter *Spartina alterniflora* in the front, and darker *Juncus roemerianus* to the rear.

On the left you will see several floating islands, a coastal project that is an attempt to see if artificially constructed islands might successfully serve as breakwaters to stabilize moving water and lessen the impact of waves approaching the highway.

Floating Island Project along LA 1 between Fourchon and Grand Isle.

CHARATERISTIC VEGETATION OF LOUISIANA COASTAL MARSHES [1] [2]

Marsh Type

SALT (>20ppt*)	**BRACKISH** (10+ to 20ppt)	**INTERMEDIATE** (2+ to 10ppt)	**FRESHWATER** (0 to 2ppt)
Spartina alterniflora 62.1%	*Spartina patens* 55.2%	*Spartina patens* 34.0%	*Panicum hemitomon* 25.6%
Distichlis spicata 14.3%	*Distichlis spicata* 13.3%	*Phragmites australis* 6.6%	*Sagittaria lancifolia* 15.2%
Juncus roemerianus 10.1%	*Spartina alterniflora* 5.0%	*Sagittaria lancifolia* 6.5%	*Eleocharis* sp. 10.7%
Spartina patens 6.0%	*Schoenoplectus americanus (*used to be *Scirpus olneyi)* 5.0%	*Alternanthera philoxeroides* 5.3%	
13 more species [3]	36 more species [3]	51 more species [3]	89 more species [3]

[1] This table was constructed by Robert A. Thomas from data in Chabreck, Robert H. 1972. Vegetation, water, and soil characteristics of the Louisiana coastal region. L.S.U. Agricul. Exper. Sta. Bull 664:1-72

[2] only species covering over 5% of the habitat are listed

[3] each with at least 0.01% representation, totaling to 100%

* ppt=parts per thousand

As you study this table, notice the trends as one moves from freshwater marshes through intermediate, brackish, and finally to salt marshes – then the open Gulf of Mexico. Salt content of the water increase from zero to 20 ppt or greater (very salty). Only specialized plants can tolerate salt (and they have special features that allow this), so the trend in biodiversity of marsh plants decreases as the salinity increases.

A FEW WORDS ABOUT COMMUNITIES – HABITATS & ZONATION:

Coastal areas are often subdivided into several types of communities. Grand Isle and Elmer's Island are excellent examples of a variety of communities working together to provide habitats for an interesting assortment of flora and fauna.

In Louisiana, most of our "beaches" are actually *barrier islands* – strands of sand laid down in the past at the leading edge of freshwater distributaries. When those distributaries stopped carrying water and sediment, the marshes behind the barrier islands subsided beneath the surface leaving the sandy barrier island as the first contact from the sea, normally separated from the marshes by a lagoon.

Zonation is an *important concept* to understand when visiting beaches and barrier islands, and it is vital to the biodiversity found in those habitats. In the discussion below, make note that we view the zone based on their exposure to tidal influence:

- subtidal – habitats that are always submerged
- intertidal – habitats that are exposed to the air during low tide and are submerged at high tides.
- supratidal – habitats that are always above the tides but are influenced to some degree by the ever-present salt spray in the air.

ESTUARIES – This term refers to areas where fresh and saltwater mixes. Estuaries are classically fresher toward their freshwater sources, and saltier toward the open sea. A deflection affect is frequently present. Due to the turning of the earth (Coriolis effect), rivers in the northern hemisphere deflect to the right (west) as they enter the ambient water, so the freshest water is there, and the most saline water is to the left (east).

Productivity is very high in estuaries due to the following:

1. Estuaries are nutrient traps.
    a. Benthic critters are rapidly recycling nutrients.
    b. High formation of detritus and organic materials.
    c. Recovery of deep sediment nutrients by microbial activity and penetrating roots.
2. High diversity of producers. All are present: macrophytes, benthic microphytes, and phytoplankton.
3. Water circulation. The constant movement of estuary water, back and forth, provides work to carry waste away and to move food about. This saves metabolic expenditure of the fauna and allows for the increase in number of sessile critters (those that sit in one place, like oysters, clams, sponges, etc.). The water movement also circulates nutrients and organic matter. Saltwater wedges moving under freshwater do so, as well.

SALT MARSH – Salt marsh has a salinity above 20 ppt. This level of salt diminishes the number and types of species of plants that can survive in this zone. In Louisiana, these marshes have an abundance of saltmarsh cordgrass (*Spartina alterniflora*), black needlerush (*Juncus roemerianus*), and only a handful of additional species. Periwinkle snails make their living on the stalks of saltmarsh cordgrass, moving up with the tide, then back down with a dropping tide, and consuming algae from the stalks. In the smelly soils (mainly due to the presence of sulfides) live bivalve mollusks like ribbed mussel (*Geukensia demissa*), hooked mussel (*Ischadium recurvum*), and snails such as olive nerite (*Neritina reclivata*) and coffee bean shell (*Melampus bidentatus*). Two of the common crabs here are fiddler crabs (genus *Uca*) and common mud crab (genus *Panopeus*).

When I took my first coastal marsh ecology course, we referred to salt marsh as *Spartina-Juncus* marsh, as the most abundant indicator species were the species of these genera listed above.

HOW DO PLANTS LIVE IN SALT WATER?

This is the least diverse of the habitats, primarily due to the twice daily flushing that creates the extremes of dry and salty. In the Barataria Basin, 63% of the vegetation is one species, oyster grass (*Spartina alterniflora*). This species is well adapted for the salt environment due to the following characteristics:

1. It can concentrate salt in cells at higher concentrations than sea water, so it maintains a balanced osmoregularity.
2. It can excrete excess salt (lick the leaves and, in the absence of recent rain, you will taste the excreted salt – which if often visible).
3. It has air tubes that take oxygen from the leaves to the roots.

Oyster grass can tolerate low salinity, but it has less competition in saltwater environments, so it becomes the dominant species.
There are four very important positive values to oyster grass:

1. It has dense roots that inhibit erosion. In fact, it produces more biomass below the surface than above.
2. It acts as a nutrient pump. Its roots pull phosphorus out of the anaerobic mud to the surface.
3. Through death, it supplies the estuaries and the Gulf of Mexico with nutrients.
4. It provides important habitat for many critters.

Oyster grass is replaced at 5 cm above mean high tide by *Spartina patens* and *Distichlis spicata*. **So, just 5 cm in elevation changes the whole look and feel of coastal marshes.**

BRACKISH MARSH – At the margins of salt marshes one normally finds the less saline (10-20 ppt) brackish marshes. The indicator species (the species whose presence defines the habitat) is saltmeadow cordgrass (*Spartina patens*) – if this is the very dominant existing species, you are standing in brackish marsh. This is a nutrient rich habitat and is used by many forms of wildlife for shelter and food.

MANGROVE-MARSH SHRUB ZONE – The only mangrove in Louisiana is black mangrove (*Avicennia germinans*). It has an oval seed that is often seen on nearby beaches, and it has an interesting adaptation for gas exchange (carbon dioxide and oxygen) – finger-like projections sticking up into the air that are termed *pneumatophores*. Black mangrove is the only mangrove species that can withstand our winter temperatures. In 1983, we had a hard freeze that extended to the coast, and virtually all mangroves died. What you see today is 30+ years growth. They are very important is stabilizing our coastal wetlands.

It is not uncommon that we see what people call black mangrove "seeds." These are not seeds but are propagules. These are totally ready to grow, as seen below. Naturally, they fall from the mangroves, and will easily float away to be distributed. We had an active distribution system going around 2020, led by Dr. Sarah Mack of Terra Resources, whereby propagules were gathered in large numbers and air-distributed by crop-duster aircraft (the Black Mangrove Airseeding Initiative). Many volunteer citizen scientists participated in the program.

Black mangrove propagules float about and begin to germinate when they encounter suitable habitat.

By the way, the word "mangrove" does not suggest taxonomic relationship. It is a word that defines a "way of life" – i.e., woody plants that can live in salt water. All the common U.S. mangrove species (white, red, black) are in different families.
Since they are woody plants growing in water, a coastal forest of mangroves is called a swamp – a marine swamp.

Adaptations:

1. Black mangroves can live in salt water because they excrete salt from the upper surface of their leaves. This is usually visible, as in the photo below.

Black mangrove leaves can exude salt on their upper surfaces.

2. They can live in salt marshes, which have toxic sulfides in their soils, by having pneumatophores (image below) which allow the roots to receive oxygen while other gasses are exchanged.

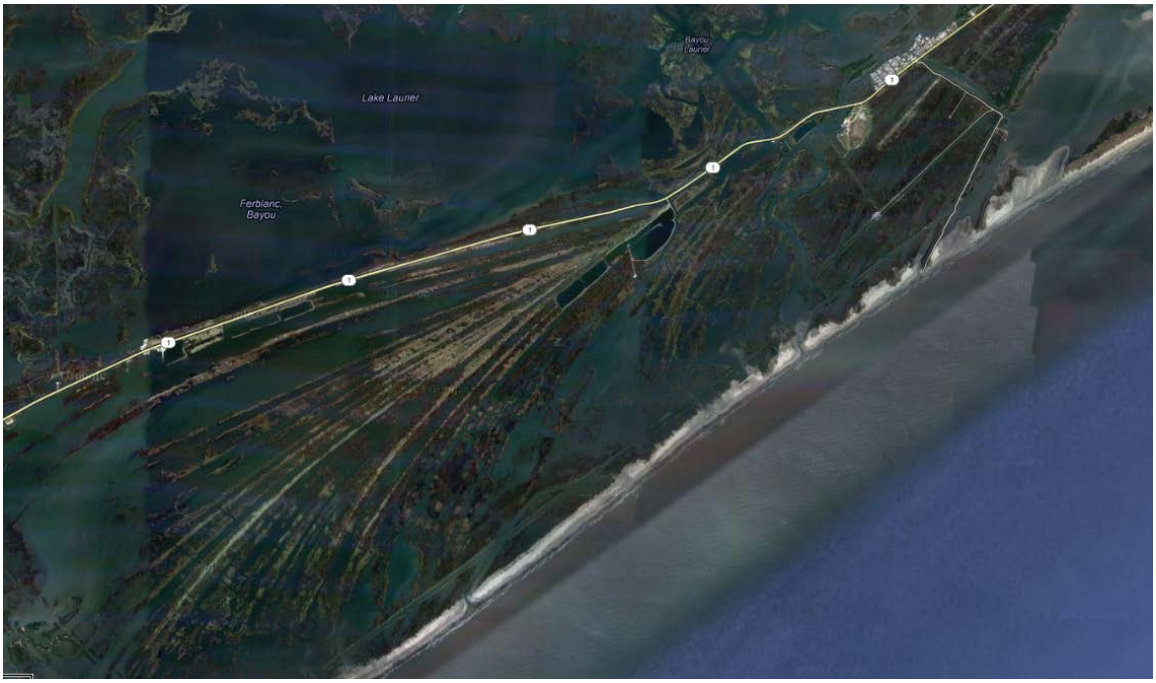
Vertical pneumatophores allow gas exchange for black mangrove growing in salt marsh.

RAISED/DISTURBED AREAS – Anywhere you visit habitats on disturbed, higher, human-affected land you find an odd assortment and association of plant species. Coastal areas are no exception. All the rules-of-thumb we discuss about the effects of salinity, proximity to the sea or freshwater, etc., go out the window when an area is artificially created or highly disturbed by the activities of humans, or even a major storm. They are unnatural in one sense, but once Mother Nature gets involved you could argue they are part of nature.

These areas are easily identified by seasoned naturalists by noting a mixture of species that would normally not be growing together. One might see lantana, giant reed, salt grass, a seedling tree of some species, goldenrods, hedge bindweeds, and many obviously introduced species like torpedo grass (*Panicum repens*) or St. Augustine.

CHENIERS – Naturalists normally think of cheniers – old beach fronts that support (or supported) live oak trees (the French name is chêne) – as being characteristic of southwest Louisiana – and they are! However, there are nice cheniers north of the Elmer's Island. They are very visible to the west (right) of LA 1 as one approaches Grand Isle in the form of rows of live oak trees – many dead due to their roots being exposed to salt water, but many still hanging on – barely.

They are visible as a spreading "fan" from above (in the image below, note LA 1 above the cheniers, and the turn onto Elmer's Island to the far right):



Chéniers north of Caminada-Moreau Headlands, GoogleEarth May 5, 2013.

Chéniers west of Grand Isle.

Cheniers are extremely valuable habitat along our coast since they provide higher, drier ground with shrubs, grasses, and trees among which many types of animals live.
NOTE: Ridges that typically run north-south are probably the remnants of natural levees that formed along the margins of bayous or former pathways of a river distributary.

From the blinking light at the base of the elevated highway (at the Conoco station) to the entrance on the right to Elmer's Island (watch for the sign) is 6.7 mi. Elmer's Island (technically a portion of the Caminada-Moreau Headlands) is now owned by the state and operated by the Louisiana Department of Wildlife & Fisheries. Just drive down the entrance road until you drive onto the beach. To be safe, park there on hard sand and you can walk into the dunes to the right (west) toward Fourchon Beach (which is the west end of this barrier island), to the left (east) toward the Caminada Pass end of Elmer's Island, or through an obvious opening in the dunes to the beach front. In the past, under normal

conditions, cars and trucks could drive down these beachfronts, but you didn't want to get stuck! You had to be especially careful if there is a wash over of Gulf water underway. There was fear that the wash over would result in Elmer's Island being cut in half, so a massive enhancement project between 2013 and 2015 placed a lot more sand on the beach, and vehicle travel along the beach is no longer allowed. It is still a very nice walk and worth every minute (hour) it takes to travel.

Ann Rogers where cars used to be parked. It is a washover spot without rushing water. One could drive east or west down the beach under these conditions. Photo by Bob Rogers.

This is the way the parking lot used to be when there was a storm, especially during high tide. A washover in action! Photo by Bob Rogers.

Here is a synopsis of the Caminada-Moreau Headlands Back Barrier Marsh Creation project (note: there have been alterations along the way, and they will continue, so you will find differing numbers if you read many sources – even the name of the project varies depending on the source; the numbers I use below seem to be reasonable and give you context on the size of the operation). It was at its time of construction the largest, costliest project in the state's coastal plan accomplished by the CPRA – some 8.7 million cubic yards of sand was spread along 13 miles of beach at a cost of $215.9 million –

restoring and enhancing about 800 acres. The very high-quality sand is from Ship Shoal, a submerged beach (or sand accumulation from many former beaches) from a time when sea level was much lower than today, now located about 40 miles southwest of Elmer's Island (27 miles southwest of Belle Pass at the mouth of Bayou Lafourche near Port Fourchon). Scow barges were loaded by cutter dredges over the shoal, moved to the west end of the Caminada-Moreau Headlands at Belle Pass, then piped all the way to the vicinity of Caminada Pass at the east end of Elmer's Island. As the work progressed toward the east, sand was poured from the pipes onto the beach, then moved about by bulldozers to create a higher, more efficient barrier beach.

Loyola students standing on the sand dispersal pipe near its beginning at Fourchon Beach.

Port Fourchon in the rear, and note the pipeline in the center of the beach to the left that forks to three pipes that deliver the sand. Note how wide the nourished beach is to the left as opposed to the soon-to-be nourished beach to the right where sand has progressively moved north into the estuary.

Beach at Elmer's Island separating the parking lot from the Gulf - post-nourishment. 4-21-17.

The east end of Elmer's Island at Caminada Pass – top is before the beach nourishment, bottom is after.

The purpose of and justification for the expense and effort were:

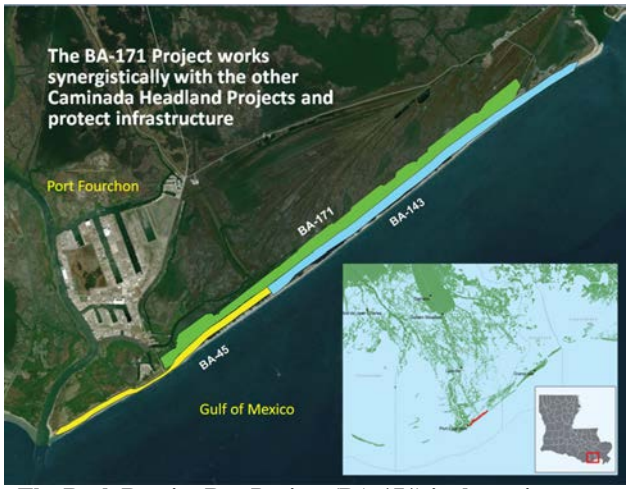
- To halt what had been an approximately 45 foot per year retreat of the barrier island toward the marshes.
- To protect Port Fourchon, surrounding marshes, and Louisiana highway 1 from storm damage.
- To enhance beach feeding and breeding sites for shore birds, especially the endangered piping plover, least terns, and red knots.

Critical portions of the beach nourishment took place when shore birds might nest and their nests be damaged. In order to discourage the birds from using the beach under

construction at the time, contractors-built windrows that appeared to deter nesting by these birds in the construction zone. By law their presence would have halted the project. The windrows were eliminated as construction progressed.

Bird nesting abatement windrows. Their purpose was to Discourage birds from nesting during construction. 4-10-16.

CAMINADA HEADLAND BACK BARRIER MARSH CREATION PROJECT
This sand nourishment project began construction in June 2020 and was completed in summer 2021. Its intent was to shore up the rear of the beaches constructed along the edge of the Gulf of Mexico, and its purpose is to give further protection to infrastructure to its north – especially Port Fourchon and LA 1.



The Back Barrier Bay Project (BA-171) is shown in green. US EPA image.

Back barrier marsh is simply the marsh behind a continuous barrier island (in this case the marsh behind the Caminada Headlands beaches) and back barrier lagoons, bays, and sounds are open water in the same position.

UPDATE ON THE ELMER'S ISLAND BEACH AFTER THE PASSING OF HURRICANE ZETA IN LATE OCTOBER 2020

Grand Isle as Hurricane Zeta approached:
https://www.youtube.com/watch?v=EDPiZ8A0HGs

Hurricane Zeta was the 6th hurricane to make landfall in the United States (and 5th in Louisiana) in 2020, and it came ashore near Grand Isle and Elmer's Island in late October as a Category 2 hurricane with 110 mph winds. It battered the coastline and had a huge but still undefined impact on the Caminada-Moreau Headlands project that was meant to protect inshore facilities like Port Fourchon. In fact, the early evaluation in progress suggests it performed as it was designed, with an estimated 1,000,000 cubic yards of sand being washed around (most pushed into the lagoons and nearby marshes, and some was taken back to the Gulf of Mexico). The bottom line is that the sand that was "washed away" is still in the system and available to be moved back to the dune areas or remain where it is and stabilize those areas. Only time and scientific evaluation will tell how the Caminada-Moreau Headlands served its original intended purpose during a very powerful storm.

Elmer's Island beach at cut through the dunes to the Gulf – April 11, 2021
Compare to the photo on page 46 above.

Passage from Elmer's Island parking lot to the Gulf after scouring by Hurricane Zeta. Taken 5-29-21.

Post-Hurricane Zeta results of washover – the lagoon at Elmer's Island was plugged. 5-29-21.

Post-Hurricane Zeta washover through the opening to the Elmer's Island parking lot. View from the Gulf of Mexico. 5-29-21

Post-Hurricane Zeta washover west of the Elmer's Island parking lot. View toward the Gulf of Mexico. 5-29-21

Washover near the lagoon behind the dunes – just west of the photo above. 5-29-21.

When the Caminada-Moreau Headlands Project was established, the area in the photo above was no longer ravaged by storm surge from the Gulf of Mexico. Over a short period of time, grasses filled in and the open sand hosted a complex ecosystem of algae and associates. A mat (about ¼ inch thick) covered the area. When there was little rain, it resembled a linoleum surface. Following rainy periods, it would turn green and begin to produce oxygen as indicated by tiny bubbles over its surface under surface water.

Algal mats in back dune washover on Elmer's Island.

Water from a rising tide covering the algal mats. Soon, the algae began photosynthesizing and bubbles of oxygen appeared on the algal surface.

In the early 2020s, there has been a huge die-off of black mangroves in the adjacent back dunes. Back in the early 1980's this occurred due to severely cold weather. There has not been a recent freeze to kill these, so what might it be?

Back dune west of Elmer's Island parking lot: note dead black mangrove and salt deposits on surface of sediment. Photo by Bill van der Meer, 11-27-22.

The aforementioned Caminada Headland Back Barrier Marsh Creation Project terminated not far to the west of this site. To build height in the barrier island, a levee was constructed around the project area and filled with pumped sand and saltwater. Much of the saltwater escaped through the east end levee and flooded the area of the above photograph. Though black mangrove is very salt tolerant, it may be that the salt concentrated enough to kill existing mangroves – note the white surface in the photo that

is salt on the surface of the sand. This was not a good sign for stabilizing this portion of the coast, but the photo below gives hope. It shows a black mangrove propagule replacing its dead relatives.

Black mangrove propagule with healthy growth. Photo by Bill van der Meer, 11-27-22.

UPDATE ON THE ELMER'S ISLAND BEACH AND GRAND ISLE AFTER THE PASSING OF HURRICANE IDA ON AUGUST 29, 2021

Frequently termed the strongest storm to hit coastal Louisiana, Hurricane Ida devastated the coast. It came ashore as a Category 4 storm at Port Fourchon, with winds of 130 (gusts much higher), then stalled. Local officials believe that during post-storm analysis, Ida will be upgraded to a Category 5 storm during landfall. Grand Isle and most of Bayou Lafourche were just to the east of the eye where the strongest winds occur and experienced sustained winds well above 100 mph for as long as 12 hours. The results for human structures and property were tragic. The west end of Grand Isle was essentially leveled, and the burrito levees were exposed or destroyed. Water many feet deep surged across the barrier island and many buildings simply disappeared.

As of this writing (February 26, 2022), those who live in this region are still horribly affected. Businesses have not opened, and homes are completely destroyed – or, at best terribly damaged. For most, there is little to no relief in sight. One man in his 70s commented on a new interview that he has always been able to scrape together enough money to recover is dwelling and business after a hurricane, but he is struggling post-Ida. The level of destruction is much higher than even past direct hits by hurricanes, and although money is not his deterrent, his stamina due to age looms large. He said what he needs most is help from more able-bodied people. Very, very sad to see the positive spirit of local residents who wish to honor their multigenerational culture by rebuilding and continuing their way of life. This is the norm along the coast, but Ida, much like

Hurricane Michael that obliterated Mexico Beach, Florida, in October 2018, was and remains devastating. I'll bet on recovery, but no one knows the time frame.

If you were not in Louisiana when Hurricane Ida came ashore, Google it and look at the images.

"Burrito" levees were unearthed in the overall levee systems on Grand Isle in Hurricane Ida. Taken November 19, 2021.

Hurricane Ida home destruction. CNBC image.

Hurricane Ida destruction. NPR image.

Elmer's Island was closer to the eye of Hurricane Ida and received enormous winds and surge. There are no structures on the island, but the entrance road received lots of damage. That said, barrier islands are part of nature and Elmer's Island west to Fourchon Beach still exists, but much of the sand was moved about: into the marsh, into the lagoon, back to sea, all along the beach front, and more. The best news to share is that the Caminada Headlands Project was done, and its job of protecting Port Fourchon was accomplished (even though many structures at the port were badly damaged). The port was reactivated within a week due to the protection the Caminada Headlands project!

Note the total absence of dunes post-Ida. All the sand is now in the marsh nearby. Taken November 19, 2021.

New dunes are forming behind the former dune line, but total recovery will require more sand being pumped from Ship Shoal. Taken November 19, 2019.

At this writing, there were no deaths along the coast due to wind or water during Ida. Twenty-six died due to storm related choices/activities not originating directly from wind and water. Many lives are changed forever, and thousands are left homeless for now, and without work or access to supplies need to restore their property and businesses.

Anatomy of the Shore

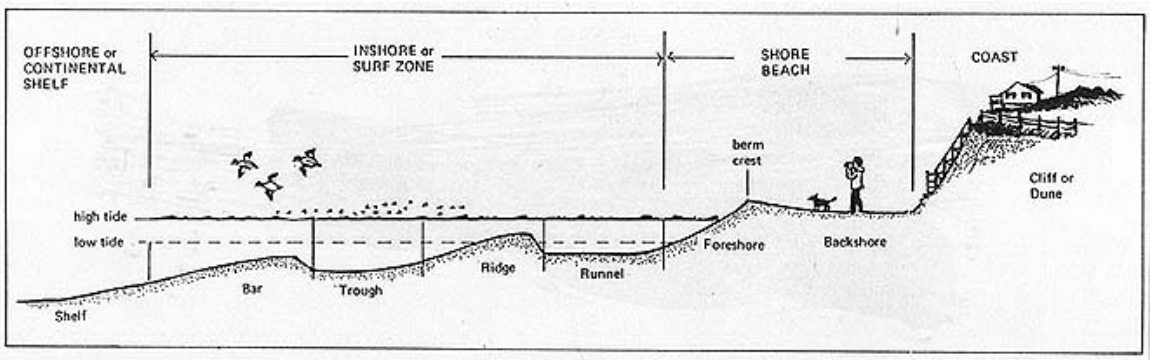
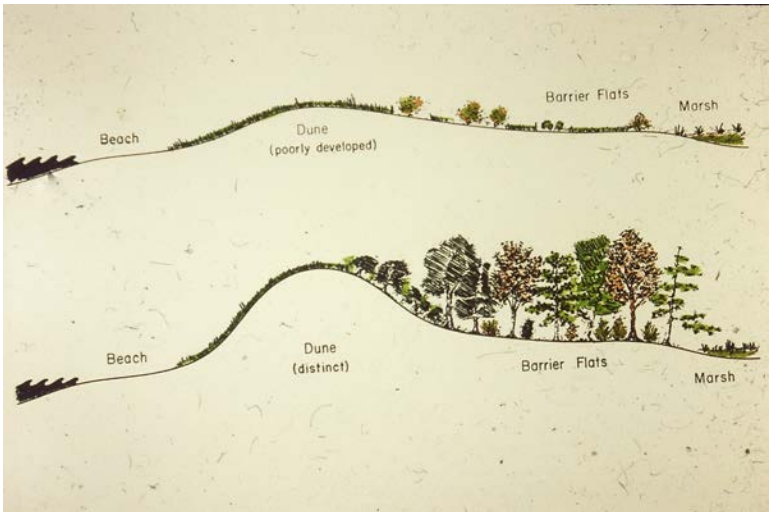


FIGURE 5–3. Profile across the coast.

from W.T. Fox. 1983. At the Sea's Edge. Prentice Hall Press.

SHOAL – Shoals are expanses of pure sand below the surface offshore. They begin as submerged former beaches and/or barrier islands but become aggregated accumulations of sand that may have originated in different zones over several thousand years. As an example, Ship Shoal is about 40 miles offshore southwest of Elmer's Island, 9-12 feet beneath the surface. About 4000 years ago, it was the edge of the land – sea level at the time was about 60 feet lower than today.

BEACHES – LOW AND HIGH PROFILE – One of the issues in coastal Louisiana is that our beaches are "low profile," meaning they are not built up high with substantial dunes like we see in Padre Island, Texas, and even the Gulf Islands National Seashore on Santa Rosa Island, Florida. Being low profile is not a problem, but it makes the beaches more vulnerable to strong storms that can wreak havoc and be very destructive. The profile of beaches is determined by many ecological factors, including but not limited to types of sands available, ambient winds, vegetation that holds them together, and related characteristics.



Low profile barrier island above, high profile below.

Low profile beach, Elmer's Island before the beach nourishment.

LONGSHORE CURRENTS – The rule-of-thumb is that longshore currents, currents that run parallel to beaches, flow from east to west. The ecological effect of this is that sand along Gulf of Mexico beaches move, grain by grain, toward the west. When waves break along the shore, sand is lifted, then falls just a bit to the west. Each event in inconsequential, but what is important that it happens every second 24/7 so overtime beaches and barrier islands move to the west. All hard engineering efforts have failed, and the sand moves on.

This is true from the Florida panhandle all the way to Brownsville, Texas, and beyond – *except* for one area in Louisiana. Because of the dynamics of local geography and the impact of massive amounts of water flowing west out of the mouth of the Mississippi River, longshore currents from Belle Pass at the mouth of Bayou Lafourche to the east end of Grand Isle flow west to east. The Caminada-Moreau Headlands and Grand Isle are moving toward the east!

Such a site (the "split" at Belle Pass with longshore currents going east and west) is called a *nodal zone*.

BEACH – SUBTIDAL AND INTERTIDAL ZONE – This is the zone that is inundated during high tide and exposed to the air (subaerial) during low tide. There is normally no emergent vegetation here, but there are many animals who specialize in this zone. If you don a snorkeling mask (works better in clear water to the east), you will note that there are many juvenile fishes that make a living in this zone (such as pompano, threadfins, ladyfish, hardhead and gafftopsail catfish), speckled and blue crabs, ghost shrimp, moonsnails and lettered olives, and much more.
Thixotropy is especially important to burrowing in ghost shrimp. This is where many of the familiar seashells make a living, such as ark species, *Venus* species, razor clams, angelwings, and common rangia clam. Almost all the oyster shells found here are the remnants of days gone by when this area was all estuary and/or lagoon – their preferred habitat.

BEACH – SWASH ZONE – This is the zone where waves run up on the face of the beach, then return to the sea. It appears barren, but in fact it is a very important habitat to many animals. Beach lovers (especially beach combers) enjoy observing and learning about *life in the shifting sands* of this zone.
This, and the next habitat, are where ***thixotropy*** truly plays a major ecological role. Dry sand is very hard to penetrate. Wet sand, however, is easily mobilized by poking it with something sharp and narrow, like the beak of a sanderling, the muscular foot of a coquina clam, or the smooth oval body of a mole crab. In the swash zone, thixotropy is in play each time a wave sends water up, then down, the beach front. It is easy to observe small birds taking advantage of thixotropy as they scoot away from an incoming wave, then rapidly run down the beach at the receding edge of the wave and poking their beaks into the sand in search of clams, amphipods, and other such animals.
Although no plants grow in this zone, it is common to find sargasso weed (or, gulfweed, genus *Sargassum*) washed up. Also, especially if the beach is near the mouth of a river, one can find large quantities of freshwater plants washed up on the beach.

Lithiphied Sand (Beach Stones or Rock) – of interest on Louisiana beaches.

> These flat sand stones are usually found in coastal deposits (often washed out on the beach front). They are an indication that the beach is eroding and that the spot where they were found used to be the rear of the barrier island. Where do they come from? Lithiphied sand is formed in washover zones at the rear of barrier islands, at the interfaces of beach/marsh and water/sand. Methane is produced in marsh areas. When the methane reacts with shells in the presence of fine sands, a carbonate cement is formed. This becomes the lithiphied sand (beach stone or rocks). They are usually irregular in shape, although almost always flat. Holes are usually caused by a plant growing through them or them forming around

something that has either fallen or eroded away. These stones may also form as a result of iron interacting with its surrounding environment.

THE BACKSHORE OF THE BEACH – THE DRY PART – The backshore and upper foreshore have lower animal and plant diversity than other habitats being discussed. But they are very important to the overall ecology of beaches and lots of plants and animals move about in this zone. One of the characteristic denizens is the ghost crab, small white crabs observed moving quickly across the surface, or scurrying down their tunnels that are excavated at an angle into the sand – usually with a pile of balled up sand piled at the entrance. Birds perch, feed, and poo on this part of the beach. Beachcombers typically walk the swash zone in search of shells and other natural artifacts. Experienced naturalists know to check the "beach wrack" line, normally away from the swash zone, that was placed there by a recent storm – the high waves deposit lots of marine goodies back on the beach and there are treasures there to be discovered!

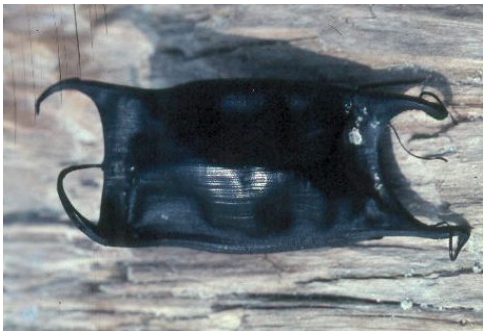
As stated, one can find many interesting items in the beach wrack. Six favorites are:

1. Black drum, *Pogonias cromis*, pharyngeal bones with molariform teeth. These modified and recognizable bones are in the mouths of black drum and are used to crush mollusks. They separate nicely from the skeletons as the fish rots on the beach and are always a sense of wonder for beachcombers.

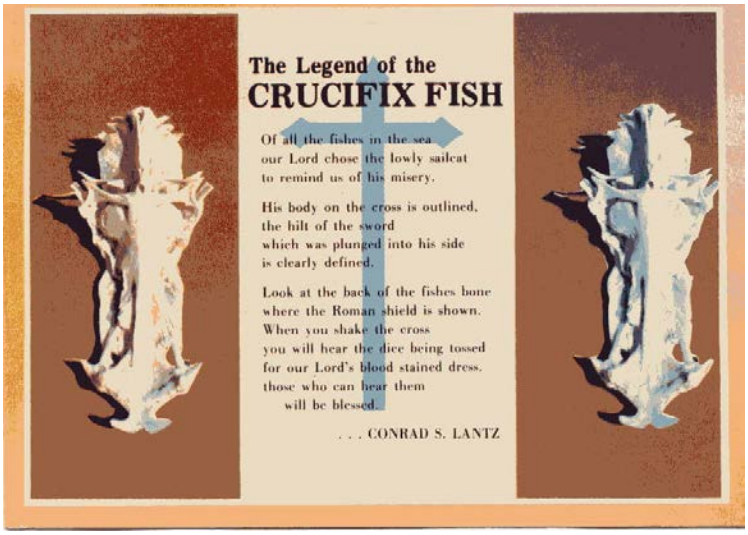
Black drum lower pharyngeal bones with molariform teeth – a commonly found item on Louisiana beaches.

Same in freshly caught black drum – side view. Note molariform teeth in both upper (left) and lower right) surfaces. Photo by Ryan Moody.

2. Mermaid's purse, an egg case of a skate (a flat fish that resembles a stingray, sans the venomous stinging apparatus). The dried egg case looks like black plastic, and the tendrils on each corner wrap around corals and sea weeds to anchor the egg case during development.



3. The legend of the top of the skull of a hardhead catfish, *Ariopsis felis*.



4. Shark eye egg "collar" – One of the weirder things sometimes found on Grand Isle and Elmer's Island beaches are the egg cases (look like a collar of some type) of the predacious shark eye snail, *Neverita duplicata*.

5. Tar balls still present after the 2010 British Petroleum blowout. Tar balls can normally be distinguished from clay-peat balls by the presence of an oil aroma.

Tarball on Elmer's Island, July 6, 2010

6. Clear, hard jelly-like "stuff" along the beach. These are pieces-parts of dead jellyfish, normally the large, flat moon jellyfish, *Aurelia aurita*.

MARSH PLATFORMS, OR MATS – At times, one may see an expanse of non-sand near the leading edge of the beach (or, now behind the recently nourished beach front, just in front of the dunes). These *marsh platforms* are characterized by being composed not of sand, but instead of soils composed of clay, sand, and organic matter. Sometimes they have dead wood sticking out of them. These platforms were once on the rear of the barrier island and are evidence that the barrier islands are moving north (inland), leaving marsh platforms on the front of the barrier island with the remains of dead black mangrove (which is normally on the interior or back of the barrier islands).

Note the holes of boring organisms that often live in the heavy soils of marsh platforms.

BEACH – DUNES – Louisiana has small dunes, mainly due to the nature of the sand at our sea's edge – it is heavier and composed of a variety of materials including ground mollusk shells. Dunes in Louisiana that are 5 ft tall are considered large, while in south Texas dunes may be well over 10 ft – even 20 ft - high. Since the dunes are generally removed from the wave actions, and are higher, they are inhabited by species of grass (salt grass, saltmeadow cordgrass, rushes, sedges, and other plant species that are thin and capable of living on rainwater and exposure to salt spray. Many animals live in this zone, including mice, snakes, lizards, insects, and dunes are visited by coyotes, hogs, and the like.

BEACH – LAGOON (backbay) – Lagoons are bodies of water at the rear of a barrier island. They may be lower in salinity than the Gulf, the same, or even higher is there is little addition of freshwater and lots of evaporation. They tend to be high in biodiversity, with solid populations of fish, blue crabs, diamondback terrapins, occasional sea turtles, bottlenose dolphins, and loads of wading birds and other avian icons such as brown pelicans, ospreys, reddish egrets, willets, and more.
Many lagoons bleed into adjacent estuaries, so species typical of those habitats are usually present – e.g., this is where one typically finds oysters around the barrier islands.

View from the road onto Elmer's Island. Immediately in front is the lagoon, then Elmer's Island, then the open Gulf of Mexico with Grand Isle on the left in the distance, a shrimp trawler, and a couple of oil platforms.

Beach & Lagoon natural history of Elmer's Island

See Appendix III for a checklist of seashells found on Elmer's Island and Grande Isle by LMNGNO workshop participants.

Living shells (mollusks)

Many living clams, such as the species of arks, have a brown surface called the periostracum. The periostracum wears off after the clam dies, so most of these shells, when found on the beach, are while to dark gray. The most abundant living shells along Elmer's Island (and Grand Isle and the rest of the northern Gulf) are coquina or bean clams, *Donax variabilis*, which typically burrow in the sand in the swash zone and are exposed as waves come and go – but they quickly burrow back into the sand. The specific epithet "*variabilis*" refers to their variability in pattern and color.

Non-living shells (mollusks)

Although there are many living species along the beach front and just offshore, most of the shells found along the beaches are very old (thousands of years, in many cases) and

have been buried and are constantly being exposed by wave action, storms, and beach nourishment projects.
Along Elmer's Island, it is common to find, along the beach front, many black shells. Many/most of these are oysters. The reason they are black is because after they were "dead," they became buried in sulfurous muck in the back lagoons and infused with iron sulfide. As time passed, the barrier island moved toward the marshes to the north and these dark shells become exposed due to wave action. But good naturalists learn to think about what they see and apply their knowledge of ecology – where do oysters grow? Not on beaches, and not in the open gulf. They prefer the salinities found in estuaries – behind the barrier islands. So, the prevalence of black oyster shells has two rational explanations:

- The barrier island has moved shoreward thus revealing shells on the beach that where formerly in the lagoons and estuaries on the marsh side of the barrier island.
- The shells one sees were embedded in sands pumped from offshore for restoration (they originated just as those mentioned in the first bullet, but at a time when sea level was much lower and are now in deeper water).

Remember, "think like a naturalist."

Darkened shells, Fort Morgan, Alabama. August 2009.

Shells on a beach: remains of recent shells in Navarre, Florida (l); 4000 year-old shells on Elmer's Island

NOW – ON TO GRAND ISLE

Return to LA 1 then turn right. In 2.0 mi you will encounter the foot of the Andy P. Valence Memorial Bridge over Caminada Pass. Cross this bridge and you are on Grand Isle. See the attached map for mileages to important spots.

On your left, you will see at one spot small, odd structures on the electric wires; each should have a little "flag" twisting in the wind (they often fall off). Flags were placed on these wires by Entergy as bird deterrents when a number of brown pelicans were electrocuted when they came in contact with the wires.

Photo by Wayne Keller.

SPEED LIMIT WARNING: Grand Isle now has strictly enforced speed zones that change from 25 mph to 45 mph and back to 25 mph. Changes to 25 mph are marked with a red and white sign that has a flashing light. DO NOT DRIVE EVEN ONE MILE PER HOUR OVER 25, OR POSSIBLY SUFFER THE CONSEQUENCES WITH A SPEEDING TICKET!

As you approach the Grand Isle side of the bridge, notice to the left the rock breakwaters that parallel the northern shore of the barrier island. Their purpose is to stop large waves driven by storms from the north that often erode the shoreline. They are also loving bird resting spots for better birdwatching!

Some things you can't see that are very important to the ecology of Grand Isle are a host of artificial concrete reef domes that have been placed offshore to serve as habitats for fish and other sea life, thus enhancing the marine biota in the region. They become part of the "living shoreline," a term normally used when artificial contraptions are placed along the shoreline and become festooned with oysters and the community that populates those resources. In this case, they are not continuous as a living platform, but there are many in place and they have the same function supporting marine communities.

Artificial reef domes just before they were placed in the northern nearshore waters in April 2017.

ONE OF THE JOYS OF VISITING GRAND ISLE IS NOTING THE NAMES THAT PEOPLE HAVE PLACED ON THEIR HOMES AND "CAMPS"
All have some personal meaning, and are just fun to read: Lil Mamas, Sand Palace, D'Bonefish, Goodbye Tension - Hello Pension, Fishing Rink, Claw Enforcement, Milk Shak, Sugar Shack II, Mellu 2, Camp No Problem, Cher-Ami, Beach Blessing, Footprints, Therapy, Barbara Coast, Pride, In Neutral, Last Cast, Cajun Sunset, Pops and Docs, Never Again, Mammas and Papas Grand Slam, Sweet retreat, Half Way to Heaven, The Medicine Box, Not a Holiday Express, Old Timer, Joie de Vie, Fais Do Do, Vitamin Sea, Group Therapy, Beach Get Away, Behind the times, Fish Commander, Douglas Sea Weed, Mouse Trap II, Mr. Butch, Mom's, Son ova Beach, Will Sea, Law & Order, Cancoon, Katrina Beach, Fishing Rink, My Moose, Moontide, The Laffin Place, One of Life's Perques, Big Shad I 2, Saui's Fun, Make Waves, Almost Jamaica, Milky Way, Acadia, Smith's Ridge, Poverty Point, Uno Mas, Lucky 7, Go Fish.

LOUISIANA MASTER NATURALISTS WILL BE THOROUGHLY SCHOOLED ON THE NATURAL HISTORY OF GRAND ISLE AND ELMER'S ISLAND IN THE LMNGNO WORKSHOP. The Appendices on this document list species we normally encounter on the barrier islands.

There are several situations and events that draw people to Grand Isle:

- It is a "get-away" for many homeowners, and you get an idea of this importance by reading the names on the houses ("camps," as locals call them).
- Sport fishing: there is wonderful sport fishing in the region, and people come from all over the world to enjoy. Techniques include standing on the old bridge, surf fishing, boating to nearby or remote areas, or taking commercial boat trips out.
- Commercial fishing: This is an important port for landing commercially important fish and shellfish.
- Bird watching: This is one of the major routes for migrating birds passing through – heading north in mid-spring and south, in early to late fall. LMNGNO always has its Grand Isle/Elmer's Island workshops on the same weekend as the

Grand Isle Bird Festival in Spring – the birds cannot easily be understood without making the trip. Splendid colors, activity, diversity, and much more. There are many birds that spend their winters in the area, thus attracting birding activity all winter.

In order to know more about birds, their distributions, tracking them on radar, numbers of species seen in different regions, and MUCH more, sign on to eBird.org and expand your knowledge of birds.

Below is a listing of the places people enjoy birdwatching, or just nature walks.

ANOTHER IMPORTANT HABITAT – MARITIME FOREST

The most important habitat feature of Grand Isle is its ***maritime forest***. These supratidal forests exist at the edges of marine habitats and often share common features. Trees are stunted, wind swept in shape, can withstand flooding, and receive salt spray from the sea. They are located on higher ground behind the beach and dune zones, and act as windscreens for many species that live under the canopy or on the leeward side of the forest. In Louisiana, the tree that is most abundant is the live oak (*Quercus virginiana*), but a variety of other trees may be present. Non-woody plants are like those in other coastal community components, but they may be denser in maritime forests. This habitat is *extremely* important as a resting and feeding place for migratory Neotropical birds, both arriving and leaving. Oddly, there are some reptiles (Slender Glass Lizard - *Ophisaurus attenuatus*, Black-masked Racer - *Coluber constrictor latrunculus*, and Saltmarsh Watersnake - *Nerodia clarkii*) and amphibians (especially narrowmouth toads, *Gastrophryne carolinensis*; green treefrogs, *Dryophytes* (*Hyla) cinerea*; and squirrel treefrogs, *Dryophytes* (*Hyla) squirella*) that are abundant in this habitat.

There are some extensive stands in Grand Isle, but many are somewhat patchy, and all are vitally important to migrating Neotropical birds and year-round residents.

Classic maritime forest in the Landry-LeBlanc Tract behind Sureway grocery store, 2018.

NOTE: If you are sensitive to poison ivy (*Toxicodendron radicans*), the maritime forests and their surrounding open habitats are heavily populated with this plant. You don't have to be anxious about its presence, just know how to recognize it and avoid contact. The leaves may be quite large and appear to be part of a tree on which they climb. Learn to recognize the species.

Poison ivy in flower, *Toxicodendron radicans*. Grilletta Tract.

SUMMARY OF PLACES TO VISIT ON GRAND ISLE (sites are in the order you will encounter them as you enter the island, mileages from southern base of bridge):

- Bridge Side Marina – south base of the Andy P. Valence Memorial Bridge (on the right; restrooms, poboys, drinks, fishing supplies, etc.)
- The gulf-side tip of Grand Isle behind the Bridge Side Marina, the Grand Isle State Park West, is often good for birds.
- Megan's Sno Balls (3.1 mi on the left, corner of LA 1 and Neptune Lane; obvious value – small size will suffice)
- Water Edge Beach Apartments (3.3 mi on the right; cross levee here to see the remnants of former (and the late) Mayor Andy Valence's "jetties" (they were actually groins, structures that touch the shore and jut perpendicular into the water; jetties are similar in appearance but are placed on each side of a boat entrance with the function of keeping sand from filling the channel) that he believed would expand the size and stability of Grand Isle (now appear as large rocks sitting on the beach). They did not work, just like all other failed groin projects. His goal was to build a succession of such groins as the island widened. Only the original "jetty" was constructed.

- Between 3.3-3.7 mi on the left – Ludwig Lane
    - Louisiana Wildlife & Fisheries Labs (very end of Ludwig Lane – Louisiana Master Naturalists of Greater New Orleans classes meet in the middle building).
    - Behind the labs is a wetland zone with marsh and many black mangroves – a recent thrill (2019) was the arrival of mangrove warblers in this area. Just walk the road and side trails back to the Kayak Launch.
    - Most citizens invite you to watch birds in their area but be respectful of their property and where you point your binoculars!

- Coulon Rigaud Lane – a nice street to stroll while watching birds. Most homeowners are welcoming.

The Grilletta Tract and LOSCO/Jambon Tract nature trails (named for the Louisiana Oil Spill Coordinator's Office and Josh Jambon) are accessible from the yard of the Santiny house at the end of Coulon Rigaud Lane.

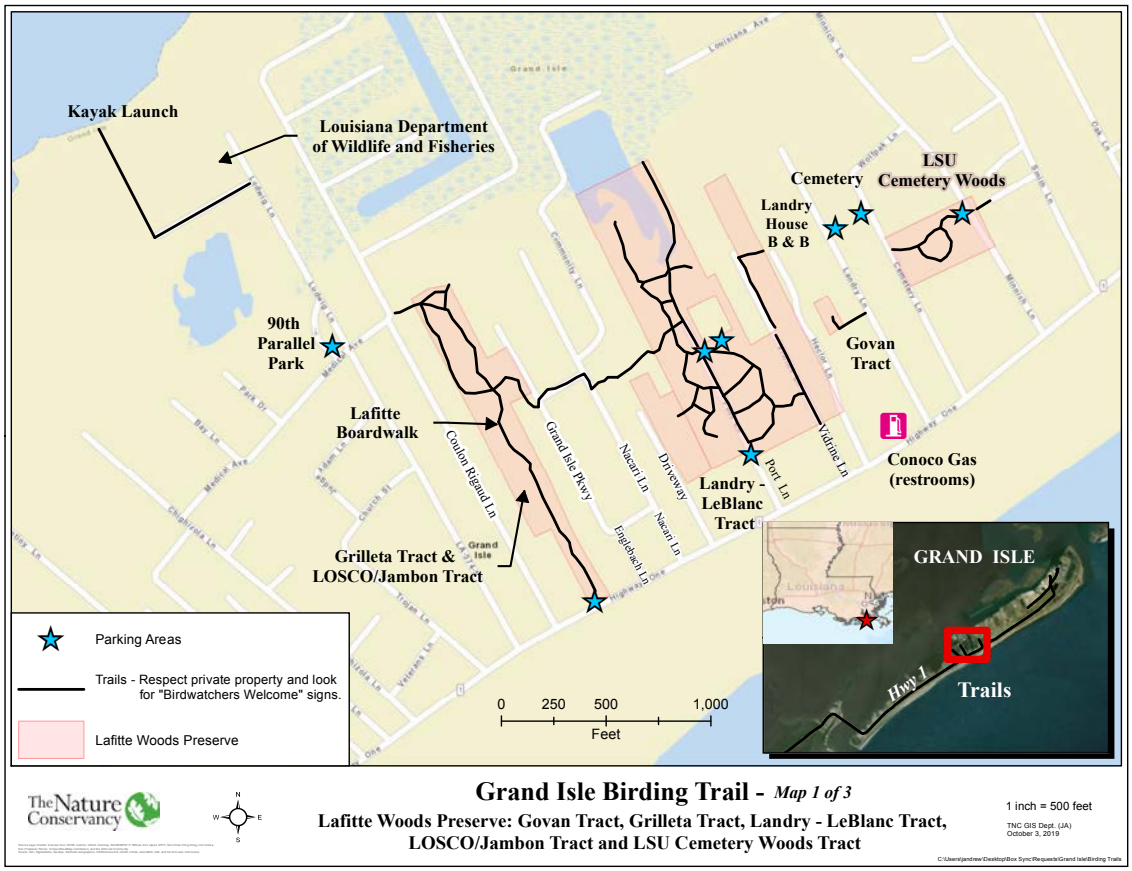
Yard of the late Bobby Santiny, still owned by his family. Great for bird viewing and "Birder friendly."

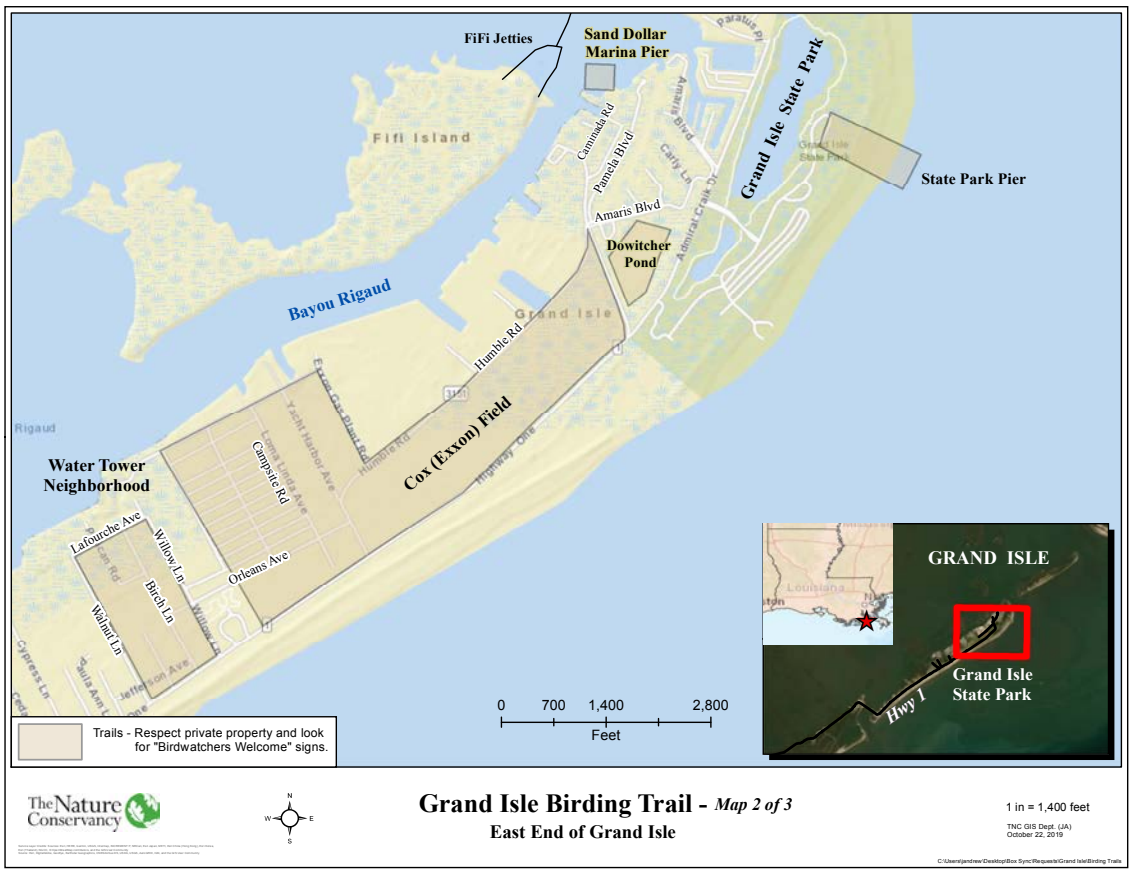
  - Grilletta Tract Nature Trail of the Lafitte Woods Preserve – named after donor Xavier Grilletta, Sr. (between Coulon Rigaud Lane and Englebach Lane) – very small parking lot at the kiosk on LA 1, and the trail, featuring the Lafitte Boardwalk, extends north into the maritime forest and curves to the left where it comes out on Coulon Rigaud Lane at the late Bobby Santiny's home. Mr. Grilletta donated 10 acres to The Nature Conservancy known as the Lafitte Woods Preserve, which includes the Grilletta Tract Nature Trail.
  - The LOSCO/Jambon Tract is along the west side and indistinguishable from the Grilleta Tract.
- Landry-LeBlanc Tract, of the Lafitte Woods Preserve, formerly known as "Sureway Woods" (behind the Sureway Grocery, 3.7 mi on left; park on right side of the grocery parking lot on Post Lane and enter the woods to the rear of the store) – wander the maritime forest woods and enjoy one of the best bird watching sites in the U.S., especially during spring migration (April) and the fall migration (August-into fall). This tract is named after its former owners, Dr. Andre Landry, a renowned marine scientist who grew up closely associated with the island, his father (A.M.) and sister (Anna), and his father's business partner, Mr. James (Jimmy) LeBlanc.
- Govan Tract (donated by the Govan family) of the Lafitte Woods Preserve – located behind the Conoco Station between Landry Lane and Hector Lane.
- LSU Cemetery Woods of the Lafitte Woods Preserve – wooded area between Minnich Lane and Cemetery Lane. Park on a cross-trail with a kiosk. This land is owned by LSU, with a long-term management lease to The Nature Conservancy.

- Near 8.8 mi, there is a popular birding site (the Water Tower Neighborhood) at the corner of Willow Lane and Orleans Avenue, close to the water tower. One of the homeowners, Tommy Bradberry, nurtures bird attracting plants and is very friendly to birders.
- Community Center (8.9 mi on the left, just east of Willow Lane) – sometimes called the Cajun Stonehenge (or Mt. Rushmore) due to the large, imported rocks, one carved with the face of former Governor Edwin Edwards. Meetings are commonly held in this building.
- The Nature Conservancy offices, 4090 LA 1, Grand Isle, LA 70358. This is the agency that manages the Lafitte Woods Preserve and gives birders permission to enjoy the Cox Fields (see next bullet).
- The extensive open grass fields are commonly referred to as the Cox (formerly Exxon) Fields and are very popular sites for open habitat birds. Presently (2019), direct access to the fields required permission obtained at The Nature Conservancy offices; naturalists drive the periphery without permission for observations from their cars.
- Dowitcher Pond (also called the "Mitigation Pond," or "End of Highway 1 Mitigation Area," is visible from LA 1 on the right (east) side of the road between the junction with Admiral Craik Drive and Amaris Boulevard. Good site for water birds.
- If one follows LA 1 to the left at the 10.6 mi point, then turns right on Camanada, one arrives at the Sand Dollar Motel Pier. Birders enjoy views of the birds visiting the Fifi jetties across Bayou Rigaud from the end of the pier.
- Go straight (don't veer left as LA 1 turns) at 10.6 mi and drive down Admiral Craik Drive and enter Grand Isle State Park on the right. After paying ($3 per person, free to those 62 and older), turn left and proceed to the last building (with the tower). Walk the elevated boardwalk for wildlife viewing or go down on the beach for excellent aquatic bird viewing, especially in spring. There are good beach habitat and plants as well.

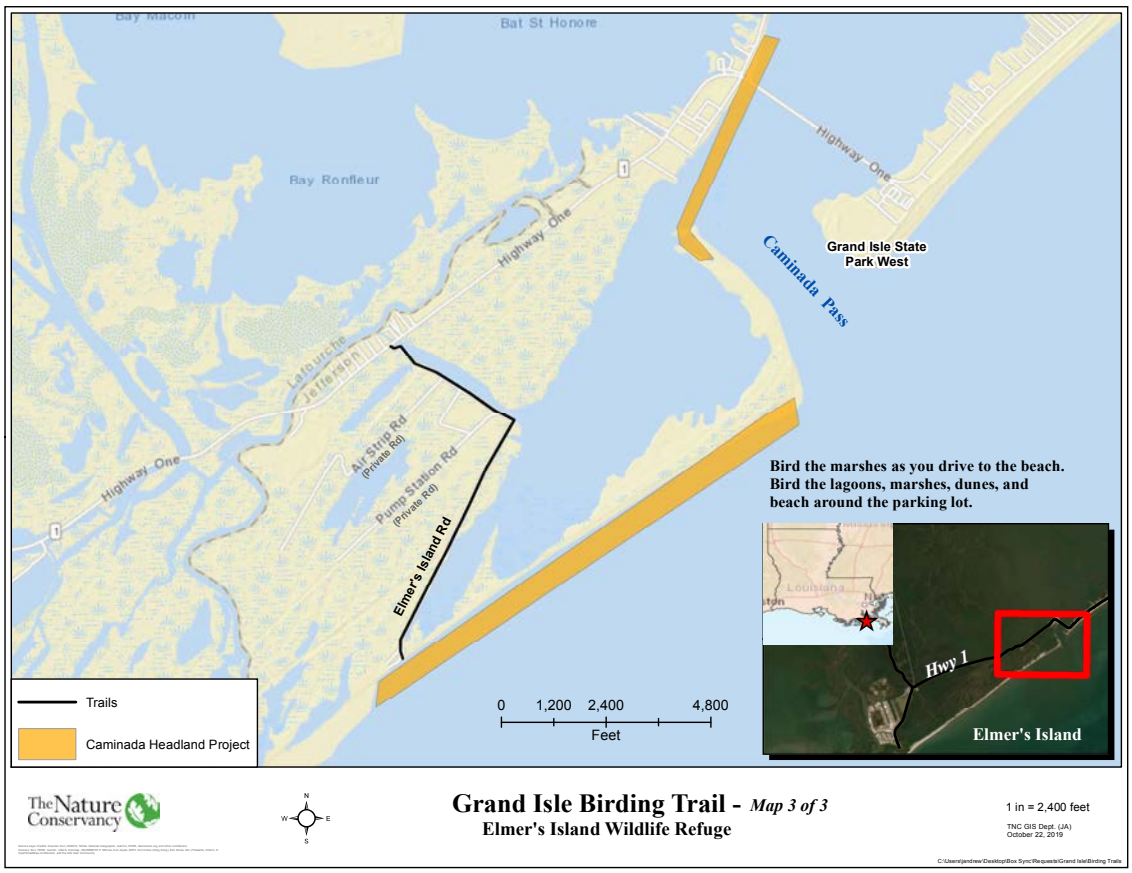
Certified Louisiana Master Naturalist Mark Meunier identifying shorebirds at Grand Isle State Park in April 2015.

BIRDING/ADVENTURE MAPS OF GRAND ISLE & ELMER'S ISLAND





An additional site many birders use is called King Tarpon Park on Google Earth. The parking for this site is labeled Grand Isle Beach at Humble Lane. To get there, turn into the parking lot on the beach side where LA 1 intersects with Humble Lane (also labeled as LA 3151). From King Tarpon Park, enjoy a nice walk to the Gulf of Mexico and then along the beach.



SO, WHY THE FASCINATION WITH BIRDING IN THE GRAND ISLE REGION?

Each spring there is a magnificent migrational flow of arriving birds from the Neotropics (new world tropics of South America, Central America, and the Caribbean) into the United States. It is spread across the entire spring, but the most massive movements take place in April and into mid-May. The driver of this migration is that the spring in North America is the awakening of the insect/spider/other worlds – meaning reproduction and hatching, coupled with a plethora of budding and blooming plants, all of which represent a booming availability of food available to the arriving birds and their offspring.

These birds have flyways and the largest is the Mississippi Flyway that passes right through Louisiana and adjacent east Texas. As of 2021, the species count for the Grand Isle region on eBird is 314! Ultimately, the birds distribute themselves throughout the United States and Canada, but after crossing the Gulf of Mexico, they ordinarily stop in our coastal maritime forests for a rest and a snack. During these stopovers, the Grand Isle area can be a cornucopia of colorful birds and overall avian activity and excitement. The coastal maritime forests may be full of birds and are normally packed with bird watchers! A full weekend in April each spring is the host of the Grand Isle Bird Festival which

sponsors lectures, programs, tabling, guided nature walks, bird banding stations, and more to educate and entertain the numerous visitors who “flock” to the barrier island to enjoy the arrival of our guests from the south.

If you are or are interested in becoming a birder, there are basic rules-of-thumb that are used to predict the best times for spring migration bird watching:

- April is the focal month, but adjacent times (February through May) can be wonderful
- Since the birds have flown a great distance without rest, one hopes they choose to stop and recoup. This is enhanced if there is heavy rain or a north wind blowing (such as a passing front heading south) – it is harder to fly into a wind, so they are more likely to land in the coastal maritime forests, marshes, and beaches. Alternatively, a clear day of arrival, especially with a southern tail wind, typically results in their continuing their flight to the north, resulting in many fewer birds on Grand Isle.

Fall sees a reverse migration, consisting of adults and newly fledged birds moving back to the tropics. Most are no longer brightly colored, but they are none-the-less still identifiable. Novices typically find it much more difficult to identify the birds, but it is still a wonderful time to visit the coast.

Some of the birds that are much beloved include ospreys, roseate spoon bills (Cajun flamingos), reddish egrets, various plovers, a variety of terns, red knots and other species of sandpipers, black skimmers, American oystercatchers, rails, and many more species. In 2022 there was at least one white reddish egret dancing nicely in the shallow waters.

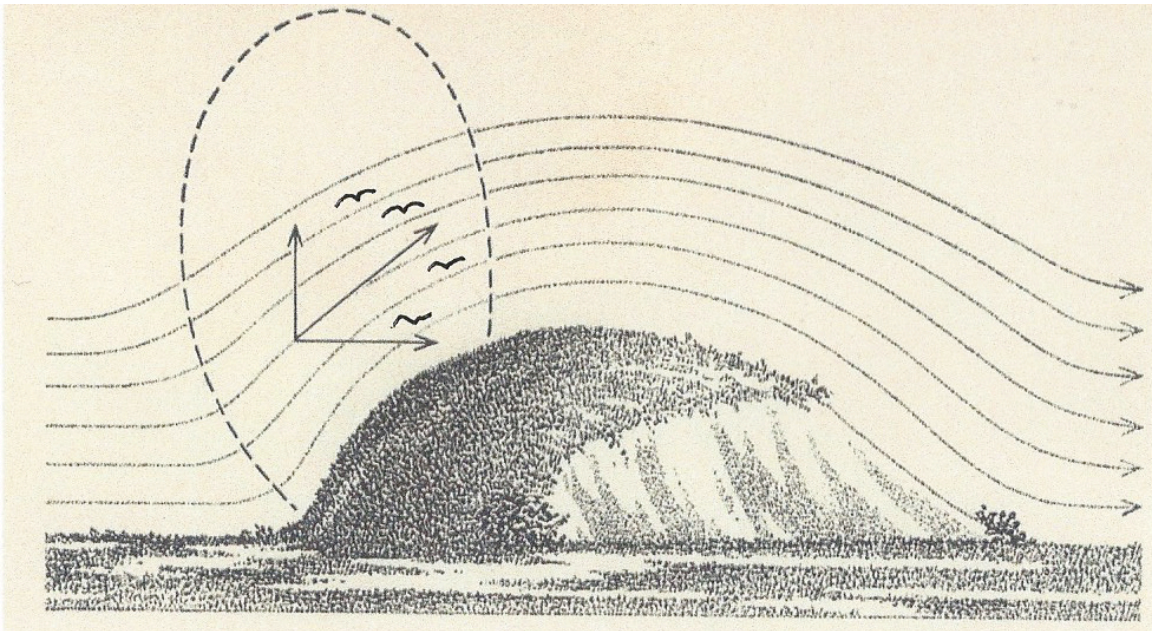
Reddish egret. Photo by Joan Garvey.

Roseate spoonbill on nest. Photo by Julie Dermansky.

The following photos (mostly by Joan Garvey, but also Tom Finnie, Mike Mather, and Ed Kanze) illustrate the fun, beauty, and excitement of birding in Louisiana. Be careful – it's easy to get hooked! And you never know what is appear and draw birders from all over to Grand Isle. In 2022 a number of red-legged honeycreepers from Central America visited the maritime forest and thrilled the birders who say them.

WE SIMPLY MUST DISCUSS COMMONLY OBSERVED FLIGHT PATTERNS USED BY VARIOUS BIRDS:

DECLIVITY CURRENTS: THE ELEVATED HIGHWAYS AND HIGHER BRIDGES SERVE AS TOOLS FOR LAZY (ENERGY EFFICIENT?) BIRD FLIGHT.



Adapted from Cone, 1962, Sci. Amer. 206(4[April]):131.

In a coastal estuary, the wind may blow great distances unimpeded. On our coast, the wind may eventually hit an elevated highway (like LA 1 between Golden Meadow and Port Fourchon) or an arching, high bridge (such as the Andy Valence Memorial bridge over the Caminada Pass. These structures deflect wind upward, thus forming declivity currents that allow birds to get an energy-free ride – sometimes the entire length of the elevated structures.

In the photos below, note the motionless glide (although they do continually adjust their feathers to maintain stability), always at the perfect angle to the wind.

One of the interesting strategies in nature is to find and use the most energy efficient method of movement, and riding declivity currents always trumps flapping wings!

Here is a brown pelican riding the declivity currents along a highway.

Another brown pelican gliding along declivity currents on the Twin Spans of I-10.

DYNAMIC SOARING

Burton, R. Bird Flight. 1990. An illustrated study of birds' aerial mastery. Facts on File, NY.

Dynamic soaring is a technique wherein the bird faces into the wind and is lifted, then glides downwind until it gets too low, then faces the wind again - another excellent energy saving strategy. This is VERY obvious in the open seas where most birds use this constantly – especially albatrosses and other open sea birds.

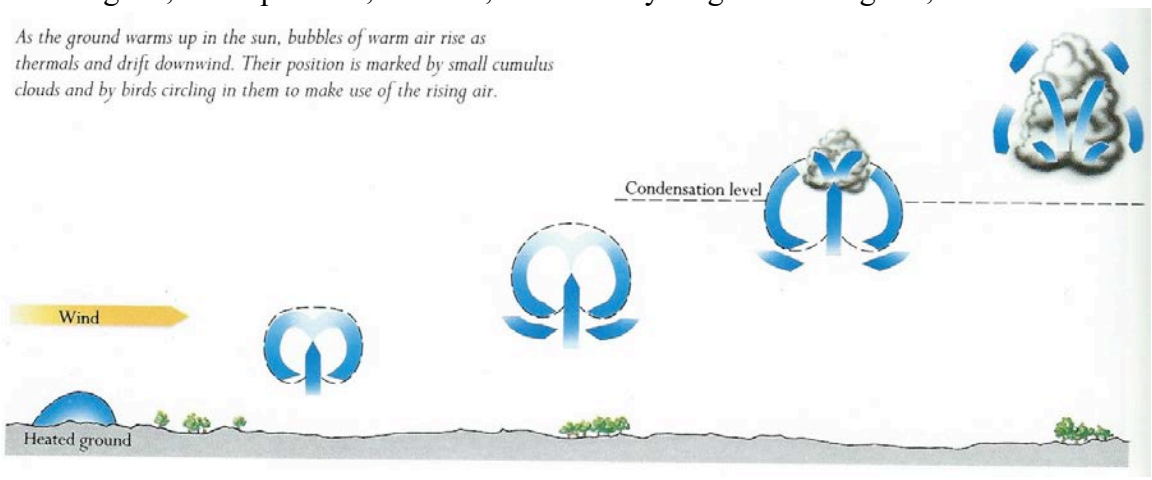
RIDING THERMALS

Birds are experts at finding any element of air that effortlessly gives them lift. One often sees "kettles" of birds drifting aloft in circles that are moving through lateral space. Stand and watch and the spiral of birds is obviously moving. And, at some point, their organized gliding and movement will end and all the birds will begin flapping their wings and flying until they mysteriously begin to glide in circles again. What is happening?

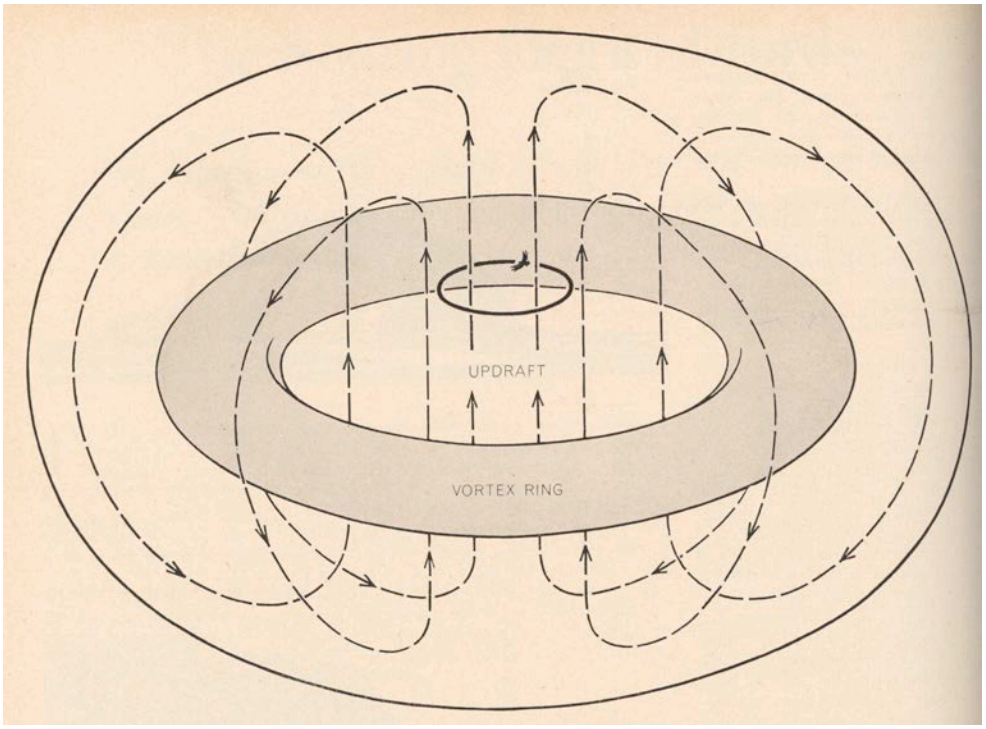
The answer is simple. In warm months air heats when sunlight is reflected off some surfaces. The heated air rises. As it does, it often becomes a doughnut-shaped circulation of air - called a ***thermal shell*** - that is shaped somewhat like a mushroom with a circulating doughnut on top of the "stalk" of rising air. When and if the reflective surface no longer supplies rising air to the thermal shell, it may break free and float off in

the winds. If a group of birds are using the thermal shell to lazily glide in circles, then they drift away with the invisible doughnut until it no longer circulates and ceases to provide lift. That is when the birds begin to actively fly about searching for another thermal shell of lift.

All soaring birds may do this behavior, and common species seen doing so over our coast include gulls, white pelicans, vultures, occasionally magnificent frigates, and more.



The development of thermal shells; the "bubbles" of this figure are actually vortex rings – see figure below (Burton, R. Bird Flight. 1990. An illustrated study of birds' aerial mastery. Facts on File, NY).



The vortex ring (or torus) is more like a doughnut, with air circulating within to structure that gives birds lift (see the bird near the center); as the vortex ring eventually weakens, the birds glide until they find a fresh donut to ride (from Cone, 1962, The Soaring Flight of Birds, Sci. Amer. 206: 132).

COMPRESSION LIFT IN FLIGHT OVER WATER

Brown pelican using compression lift. Photo by Thomas Finnie.

One of the most fascinating areas of study is the realm of functional morphology, especially as it relates to animal behavior and adaptive physiology.

That may seem like a mouthful, but to a naturalist trying to understand why animals do what they do and how they do it, it is a font of discovery that usually results in saying, "Now that is really cool!"

If you love watching brown pelicans flying over water in and about America's WETLAND (coastal Louisiana), you've no doubt noticed how often they zip along near the surface. This may occur over smooth water surfaces, or in troughs between waves breaking toward a beach.

Most people who sit on a beach and watch pelicans glide by don't notice the relationship. Why would they? The pelicans are simply birds flying by, and sometimes they are near the water and sometimes they fly higher.

As one better understands animal activities in their natural habitats, it may become apparent that everything they do has a purpose. It is fun to see them do something and ask, "Why are they doing that? Might they be gaining an advantage?"

Brown pelicans are large birds, having a tip-to-tip wingspan of over seven feet and weighing 10 lbs. To any animal, efficiency of movement has physiological value. Flying more efficiently saves energy, thus requiring less food and less time feeding.

In fact, brown pelicans fly close to the water, as do other birds, to take advantage of a concept of physics called *the ground effect*, or sometimes *compression gliding*.

Ground effect comes into play when the bird is within its full wingspan of the surface of the water. As the bird nears the surface, the efficiency increases. It has everything to do with the relative length of the wings, and it is commonly seen in high aspect ratio winged birds (those with long, narrow wings) like skimmers, petrels, albatrosses, shearwaters, cormorants, and others.

Basically, as the bird glides over the water the air is "funneled" between the lower surfaces of the wings and the upper surface of the water. The air is thereby compressed and functions like a cushion of dense air that supports the bird aloft, in addition to the normal aerodynamic forces at work. As the bird nears the water surface, the ground effect becomes stronger. It is also more efficient over calm (flat) water.

This aerodynamic phenomenon is very important to aerial wildlife, and it has been mimicked by humans. During World War II, long-range bombers often flew close to the water's surface to conserve fuel. Inexperienced pilots coming in for a landing are often surprised as they gradually drop down as expected, then get within half a wingspan to the ground and are suddenly buoyed upward by the ground effect. It even happens in commercial aircraft. Pay close attention when you are on a landing plane and you may feel an unexpected buoyant sensation just before touchdown.

Pelicans prefer to glide along the surface but must occasionally gain a bit of altitude in order to flap their wings so they can gain speed and resume their glide. Yes, we may often see the relatively large pelicans flying much higher above the water, but we don't see the physiological tax they pay for escaping the ground effect.

The ground effect also comes into action when the large birds want to land. Pilots often joke that successfully landing an airplane is just a pilot-controlled crash. For the pelican, the ground effect allows the bird to slow its flight while remaining aloft until its landing gear (feet) touch down.

In case you wondered, the ground effect works as well over land as it does over water, but over land there is a higher probability of encountering a rock, tree, cliff, building, telephone pole, or the like. Of course, at sea there are buoys and boats!

Bird flight is complex and fascinating. Maybe that is why books and reams of articles have been written about it, and we learn more every day.

A FEW WORDS ABOUT THE OPEN GULF OF MEXICO:

Be sure to see the discussion of the Louisiana Offshore Oil Port (LOOP) above.

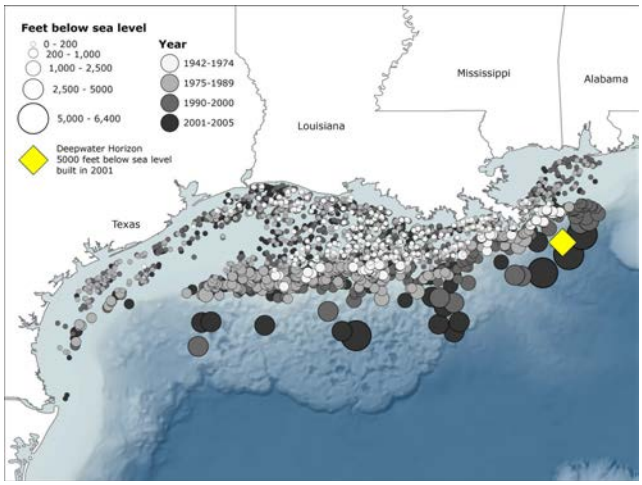
In many places and to many people, open marine water is just that – a flat surface of water (excepting storms!) that reaches the horizon. Coastal Louisiana is very different in that it is what we call a working coast. It is alive with resources such as fisheries, oil and

gas, shipping, a huge offshore oil service industry, constant flights overhead taking workers to distant platforms and rigs, and much more.

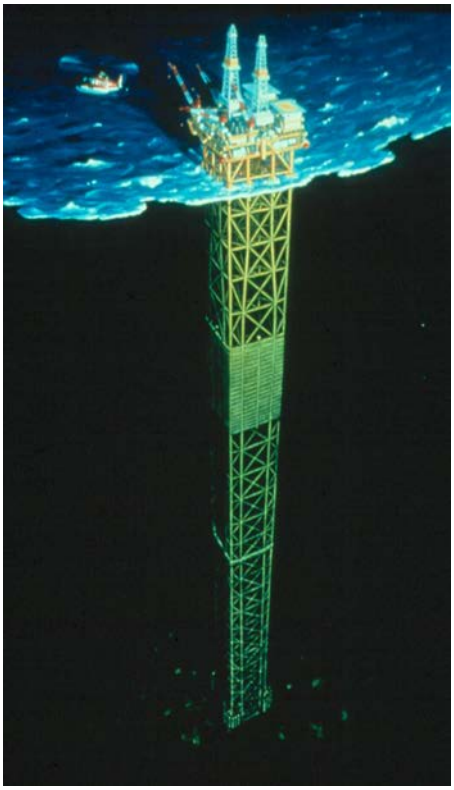
BP Thunderhorse (L) and Shell Ursa platforms (R).

You must know the meaning of oil rigs and platforms. In the strict sense, a rig is an actively drilling facility, searching for oil and gas. A platform is a facility that is actively handling found oil and gas – moving it from underground into the conveyance system – offshore that is typically into pipelines that normally end up at a refinery onshore. In today's world, many of the very large offshore facilities combine drilling and production, so they are both rigs and platforms – but they are called production platforms.

There are presently (2019) about 1,850 oil/gas structures actively working the Gulf of Mexico off Louisiana. The vast majority of those are on the continental shelf, but virtually all expansion of oil and gas in the Gulf of Mexico is now off the shelf, in thousands of feet of water. The scale of the platforms is unbelievable, and the more sophisticated newer versions are beehives of activity, employing hundreds of highly technical workers.



Production platforms in the Gulf of Mexico.



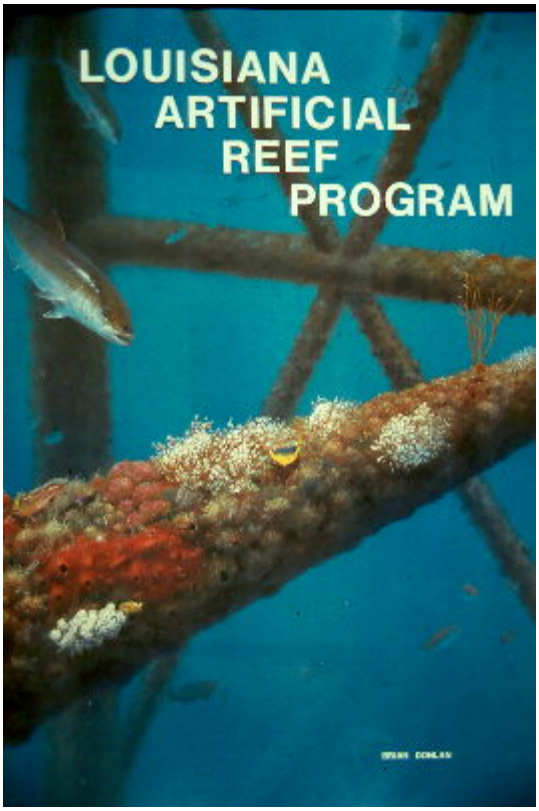
Shell Oil Company platform.

Shell platform superimposed on New Orleans to give a sense of scale.

THE ENVIRONMENTAL VALUE OF OIL AND GAS RIGS AND PLATFORMS IN THE GULF.

Of the 1400+ oil and gas related structures in the Gulf of Mexico, 90% are within Louisiana waters. Since the first offshore platform was constructed in 1947 in Ship Shoal (about 12 miles south of Terrebonne Parish), they have been very important in two ways: 1) they recently supplied our nation with 18% of its oil and gas requirements, and 2) they serve as hard structures (in an otherwise soft bottom environment) for reef species to

grow (barnacles, corals, and all sorts of other reef animals). The latter, in conjunction with the cover provided, make the structures ideal habitat for all sorts of commercial and sport fish, especially snapper, grouper, cobia, amberjack, and various mackerels.



Since the structures have such value to fisheries, their removal caused concern. Senator John Breaux sponsored the **National Fishing Enhancement Act of 1984** to encourage coastal states to establish artificial reef programs. This was followed by the **Louisiana Fishing Enhancement Act of 1986 (LFEA)** which set the standards for our state's program. It formed the **Louisiana Artificial Reef Development Council** to give oversight to the program and the **Louisiana Artificial Reef Trust Fund (LARTF)** to support it. Louisiana Department of Wildlife & Fisheries, in cooperation with the Louisiana Geological Survey and the Coastal Studies Institute (of LSU's Center for Energy and Environmental Research), administers the program.

It has been the responsibility of the oil and gas company to remove the structure within one year of when it completed production. This was normally done by taking the structure to land and dismantling it - a very expensive endeavor. LFEA gave them a new option. They could now scuttle the structures, thus saving large sums of money and retaining the resource. Each company must pay LARTF an amount equal to one half its savings realized by reefing the structure rather than dismantling it.

The deck (the operations part one sees above water) must be removed and moved to shore where it is environmentally safely dismantled so it does not pollute offshore waters. The platform jacket (the portions of the platform extending from the seafloor to the bottom of the deck) is the part that is reefed – dropped below safe levels to rest on the bottom.

Of course, there are controls. There are prohibited areas such as shipping lanes, known commercial fishing grounds, shallow waters, and the like. There are 77 approved sites where this activity can occur, and as of 2019, 402 structures have been placed by the program. The decision of the fate of each structure is taken seriously and not all will qualify for use in the artificial reef program.

The beauty of the program is that everyone wins: we keep the reef resources, industry saves lots of money, and our program is funded without tapping the state's general fund.

Commercial fisheries along the coast are very important to the economy and culture of coastal Louisiana. During shrimp season, as an example, boats are trawling 24/7. It is fun to sit on a camp porch on a clear evening and view the lighted rigs/platforms and the shrimp boats plying their trade – back and forth, all night long.

Shrimper working just offshore in Grand Isle. Photo by Steve Wulff.

FOR MORE STORIES ON NATURE IN COASTAL LOUISIANA - *NATURE NOTES* – A PERIODIC TREATISE ON NATURAL HISTORY TOPICS FOCUSED ON SOUTHEAST LOUISIANA by Bob Thomas.

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ACKNOWLEDGMENTS. Many fine people have contributed to this story. The following have offered many facts and interpretations: Kerry St. Pé, Jean Landry, Ted Falgout, Chet Chiasson, Windell Curole, Julia Lightner, Wayne Keller, Andrew Barron, Matt Benoit, Davie Breaux, the late Reggie Bagala, Terry Coleman, Michael Massimi, Kevin McCaffrey, and many more. For the new birding maps, thanks to the good work of Jill Andrew (The Nature Conservancy map production), Jean Landry, David Muth, Mark Meunier, and other birders. I appreciate Aimée K. Thomas's edits. Photos are mine unless credit is shown.

REQUEST: This is a "living document" in that changes will occur over time, and I intend to keep it current. Please feel free to send comments, corrections, other interpretations, additional info to me at rathomas@loyno.edu.

APPENDICES

Appendix I. FLORAL & FAUNAL CHECKLISTS: Elmer's Island

The following floral and faunal checklists include species we normally see on our trips. They are not meant to cover the entire community of plants and animals.
NOTE: Remember that scientific names change (in an orderly, yet frustrating manor), so use of books and other reference materials will undoubtedly expose naturalists to names that are different than those we use below. If you simply google names, you will find synonyms and names that are most current. Our program uses the most recently accepted names, but new publications may change what we know today. We follow plants.usda.gov.

SWASH ZONE PLANTS (also in the open Gulf):
Broad-toothed gulfweed, *Sargassum fluitans* – short-stalked, broader leaves; pods not tipped with spikes or small leaves; bladders smooth. - native
Common gulfweed, *Sargassum natans* – long-stalked, narrow leaves; pods usually tipped with spikes or small leaves; bladders with spur-tips. - native

PLANTS: DUNES
Saltwort, *Batis maritima* - native (in Jefferson and St. Bernard Parishes)
Gulf searocket, *Cakile edentula* - native (in Plaquemines Parish) – 3 species occur in Louisiana
Hedge bindweed, *Calystegia sepium* – native and introduced
Sandbur, *Cenchrus* spp. – native and introduced
Gulf croton, *Croton punctatus* - native
Gulf Coast swallowwort, *Cynanchum angustifolium* - native
Red lovegrass, *Eragrostis secundiflora* - native
Corpus Christi fleabane, *Erigeron procumbens* - native
Marsh fimbry, *Fimbristylis castanea* - native
Seaside heliotrope, *Heliotropium curassavicum* - native
Coastal Pennywort, *Hydrocotyle bonariensis* - native
Beach morning glory, *Ipomoea imperati* (formerly *I. stolonifera*) – native (cosmopolitan)
Railroad vine, goat's foot, *Ipomoea pes-caprae* – native (cosmopolitan)
Beach evening primrose, *Oenothera drummondii* - native
Sand rose gentian, *Sabatia arenicola* - native
Rose of Plymoth, *Sabatia stellaris* - native
Dwarf glasswort, *Salicornia bigelovii* – native – green, grows like a small tree from a single root
Virginia glasswort, *Salicornia depressa* – native – grows as a mat and roots at nodes, green, yellow, and red colors common

Common threesquare, *Schoenoplectus pungens* - native (in Jefferson and St. Bernard parishes)
Sea purslane, *Sesuvium portulacastrum* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native
Seashore dropseed, *Sporobolus virginicus* – native
Amberique-bean, *Strophostyles helvola* - native
Annual seepweed, *Suaeda linearis* – native
Sea oats, *Uniola paniculata* – introduced on Elmer's Island; native to the east

PLANTS: ADAPTED TO LIVING IN THE PRESENCE OF SALT
Black mangrove, *Avicennia germinans* - native
Saltwort, *Batis maritima* - native (in Jefferson and St. Bernard Parishes)
Gulf searocket, *Cakile geniculata* - native – 3 species of the genus occur in Louisiana
Salt grass, *Distichlis spicata* - native
Dwarf glasswort, *Salicornia bigelovii* – native – green, grows like a small tree from a single root
Virginia glasswort, *Salicornia depressa* – native – grows as a mat and roots at nodes, green, yellow, and red colors common
Sea purslane, *Sesuvium portulacastrum* - native
Saltmarsh cordgrass, *Spartina alterniflora* - native

PLANTS: SALT MARSH
Saltwort, *Batis maritima* - native (in Jefferson and St. Bernard Parishes)
Salt grass, *Distichlis spicata* - native
Black needlerush, *Juncus roemerianus* - native
Virginia glasswort, *Salicornia depressa* – native – grows as a mat and roots at nodes, green, yellow, and red colors common
Saltmarsh cordgrass , oystergrass, *Spartina alterniflora* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native

PLANTS: COASTAL MANGROVE-MARSH SHRUB LAND
Black mangrove, *Avicennia germinans* - native
Groundsel bush, *Baccharis halimifolia* - native
Saltwort, *Batis maritima* - native (in Jefferson and St. Bernard Parishes)
Sea ox-eye, *Borrichia frutescens* - native (in Jefferson and St. Bernard Parishes)
Salt grass, *Distichlis spicata* - native; beaches, intermediate/brackish marsh
Marsh elder, *Iva frutescens* - native
Dwarf glasswort, *Salicornia bigelovii* – native – green, grows like a small tree from a single root
Virginia glasswort, *Salicornia depressa* – native – grows as a mat and roots at nodes, green, yellow, and red colors common
Sea purslane, *Sesuvium portulacastrum* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native

PLANTS: BRACKISH MARSH

Coastal water hyssop, *Bacopa monnieri* - native
Sturdy bulrush, saltmarsh bulrush, leafy three-square, *Bolboschoenus (Schoenoplectus) robustus* – native
Salt grass, *Distichlis spicata* - native
Marsh morning glory, *Ipomoea sagittata* - native
Black needlerush, *Juncus roemerianus* - native
Widgeon grass, *Ruppia maritima* - native
Chairmaker's bulrush, three-cornered grass, *Schoenoplectus (Scirpus) americanus* (synonym – *Scirpus olneyi)* – native
Saltmarsh cordgrass, *Spartina alterniflora* - native
Big cordgrass, *Spartina cynosuroides* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native

PLANTS: COMMUNITY ASSOCIATED WITH RAISED OR DISTURBED AREAS

Meadow garlic, *Allium canadense* var. *mobilense* - native
Alligatorweed, *Alternanthera philoxeroides - introduced (South America), invasive (but a fun name to say out loud)*
Common dodder, Scaldweed, *Cuscuta gronovii* - native
Fragrant flatsedge, *Cyperus odoratus* - native
Clasping coneflower, *Dracopis amplexicaulis* - native
Rosemallow, *Hibiscus lasiocarpus* - native
Marsh mallow, *Kosteletzkya virginica* - native
Lantana, *Lantana camara* - there are many varieties - introduced
Lindheimer's beeblossum, *Oenothera lindheimeri* - native
Bitter panicgrass, *Panicum amarum* - native
Switch grass, *Panicum virgatum* - native
Seashore paspalum, *Paspalum vaginatum* - native
Common reed, roseau cane, *Phragmites australis* - native & introduced (cosmopolitan); freshwater, intermediate/brackish marsh (where salty, usually on land)
Camphor-weed, *Pluchea camphorata* - native
Southern dewberry, *Rubus trivialis* - native
Bulltongue, *Sagittaria lancifolia* - native
Chairmaker's bulrush, three-cornered grass, *Schoenoplectus (=Scirpus) americanus* - (synonym – *Scirpus olneyi)* – native
Rattlebush, *Sesbania drummondii* - native
Earleaf greenbriar, *Smilax auriculata* - native
Seaside goldenrod, *Solidago sempervirens* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native
Amberique-bean, wild bean, *Strophostyles helvola* – native – purple flower
Deer pea, *Vigna luteola* – native – yellow flower

Salt Marsh Fauna

Insects - butterflies
Giant southern white, *Acacia monuste* – native

Mollusks
Atlantic oyster, *Crassostrea virginica* - native
Ribbed mussel, *Geukensia demissa* - native
Hooked mussel, *Ischadium recurvum* - native
Saltmarsh periwinkle, *Littorina irrorata* - native
Olive nerite, *Neritina reclivata* - native
Coffee bean shell, *Melampus bidentatus* - native

Crustaceans
Gulf Stone crab, *Menippe adina* - native
Common mud crab, *Panopeus herbstii* - native
Estuarine mud crab, *Rithropanopeus harrisii* - native
Wood crab, *Sesarma cinereum* - native
Fiddler crab, *Uca spp.* - native

Subtidal and Intertidal Zone Fauna

Porifera
Boring sponge, *Cliona celata* - native

Cnidaria
Star coral, *Astrangia astreiformes* - native
Moon jellyfish, *Aurelia aurita* - native
Portugese man-of-war, *Physalia physalis* - native
By-the-wind-sailor, *Velella velella* - native

Ctenophora (Comb Jelly)
Sea walnut, *Beroe ovate* - native
Phosphorus jelly, *Mnemiopsis mccraydi* - native

Ectoprocts (Bryozoans)
Gulf weed bryozoan, *Jellyella tuberculata* – on *Sargassum* - native
Encrusting bryozoan, *Membranipora commensale* – mostly on shells(?) - native

Polychaeta
Plumed worm, *Diopatra cuprea* - native
Parchment worm, *Chaetopterus variopedatus* - native
Serpulid worm, *Hydroides dianthus* - native
Pile worm, *Neanthes succinea* - native

Mollusca – general
Shell hash – tiny shells or broken fragments that pile up on the beach swash line

Mollusca—Gastropoda

Common sundial, *Architectonica nobilis* - native
Lightning whelk, *Busycon contrarium* - native
Common nutmeg, *Cancellaria reticulata* - native
Purple storm snail, Janthina, *Janthina janthina* - native
Marsh periwinkle, *Littoraria irrorata* – native – common on nature trail at the Grand Isle State Park
Cloudy periwinkle, *Littoraria nebulosa* - native
Moon snail, *Neverita* (*Polinices) duplicata* - native
Lettered olive, *Oliva sayana* - native
Apple murex, *Phyllonotus pomum* - native
Oyster drill, *Stramonita* (*=Thais) haemastoma* - native
Florida fighting conch, *Strombus alatus* - native

Mollusca—Bivalvia
Transverse ark, *Anadara transversa* - native
Cross-barred venus, *Chione elevata* (formerly *cancellata*) - native
Imperial venus, *Chione latilirata* - native
American oyster, *Crassostrea virginica* - native
Angel wing, *Cyrtopleura costata* - native
Giant cockle, *Dinocardium robustum* - native
Oyster piddock, *Diplothyra curta* - native
Bean clam, coquina, *Donax variabilis* - native
Jackknife clam, *Ensis minor* - native
Blood ark, *Lunarca ovalis* - native
Constricted macoma, *Macoma constricta* - native
Southern quahog, *Mercenaria campechiensis* - native
Ponderous ark, *Noetia ponderosa* - native
False angel wing, *Petricola phaladiformis* - native
Common rangia, *Rangia cuneata* - native
Brown rangia, *Rangianella flexuosa* - native
Incongruous ark, *Scapharca brasiliana* - native
Stout razor clam, *Tagelus plebeius* - native

Crustacea
Speckled crab, *Arenaeus cribrarius* - native
Acorn barnacle, *Balanus sp.* - native
Ghost (mud) shrimp, *Callianassa jamaicense* - native
Generally burrowed. probably—*C. jamaicense louisianae*
Common ghost shrimp, *Callichirus islagrande* - native
Blue crab, *Callinectes sapidus* - native
Great land crab, *Cardiosoma guanhumi* – introduced by currents & nature
Gooseneck barnacle, *Lepas anatifera* - native
Estuarine ghost shrimp, *Lepidophthalmus louisianensis* - native
Ghost crab, *Ocypode quadrata* - native
Grass shrimp, *Palaemonetes vulgaris* - native

Marsh Vertebrates & Other Animals observed

REPTILES: SNAKES
Saltmarsh watersnake, *Nerodia clarkii* - native

REPTILES: TURTLES
Diamond-backed terrapin, *Malaclemys terrapin* native
There are five seaturtles in the Gulf of Mexico – all native:

- Loggerhead
- Green
- Kemp's ridley
- Hawksbill
- Leatherback.

All of them are on the protected list; none of them nest in Louisiana waters. The threatened Loggerhead seaturtle (*Caretta caretta***)** would be the most expected to be seen on Elmer's Island, with Kemp's ridley seaturtle (*Lepidochelys kempi*) commonly working the lagoons and beach fronts.

MAMMALS: TERRESTRIAL
Coyote, *Canis latrans* - native
Feral hog, *Sus scrofa* – introduced, invasive

MAMMALS: MARINE (Gulf of Mexico, lagoons, bays)
West Indian Manatee, *Trichechus manatus* - may appear in late spring and summer
Bottlenosed dolphin, *Tursiops truncates* - native

LAGOON CRITTERS:
Mollusks - bivalves:
Atlantic oyster, *Crassostrea virginica* - native

Birds – all native - THIS IS PART OF THE MAJOR MIGRATION FLYWAY. BEST TO VISIT eBird.com to see the lists for this region. Below are a few commonly seen birds.
Reddish egret
Roseate spoonbill
Tricolor (Louisiana) heron
Willet
Plovers (piping, Wilson's, black-bellied, semipalmated)
Gulls (laughing, herring, ringbill)
Sanderling, rudy turnstones, western sandpiper, dunlin, red knot
Terns (royal, least, sandwich, Caspian)

Appendix II. FLORAL & FAUNAL CHECKLISTS: Grand Isle

MARITIME FORESTS & TRAILS
PLANTS:
Oppositeleaf spotflower, *Acmella oppositifolia* - native
White snakeroot, *Ageratina altissima (Eupatorium rugosum)* – native – see 11-2017
Herb of Grace, water hyssop, *Bacopa monnieri* – native, cosmopolitan
Hedge bindweed, *Calystegia sepium* - native and introduced
Southern hackberry, Sugarberry, *Celtis laevigata* – native
Giant thistle, *Cirsium horridulum* – native
Carolina coralbead, *Cocculus carolinus* - native
Elephant ear, *Colocasia esculenta* – introduced
Blue mistflower, *Conoclinium (Eupatorium) coelestinum* – native, fall powder blue flowers – blooming 11-2017
Swamp lily, *Crinum americanum* – native
Wild yam, air potato, *Dioscorea bulbifera* – introduced, invasive
Corpus Christi fleabane, *Erigeron procumbens* - native
Crybabytree, *Erythrina crista-galli* - introduced
Indian blanket, *Gaillardia pulchella* – native
Common sunflower, *Helianthus annus* - native
Northern spiderlily, *Hymenocallis occidentalis* – native
Marsh mallow, *Kosteletzkya virginica* – native
Texas bluebonnet, *Lupinus texensis* – native to U.S. (introduced here)
Mazapan, sleeping hibiscus – *Malvaviscus penduliflorus* - introduced
Red mulberry, *Morus rubrum* – native – may be a hybrid form of mulberry throughout coastal Louisiana
Seabeach evening primrose, *Oenothera humifusa* – native
Yellowtop, *Packera glabella (=Senecio glabellus)* – native
Virginia creeper, *Parthenocissus quinquefolia* – native
Canary Island date palm, *Phoenix canariensis* - introduced
Turkey tangle frogfruit, *Phyla nodiflora* - native
Swamp smartweed, *Polygonum punctatum* – native
Live oak, *Quercus virginiana* – native
Hairy buttercup, *Ranunculus saardus* introduced
Cursed buttercup, *Ranunculus scleratus* - native
Curly dock, *Rumex crispus* - introduced
Swamp dock, *Rumex verticillatus* - native
Wild sugarcane, *Saccharum sponteneum* – introduced
Earleaf greenbriar, *Smilax auriculata* – native
Giant goldenrod, *Solidago altissima* – native (other list says Canada Goldenrod)
Seaside goldenrod, *Solidago sempervirens* – native
Tamarisk, salt cedar, *Tamarix* sp. – introduced
Poison ivy, *Toxicodendron radicans* - native

Chinese tallow, *Triadica sebifera* – introduced, invasive
Mexican fan palm, petticoat palm – *Washingtonia robusta* - introduced

BEACHES & STATE PARK
Saltwort, *Batis maritima* - native (in Jefferson and St. Bernard Parishes)
Gulf searocket, *Cakile edentula* - native (in Plaquemines Parish) – 3 species in Louisiana
Gulf croton, *Croton punctatus* - native
Marsh fimbry, *Fimbristylis castanea* - native
Seaside heliotrope, *Heliotropium curassavicum* - native
Coastal Pennywort, *Hydrocotyle bonariensis* - native
Beach morning glory, *Ipomoea imperati* (formerly *I. stolonifera*) – native (cosmopolitan)
Railroad vine, goat's foot, *Ipomoea pes-caprae* – native (cosmopolitan)
Beach evening primrose, *Oenothera drummondii* – native – large flower
Seabeach evening primrose, *Oenothera humifusa* – native – smaller flower than *O. drummondii*
Bitter panicgrass, *Panicum amarum* – native, but often planted on beaches
Common threesquare, *Schoenoplectus pungens* - native (in Jefferson and St. Bernard parishes)
Sea purslane, *Sesuvium portulacastrum* - native
Saltmeadow cordgrass, marshhay cordgrass, wiregrass, *Spartina patens* - native
Amberique-bean, *Strophostyles helvola* - native
Annual seepweed, *Suaeda linearis* – native

AMPHIBIANS: FROGS
Green treefrog, *Dryophytes (Hyla) cinereus* – native
Squirrel treefrog, *Dryophytes (Hyla) squirellus* – native
Eastern narrowmouthed toad, *Gastrophryne carolinensis* – native
Gulf coast toad, *Incilius nebulifer* – native

REPTILES: LIZARDS
Green anole, *Anolis carolinensis* – native – males possess a pink dewlap under chin
Slender glass lizard, *Ophisaurus attenuatus* - native

REPTILES: SNAKES
Black-masked racer, *Coluber constrictor latrunculus* - native
Saltmarsh watersnake, *Nerodia clarkii* - native

REPTILES: TURTLES
Diamond-backed terrapin, *Malaclemys terrapin* - native

BIRDS – all native – THIS IS PART OF THE MAJOR MIGRATION FLYWAY. BEST TO VISIT eBird.com to see the lists for this region. Below are a few commonly seen birds.
Black skimmers
Lark sparrow

Shorebirds
Ruddy turnstone
Sanderling
Willet

Gulls (herring, laughing, ringbill)

Pelicans
Brown pelican
White pelican

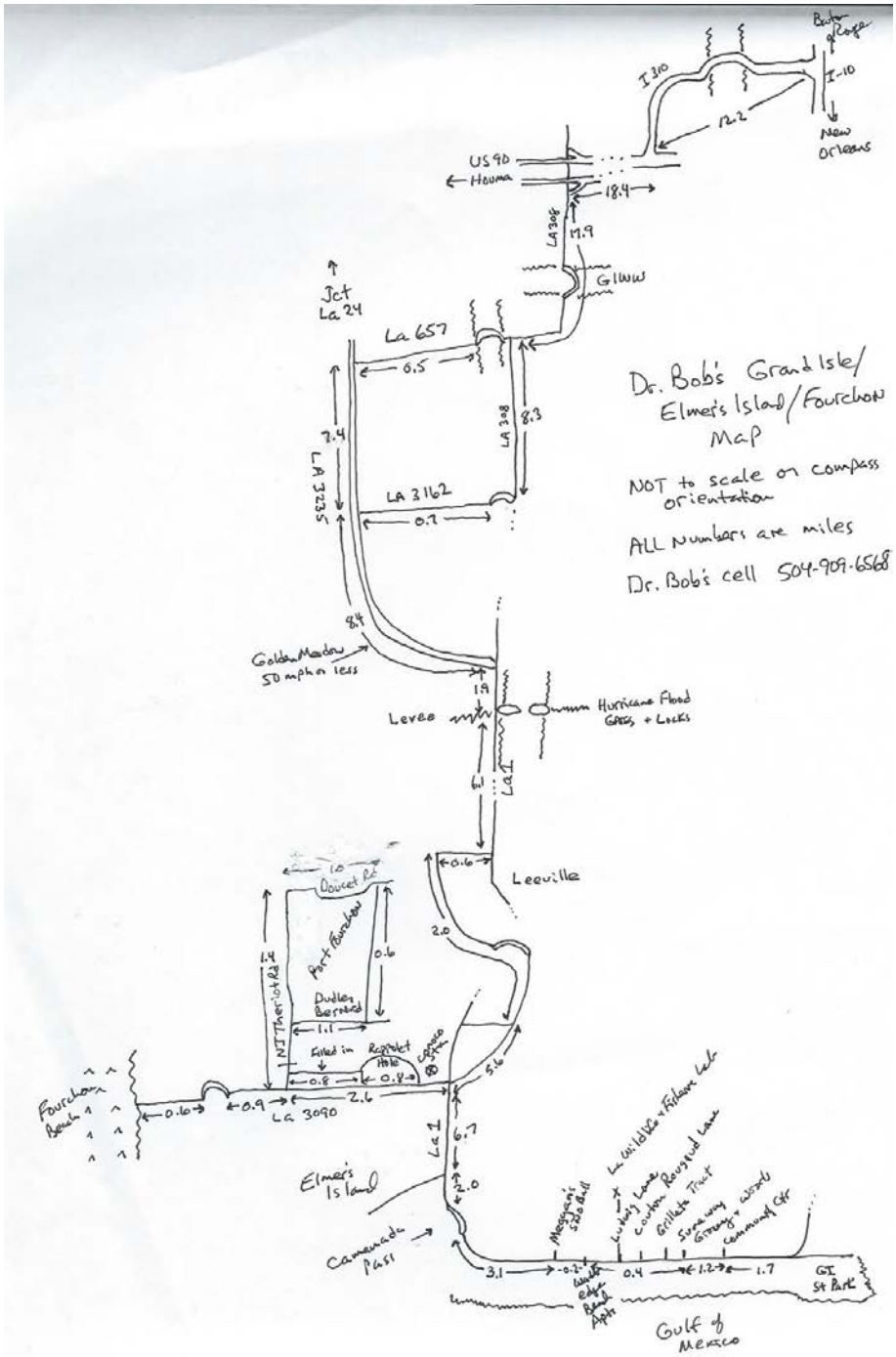
Appendix III. Sea Shells of Elmer's Island and Grande Isle, Louisiana (Shells collected from 2013 through 2018 during LMNGNO Workshops) – compiled by Dr. Robert Rogers

Pelecypoda (Bivalves)
- Arcidae
  - Transverse ark, *Anadara transversa* - native
  - Blood ark, *Lunarca ovalis* - native
  - Ponderous ark, *Noetia ponderosa* - native
  - Incongrous ark, *Scapharca brasiliana* - native
- Mytilidae
  - Atlantic ribbed mussel, *Geukensia demissus* - native
  - Hooked mussel, *Ischadium recurvum* - native
- Pectinidae
  - Atlantic calico scallop, *Argopecten gibbus* - native
- Ostreidae
  - American oyster, *Crassostrea virginica* - native
- Cardidae
  - Giant Atlantic cockle, *Dinocardium robustum* - native
- Mactridae
  - Fragile mactra clam, *Mactra fragilis* - native
  - Atlantic rangia, *Rangia cuneate* - native
  - Brown rangia, *Rangianella flexuosa* - native
- Tellinidae
  - Constricted macoma, *Macoma constricta* - native
- Donacidae
  - Variable coquina, *Donax variabilis* - native
- Anomidae
  - Jingle shell, *Anomia simplex* - native
- Plicatulidae
  - Atlantic kitten's paw, *Plicatula gibbosa* - native
- Solecuridae
  - Channeled duck clam, *Raeta plicatella* - native
  - Stout tagelus clam, *Tagelus plebeius* - native
- Pharidae
  - Minor jackknife clam, *Ensis minor* - native
- Pholadidae
  - Angel wing, *Cyrtopleura costata* - native
  - Oyster piddock, *Diplothyra smithii* - native
  - Wedge piddock, *Martesia cuneiforms* - native
  - False angel wing, *Petricola pholadiformis* - native
- Veneridae (Venus clams)
  - Cross-barred venus, *Chione elevata* - native
  - Imperial venus clam, *Chione latilerata* - native

Lady-in-waiting venus clam, *Chione intapurpurea* - native
Disk dosinia, *Dosinia discus* - native
Southern Quahog, *Mercenaria campechiensis* - native
Teredinidae
Bartsch's shipworm, *Teredo bartschi* - native

Gastropoda (Snails, Whelks, Conchs)
Neritidae
Olive nerite, *Neritina usnea* - native
Littorinidae
Marsh periwinkle, *Littorina irrorata* - native
Strombidae
Florida Fighting conch, *Strombus alatus* - native
Calyptraeidae
Eastern white slippershell, *Crepidula plana* - native
Naticidae
Shark eye, *Neverita duplicata* - native
Buccinidae
Cancellate cantharus, *Cantharus cancellarius* - native
Cassididae
Scotch bonnet, *Phalium granulatum* - native
Personidae
Atlantic distorsio, *Distorsio clathrata* - native
Conidae
Florida conch, *Conus floridanus* - native
Terebridae
American augur, *Terebra dislocata* - native
Architectonidae
Common sundial, *Architectonica nobilis* - native
Fasciolaridae
Banded tulip shell, *Fasciolaria lilium* - native
Horse conch, *Triplofusus giganteus* - native
Melongenidae
Shouldered pearwhelk, *Busycotypus plagosus* - native
Lightning whelk, *Busycon pulleyi* - native
Muricidae
Giant eastern murex, *Hetaplex fulvescens* - native
Apple murex, *Phyllonotus pomum* - native
Oyster drill, *Stramonita haemostomum* - native
Olividae
Lettered olive, *Oliva sayana* - native
Ellobiidae
Coffee bean snail, *Melampus bidentatus* - native

Appendix IV. Hand-drawn map, with mileages, from Greater New Orleans and U.S. 90.



NOTE: AT THIS WRITING (February 2022), THE BRIDGE BETWEEN PORT FOURCHON AND FOURCHON BEACH IS NOT OPEN.

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