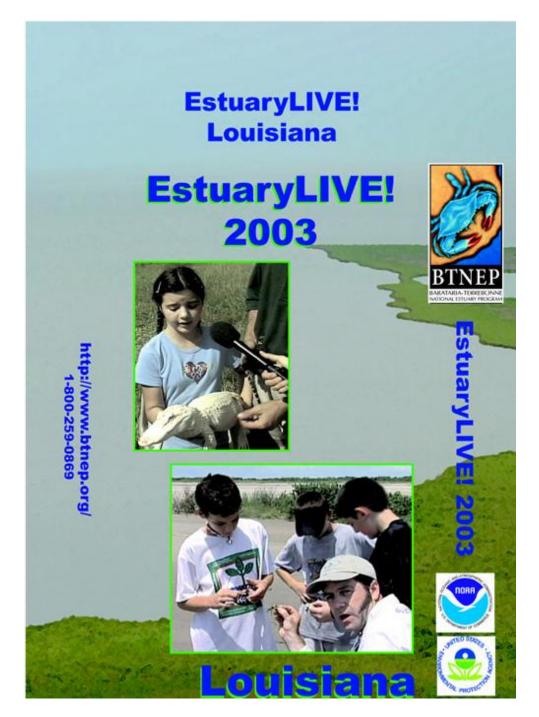
EstuaryLIVE!

Teachers Guide



EstuaryLIVE!

This curriculum includes a variety of activities to support the national estuary live broadcast and additional pages specifically for the Barataria Terrebonne program. Funding for the activates developed was provided by The National Oceanic & Space Administration. Activates were developed by Dr. Pam Blanchard (LSU Curriculum and Instruction) and Dianne Lindstedt (Louisiana Sea Grant College Program).

EstuaryLIVE! is an interactive virtual field trip accessible via the internet for classrooms around the country. Students have the opportunity to participate with questions for scientists and other experts as we explore the former hideout of Jean Lafitte the pirate. We will investigate the rich bounty of shrimp, redfish, crabs and oysters, offshore oil rigs, pelicans and other resident and migratory birds and learn of Barataria-Terrebonne's importance to the nation. Students will learn about the levees that protect these fragile wetlands and why this national treasure, the Barataria-Terrebonne National Estuary is "the fastest disappearing landmass in the world".

To access the video portion of the EstuaryLIVE! Curriculum, visit the educator's portal located on the Barataria-Terrebonne National Estuary Program's website at http://www.btnep.org.

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The Barataria-Terrebonne National Estuary

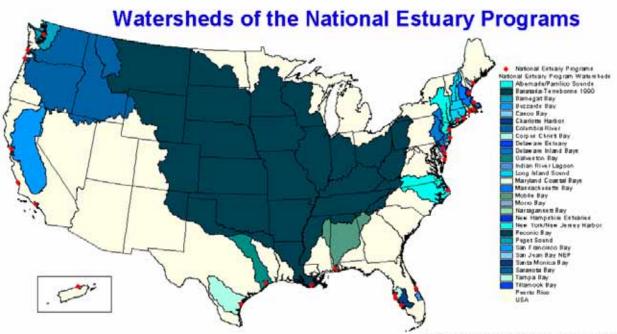


Estuary LIVE 2003 - A Visit to the Barataria-Terrebonne National Estuary

A Picture is Worth a Thousand Words: Watersheds of the National Estuary Program

Estuaries are places where rivers meet the sea. Estuaries are critical to the health of coastal environments and to our enjoyment of them. The National Estuary Program currently contains 28 estuaries considered to be important to our nation. The Environmental Protection Agency, which is in charge of the National Estuary Program, works with these particular estuaries to protect public water supplies as well as to protect and propagate a balanced, indigenous population of shellfish, fish, and wildlife.





U.S. Environmental Protection Agency, 1999

The map above shows the distribution and size of the watersheds of the 28 National Estuaries.

- Which estuary program manages the largest watershed?
- What major river systems are within the watershed of this large estuary?
- How are all of these river systems connected to this particular estuary?
- Look at the Barataria-Terrebonne National Estuary website, <u>http://www.btnep.org</u>. The left-hand column at the top of the page lists the five most important concerns within the Barataria-Terrebonne National Estuary. Pick one that interests you and find out what type of projects are being conducted to address this concern within the estuary.
- Can you think of any other projects that could be done to address these concerns?

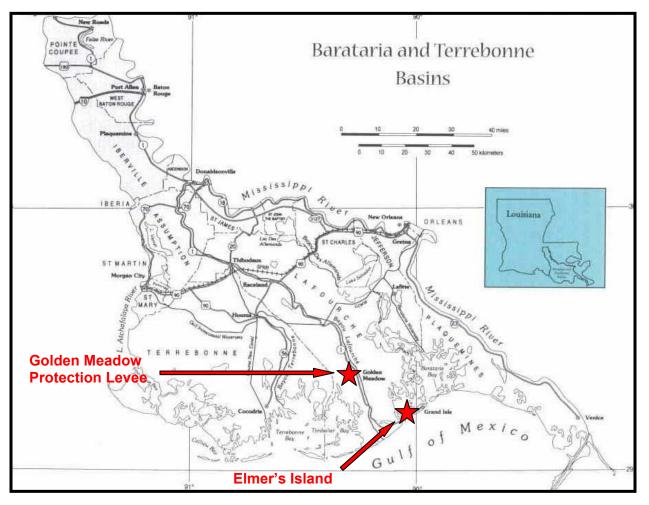


Estuary LIVE 2003 - A Visit to the Barataria-Terrebonne National Estuary

A Picture is Worth a Thousand Words: Location Map of BTNE Estuary LIVE

Below is a map of the Barataria-Terrebonne Estuary. The arrows point to two Estuary LIVE sites in the Barataria-Terrebonne National Estuary.

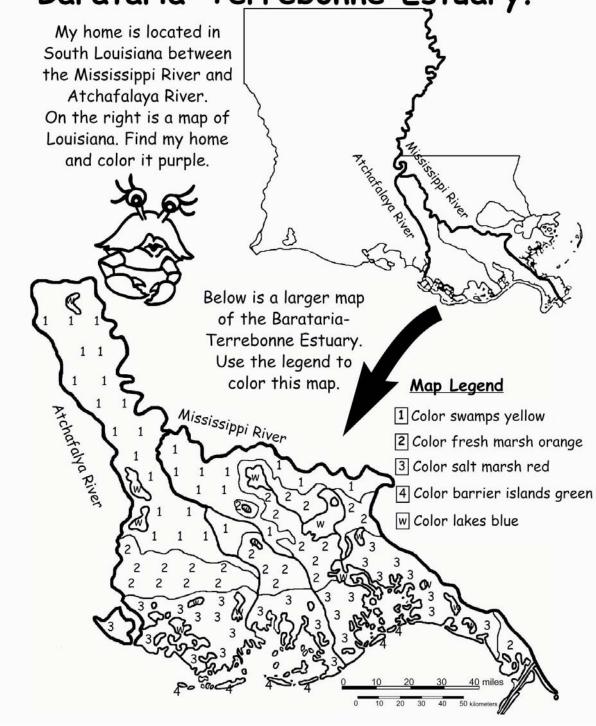
- Write directions from your home or school using major highways to get to the Estuary LIVE broadcast sites.
- Estimate how long it would take to drive to the Estuary LIVE 2003 site from your home or school, if the speed limit was posted at 60 miles per hour the entire route.





Clawdette, Where Is The Barataria-Te<u>rrebonne Estuary</u>?

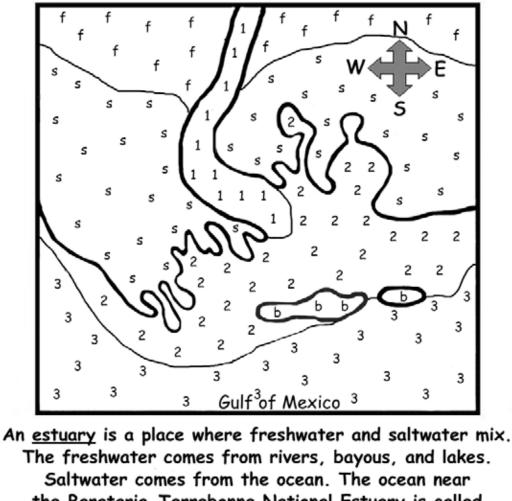
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Taken from SALT MARSH HABITAT OF THE BARATARIA=TERREBONNE ESTUARY. Downloadable for free from the Barataria-Terrebonne National Estuary website at: <u>http://www.btnep.org/</u>







the Barataria-Terrebonne National Estuary is called the Gulf of Mexico.

1 Color freshwater yellow	f Color fresh marsh orange
2 Color estuary water green	s Color salt marsh red
3 Color saltwater blue	b Color barrier islands brown

Taken from SALT MARSH HABITAT OF THE BARATARIA=TERREBONNE ESTUARY. Downloadable for free from the Barataria-Terrebonne National Estuary website at: <u>http://www.btnep.org/</u>



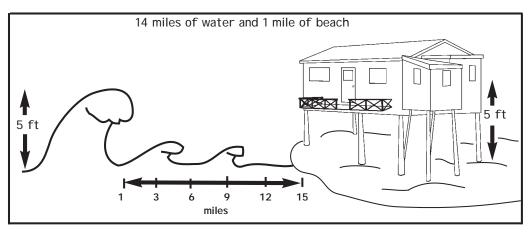
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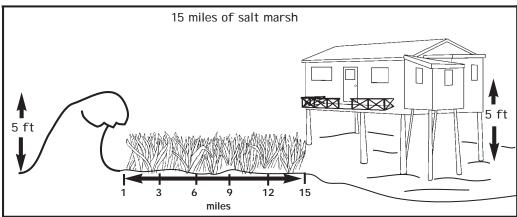
The Spongy Marsh

Salt marshes and other wetlands act like a sponge to absorb water. To prevent flooding, wetlands often absorb rain and waves of water brought in by storms.

For every 3 miles of marsh, flooding from storms is reduced by 1 foot.

There is a hurricane heading straight toward two camps below. The winds from the hurricane are pushing a wall of water 5 feet high. Below, draw where the water would hit each camp.





Taken from SALT MARSH HABITAT OF THE BARATARIA=TERREBONNE ESTUARY. Downloadable for free from the Barataria-Terrebonne National Estuary website at: <u>http://www.btnep.org/</u>

Flooding and Flood Protection



Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary A Picture is Worth a Thousand Words:

Where Do Black Mangroves Grow Best?

Sometimes scientists must use their power of observation to help solve problems and answer questions. Observations, coupled with research, can help answer many important questions and solve many problems.

In the photograph below, you see students from Montegut Middle School planting **black mangrove** seedlings along the back canal at Elmer's Island as part of the Coastal Roots Project. These black mangroves are tough plants that help stabilize the sand and soil in which they grow. One of the things the Coastal Roots Project wants to know is where to plant black mangrove seedlings so that the most seedlings will survive.



Read about black mangrove plants at the Coastal Roots Project website: <u>http://www.lamer.lsu.edu/projects/coastalroots/pdf/Learning_about_black_mangrove.pdf</u>

Your job is to **propose a strategy or experiment to identify the best location** (relationship to tides, nearness to other plants, nearness to water, etc.) for students to plant black mangrove seedlings. Several of the plants have been circled in the picture so that you can tell where they've been planted.

- What kinds of information would you need to know in order to make a recommendation of where the black mangrove plants should be planted?
- Based on your research and the photo above, what experiment would you recommend to identify the best location in which to plant black mangrove seedlings?





A Picture is Worth a Thousand Words: Packing It On: The Width of Levees

Sometimes scientists must use their power of observation to help solve problems and answer questions. Observations, coupled with research, can help answer many important questions and solve many problems.

In the photograph below, you see a dredge barge in the process of dumping scoops of clay and sand from the waterway immediately in front of the Golden Meadow Hurricane Protection Levee that will be featured in *Estuary LIVE 2003*. The photo was taken in May 2001. Adding additional material to the top of the levee was necessary because the height of the levee prior to the "recapping" was not high enough to protect the residents on the other side of the levee from hurricane storm surges.



- What are some things that you can observe about the recapped levee in this photo? (shape, size, plants, etc.)
- The above photo was taken between the cities of Galliano and Golden Meadow, on the east side of the Hurricane Protection Levee system. Find this location on the map of the Larose to Golden Meadow Hurricane Protection Project (red start on map at upper right). What is the height of the levee system at this location?

Levee engineers use a formula to determine how wide a levee needs to be built based on the height the levee needs to be. The formula is

Levee Height X 7 = Width of Levee Base.

Based on this height of the Golden Meadow Levee information you have from the map, what should the width of the levee be at this point?

• Why do you suppose the levee must be so much wider than it is tall?

Reference:

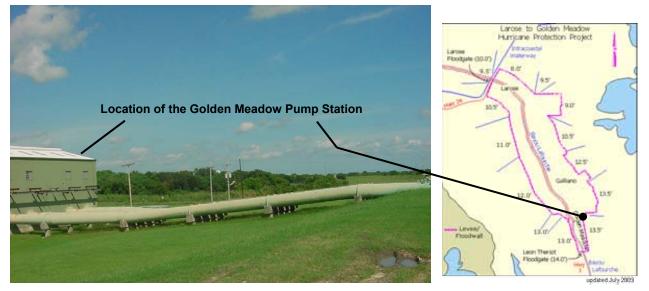
U.S. Army Corps of Engineers, *Larose to Golden Meadow Hurricane Protection Project Map*, accessed August 6, 2003, <u>http://www.mvn.usace.army.mil/pao/response/Larose.asp</u>.



A Picture is Worth a Thousand Words: Keeping Up With the Surge!

Most populated areas within the Barataria-Terrebonne estuary are protected against hurricane storm surges by levees. To prevent flooding, runoff from rural and agricultural areas is collected in a borrow canal that is located just inside the levee system. Storm runoff waters are pumped over the levee system into adjacent wetland areas by a series of stormwater pump stations. Over 250 pump stations operate to keep the populated areas within the Barataria-Terrebonne estuary dry. These pump stations discharge stormwater into large, ponded areas in the surrounding coastal marshes and then into a system of human-made canals to ensure that stormwater is moved away from the levee area as quickly as possible. This redirected stormwater flows directly to high-salinity bays, often through some of Louisiana's prime oyster growing waters. Redirecting discharges so that they are retained in adjacent wetlands may (1) help to maintain lower local salinities, (2) provide a source of sediments to subsiding wetland areas, and (3) support plant growth.

In the photograph below, you see the Golden Meadow pump station that is featured in *Estuary LIVE 2003*. The pump station has five large pumps that carry water from within the hurricane protection levee system and empty it out into the surrounding coastal marshes.



The five pumps at the Golden Meadow Pump Station #1 can pump out a total of 235,000 gallons of water per minute from within the levee system. These pumps are turned on during large thunderstorms, tropical storms and hurricanes.

Let's say that a big thunderstorm came along and the pumps at Golden Meadow Pump Station #1 had to be turned on for 15 minutes. How many gallons of water can Golden Meadow Pump Station #1 remove from within the levee system in 15 minutes? That's a lot of water! But how much water is it really?

Let's use a football field to help us visualize how much water that really is! A regulation football field is 300 feet long (goal line to goal line) and 160 feet wide. It takes about 7.5 gallons of water to fill up one cubic foot.

1 cubic foot ≈ 7.5 gallons

- Step 1. Figure out how many cubic feet of water was pumped out of the levee system in 15 minutes. To do this, divide the total amount of water pumped out (in gallons) by 7.5 gallons/cubic foot. This will give the total number of cubic feet that the water will occupy.
- Step 2. Figure out how many cubic feet of water a football field can hold if the water was one foot deep across the whole field from goal line to goal line. To do this, multiply the length of the football field by the width of the football field by the depth of the football field.

Step 3. Figure out how deep the water will stand on the football field. To do this take your answer from Step 1 and divide it by your answer from Step 2. Your answer will tell you how high the water will stand on the football field after just a 15-minute thunderstorm.





20.30.40.50.40

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Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary A Picture is Worth a Thousand Words:

Standing Up to the Surge!

A hurricane protection levee surrounds the most populated areas within the Barataria-Terrebonne estuary. This levee is meant to protect residents from a storm surge of a strong Category 2 hurricane. Category 2 hurricanes typically have winds of 96-110 mph and storm surges of generally 6-8 feet above normal.

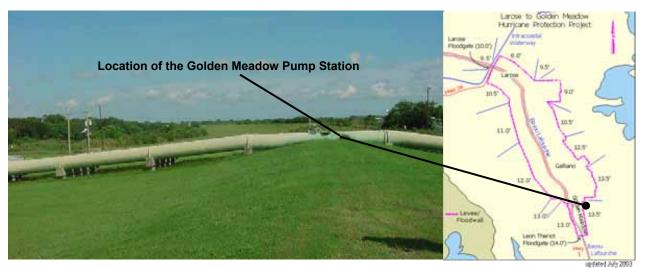
From the map, you can see that the height of the Golden Meadow Hurricane Protection Levee is about 13.5 feet at the location of the Golden Meadow Pump Station. The building material used to build this levee system was dug



from a borrow canal located just inside the levee. The shape of the levee in cross section resembles an isosceles trapezoid like the one pictured at the left. The flat top of the levee is about 10 feet across and the base of the levee is generally around 7 times wider than its height.

 Using the formula for the area of a trapezoid below, what is the cross-sectional area of the levee near the Golden Meadow Pump Station?

Area of an isosceles trapezoid = $\frac{1}{2}$ (sum of the long and short parallel sides) multiplied by the height.



- What volume of dredged material (in cubic feet) was needed from the borrow canal to build a levee one mile (5,280 feet) long on this part of the Golden Meadow Hurricane Protection Levee?
- How high would this pile of dirt get if the volume were spread out across a regulation football field? (Hint: 48,000 cubic feet of dirt would stand 1 foot high on a football field from goal line to goal line).

That's a whole lot of dirt! Keep in mind that the height of the levees must be maintained after they are built. Often this requires as many as three "recappings" or "lifts", meaning that more dredge material need to be added across the top of the levee to build it back to its required height. This is mainly because the soil, both in and beneath the levee, compacts as the levee gets older and water is expelled from pore spaces between the grains of dirt. Usually after three lifts, the levee is stable and needs only to be checked to ensure that there are no weak spots or breaks.

One last question to ponder... In the picture above, why do you suppose the levee maintenance crews do not allow trees or bushes to grow on the levee itself?

Hurricanes



Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary

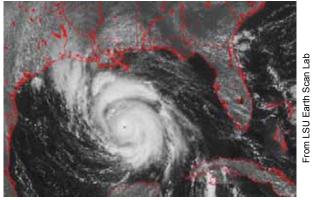
A Picture is Worth a Thousand Words: Hurricanes Isidore and Lili: A View from Space

Hurricane wind, rain and storm surge are forces that coastal residents must live with from time to time. In 2002, two hurricanes, Lili and Isidore hit southeastern Louisiana. From space it is clear that these storms had distinct shapes and sizes

Hurricane Isidore, September 22, 2002



Hurricane Lili, October 2, 2002



Weather forecasters and scientists study hurricanes and storms from satellite images like these above. These two storms prevented Louisiana from participating in Estuaries LIVE 2002 broadcast last year because of the threat to people and property.

Observe the images of Hurricane Isidore and Hurricane Lili shown above.

- How do these storms appear to be similar?
- How do they appear to be different?
- Which storm appears to be the better organized storm?
- Estimate percent of the Gulf of Mexico that is covered by each of the storms in these photos.
- How much of the Gulf of Mexico do you think Isidore covered once it moved closer to the Louisiana shore?



Estuary LIVE 2003 - A Visit to the Barataria-Terrebonne National Estuary

A Picture is Worth a Thousand Words: Hurricanes Isidore and Lili: Another Look

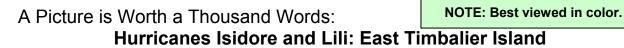
In the Fall of 2002, two hurricanes, Isidore and Lili, moved into the Gulf of Mexico and hit Louisiana's southeastern shoreline. These two storms took different tracks and caused enormous damage along Louisiana's shoreline. The damage included extensive dune destruction, overwash, multiple barrier island breaches, and beach erosion of up to 150 feet.



- Observe the storm track map above. List some differences between the two storms from information that you have from the map and the legend. Consider location of landfall and force of the storm. Which was the weaker storm?
- What is the approximate distance between the two storms where they made landfall?
- Which storm appears to have changed more rapidly? Approximately how far inland did Lili's force begin to reach Isidore's strength at landfall? At that point do you think the force of Isidore was equal to Lili's. Why or why not? Why does the storm's force change as it moves over land?

To learn about the force of hurricanes and the Saffir-Simpson Hurricane Scale go to the National Hurricane Center's website at http://www.nhc.noaa.gov/aboutsshs.shtml.





To begin, find East Timbalier Island on a Louisiana map. Where is this island in comparison with Golden Meadow, one of the locations of the eLIVE 2003 broadcast?



 In the images above, the red arrows point to the same spot on each image. Observe and compare the two photos. As you compare the two images, look for differences in the land area and shape between the two photos. Describe the changes you see in the two images.

- On which side of the Hurricane Lili storm track does East Timbalier Island lie? ______. The storm track map is on the *Hurricanes Isidore and Lili: Another Look* activity. Does the side of the storm track matter? Explain your answer.
- What kinds of changes occurred to this area after the storm? Did the storm help or harm the island?
- What processes are responsible for these large scale changes in an island during a storm?

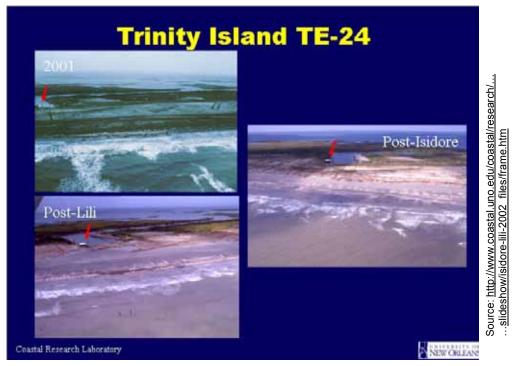
Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary



NOTE: Best viewed in color.

A Picture is Worth a Thousand Words: Hurricanes Isidore and Lili: Trinity Island

To begin, find Trinity Island on a Louisiana map. Where is this island in comparison with Golden Meadow, one of the locations of the eLIVE 2003 broadcast?



The red arrows point to the same spot on each photo. Trinity Island was affected by both storms, Hurricane Isidore on September 26, 2002, and Hurricane Lili on October 2, 2002. Observe and compare the photos. As you compare the photos, look for differences in the land area, vegetation (darker areas) and shape before and after each storm.

- What kinds of changes occurred after each storm?
- How were the changes different and how were they similar?
- What processes could have caused the kind of changes you can observe at east Timbalier and Trinity Islands?
- How do you think the area of land loss and shoreline erosion is determined by scientists? What kind(s) of data need to be collected and how do scientists collect it?

Animals



Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary

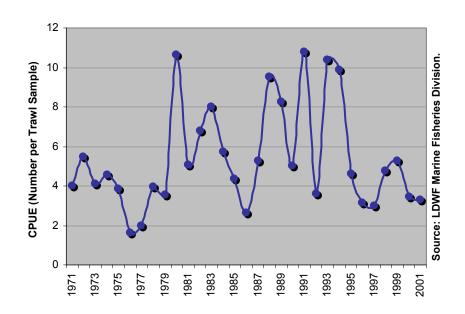
A Graph is Worth a Thousand Words: Blue Crab Blues

The blue crab, *Callinectes sapidus*, is the Barataria-Terrebonne National Estuary mascot. Its scientific name means "beautiful swimmer". Blue crab is the second largest shellfish industry in Louisiana and in the Barataria-Terrebonne estuary. The blue crab uses the estuary all through its life cycle. During the year, blue crabs can be found in all salinities of waters within the estuary – from almost fresh water areas to the nearshore open Gulf waters. In the Barataria-Terrebonne estuary, blue crabs are also an important recreational shellfish. You can often find families parked along the bayous and canals fishing for crabs with hand nets.



Consider the graph below of blue crab CPUE, *catch per unit effort*, which is an average measure of species population. Which years were populations relatively low for crabs in the Barataria-Terrebonne estuary? Which years were they high? Which years do you think it would be easier to catch crabs?

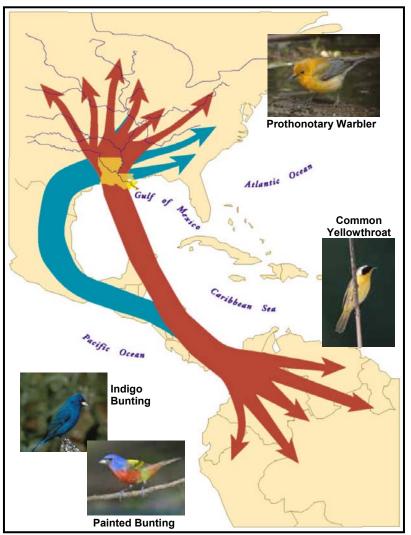
What factors do you think affect the size of crab populations in the estuary?



Catch Per Unite Effort for Blue Crab in the BTES 1971-2001



A Picture is Worth a Thousand Words: Birds: Beautiful Migrants



The Barataria-Terrbonne estuary is critical to several species of migratory birds. Several of these birds are neotropical birds, such as the Prothonotary Warbler, Indigo Bunting, Common Yellowthroat and Painted Bunting. They migrate from South America across the Gulf of Mexico to and from their breeding grounds in South America. Barataria-Terrebonne's barrier shorelines are especially important for these birds because they are the first land area the birds approach after crossing the Gulf of Mexico. This area serves as an important resting and refueling stop for these visitors.

When these birds fly over land at the Louisiana shoreline they virtually fall out of the sky from exhaustion from their long flight. When this occurs Barataria-Terrebonne's coastal habitats provide rest, food and refuge for them especially during stormy weather. Most birds stay in the southern portions of the estuary for a short time and then continue their migration north to forests where many nest and raise their young.

Getting there from here... When migrating, most migrants fly

at low altitudes, usually below 7,400 feet, but they may travel as high as 20,000 feet. The speed of flight depends largely on the species and the type of terrain they fly over. Did you know that birds fly faster when migrating? Birds also seem to fly faster in spring migrations than in the fall. Migrant birds also fly faster over water than over land. One thing is certain...every bird is different. When migrating, most birds cruise at about 20-40 mph. Common Loons are some of the fastest flyers at nearly 70 mph and Woodcocks are some of the slowest at 10 miles per hour. When flying over water, birds fly non stop until they reach land and while migrating over land they may make several stops for food and rest.

- The map above depicts the general flyway routes that neotropical migratory birds take each spring and winter. Consider the map of migratory routes. What would the advantages for a bird to fly over land (blue route) compared to over the Gulf route (red route)?
- On a map with a scale, choose a point on the Louisiana portion the map near your school and a point in a South American country of your choosing. Estimate the total distance a bird would have to fly from South America to its Louisiana destination. Estimate the distance the birds have to fly over the Gulf of Mexico
- With the distance you have determined over the Gulf of Mexico calculate the number of hours the bird has to fly without stopping if its flight speed is 30 mph. Convert that number into days.

To learn more about migrating birds check out <u>http://www.tpwd.state.tx.us/nature/birding/migrant/section1/pg5.htm</u>



A Graph is Worth a Thousand Words: **Brown Pelican: A Recovery Success Story**



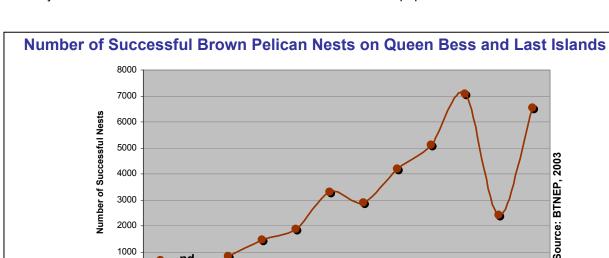
Once abundant, the Brown pelican, Pelecanus occidentalis, Louisiana's state bird, is a year round resident in the state. Unfortunately the presence of persistent toxic pesticides affected the brown pelican so much that the native population was reduced to zero in the 1960s. In the 1970s several pesticides were banned and the Brown pelican was reintroduced into the state. The number of *successful nests* has been monitored since 1990 to determine how well the brown pelican population is rebounding.

What do you think a successful nest is?

2000 1000

0

1990



Why would scientists use successful nests as data to assess a population?

Look at the line graph above. Based upon the data on this graph what can you say about the Brown pelican in Barataria-Terrebonne estuary?

1994

1995

1996

1997

1998

1999

2000

What might have been the cause of the drop in the number of successful Brown pelican nests in 2000?

nd

1991

1992

1993

Brown pelican

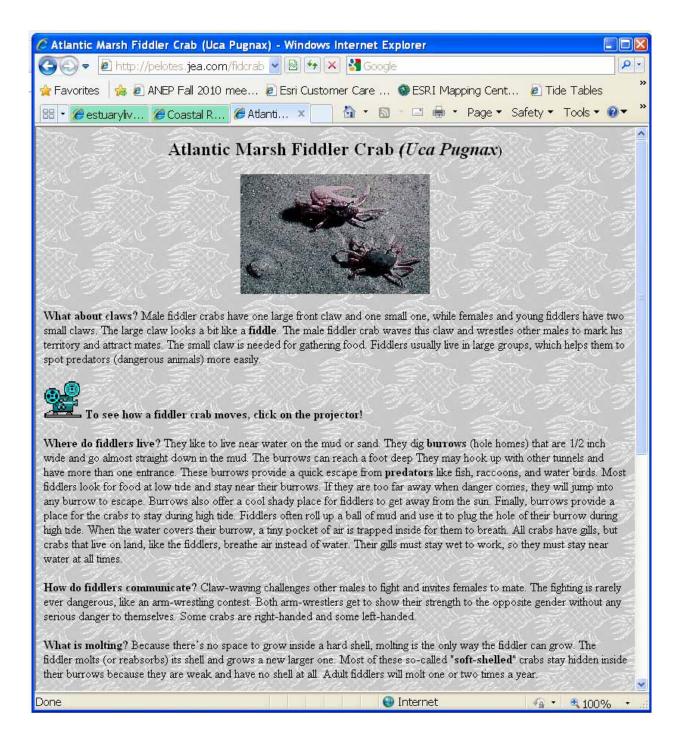
2001



Two species of pelican (the Brown and the White) occur in coastal Louisiana. Why do you think the Brown pelican became virtually extinct in the state and the White pelican did not?

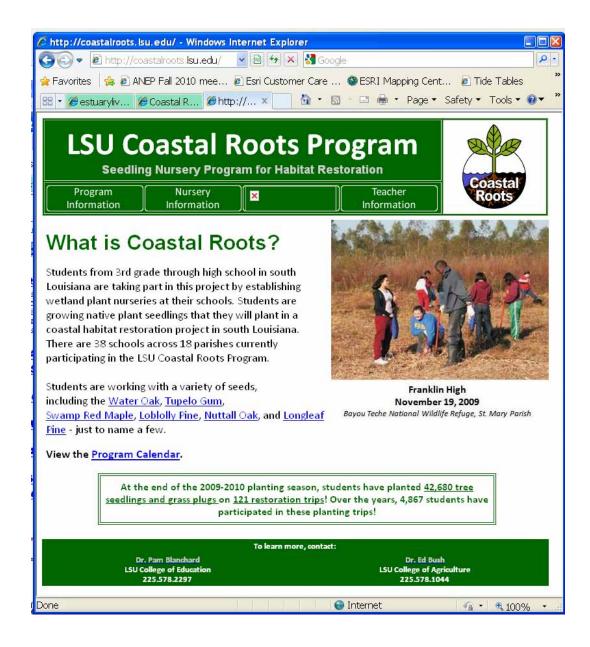


Visit <u>http://pelotes.jea.com/fidcrab.htm</u> to learn how fiddler crabs walk.



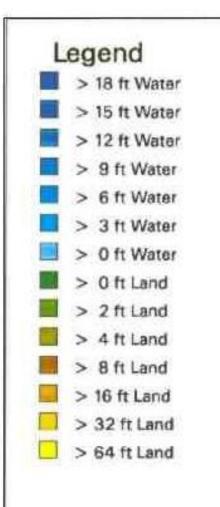
Coastal Erosion

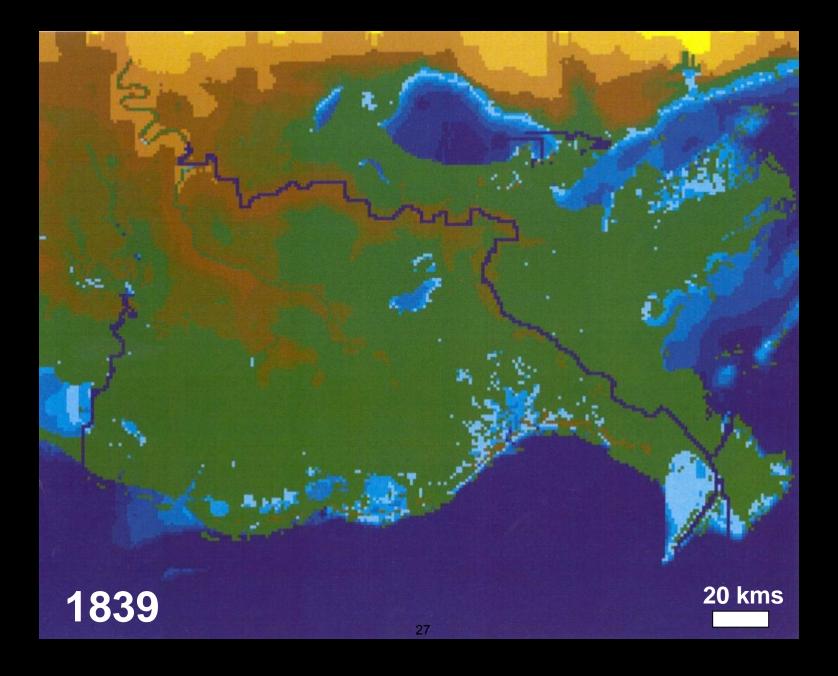
Visit <u>http://coastalroots.lsu.edu</u> to learn more about the coastal roots program.

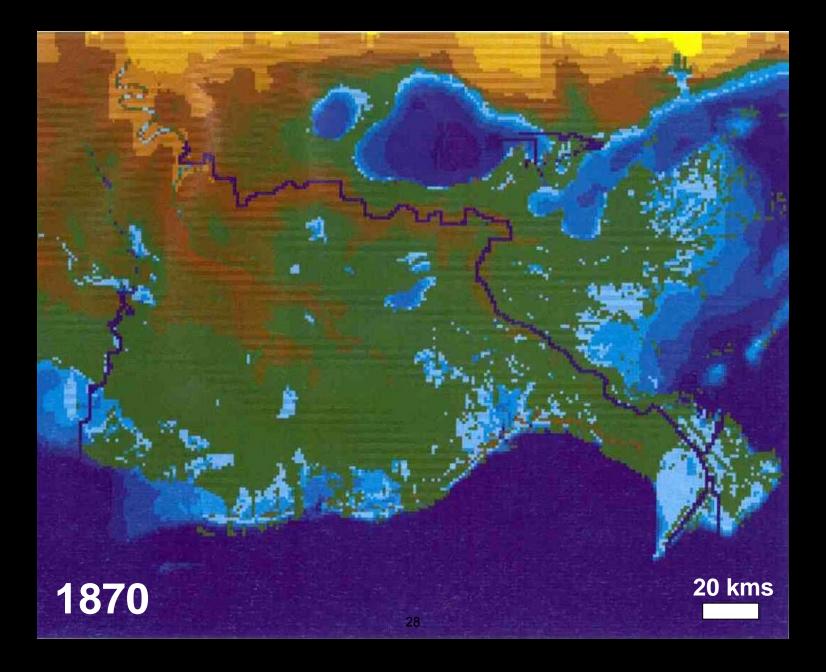


Louisiana's Coastal Plain: A history of change 1839 to 2020

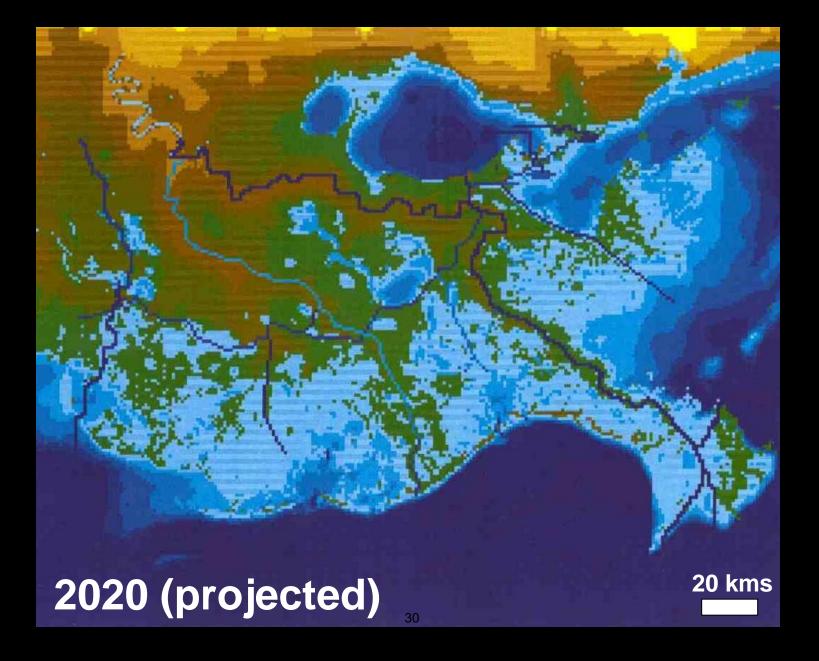
Blue = Water Green = Wetlands Brown/Orange = Land











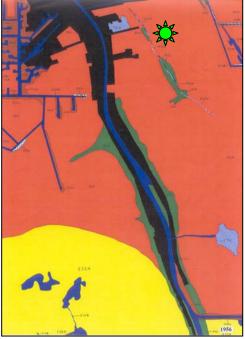
Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary

NOTE: This activity is best

viewed in color.

A Picture is Worth a Thousand Words:

A green sun [] marks the location of the Golden Meadow Pump Station in the four habitat maps below. What changes do you see happening over time to the amount of land covered by fresh marsh (orange), salt marsh (yellow) and open water (blue)? How do you think these changes have affected the human population that lives in Golden Meadow? The bird population that lives or flies through this area? The oyster population? Locate the hurricane protection levee (white line). Between what years was the hurricane protection built? Why do you think citizens decided to build it at that time?

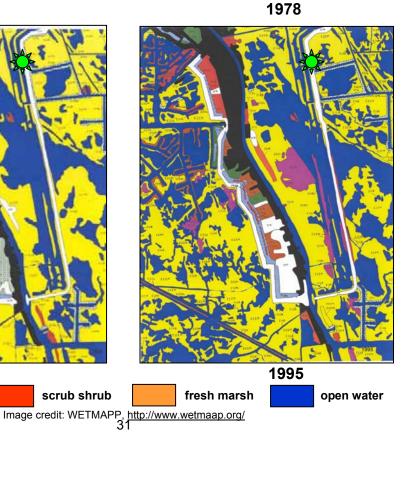


1956

1988

scrub shrub

salt marsh





25

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Why Are We Losing Salt Marsh?

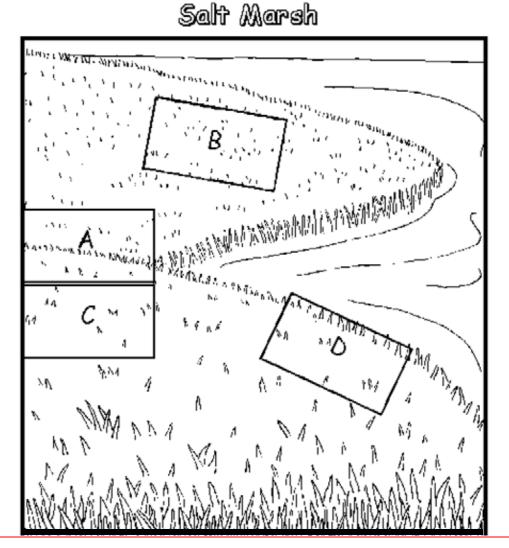
Land loss occurs through natural causes and man's activities.

- 1. Color the salt marsh on the diagram below. As you read the following scenarios, color each lettered box blue to indicate the land turning in to water.
 - A. An oil company digs a canal through the marsh to look for oil to supply our nation with energy.
 - B. A patch of salt marsh grass drowns due to subsidence.
 - C. Wake from boats traveling through the canal causes it to become wider.
 - D. Tropical Storm Edgar pushes large waves towards the marsh causing erosion.

2. Answer these questions.

What does the marsh look like now with the boxes colored blue for water? How does this affect you?

If four acres of land are lost every three hours, how much salt marsh would be lost to open water in 24 hours?



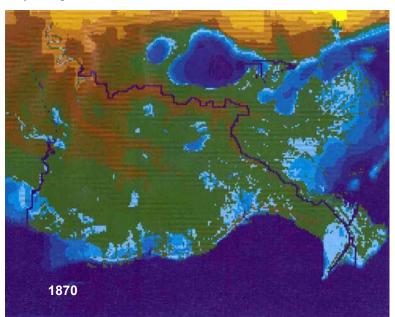
Taken from SALT MARSH HABITAT OF THE BARATARIA-TERREBONNE ESTUARY. Downloadable for free from the Barataria-Terrebonne National Estuary website at: <u>http://www.btnep.org/</u>

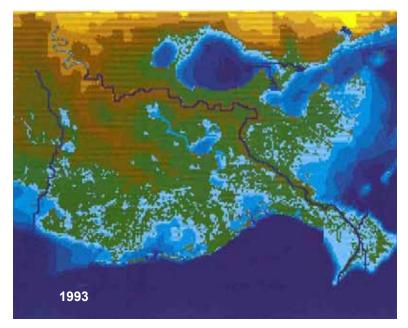


A Picture is Worth a Thousand Words: Coastal Land Loss

NOTE: You need to see color for this activity. It is best done when using a color printer or online.

Understanding how much land has been lost from the Louisiana Coastal Plain is sometimes difficult. Comparing two maps of the same region and looking for changes over time is one way to begin to understand how big the problem is for Louisiana citizens. Remember, when land turns into open water, people can't live there anymore or use their land in the same way they have in the past. Coastal land loss forces people to change where they live, how they make a living, where they can go to school and where they can go to have fun.





For help with these questions, visit the following websites:

- BTNEP <u>http://www.btnep.org</u>
- LA Coast http://www.lacoast.gov

- Compare the two images of southeastern Louisiana.
- Make observations about where land loss is occurring in southeast Louisiana.
- Draw a polygon around the Barataria- Terrebonne
 Estuary on the maps to the left to get a better idea of how coastal land loss is affecting this estuary.
- Where in the Barataria-Terrebonne Estuary does land loss seem to be the biggest problem?
- List three things that contribute to coastal land loss.



The green area indicates the Barataria-Terrebonne National Estuary.

Fisheries Management



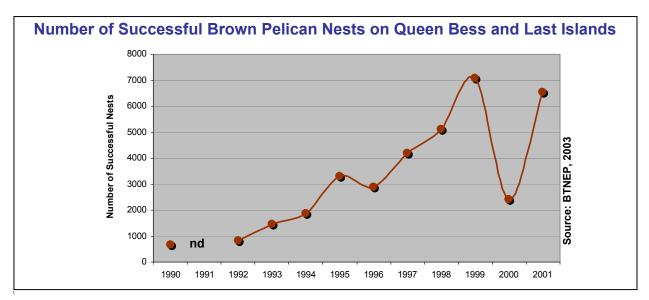
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A Graph is Worth a Thousand Words: Brown Pelican: Louisiana's state bird



Once abundant, the brown pelican, Louisiana's state bird, is now in recovery. Unfortunately the presence of persistent toxic pesticides affected the brown pelican so much that the native population was reduced to zero in the 1960s. In the 1970s several pesticides were banned and the brown pelican was reintroduced into the state. The number of *successful nests* have been monitored since 1990 to determine how well the brown pelican population is rebounding.

- What do you think a *successful nest* is?
- Why would scientists use successful nests as data to assess a population?



- Look at the line graph above. Based upon the data on this graph what can you say about the brown pelican in Barataria-Terrebonne estuary?
- What might have been the cause of the drop in the number of successful brown pelican nests in 2000?

brown pelican



Think about it:

Two species of pelican (the brown and the white) occur in coastal Louisiana. Why do you think the brown pelican became virtually extinct in the state and the white pelican did not?



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A Graph is Worth a Thousand Words: Shrimp: An Important Fishery

Shrimp are an extremely important fishery in Louisiana. More shrimp are caught in Louisiana's estuaries than anywhere else in the country. Most of this shrimp harvest comes from the Barataria-Terrebonne estuary. In Louisiana, two species of shrimp, the brown and the white, are commercially harvested.

Harvest data for all fisheries are reported as *landings* by weight and by value. This is strictly how much a fisherman has caught. Below is a table of landing data for brown and white shrimp from 1981 to 2001 in Louisiana. At the bottom of the table the total landings for the period for the whole United States is given.

Shrimp Landings in Louisiana					
Year	White Shrimp (pounds)	Brown Shrimp (pounds)	Total		
1981	48,546.99	57,392,972	57,441,519		
1982	36,101,722	50,718,109	86,819,831		
1983	3,300,783	39,925,384	43,226,167		
1984	45,874,767	54,337,801	100,212,568		
1985	53,829,621	55,948,367	109,777,988		
1986	71,540,547	62,760,689	134,301,236		
1987	53,011,888	58,296,288	111,308,176		
1988	45,624,881	52,467,622	98,092,503		
1989	40,181,325	55,181,298	95,362,623		
1990	44,692,880	71,622,853	116,315,733		
1991	46,346,466	43,942,110	90,288,576		
1992	46,827,690	40,251,413	87,079,103		
1993	37,444,989	40,603,130	78,048,119		
1994	46,755,726	35,562,377	82,318,103		
1995	50,752,795	45,023,758	95,776,553		
1996	29,368,900	51,420,060	80,788,960		
1997	36,249,347	43,137,080	79,386,427		
1998	52,922,374	50,140,696	103,063,070		
1999	55,236,737	58,506,585	113,743,322		
2000	75,864,291	62,115,420	137,979,711		
2001	53,648,584	63,302,987	116,951,571		
LA Total	1,003,823,307	1,226,551,321	2,230,374,628		
US Total 1981- 2001	1,998,506,713 from National M		4,956,337,478		



- Graph the Louisiana landings for each shrimp species.
- Based on your graphs, what can you say about the shrimp fisheries in the state? Is there a pattern in the catch? When were the higher catches? The lowest?
- Which species is the most important fishery?
- How did you make this determination?
- Determine what percentage of the United State's harvest is from Louisiana by using the LA Total Shrimp Harvest and the US Total Shrimp Harvest from 1981-2001 at the bottom of the chart.
- If 50% of Louisiana's shrimp harvest comes from Barataria-Terrebonne estuaries, how much total shrimp (in pounds) has been harvested from the estuary over the 20-year period?
- If shrimp average \$4.00 per pound in the grocery store, how much is the total catch worth? Does the shrimp harvest represent an important part of the Barataria-Terrebonne economy?



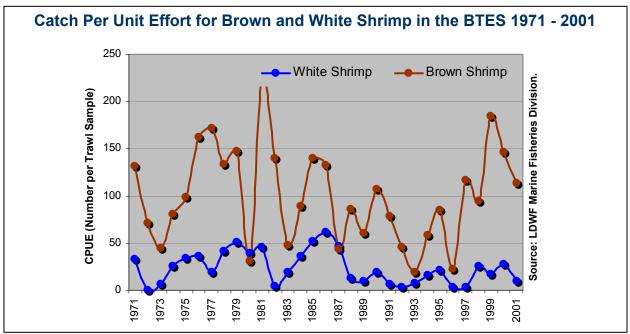
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A Graph is Worth a Thousand Words: Fishery Populations: Shrimp

Managers and scientists collect data on specific animals that they are managing for the public good. One way to determine the size of the population is to take a small sample of it. For the fisheries industry, scientists and fisheries managers use *catch per unit effort* (CPUE) as an average abundance measure of a species in the area. Data reported as CPUE can give us an idea of how well a population is doing and whether it is increasing or decreasing.

Below is a graph of *catch per unit effort* (CPUE) data for brown and white shrimp in the Barataria-Terrebonne Estuary. Discuss the following questions based on your examination of the data represented in the graph.

- What can you say about white and brown shrimp from this graph?
- When do each species have the greatest population size? When did they have the least?
- What physical variables (conditions) could they be affected by?
- Why do you think that each CPUE varies each year?



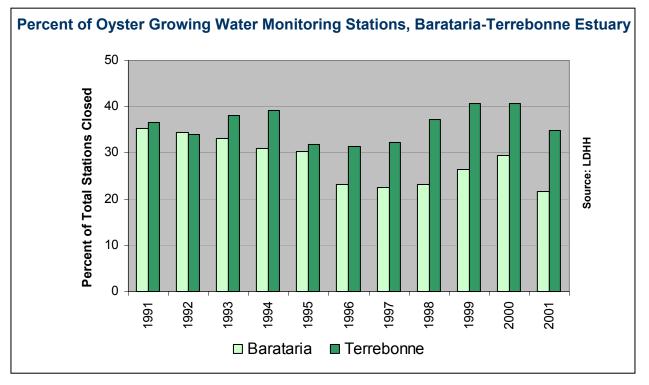
Comparing data:

- Compare the graph you made of fisheries landings on "SHRIMP: An important fisheries" with the data shown on the CPUE graph above. Do these two measures of shrimp abundance tell the same story about shrimp?
- What factors do you think would influence landing data of a fishery?
- What factors would influence CPUE data?
- Which data do you think best represents the state of the shrimp population. Why?



A Graph is Worth a Thousand Words: Oysters: Sentinels of the Estuary

People love to eat oysters and they are plentiful in the Barataria-Terrebonne Estuary. They are also a multimillion dollar industry in Louisiana and 80% of Louisiana's oysters are harvested from the Barataria-Terrebonne estuaries. However, because oysters are often served uncooked, they must be safe for people to eat. When fecal coliform bacteria are present in the water where oysters are harvested, it indicates that the water has been contaminated with human waste or other animals through sewage or non-point sources. This poses a potential health risk to humans. To make sure oysters are safe to eat, water quality is checked and when fecal coliform bacteria are present, oyster beds are **closed down**, which means that they cannot be harvested.



- Consider the bar chart of oyster bed closings in Barataria and Terrebonne parishes. What can you say about the water quality near oyster beds in the two parishes? Is it the same each year?
- Which parish has a greater problem with closures?
- What are some reasons why the number of closures might vary from year to year?
- Think of some reasons why the number of closures vary or are similar for the two parishes.

For background on fecal coliform bacteria visit http://bcn.boulder.co.us/basin/data/FECAL/info/FColi.html

Dead Zones



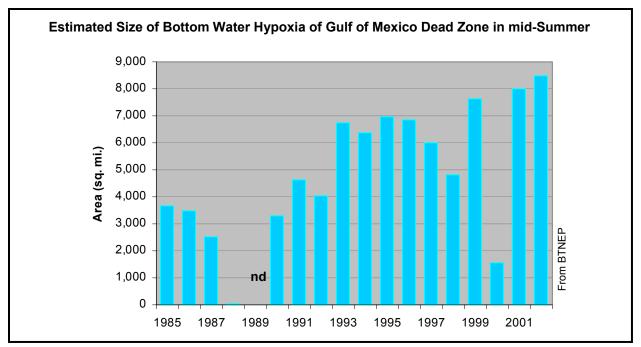


A Graph is Worth a Thousand Words: Hypoxia: Root of the Dead Zone

You may have heard of the "dead zone" in the Gulf of Mexico. This zone is not really "dead," but the area lacks enough oxygen for most living creatures to be healthy and to survive. When low levels of oxygen (below 2 mg/L) occur in the water it is hypoxic. A combination of physical, chemical and biological processes creates conditions that result in low oxygen levels offshore. Excess nutrients from the Mississippi River combined with warm temperatures trigger an explosion in production of plankton causing algal blooms. When the plankton die, they sink to the bottom and decompose. During decomposition, bacteria use up the oxygen at the bottom creating hypoxic conditions.

Dissolved oxygen can be used to access the health of a water body. Scientists have been measuring oxygen levels in the Gulf of Mexico since 1985 and have found that the total area affected is different every year. Below is a bar chart that graphs the area of the dead zone in the Gulf of Mexico since 1985.

 From your observation of the chart below, what can you infer about the dead zone since scientists began collecting data in 1985? Think about the size of the dead zone, how it changes over time, relative size and inconsistencies.



Why do you think the size of the dead zone has changed? What could have happened in 2000?

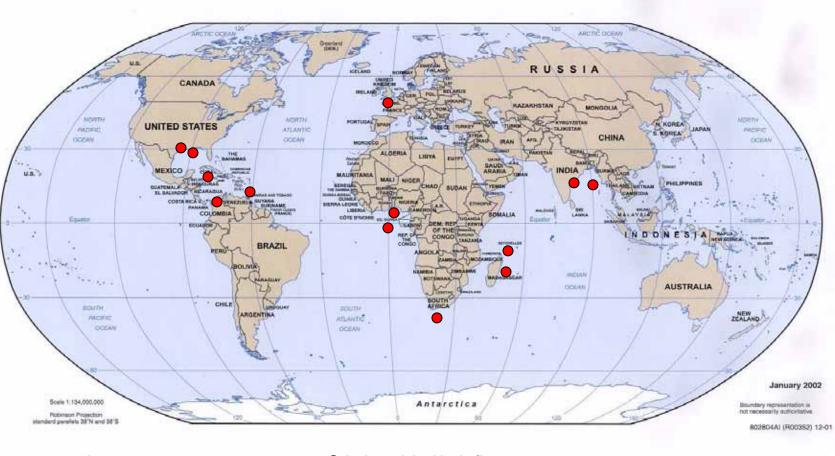
- What processes do you think will cause the dead zone to decrease in size and disappear? How does oxygen get back into the water column?
- The dead zone is a seasonal occurrence (mid-summer to early fall) and we do not know how long it will be present each year. What might account for how long this dead zone is present in a given year?
- Many organisms that can swim such as fish and shrimp can move away from the hypoxic area but others like worms and clams are immobile and cannot leave. Low oxygen levels cause these animals to become stressed and some even die. Think about what it would be like to temporarily live in an environment that has low oxygen levels. What kinds of stresses or reactions do you think humans would have? What do you think free-living organisms (fish, crab, shrimp) would experience prior to leaving the area. What additional stresses do you think the stationary animals (worms, clams) may experience without enough oxygen?

Jean Lafitte



Estuary LIVE 2003 – A Visit to the Barataria-Terrebonne National Estuary

A Picture is Worth a Thousand Words



The Travels of Jean Lafitte

• A place visited by Lafitte



A Picture is Worth a Thousand Words The Travels of Jean Lafitte

Jean Lafitte was well known for his cleverness, resourcefulness and mystery. Accounts of his life and travels are inconsistent. The following is one account of his life and travels around the world. Read the short account of his travels below. In the text, Lafitte's ports of call" from parts of his life are marked chronologically with a letter in parentheses in the text. Each of these places is labeled with a red dot on the map above. Use your knowledge of geography and/or a world map or atlas and mark on the map with the letter corresponding to the dot located on the map. Reread the account of Lafitte's travels and join the "ports



of call" to track the path of his voyages around the world. Note: He visited some places more than once.

Some say that Jean Lafitte was born in 1781 in St. Maloes, France (A). At the age of thirteen he went to sea and traveled in European waters and along the coast of Africa until he was appointed a mate on a ship which was bound for India. While sailing around the Cape of Good Hope (B) storms disabled his ship and he arrived at Mauritius (C) off the east coast of Madagascar. In Mauritius Lafitte secured his first position as captain on a privateer fleet and robbed English merchant ships. He stopped at the nearby Sevchelles (D). On his way back to Mauritius he was chased by an English Frigate as far north as the equator. He then sailed to the Bay of Bengal near India (E) to get provisions for his crew. He successfully pirated some English ships along the coast of Bengal (F) and proceeded back to Mauritius (C). From Mauritius he then commanded a ship to British India and plundered British ships in the Indian Ocean. During this time he was known as the "Terror of English Commerce". When the British began to travel in convoys, opportunities to plunder their ships declined, he set sail for France by way of the Cape of Good Hope (B). Along the way off the coast of Africa he pirated ships throughout the Gulf of Guinea (G) and the Bight of Benin (H). After visiting St. Maloes (A) he sailed for Gaudaloupe (I) and plundered the West Indies. When the British took over Guadaloupe, LaFitte moved on to Cartagena (J) and finally to Barataria (K). Based there, Lafitte privateered and pirated throughout the Gulf of Mexico and the Caribbean. He traded with many citizens of New Orleans and amassed a huge fortune. Auctions to sell his and other pirated booty were held often on Grand Terre (L). In 1814, Lafitte aided the

U.S. by fighting against the British. He proved loyal to the U.S. and he and his men were pardoned by the president. After the war, Lafitte continued pirating. Some say he met his death in a fierce battle with the British Admiralty off the coast of Jamaica (M) in 1821. Sixteen of his remaining crew were tried for piracy, six were pardoned and ten were executed in Jamaica. The legend of Lafitte continues to live. Many believe that Lafitte buried some of his fortune in the Barataria area but none of that treasure has been found.

How many times does your map show that Lafitte crossed the equator?

In what bodies of water did he travel?

Make a list of some items you think Lafitte stole from merchant ships? What do you think could be in his treasure?

Write a description of a place where you think Lafitte could have buried his treasure? What makes this place ideal for buried treasure?