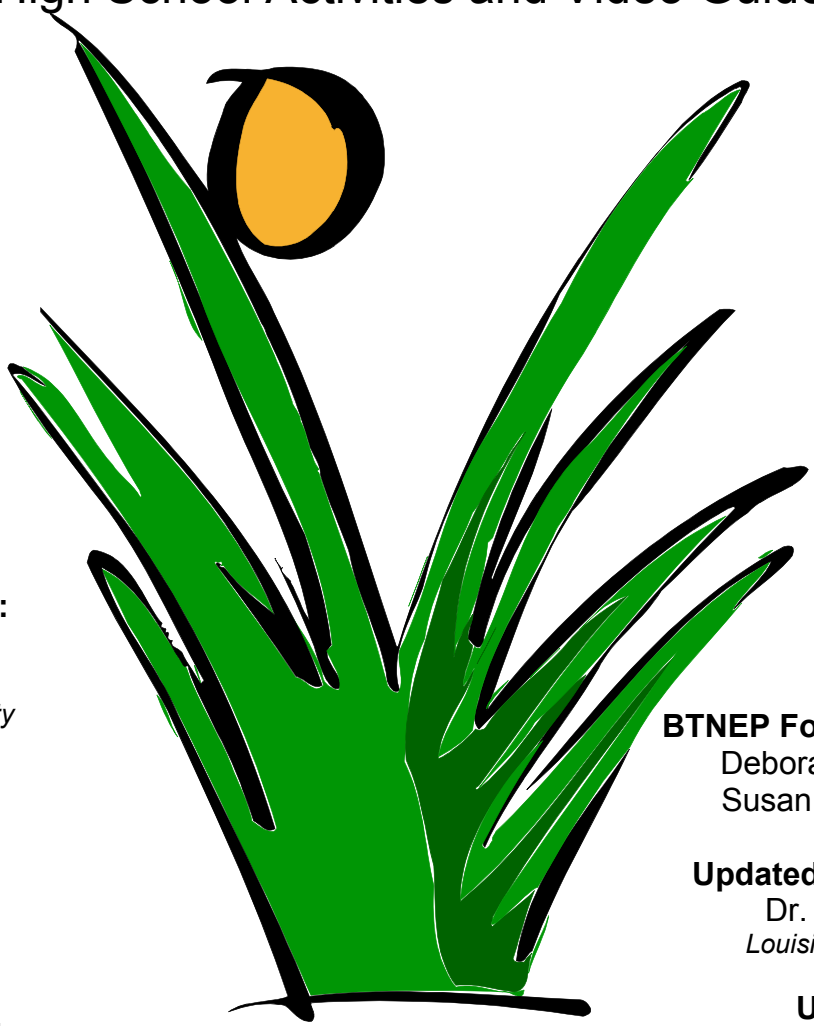
Vanishing Wetlands… Vanishing Future…

High School Activities and Video Guide



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LESSON 1 INTRODUCTION

OVERVIEW:
This lesson will be used to introduce students to the wetlands and the problems associated with them.

DURATION:
1 class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

BIO: GLE-23	Illustrate the flow of carbon, nitrogen, and water through an ecosystem (LS-H-D1)
BIO: GLE-27	Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)
HSES: GLE-20	Determine the chronological order of the five most recent major lobes of the Mississippi River delta in Louisiana (ESS-H-C3)
EnvS: GLE-12	Give examples and describe the effect of pollutants on selected
EnvS: GLE-26	Determine local actions that can affect the global environment (SE-H-D4)

OBJECTIVES:
* To describe wetland types using characteristics of each.
* To identify importance of wetlands.
* To describe how a delta forms

STUDENT HANDOUTS:
1. Background Information Sheet
2. Video Review Question Sheet
3. Eutrophication Lab Sheet

TEACHER GUIDES:
1. Background Information Sheet
2. Video Review Question Sheet
3. Eutrophication Lab Sheet
4. Types of Wetlands Information Sheet
5. Wetlands Value Information Sheet

Activity 1 Introduction (25 minutes)
1. Divide students into cooperative groups.
2. Distribute **Student Handout 1**. Have students work through the sheet in their groups.
3. Share group answers in a whole class discussion.

Activity 2 Video Clip (10 minutes)
1. Show Introduction Section of the ***Vanishing Wetlands, Vanishing Future*** video. (Show first five minutes of video, and then stop after the seven problems are shown and the girl is using phonics to pronounce hydrologic modification).
2. Distribute **Student Handout 2** and have students answer questions.
3. Review answers to questions.

Activity 3 Set Up for Demonstration (10 minutes)
NOTE: This demonstration takes about two weeks to produce noticeable results.
1. Pass out Student Handout 3.
2. Students should complete all steps under "Set Up Your Experiment:" in preparation for use after they have completed the Eutrophication review.

LESSON 1 | INTRODUCTION (continued)

ASSESSMENT:

1. Assess cooperative learning group activity as usual.
2. Assess the video handouts as a daily participation grade.
3. Assess the lab set-up as a cooperative learning activity.

Student Handout 1

Introducing the Wetlands

Group Members:		Date:	
		Period	

WETLAND – an area of land that is regularly wet or flooded and which has a water table that stands near or above the land surface for at least part of the year.

Directions: Based on the definition above, answer the following questions about wetlands using group consensus.

1. Compile a list of wetland types and give characteristics of each type of wetlands.

2. Why are wetlands important?

3. What types of wetlands are located in the Barataria-Terrebonne estuary? Describe the type of wetland(s) found near your school.

4. Identify some common organisms that live and/or benefit from wetlands.

Student Handout 1

ANSWER KEY

Introducing the Wetlands

Group Members:		Date:	
		Period	

WETLAND – an area of land that is regularly wet or flooded and which has a water table that stands near or above the land surface for at least part of the year.

Directions: Based on the definition above, answer the following questions about wetlands using group consensus.

1. Compile a list of wetland types and give characteristics of each type of wetlands.

   Wetland types are listed on "TYPES OF WETLANDS" Information Sheet.

2. Why are wetlands important?

   Possible answers are listed on "THE VALUE OF LOUISIANA WETLANDS" Sheet.

3. What type of wetlands are located in the Barataria-Terrebonne estuary?

   Possible answers are listed on "TYPES OF WETLANDS" Sheet. Answers will vary regarding local wetlands depending on school location.

4. Identify some common organisms that live and/or benefit from wetlands.

   Answers will vary.

Student Handout 2

Video Review Questions: Introduction Section

Group Members:		Date:	
		Period	

1. In the video, it related wetland loss to the size of a football field. What was the comparison used?

2. What is the name of the organization addressing wetland loss in the video?

3. Describe how a delta is formed.

4. What are the seven problems associated with the wetlands in this video?

Student Handout 2

ANSWER KEY

Video Review Questions: Introduction Section

Group Members:		Date:	
		Period	

1. In the video, it related wetland loss to the size of a football field. What was the comparison used?

   The football field was used to describe the rate at which Louisiana wetlands are disappearing. The rate at the time that the video was produced was: One football field every 90 minutes.

2. What is the name of the organization addressing wetland loss in the video?

   The Barataria-Terrebonne National Estuary Program is the name of the organization addressing wetland loss in south Louisiana. It is one of may organizations concerned with this problem..

3. Describe how a delta is formed.

   A delta is formed as sediment carried in a river is deposited when the river empties into a larger basin such as the Gulf of Mexico. Courser sediments deposit, or sink out of the water, close to the mouth of the river, while finer sediments, such as fine silt or clays, are carried much further away from the mouth of the river.

4. What are the seven problems associated with the wetlands in this video?

   Hydrological Modification
   Sediment Loss
   Habitat Loss
   Changes in Living Resources
   Eutrophication
   Pathogen Contamination
   Toxic Substances

Student Handout 3

Eutrophication: An Unwelcomed Chain Reaction

Group Members:		Date:	
		Period	

Background:
Plants consume nutrients such as nitrates and phosphates, much like humans consume proteins and vitamins. Large amounts of nutrients are sometimes released inadvertently into the waterways through human activities such as lawn fertilization. This can lead to a phenomenon called "artificial eutrophication." In this process, algae and plants consume the nitrates and phosphates and reproduce faster than they normally would. As they pass through their normal life cycles, they begin to die off, as all living things do. If artificial eutrophication occurs, the population is much larger than normal, so there are many more dead plants and algae than normal. As a result, the microorganisms responsible for the decomposing of the dead algae have more food, and they also reproduce faster than they normally would. These microorganisms also consume the available oxygen in the water faster than they ordinarily would because their population is larger than it would normally have been. Therefore, there are few oxygen molecules left in the water for the fish and other animals that depend upon oxygen for survival.

Materials:

3 one-quart milk jugs	wax pencil	fertilizer
pond water (with organisms)	plastic wrap	fluorescent lamp or window
graduated cylinder	stirring rod	microscope
slides	coverslips	eyedropper

Safety:
Adhere to the standard safety rules when conducting this lab.

Procedure:
1. Label one container CONTROL, the second container FERTILIZER, and the third container EXCESS FERTILIZER, with a wax pencil.
2. Add 750 mL of distilled water to each of the three containers. Read the label on the fertilizer container to determine the recommended dilution of fertilizer for watering plants. To the container labeled FERTILIZER, add the amount of fertilizer recommended for a quart of water. To the container labeled EXCESS FERTILIZER, add 10 times the recommended amount of fertilizer. Stir the contents of each container thoroughly to dissolve the fertilizer.
3. Collect a sample of pond water or use the prepared algae culture your teacher made if pond water is unavailable. Stir the sample gently to ensure that the organisms are equally distributed. Measure 100 mL of pond water into each of the three containers.
4. Cover all of the containers with plastic wrap. Place all three containers about 20 cm away from a fluorescent lamp or in a bright window. If placed in a window, avoid placing the containers in direct sunlight, as the infrared rays can overheat the water.
5. Examine a drop of pond water under the microscope and draw the organism types that you see in the space provided below. Determine the number of organisms and whether they are consumers (motile) or algae (green in color).

6. Based on the information in the introduction, predict how the pond organisms will grow in each of the three containers.

I predict …

7. Observe the jars when you first set them up and again on Day 4 and Day 6. The lab will be completed on Day 10. Note color, odor, and any visible presence of life. *Record* your observations in the data table below.

Data Table

Day 4				
Container	**Color**	**Odor**	**Number**	**Species and General Observations**
Control				
Fertilizer				
Excess Fertilizer				

Day 8				
Container	**Color**	**Odor**	**Number**	**Species and General Observations**
Control				
Fertilizer				
Excess Fertilizer				

8. On Day 10, examine a drop of pond water under the microscope and draw the organism types that you see in the box below.

Describe how the number and type of organisms have changed from observations made in Step 5.

Analyze Your Results.

9. Which jar shows the most abundant growth of algae? What may have caused this growth to occur?

10. Did the jar with the most abundant growth of algae show any effects on the other types of organisms? Explain.

11. Did your observations match your predictions of what would happen in the containers? Explain.

12. How can eutrophication be prevented in our wetlands?

Student Handout 3

ANSWER KEY

Eutrophication: An Unwelcomed Chain Reaction

Group Members:		Date:	
		Period	

Background:
Plants consume nutrients such as nitrates and phosphates, much like humans consume proteins and vitamins. Large amounts of nutrients are sometimes released inadvertently into the waterways through human activities such as lawn fertilization. This can lead to a phenomenon called "artificial eutrophication." In this process, algae and plants consume the nitrates and phosphates and reproduce faster than they normally would. As they pass through their normal life cycles, they begin to die off, as all living things do. If artificial eutrophication occurs, the population is much larger than normal, so there are many more dead plants and algae than normal. As a result, the microorganisms responsible for the decomposing of the dead algae have more food, and they also reproduce faster than they normally would. These microorganisms also consume the available oxygen in the water faster than they ordinarily would because their population is larger than it would normally have been. Therefore, there are few oxygen molecules left in the water for the fish and other animals that depend upon oxygen for survival.

Materials:

3 one-quart milk jugs	wax pencil	fertilizer
pond water (with organisms)	plastic wrap	fluorescent lamp or window
graduated cylinder	stirring rod	microscope
slides	coverslips	eyedropper

Safety:
Adhere to the standard safety rules when conducting this lab.

Procedure:
1. Label one container CONTROL, the second container FERTILIZER, and the third container EXCESS FERTILIZER, with a wax pencil.
2. Add 750 mL of distilled water to each of the three containers. Read the label on the fertilizer container to determine the recommended dilution of fertilizer for watering plants. To the container labeled FERTILIZER, add the amount of fertilizer recommended for a quart of water. To the container labeled EXCESS FERTILIZER, add 10 times the recommended amount of fertilizer. Stir the contents of each container thoroughly to dissolve the fertilizer.
3. Collect a sample of pond water or use the prepared algae culture your teacher made if pond water is unavailable. Stir the sample gently to ensure that the organisms are equally distributed. Measure 100 mL of pond water into each of the three containers.
4. Cover all of the containers with plastic wrap. Place all three containers about 20 cm away from a fluorescent lamp or in a bright window. If placed in a window, avoid placing the containers in direct sunlight, as the infrared rays can overheat the water.
5. Examine a drop of pond water under the microscope and draw the organism types that you see in the space provided below. Determine the number of organisms and whether they are consumers (motile) or algae (green in color).

6. Based on the information in the introduction, predict how the pond organisms will grow in each of the three containers.

I predict …

7. Observe the jars when you first set them up and again on Day 4 and Day 6. The lab will be completed on Day 10. Note color, odor, and any visible presence of life. *Record* your observations in the data table below.

Data Table

Day 4				
Container	**Color**	**Odor**	**Number**	**Species and General Observations**
Control				
Fertilizer				
Excess Fertilizer				

Day 8				
Container	**Color**	**Odor**	**Number**	**Species and General Observations**
Control				
Fertilizer				
Excess Fertilizer				

8. On Day 10, examine a drop of pond water under the microscope and draw the organism types that you see in the box below.

Describe how the number and type of organisms have changed from observations made in Step 5.

Algae probably will have further increased in number in the two fertilized jars. As the algae grew and started to become overcrowded, algae began to die.

Analyze Your Results.

9. Which jar shows the most abundant growth of algae? What may have caused this growth to occur?

The EXCESS FERTILIZER jar had the most growth because the added nutrients promoted rapid algae growth...

10. Did the jar with the most abundant growth of algae show any effects on the other types of organisms? Explain.

Other organisms increased in number as the algae increased, but when the algae began to die and decay, the oxygen was used up and organisms began to die as well...

11. Did your observations match your predictions of what would happen in the containers? Explain.

Answers will vary. There will be discrepancies if the conditions in the jars have not yet reached the die-off phase of eutrophication.

12. How can eutrophication be prevented in our wetlands?

Students might suggest passing laws, limiting fertilizer use, purifying water better, etc...

Types of Wetlands

1. **Tidal Flat** – an area that borders the seaward edges of salt marshes; muddy and/or sandy areas that are exposed during low tide and are submerged during high tide.

2. **Marsh** – an area dominated by grasses of various types and often interspersed with patches of open shallow water. There are four types of marshes.
   a.) **Freshwater Marsh**
   - occurs farthest inland
   - salinity (salt content) averages between0.5 – 1.0 ppt (parts per thousand)
   - has the most diverse array of plant life; home to grongs, turtles, ducks, alligators, muskrat, mink, otters, egrets, herons, hawks, mosquitoes and more.

   b.) **Intermediate Marsh**
   - where slightly salty water mixes with fresh water
   - salinity averages about 3.3 ppt
   - provides nursery habitat for brown shrimp, blue crab and other fishery resources

   c.) **Brackish Marsh**
   - salinity averages about 8 ppt
   - affected by both tidal action and water from fresh marsh
   - fishing industry relies on blue crab, shrimp, speckled trout, redfish, and mammals that are found in the brackish marsh

   d.) **Salt Marsh**
   - occurs along the shoreline; salinity is about 16 ppt
   - most affected by the winds and tides
   - redfish, speckled trout, crabs, and shrimp move in and out of salt marshes at different stages of their life cycles.

3. **Mangrove Swamp** – same characteristics as the salt marsh, but with mangrove trees, not grasses, as the dominant plants; found in tropical areas. In Louisiana, only Black Mangrove are able to survive along the extreme southern parts of the Mississippi Delta.

4. **Estuary** – ecosystem in which fresh water mixes with salt water becoming a nutrient trap where mineral-rich mud settles on the bottom.

5. **Bogs** – fresh-water wetlands containing a build-up of peat, a rich, organic material mostly made up of decayed plant; formed in wet areas where little water flows in or out of the wetland (Rare in Louisiana).

6. **Swamp** – fresh-water wetlands that are dominated by shrubs and trees

The Value of Louisiana Wetlands

Louisiana wetlands are a place where…

… thousands of birds come to rest and feed during yearly migrations.

… ducks and geese breed.

… floodwaters are slowed down.

… rainfall and snowmelt are absorbed and dispersed.

… ground water aquifers are recharged.

… storm surges, waves and winds are dispersed, reducing erosion.

… millions of fish, crabs, and shrimp return to spawn and the young remain until they are large enough to leave.

… of great economic activity, such as commercial fishing, the alligator industry, and fur harvest industry.

… alligator, herons, oysters, and wood ducks all find habitats that sustain them.

… recreation and tourism opportunities abound, such as fishing, hunting, hiking, boating, bird watching, and wildlife viewing.

… more that 40 percent of all threatened or endangered species either live or depend on in some significant way; threatened or endangered species include the bald eagle and the brown pelican.

… mineral production is high and the oil and gas industry flourishes.

… education and scientific research takes place.

LESSON 2 HYDROLOGICAL MODIFICATIONS

OVERVIEW:
This lesson will be used to introduce the first problem associated with the Louisiana wetlands. It is considered to be the one problem that affects all of the other problems to be studied.

DURATION:
1 class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

BIO: GLE-23	Illustrate the flow of carbon, nitrogen, and water through an ecosystem (LS-H-D1)
BIO: GLE-27	Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)
HSES: GLE-20	Determine the chronological order of the five most recent major lobes of the Mississippi River delta in Louisiana (ESS-H-C3)
EnvS: GLE-12	Give examples and describe the effect of pollutants on selected
EnvS: GLE-26	Determine local actions that can affect the global environment (SE-H-D4)

OBJECTIVES:
* To observe the natural flow of water through a system.
* To observe the changes in the natural flow of water through a system

STUDENT HANDOUTS:
4. Wetland Model Lab Sheet
5. Hydrological Modification – Review Questions
6. Barataria-Terrebonne Basin Map

TEACHER GUIDES:
4. Wetland Model Lab Sheet
5. Hydrological Modification – Review Questions

Activity 1 Introduction (3 minutes)
1. Distribute **Student Handout *Barataria-Terrebonne Basin Map*.** Have students locate the two basins and trace how the Mississippi River travels through it, along with the bayous and canals within the region.

Activity 2 Wetland Model Lab (30 minutes)
1. Give students **Student Handout 4**. Use this as a guide to help students design a wetland model to simulate the flow of water into the Gulf of Mexico.

Activity 3 Video Presentation (10 minutes)
1. Have students view the Hydrological Modification portion of the video. Start at the beginning of this section and end with the shrinking of Louisiana on the balloon.

Activity 4 Homework Assignment (2 minutes)
1. Assign **Student Handout 5** for homework. The students should also answer the review questions on **Student Handout 6**.

ASSESSMENT:
1. Assess lab assignment using the conclusion question sheet that accompanies the lab.
2. Assess reading assignment using the homework question sheet provided with the reading.

Student Handout 4

Wetland Model Lab

Group Members:		Date:	
		Period	

Purpose: To discuss interrelationships among precipitation, runoff, natural flow, and wetlands.

Materials (per student group):

modeling clay	watering can or spray bottle	beaker or jar
water	piece of carpet or sponge	paint roller tray or baking pan
graduated cylinder		

Preparation:

1. Spread a layer of modeling clay in 1/2 of the container to represent land. Leave the other 1/2 of the container empty to represent a body of water.
2. Shape the clay so that it gradually slopes down to the water. Smooth the clay along the sides of the container to seal the edges. Form a meandering river with tributaries in the clay that lead into the body of water. Refer to the Mississippi River on maps provided to give you a pattern.

Activity 1 Procedure:

1. What will happen if you pour water into the main river system? Where will the water go? Record your prediction by writing your answer below.
   _____
2. Spray 100 mL of water into the head of the river system to simulate rain and record your observations.
   _____
   _____
   _____
3. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.

Activity 2 Procedure:

4. Cut a piece of carpet or sponge to completely fill the space across the container along the lower end of the clay. Make sure there are no spaces and that the fit is precise. This represents a wetland buffer between dry land and the open waters of the Gulf of Mexico.
5. Once the carpet is in place, spray 100 mL of water into the head of the river system and record your observations.
   _____
   _____
   _____
6. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL. How does this amount compare to the amount you collected in Step #3 above? _____
   Why are the two measurements different? _____
   _____
   _____
   _____

Student Handout 4

Activity 3 Procedure:

7. Spread a thin layer of soil or sand over the clay in your river system model. Be sure not to get any soil or sand in one of your waterways. Remove the carpet from your tray (but keep it handy, you will need it again in Step 10).
8. Spray 100 mL of water into the head of the river system and record your observations.

   _____
   _____
   _____
9. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.
10. Again, spread a thin layer of soil or sand over the clay in your river system model. Be sure not to get any soil or sand in one of your waterways. Replace the carpet in your tray.
11. Spray 100 mL of water into the head of the river system and record your observations.

    _____
    _____
    _____
12. Collect the water from the open water end and measure it in the graduated cylinder.
    We collected _____ mL.

Activity 4 Procedure:

13. Spread a thin layer of soil or sand over the clay in your river system model. Be sure to not get any soil or sand in one of your waterways. Place the carpet in your tray.
14. Add several drops of a dark food coloring to your 100mL of water to represent pesticides and other pollutants. Spray the colored 100 mL of water into the head of the river system and record your observations.

    _____
    _____
    _____
15. Collect the water from the open water end and measure it in the graduated cylinder.
    We collected _____ mL.
    Describe the color of your water compared to the water that you sprayed into the system.

    _____
    _____
    _____

Conclusions:

A. Summarize what you learned about the functions of coastal wetlands from these four activities.

   _____
   _____
   _____

B. How might muddy water affect fish and other aquatic species?

   _____
   _____
   _____

C. How are aquatic plants affected by muddy water?

   _____
   _____
   _____

Student Handout 4

ANSWER KEY

Wetland Model Lab

Group Members:		Date:	
		Period	

Purpose: To discuss interrelationships among precipitation, runoff, natural flow, and wetlands.

Materials (per student group):

modeling clay	watering can or spray bottle	beaker or jar
water	piece of carpet or sponge	paint roller tray or baking pan
graduated cylinder		

Preparation:

1. Spread a layer of modeling clay in 1/2 of the container to represent land. Leave the other 1/2 of the container empty to represent a body of water.
2. Shape the clay so that it gradually slopes down to the water. Smooth the clay along the sides of the container to seal the edges. Form a meandering river with tributaries in the clay that lead into the body of water. Refer to the Mississippi River on maps provided to give you a pattern.

Activity 1 Procedure:

1. What will happen if you pour water into the main river system? Where will the water go? Record your prediction by writing your answer below.
   Answers will vary.

2. Spray 100 mL of water into the head of the river system to simulate rain and record your observations.
   The water will run down hill and end up in the body of water. There should be an overflow that floods some of the land.

3. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.

Activity 2 Procedure:

4. Cut a piece of carpet or sponge to completely fill the space across the container along the lower end of the clay. Make sure there are no spaces and that the fit is precise. This represents a wetland buffer between dry land and the open waters of the Gulf of Mexico.

5. Once the carpet is in place, spray 100 mL of water into the head of the river system and record your observations.
   The water is slowed down as it runs through the carpet. Also, the carpet absorbs some of the water, much like the way coastal wetlands absorbs waters from large storms and floods. The remainder slowly drains into the body of water at the bottom.

6. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL. How does this amount compare to the amount you collected in Step #3 above? _____
   Why are the two measurements different?
   The carpet absorbed some of the water in Activity 2. There was nothing to absorb the water in Activity 1, so all the water ran directly into the "ocean".

Student Handout 4

Activity 3 Procedure:

7. Spread a thin layer of soil or sand over the clay in your river system model. Be sure to not get any soil or sand in one of your waterways. Remove the carpet from your tray (but keep it handy, you will need it again in Step 10).

8. Spray 100 mL of water into the head of the river system and record your observations.
   The rain should pick up and carry some of the soil as it travels over the land and into the rivers and streams that drain to the ocean.

9. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.

10. Again, spread a thin layer of soil or sand over the clay in your river system model. Be sure to not get any soil or sand in one of your waterways. Replace the carpet in your tray.

11. Spray 100 mL of water into the head of the river system and record your observations.
    The carpeting, making the water in the body of water much clearer, traps the soil particles. The uphill side of the wetland (carpet) should be coated with trapped sediment.

12. Collect the water from the open water end and measure it in the graduated cylinder.
    We collected _____ mL.

Activity 4 Procedure:

13. Spread a thin layer of soil or sand over the clay in your river system model. Be sure to not get any soil or sand in one of your waterways. Place the carpet in your tray.

14. Add several drops of a dark food coloring to your 100mL of water to represent pesticides and other pollutants. Spray the colored 100 mL of water into the head of the river system and record your observations.
    The colored water should drain as it did earlier, however, the colored water will appear in the body of water.

15. Collect the water from the open water end and measure it in the graduated cylinder.
    We collected _____ mL.
    Describe the color of your water compared to the water that you sprayed into the system.
    The water that passed through the wetlands (carpet) should appear slightly lighter in color than the original water that was spayed on the upper part of the river system.

Conclusions:

Summarize what you learned about the functions of coastal wetlands from these four activities.

Wetlands perform four valuable functions:

(1) Wetlands act as a sponge (Activity 2) and soak up floodwaters.

(2) Wetlands act as buffers (Activity 2) and slow water down that is moving quickly, thereby reducing erosion problems.

(3) Wetlands act as sediment collectors (Activity 3) and allow soil and sand carried by waters passing through them to settle out and deposit.

(4) Wetlands act as a filter (Activity 4) and take pesticides and other pollutants out of waters that pass through them.

Student Handout 5

Hydrological Modifications

Name:		Date:	
		Period	

1. Why is hydrological modifications called the “linch pin” problem?

2. Explain what hydrological modification means and give some examples of hydrological modification.

3. What are the major results of hydrologic modification?

4. What was the major reason for building the levees along the Mississippi River?

5. What was the primary source of sediment that fed the marshes?

6. What negative results came about due to the construction of the navigation canals?

7. What positive results developed due to the navigation canals?

Student Handout 5

ANSWER KEY

Hydrological Modifications

Name:		Date:	
		Period	

1. Why is hydrological modifications called the “linch pin” problem?

   This particular problem affects all the other problems being experienced in the estuary.

2. Explain what hydrological modification means and give some examples of hydrological modification.

   Hydrological modification occurs when the natural flow of water through a watershed is changed. Examples of hydrological modification include levees, dams, diversions, weirs, water control structures, etc.

3. What are the major results of hydrologic modification?

   The major results of hydrologic modification are acceleration of erosion, changes in salinity, and preventing of sediment from depositing where needed

4. What was the major reason for building the levees along the Mississippi River?

   The major reason for building the levess is to stop the flooding of homes.

5. What was the primary source of sediment that fed the marshes?

   The primary source of sediment that fed the marshes was from the Mississisippi River.

6. What negative results came about due to the construction of the navigation canals?

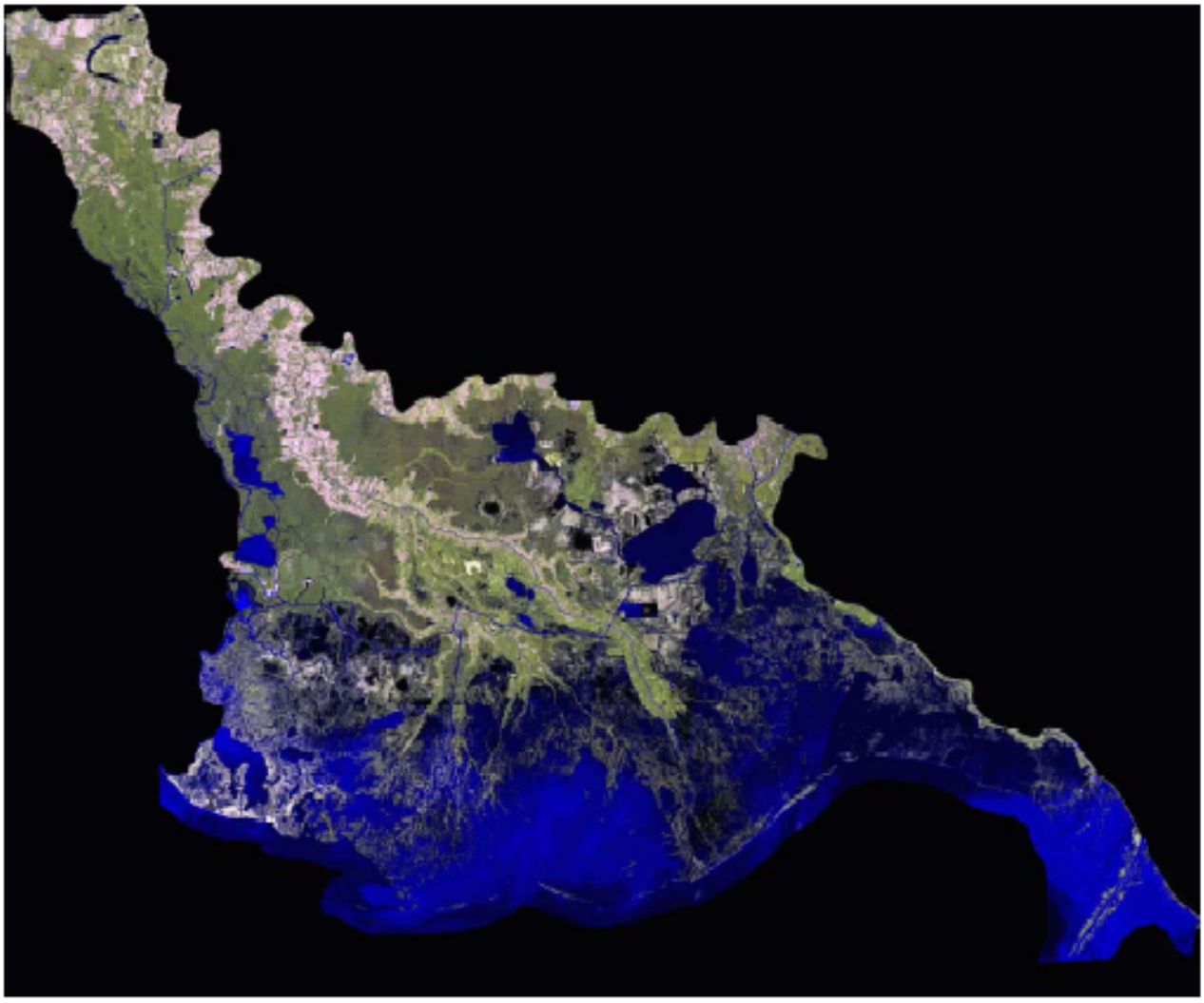
   Some negative results are higher salinity rates forcing animals to relocate, erosion of land areas, and alter the natural flow of water across the estuary landscape.

7. What positive results developed due to the navigation canals?

   Some positive results are canal banks provide some diversity of habitat, recreational opportunities, and help the shipping industry grow

Student Handout 6

Map of the Barataria-Terrebonne Basins



LESSON 3 SEDIMENT LOSS

OVERVIEW:
This lesson will be used to introduce the second problem associated with the Louisiana wetlands. The Mississippi River provided the sediment needed for survival of the Louisiana marshes. However, levees now confine the sediment to the river channel and direct it into the deep waters of the Gulf of Mexico.

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

BIO: GLE-23	Illustrate the flow of carbon, nitrogen, and water through an ecosystem (LS-H-D1)
BIO: GLE-27	Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)
HSES: GLE-20	Determine the chronological order of the five most recent major lobes of the Mississippi River delta in Louisiana (ESS-H-C3)
EnvS: GLE-12	Give examples and describe the effect of pollutants on selected
EnvS: GLE-26	Determine local actions that can affect the global environment (SE-H-D4)

OBJECTIVES:
* To observe the natural flow of water through a system.
* To identify the causes of sediment loss to the marshes.
* To identify problems associated with sediment loss in the coastal plain.

STUDENT HANDOUTS:
7. Wetland Model Lab, Part 2
8. Sedimentation Reduction Review Questions

TEACHER GUIDES:
7. Wetland Model Lab, Part 2
8. Sedimentation Reduction Review Questions

Activity 1 Review (10 minutes)
1. Review the answers to the Wetland Model Lab (**Student Handout 5**) covered in Day 2 of this Activity Guide.

Activity 2 Wetland Model Lab, Part 2 (10 minutes)
1. Give students **Student Handout 7**. Help students discover what causes sediment loss in the wetlands using the wetland models they created on Day 2.
2. Review answers to questions for this activity.

Activity 3 Video Presentation (10 minutes)
1. Have students view the Sediment Loss portion of the video. Start at the beginning of this section and end with the crushing of the potato chips at the levee bank.

Activity 4 Closure (7 minutes)
1. Discuss the video and answer the review questions on **Student Handout 8**.

ASSESSMENT:
1. Students should be able to identify the causes of sediment loss and predict problems associated with sediment loss by answer the review questions on Student Handout 8.

Student Handout 7

Wetland Model Lab, Part 2

Group Members:		Date:	
		Period	

Purpose: To discover the role that levees play in sediment distribution on the coastal plan.

Preparation:

1. Use the wetlands models prepared on Day 2. If the clay has started to dry and pull away from the sides of your container, add more clay to seal it. Since the Mississippi River empties her waters directly into the Gulf of Mexico, you will need to remove the carpet or sponge that represented wetlands in your model.

Activity 1 Procedure:

1. Build levees along the main river of the model using modeling clay. Levees are low hills that run parallel to the river.

2. Place a thin layer of soil or sand over the land area outside of the levees.

3. What will happen if you pour water into the main river system? Where will the water go? Record your prediction by writing your answer below.

4. Spray 100 mL of water into the head of the river system to simulate rain and record your observations.

5. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.

6. Summarize how this experiment was similar and different from the results of your previous experiments.

Student Handout 7

ANSWER KEY

Wetland Model Lab, Part 2

Group Members:		Date:	
		Period	

Purpose: To discover the role that levees play in sediment distribution on the coastal plan.

Preparation:

1. Use the wetlands models prepared on Day 2. If the clay has started to dry and pull away from the sides of your container, add more clay to seal it. Since the Mississippi River empties her waters directly into the Gulf of Mexico, you will need to remove the carpet or sponge that represented wetlands in your model.

Activity 1 Procedure:

1. Build levees along the main river of the model using modeling clay. Levees are low hills that run parallel to the river.

2. Place a thin layer of soil or sand over the land area outside of the levees.

3. What will happen if you pour water into the main river system? Where will the water go? Record your prediction by writing your answer below.

   Answers will vary.

4. Spray 100 mL of water into the head of the river system to simulate rain and record your observations.

   The water will run down hill and end up in the body of water. There should be an overflow that floods some of the land.

5. Collect the water from the open water end and measure it in the graduated cylinder.
   We collected _____ mL.

6. Summarize how this experiment was similar and different from the results of your previous experiments.

   Water that fell inside the river system could not easily overflow the levees and so went straight to the Gulf of Mexico. Water that fell outside of the levees could not drain into the river and so had to find another way to the Gulf of Mexico through smaller bayous and then through the wetlands. None of the water in the river channel could disperse onto the wetlands on either side of the river, and so all the sediment that was in the river stayed in the river channel and could not be dispersed over the wetlands.

Student Handout 8

Sediment Reduction

Name:		Date:	
		Period	

1. What is the major cause for the loss of sediment into the Louisiana marshes?

2. Where is most of the rich sediment being deposited now? Why?

3. What is “subsidence”?

4. What other processes lessened the amount of sediment flowing down the Mississippi River?

5. What problems are associated with sediment loss?

Student Handout 8

ANSWER KEY

Sediment Reduction

Name:		Date:	
		Period	

1. What is the major cause for the loss of sediment into the Louisiana marshes?

   Levees along the Mississippi River and the major reason why sediment no longer replenishes the Louisiana marshes.

2. Where is most of the rich sediment being deposited now? Why?

   Sediment carried by the Mississippi River is now being deposited off the continental shelf of Louisiana into the deep Gulf of Mexico. This is because the Mississippi River delta has built out all the way to the edge of the continental shelf and sediments are now being deposited into the deep Gulf of Mexico basin.

3. What is "subsidence"?

   Subsidence is a natural geological process that happens as river sediments are deposited to build deltas. Subsidence occurs as the loosely deposited sediments (sands, silts and clays) are compacted and sink under their weight due to gravity.

4. What other processes lessened the amount of sediment flowing down the Mississippi River?

   Dams, reduction of land clearing and tilling of soil on farmland, and land conservation measures upriver have all lessened the amount of sediment flowing down the Mississippi River.

5. What problems are associated with sediment loss?

   As sediments are lost from the coastal marshes, land slowly subsides. This natural process results in land converting to open water. This process results in a change and/or loss of vegetation and an internal fragmentation of the wetlands.

LESSON 4 HABITAT LOSS

OVERVIEW:
This lesson will be used to introduce the third problem associated with the Louisiana wetlands. The altering of waterways along with natural subsidence creates a habitat problem for plants, animals, and people.

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

BIO: GLE-27	Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)
EnvS: GLE-12	Give examples and describe the effect of pollutants on selected
EnvS: GLE-26	Determine local actions that can affect the global environment (SE-H-D4)

OBJECTIVES:
* To explore the impact of habitat loss on species.
* To describe the steps leading to habitat destruction.

STUDENT HANDOUTS:
3. Eutrophication Lab Sheet (from Day 1)
9. Thrown Into a New Environment
10. Habitat Loss Review Sheet

TEACHER GUIDES:
9. Thrown Into a New Environment
10. Habitat Loss Review Sheet

Activity 1 Eutrophication Lab (10 minutes)
1. Students will observe the ecosystem changes in the Eutrophication Lab that was set up on Day 1. Refer to **Student Handout 3**, Step 7. Record observations.

Activity 2 Video Presentation (13 minutes)
1. Have students view the Habitat Loss portion of the video. Start at the beginning of this section and end with the words "Changes in Living Resources".
2. Have students discuss the questions on **Student Handout 10**. Students should finish this worksheet for homework if not completed in class.

Activity 3 Thrown Into a New Environment Activity (20 minutes)
NOTE: In order for enough time to be available for this activity, all materials should be prepared in advance and ready for student use. The bulletin board paper should be cut into sheets for students to punch holes in or cut in advance.
1. Divide students into cooperative groups to investigate the impact of habitat loss on species. Give students **Student Handout 9**. .
2. Students begin by answering the pre-activity questions and punch out or cut out the appropriate pieces of each color paper.
3. Arrange classroom space to accomplish the activity.
4. Have students collect data as described in the procedures of the student handout.
5. Discuss the follow-up questions with the class.

LESSON 4 | HABITAT LOSS (continued)

ASSESSMENT:

1. Randomly call on students to answer questions and/or collect one paper from each group to be graded.

SUGGESTION:

If time will be a problem in completing the activity, Thrown Into a New Environment, you may cut the pieces of paper in advance and skip the procedures on Student Handout 9 that explains how to cut or punch the paper (Steps 1 and 2).

Student Handout 9

Thrown Into a New Environment

Group Members:		Date:	
		Period	

Pre-Activity Questions:

1. Define the term "camouflage", and explain the significance of this characteristic of some animals.

   _____

   _____

2. As land becomes covered with water, animals and plants are effected. List some of the responses that plants and animals have to this change in their environment.

   _____

   _____

3. Do you think all of these displaced species will survive in a new environment? Explain your answer.

   _____

   _____

Purpose: To simulate the effects on a species moving into a new environment.

Materials: Bulletin board paper (15 cm x 15 cm of four different colors for each group of students)
Bulletin board paper (2-4 feet sections taped side by side, of only one color).
Ruler and Scissors or Hole puncher
Paper or plastic cup
*** All bulletin board paper should be the same color on both its sides.*

Procedure:

1. Each group should cut out twenty-five 1cm x 1cm squares of four colors of poster paper. (An alternate way to accomplish this is to use a hole puncher to punch 25 holes in each of the four colors of poster paper.) Each of the four colors represents a species of animal. Place all the pieces in a paper cup.
2. Multiply the number of groups by 25 for each color paper to attain a total number of pieces for each color. Record these numbers in the data table of this worksheet.
3. Clear an area of floor that will be designated as the habitat area in the classroom.
4. All of the cut paper squares should be dumped and spread out in the designated habitat area.
5. The teacher will allow one student from each group (or any appropriate number of students) 10 seconds to pick up as many pieces of paper as they can. Following the 10 seconds, each group will count how many pieces of each color they have and report to the class to obtain a total number of each color picked up. Record these class totals in the data table of this worksheet.
6. Pick up all of the pieces of paper and place them back in the cups. Now place the taped 4-foot sections of 1 color of paper in the designated habitat area. This represents a new area that your species have been forced to move due to habitat loss.
7. Repeat steps 4 and 5. Record data.

Data Table

Total number of each color of pieces of paper:
_____

Total pieces of paper:
_____

Color of the taped 4-foot poster paper sections:
_____

Species/ Color	# picked up bare floor	# picked up on color paper
Species A Color: _____		
Species B Color: _____		
Species C Color: _____		
Species D Color: _____		

Student Handout 9

Thrown Into a New Environment (PAGE 2)

Follow-Up Questions:

1. Was there a significant difference between how many pieces of each color was picked up during the first trial on the bare floor? Explain. _____
   _____
   _____

2. Were you able to see all colors clearly when the paper was on the plain floor? Explain.
   _____
   _____

3. Was there one color during the second trial with the colored paper on the floor that was not picked up as much as the others? _____ If so, which color? _____

4. Why do you suppose one color might be more difficult for you to pick up once the colored paper was placed in the habitat area?
   _____
   _____
   _____

5. Do you believe when animals are forced to move into new environments they might be easier for predators to find? Explain your answer, comparing it to the data collected in this activity.
   _____
   _____
   _____

6. How might habitat loss cause the extinction of a species living in the Louisiana wetlands?
   _____
   _____
   _____

Student Handout 9

ANSWER KEY

Thrown Into a New Environment

Group Members:		Date:	
		Period	

Pre-Activity Questions:

1. Define the term "camouflage", and explain the significance of this characteristic of some animals. ***Camouflage is the method which allows an animal to change or blend into its surroundings. Answers will vary.***
2. As land becomes covered with water, animals and plants are effected. List some of the responses that plants and animals have to this change in their environment. ***Answers will vary.***
3. Do you think all of these displaced species will survive in a new environment? Explain your answer. ***Opinion supported by factual information.***

Purpose: To simulate the effects on a species moving into a new environment.

Materials: Bulletin board paper (15cm x 15 cm of four different colors for each group of students)
Bulletin board paper (2-4 feet sections taped side by side, of only one color).
Ruler and Scissors or Hole puncher
Paper or plastic cup
*** All bulletin board paper should be the same color on both its sides.*

Procedure:

1. Each group should cut out twenty-five 1cm x 1cm squares of four colors of poster paper. (An alternate way to accomplish this is to use a hole puncher to punch 25 holes in each of the four colors of poster paper.) Each of the four colors represents a species of animal. Place all the pieces in a paper cup.
2. Multiply the number of groups by 25 for each color paper to attain a total number of pieces for each color. Record these numbers in the data table of this worksheet.
3. Clear an area of floor that will be designated as the habitat area in the classroom.
4. All of the cut paper squares should be dumped and spread out in the designated habitat area.
5. The teacher will allow one student from each group (or any appropriate number of students) 10 seconds to pick up as many pieces of paper as they can. Following the 10 seconds, each group will count how many pieces of each color they have and report to the class to obtain a total number of each color picked up. Record these class totals in the data table of this worksheet.
6. Pick up all of the pieces of paper and place them back in the cups. Now place the taped 4-foot sections of 1 color of paper in the designated habitat area. This represents a new area that your species have been forced to move due to habitat loss.
7. Repeat steps 4 and 5. Record data.

Data Table

Total number of each color of pieces of paper:
_____

Total pieces of paper:
_____

Color of the taped 4-foot poster paper sections:
_____

Species/ Color	# picked up bare floor	# picked up on color paper
Species A Color: _____		
Species B Color: _____		
Species C Color: _____		
Species D Color: _____		

Student Handout 9

ANSWER KEY

Thrown Into a New Environment (PAGE 2)

Follow-Up Questions:

1. Was there a significant difference between how many pieces of each color was picked up during the first trial on the bare floor? ***There should not be a difference.***

2. Were you able to see all colors clearly when the paper was on the plain floor? Explain.
   This will depend upon the colors of the paper and the color of the floor. If all of the four colors of paper clash with the color of the floor, then all the colors should be easily seen.

3. Was there one color during the second trial with the colored paper on the floor that was not picked up as much as the others? ***varies*** If so, which color? ***varies***

4. Why do you suppose one color might be more difficult for you to pick up once the colored paper was placed in the habitat area?
   One color should be more difficult because it will blend in with the color of the paper placed in the habitat area.

5. Do you believe when animals are forced to move into new environments they might be easier for predators to find? Explain your answer, comparing it to the data collected in this activity.
   Yes, because the animals are no longer camouflaged for the environment that they are living in just as none were camouflaged on the plain floor. But if placed in the same color, the animal was protected.

6. How might habitat loss cause the extinction of a species living in the Louisiana wetlands?
   This might occur in extreme cases where a species just does not adapt to a new environment. There could be a shortage of food supply or a major difference in climate. Loss of habitat might also interfere with mating or spawning grounds. Or, predators could realistically wipe out a species that does not adapt.

Student Handout 10

Habitat Loss

Name:		Date:	
		Period	

1. What was the estimated loss of land in the Barataria-Terrebonne basins as of 1990?

2. According to estimates, how much land in the Barataria-Terrebonne basins will be lost by the year 2010?

3. Which area of Louisiana is experiencing the greatest land loss?

4. What are the most significant problems leading to habitat loss?

5. What species have been negatively affected by habitat loss?

6. What threatened or endangered species have been positively affected by habitat conservation measures?

Student Handout 10

ANSWER KEY

Habitat Loss

Name:		Date:	
		Period	

1. What was the estimated loss of land in the Barataria-Terrebonne basins as of 1990?

   13,500 acres.

2. According to estimates, how much land in the Barataria-Terrebonne basins will be lost by the year 2010?

   An additional 163,000 acres.

3. Which area of Louisiana is experiencing the greatest land loss?

   The marshes of north Terrebonne Bay, extending south along the western edge of this basin..

4. What are the most significant problems leading to habitat loss?

   The biggest problems include sediment loss and subsidence, and saltwater intrusion. For example, saltwater intrusion via the Houma Navigation Channel has lead to the loss of cypress swamps in this region.

5. What species have been negatively affected by habitat loss?

   Species negatively affected by habitat loss include shellfish, fin fish, furbearers (muskrat, mink, otter), waterfowl, migratory birds, alligators, and humans.

6. What threatened or endangered species have been positively affected by habitat conservation measures?

   Species positively affected by habitat conservation measures include the brown pelican and bald eagle.

LESSON 5 CHANGES IN LIVING RESOURCES

OVERVIEW:
This lesson will be used to introduce the fourth problem associated with the Louisiana wetlands. The economics and culture of this unique area are at stake.

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

BIO: GLE-27	Analyze positive and negative effects of human actions on ecosystems (LS-H-D4)
EnvS: GLE-16	Evaluate the effectiveness of natural resource management in Louisiana (SE-H-B4) (SE-H-B5)
EnvS: GLE-23	Describe the relationship between public support and the enforcement of environmental policies (SE-H-C5)

OBJECTIVES:
* To identify factors that contribute to the decline in animal populations in the estuary.
* To describe the effect of introduced species into an environment.
* To relate the economic and cultural changes associated with the estuary.

STUDENT HANDOUTS:
3. Eutrophication Lab Sheet (from Day 1)
9. Thrown Into a New Environment
10. Habitat Loss Review Sheet

TEACHER GUIDES:
9. Thrown Into a New Environment
10. Habitat Loss Review Sheet

Activity 1 Eutrophication Lab (10 minutes)
1. Students will observe the ecosystem changes in the Eutrophication Lab that was set up on Day 1. Refer to **Student Handout 3**, Step 7. Record observations.

Activity 2 Video Presentation (13 minutes)
1. Have students view the Habitat Loss portion of the video. Start at the beginning of this section and end with the words “Changes in Living Resources”.
2. Have students discuss the questions on **Student Handout 10**. Students should finish this worksheet for homework if not completed in class.

ASSESSMENT:
1. Randomly call on students to answer questions and/or collect one paper from each group to be graded.

SUGGESTION:
If time will be a problem in completing the activity, Thrown Into a New Environment, you may cut the pieces of paper in advance and skip the procedures on Student Handout 9 that explains how to cut or punch the paper (Steps 1 and 2).