Marine Debris Prevention and Education

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Barataria-Terrebonne National Estuary Program

Middle School Lessons

2018

BTNEP

Note from the author Ms. Dottie Hartman:

Microplastics are small, barely visible pieces of plastic that enter, pollute, and disrupt nature's ecosystems. Inspired by growing scientific and public concern about microplastics, this curriculum was developed. It includes lessons that introduce students to issues of microplastic pollution in the marine ecosystem while encouraging environmental stewardship. Aligned with the 2017 Louisiana Science Standards, these lessons are intended for middle school students, but can easily be adapted for learners of all ages.

Note from the co-author Mrs. Alma Robichaux:

Students need a background in what caused marine debris in order to learn to devalue single use plastics which are so harmful to our estuaries, waterways, drinking water, and oceans. These lessons will give students the understanding they need to change not only their behavior but that of future generations. The prevention of plastic pollution is of the utmost importance to improving global water quality.It has been such a pleasure working with Dottie Hartman to create these lesson plans. I know teachers will find them useful and students will find them engaging. Encouraging our youth to prevent plastic pollution and to improve water quality is our ultimate goal.

BTNEP and its Management Conference hopes you enjoy the lessons.

Litter Did You Know?

EARTH AND HUMAN ACTIVITY 8-MS-ESS3-3

- **Beach in a Bag**

Students "sweep" a beach wrack sample to learn about microplastics and the difficulties associated with their removal.

- **Oceans of Trash**

Students use an imaginary coastal map to identify ways trash travels through the environment. They learn the common trash items polluting Louisiana coastlines and develop stewardship as they consider ways to reduce and keep litter out of oceans.

- **How Long Until It's Gone?**

Students explore how long it takes for litter to breakdown by constructing a trash timeline. They learn different ways that litter breaks down and why plastics are so persistent in the trash landscape.

- **Hanging in the Gulf**

What happens when plastic enters the Gulf of Mexico (GOM)? To answer this question students learn about plastics and investigate their densities. They construct a water column display to explore feeding strategies and locations of various gulf sea life. Students use information from these activities to predict how plastics impact GOM food chains.

- **A Close Look at Microplastics**

The lesson begins with a discussion about microplastics. Students role play how microplastics transport toxins (POPs) into ocean food chains. Then, "Chains of Knowledge" are crafted to raise awareness of microplastic pollution.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Section 1: Beach in a Bag

Students "sweep" a beach wrack sample to learn about microplastics and the difficulties associated with their removal.

Barataria-Terrebonne National Estuary Program

2018

5E Lesson: BEACH IN A BAG

Objectives

- *Identify and sort debris from Louisiana beach samples.*
- *Define microplastics.*
- *Recognize the difficulties of removing microplastic debris from beaches.*
- *Develop and use a model for collecting microplastics from Louisiana beach samples.*

Engagement

- *Students use* **Photograph Prompt: *"High concentrations of microplastics have been found in the Gulf of Mexico"*** *to identify current knowledge and create a list of questions for future learning.*

Exploration

- **Beach in a Bag Hands-on Activity:** *Students develop an understanding of microplastic pollution while exploring beach samples.*

Explanation

- **Beach in a Bag Student Guide:** *Students answer questions and explain difficulties associated with cleaning up microplastic beach contamination.*

Elaboration

- *Students design methods of removing microplastics from beach samples.*

Evaluation

- **Microplastics Knowledge Squares**: *Students summarize what they learned about microplastics.*

Standard: Earth and Human Activity 8-MS-ESS 3-3

Performance Expectation: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.

Science & Engineering Practices:
1. Ask questions.
2. Developing and using models.
3. Analyzing and interpreting data.
4. Use mathematics and computational thinking.
5. Constructing explanations and designing solutions.
6. Obtaining, evaluating, and communicating information.

Disciplinary Core Ideas: Human activities, globally and locally, have significantly altered the biosphere, sometimes damaging or destroying natural habitats. (MS.ESS3C.a)

Crosscutting Concepts: Relationships can be classified as casual or correlational, and correlation does not mean causation.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

BEACH IN A BAG (Lesson Plan)

Standard: **EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3**

Overview: Students "sweep" a Louisiana beach sample to learn about microplastics and the difficulties associated with their removal.

Enduring Understandings:

- Everyone's actions have an impact (both positive and negative) on the environment.
- Solving problems involves making observations, asking questions, collecting and analyzing data, and collaboration with others.

Objectives:

- Identify and sort debris from Louisiana beach samples.
- Define microplastics.
- Recognize the difficulties of removing microplastic debris from beaches.
- Develop and use a model for collecting microplastics from Louisiana beach samples.

Duration: 1-2 class periods

Materials for each student groups of 3-4:

- Lab Gloves
- Scissors
- Large Trays
- Forceps
- Magnifying lens
- Markers
- Tape
- Empty plastic baggie
- Ruler

- Gallon bag of beach sample (scooped from Louisiana beach wrack line)
- Internet Access

Materials for teacher:

- Lesson Plan
- Poster Boards or Large Post-It Sticky Notes for displaying student responses
- Markers
- Beach Debris Class Totals Table

Handouts:

for each group:

- Beach Debris Data card
- "High concentrations of microplastics have been found in the Gulf of Mexico."

for each student:

- Beach In A Bag: Student Guide

Safety: Wear lab gloves throughout activity.
Wash hands at end of activity.

Part 1: Engagement with photo prompt.

1. Divide class into student groups of 3-4. Give each group handout: "High concentrations of microplastics have been found in the Gulf of Mexico." Have groups answer questions on handout. Discuss answers and summarize responses on poster boards. Display in classroom for future reference.

Part 2: Explore with Beach in a Bag activity.

1. Divide class into small groups of 3-4.
2. Distribute supplies and handouts.
3. Post "Beach Debris Class Totals" in an area where groups have easy access.
4. Have students work in groups to complete Beach in A Bag Activity.

Part 3: Explain using Beach in a Bag Handout Questions.

1. Have students answer questions on student guide.
2. Review and discuss answers with class.

Part 4: Evaluate using "Microplastics Knowledge Squares."

Use "Microplastics Knowledge Squares" on student guide to evaluate understanding.

Part 5: Elaborate

The elaborate section on the student guide challenges students to brainstorm and experiment with ways of removing microplastics from beach samples.

High concentrations of microplastics have been found in the Gulf of Mexico.

1. **OBSERVE:** **Look closely at the photo. What do you notice about it? What details stand out?**

2. **THINK:** **What do you already know that might help explain an aspect of this photo?**

3. **WONDER:** **What questions do you have? What related ideas would you like to research?**

High concentrations of microplastics have been found in the Gulf of Mexico.

1. **OBSERVE:** **Look closely at the photo. What do you notice about it? What details stand out?**

Answers will vary.

2. **THINK:** **What do you already know that might help explain an aspect of this photo?**

Answers will vary.

3. **WONDER:** **What questions do you have? What related ideas would you like to research?**

Possible student generated questions that could be used for future learning:

- *What are microplastics?*
- *Why does the Gulf of Mexico have high concentrations of microplastics?*
- *Where do microplastics come from?*
- *Are microplastics harmful?*
- *Do other oceans have high levels of microplastics?*
- *How do microplastics get into the Gulf of Mexico?*
- *Can microplastics be removed from the Gulf of Mexico?*

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Beach in a Bag

Background:

Plastic is everywhere; especially in the oceans. Plastic ocean litter is unsightly and dangerous to marine life. Too often, photographs show marine life entangled in fishing line or sea turtles ingesting floating plastic bags. Now, there are growing concerns over microplastics; plastic litter too small to be easily seen.

Microplastics are pieces of plastic 5 mm or less in size (about the size of a single Mardi gras bead). They form when large pieces of plastic fragment into smaller pieces or when synthetic clothing shed plastic **microfibers**. Microplastics can also be manufactered. For example, pre-production plastic pellets and plastic exfoliatants in body washes are examples of microplastics

Scientists estimate more than five trillion microplastic particles are polluting our oceans today. (Nature Geoscience) One reason for the high number is the fact that plastics last a LONG time. Plastics do not biodegrade. Instead, they continually wear down and break apart. Because of this, scientists have suggested that every single piece of plastic ever produced still exists today. It is likely that the amount of oceanic plastic litter will increase considering global demand for plastic goods and inadequate waste management/recycling practices in many parts of the world.

Once in the ocean, microplastics interact with marine life. Studies show that when filter feeders such as oysters consume microplastics, their reproduction rates decline. Because they are vital components of marine ecosystems, the demise of filter feeders poses a serious threat to food webs. Also, persistent organic pollutants such as DDT and PCBs, concentrate on the surface of microplastics. Studies have found concentrations of PCBs a million times higher on plastic pellets than those in surrounding seawater. (Takada, International Pellet Watch). These pollutants enter food chains when plastic is ingested by marine organisms. Once in, pollutants biomagnify into dangerous levels as they pass up food chains.

Understanding how microplastics enter the marine environment is a step towards addressing the problem. Main ways that microplastics enter oceans are:

1. **Deterioration** of existing ocean plastic litter into smaller fragments

2. **Direct Release** into waterways when personal care products containing microplastics are rinsed down the drain.

3. **Direct Release** of microfibers into waterways that are shed when synthetic fabrics are laundered.

4. **Accidental Loss** of pre-production plastic pellets during transport.

Another important step in addressing ocean microplastic pollution is for everyone to make a difference. Here are some simple practices that help limit the amount of plastic entering the marine environment.

- Avoid Single-Use Plastic
- Use a Reusable Water bottle.
- Properly Dispose of Trash
- Recycle
- Participate in Beach or River Cleanups
- Avoid Products Containing Plastic Microbeads/Abrasives
- Buy in Bulk.
- Spread the Word.
- Add Natural Fabrics to your Wardrobe.
- Pick Up Litter.

VOCABULARY:

Debris: scattered pieces of rubbish or remains

Marine debris: anything man-made that ends up in the ocean and doesn't belong there

Microplastics: plastic marine debris 5 mm or smaller in size

Nurdles: small, pre-production plastic pellets

Plastic: long manufactured chains of hydrocarbons usually derived from natural gas or petroleum

Plastic fragments: piece of a larger plastic item

Plastic pellets: small, pre-production plastic particles; often known as nurdles

Wrack line: line of debris left on a beach by high tide

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

BEACH IN A BAG (Student Guide)

Name ________________________________ **Class**__________________________

Overview: Sweep a Louisiana beach sample to learn about microplastics and the difficulties associated with their removal.

Objectives:

- Identify and sort debris from Louisiana beach samples.
- Define microplastics.
- Recognize the difficulties of removing microplastic debris from beaches.
- Develop and use a model for removing microplastics from Louisiana beach samples.

Materials for each student group:

- Lab Gloves
- Scissors
- Large Tray
- Forceps
- Magnifying lens
- Markers
- Tape
- Empty plastic baggie
- Ruler
- Louisiana Beach Sample
- Beach Debris Data Card
- Internet Access

Safety:

- Wear lab gloves throughout activity.
- Wash hands at end of activity.

Explore & Explain:

1. Empty contents of Louisiana beach sample onto large tray.

2. Remove all pieces of trash from beach sample.

3. Using the Beach Debris Data Card as a guide, sort and count the trash.

4. Record your results on the Class Totals table. How does your data compare with other group data? ____
____
____

5. What were the most common item(s) reported in the class total?____________________
____

6. Read NOAA's definition of <u>microplastics</u> at https://marinedebris.noaa.gov/what-are-microplastics-microfibers. Keeping the definition in mind, remove all microplastics from your beach sample and place them in a plastic baggie.

7. What criteria was used for deciding what should be placed in the microplastics baggie?
____

____

8. Microplastics form when plastic fragments into small pieces or when synthetic clothing shed microfibers. Microplastics can also be manufactured as small pre-production pellets or tiny exfoliating beads used in hygiene products. Recently, NOAA sampled 37 different national park beaches across the US and found all contaminated with microplastics. In general, beaches located near urban or agricultural areas showed highest pollution concentrations; as many as of 50 microplastic pieces per cup of sand.

Examine the microplastics removed from your beach sample. How many appear to be broken fragments? ___________________How many microplastics appear to be in their original size and shape? ______________________

9. Examine your "cleaned up" beach sample with a magnifying lens. Are microplastics still present in the sample? __________________________________ Why is it possible for microplastics to be present even if they are not visible with a magnifying lens?

____

____

---

10. How many cups of sand do you think was in your original Louisiana beach sample? _______________________ How many microplastic pieces were removed from this sample?______________________How many microplastic pieces do you think are present on Louisiana beaches? __________________________ Considering the difficulties with removing microplastics from beach sand, what do you think should be done about microplastic beach pollution?

____

____

____

11. Who do you think is responsible for cleaning up microplastic beach pollution?

____

12. What advice would you give to citizens of a small coastal community looking for ways to remove microplastic debris from their beaches? ______________________________________

____

____

13. Describe the difficulties you had removing microplastics from your beach sample.

____

____

____

Evaluate: Think about the things you know about microplastics. Summarize your knowledge in the "MICROPLASTICS KNOWLEDGE SQUARE" and attach it to your microplastics baggie.

MICROPLASTICS KNOWLEDGE SQUARE

Name(s) ________________________________

Name______________________________ **Class**__________________ **Date**___________

Elaborate: Brainstorm an easier/faster way to remove microplastics from beach samples. Write a plan for your idea. ____

____

____

____

With your teacher's approval, try out your plan, and evaluate its success. The plan worked or didn't work because...

____

____

____

Beach Debris Data Card

Beach Name & Location: ____

	Quantity	
Plastic		
Plastic Fragments: Unrecognizable pieces of hard plastic debris		
Plastic Foam: Expanded polystyrene used for insulation or packaging, sometimes called "Styrofoam"		
Plastic Film: Flat, flexible plastic debris, such as pieces of bags and wrappers		
Plastic Pellets: Pre-production plastic pellets, also known as "nurdles"		
Plastic Filament: Examples include fishing line, rope, synthetic fabric		
Other Plastic:		**Description:**
Total Plastic Count:		
Paper and Metal		
Paper and Cardboard		
Metal (aluminum foil, etc)		
Other:		**Description:**
Total Paper and Metal Count:		

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

BEACH DEBRIS CLASS TOTALS

	Group 1	Group 2	Group 3	Group 4	Group 5
<u>Plastic</u>					
Plastic Fragments: Unrecognizable pieces of hard plastic debris					
Plastic Foam: Expanded polystyrene used for insulation or packaging, sometimes called “Styrofoam”					
Plastic Film: Flat, flexible plastic debris, such as pieces of bags and wrappers					
Plastic Pellets: Pre-production plastic pellets, also known as “nurdles”					
Plastic Filament: Examples include fishing line, rope, synthetic fabric					
Other Plastic:					
Total Plastic Count:					
<u>Paper and Metal</u>					
Paper and Cardboard					
Metal (aluminum foil, etc)					
Other:					
Total Paper and Metal Count:					

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Section 2: Oceans of Trash

Students use an imaginary coastal map to identify ways trash travels through the environment.

They learn the common trash items polluting Louisiana coastlines and develop stewardship as they consider ways to reduce and keep litter out of oceans.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Barataria-Terrebonne National Estuary Program

2018

6E Lesson: Oceans of Trash **Standard:** EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3

Objectives

- *Develop an understanding on how trash travels to the ocean.*
- *Use data to identify types and amounts of trash collected in coastal cleanups.*
- *Create posters that advocate ways to reduce litter and keep it out of oceans.*

Engagement

- ***Station Rotation:*** *Students respond to photo prompts set up at classroom stations.*

Exploration

- ***Trash Talk Videos:*** *https://marinedebris.noaa.gov/discover-issue/trash-talk*
  - *Where does marine debris come from? (2 min)*
  - *What can we do about marine debris? (2 min)*

- ***Oceans of Trash Student Activity:*** *Students use an imaginary coastal map to study ways trash travels through the environment. They use US Coastal Cleanup data to identify common trash items polluting Louisiana coastlines and develop stewardship as they consider ways to reduce and keep litter out of oceans.*

Explanation

- ***Too Much Trash Student Worksheet:*** *Students explain how actions such as picking up litter, participating in beach sweeps, recycling, limiting single use plastics, etc have an impact on ocean health.*

Elaboration

- ***Poster Project:*** *Students become stewards of the environment as they create posters listing ways to reduce litter and keep it out of oceans.*

Extension

- ***Community Design:*** *Students design and add environmentally friendly communities to the Oceans of Trash activity map.*

Evaluation

- ***Exit Ticket****: Describe 3 or more ways trash gets into oceans.*

Performance Expectation: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.

Science & Engineering Practices:

1. Ask questions.
2. Developing and using models.
3. Analyzing and interpreting data.
4. Constructing explanations and designing solutions.
5. Engaging in argument from evidence.
6. Obtaining, evaluating, and communicating information.

Disciplinary Core Ideas: Human activities, globally and locally, have significantly altered the biosphere, sometimes damaging or destroying natural habitats. (MS.ESS3C.a)

Crosscutting Concepts: Relationships can be classified as casual or correlational, and correlation does not mean causation.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

OCEANS OF TRASH (Lesson Plan)

Standard: **EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3**

Overview: Students use an imaginary coastal map to study ways trash travels through the environment. They use US Coastal Cleanup data to identify common trash items polluting Louisiana coastlines and develop stewardship as they consider ways to reduce and keep litter out of oceans.

Objectives:

- Develop an understanding on how trash travels to the ocean.
- Use US Coastal Cleanup/Ocean Trash Index Report data to identify types and amounts of trash collected in coastal cleanups.
- Create posters that advocate ways to reduce litter and keep it out of oceans.

Time: 4 days

Materials:

- Ocean Trash Cards
- Map Sections
- Volunteer Ocean Trash Data Form
- Recent US Coastal Cleanup/Ocean Trash Index Report
- Internet Access/ Projection Equipment
- Tape
- Exit Tickets

Student Handouts:

- Oceans of Trash
- Too Much Trash
- Ways To Reduce Litter And Keep It Out Of Oceans
- Station Rotation

Trash Talk Videos: https://marinedebris.noaa.gov/discover-issue/trash-talk

- Where does marine debris come from? (2 min)
- What can we do about marine debris? (2 min)

Advanced Preparation:

1. Make copies for **each student**.
   a. Oceans of Trash
   b. Too Much Trash
   c. Ways To Reduce Litter And Keep It Out Of Oceans
   d. Station Rotation
   e. Exit Ticket
2. Make copies for **each group** (2-3 students).
   a. Set of map sections
   b. Volunteer Ocean Trash Data Form (https://oceanconservancy.org)
   c. Recent US Coastal Cleanup/Ocean Trash Index Report (https://oceanconservancy.org)
3. Cut out Ocean Trash Cards.

Engagement- Station Rotation

1. Use the photo prompts to set up 6 separate student stations. Place a copy of the Ocean Conservancy-Ocean Trash Index with the photo prompt at Station 5.
2. Distribute Station Rotation handouts.
3. Tell students that photographs and questions are set up at each station. They are to visit each station (in any order) and answer the questions on their Station Rotation handouts.
4. Discuss responses with class when everyone is done.

Day 1

1. Separate class into groups of 2-3.
2. Distribute materials.

Each Student:	**Each Group:**
Oceans of Trash	Recent US Coastal Cleanup/Ocean Trash Index Report
Too Much Trash	Volunteer Ocean Trash Data Form
Ways To Reduce Litter And Keep It Out Of Oceans	Set of Map Sections
	Tape

3. Have groups tape map sections together to create a large map depicting an Imaginary South Louisiana Parish. This parish includes rivers that empty into the gulf as well as municipal areas, local businesses, parks, and beaches. Have groups create a fictitious name for the parish and write the name on the map.
4. Have groups complete activity Parts 1-3.
   Part 1: Locate important map landmarks.
   Part 2: Use Volunteer Ocean Trash Data Forms to record trash collected on map's Shell Island.
   Part 3: Sketch participants collecting litter at cleanup.

Day 2

1. Have students regroup.
2. Direct each group's attention to Shell Island on their maps. Remind all that an imaginary cleanup took place on Shell Island. Have groups review completed Volunteer Ocean Trash Data Forms. These forms are like the "real ones" used to document trash collected in coastal cleanups. Discuss how the forms are helpful in identifying types, abundance, and origins of trash.
3. Direct attention to the Ocean Trash Cards. Tell students that each card represents an item collected during cleanup. The trash item, its starting point and distance traveled are listed on the card. Discuss the idea that beach trash can begin "locally" or "far away."
4. Have each group select an Ocean Trash Card and instruct them to complete activity Part 4.
   Part 4: Consider ways trash moves in the environment, then write a story detailing trash's journey to the ocean.
5. Have groups share their stories. Using their stories, compile a list on a poster/whiteboard. Discuss different ways trash travels to the ocean.
6. Show 2 min video: Where does Marine Debris Come From?
7. Conclude with Exit Ticket: Describe 3 or more ways trash gets into oceans.

Day 3

1. Have students regroup and complete activity Part 5.
   Part 5: Use recent US Coastal Cleanup/Ocean Trash Index Reports to answer Too Much Trash worksheet.
2. Review worksheet answers with class. Point out that most ocean trash is made of plastic and ask students to consider the reasons why. (Plastic is abundant, durable, long-lasting, and does not biodegrade.)

Day 4

1. Share African Proverb. **"If you think you are too small to make a difference, you haven't spent the night with a mosquito."** Tell class that each person can do small things to help reduce litter and keep it out of oceans.
2. Direct attention to a recent US Coastal Cleanup/Ocean Trash Index report. Have students consider the number of plastic water bottles collected in recent cleanups. Encourage students to consider the difference it would make if more people used refillable bottles instead of plastic water bottles.
3. Have students regroup and complete activity Part 6 where they brainstorm and create a list of ways to reduce litter and keep it out of oceans. Have groups share lists with class.
4. For "professional advice" show the 2 min video: What can we do about marine debris?
5. Have students return to their individual seats and ask them to reflect on their favorite suggestions discussed in class. Have each individual student create a mini-poster with the **"**Ways To Reduce Litter And Keep It Out Of Oceans" handout.

Extension:

Have students add their own developments to the map. Challenge students to plan communities, infrastructures, etc with minimal impact to the environment.

OCEANS OF TRASH (Student Handout)

Name___________________________________ Class________________ Date____________

In this lesson you will gain an understanding of how trash travels to the ocean. You will identify types and amounts of trash collected in coastal cleanups and will explore ways you can help reduce and keep litter out oceans.

Activity:

Part One: Tape the map sections together. The map depicts an imaginary area in Louisiana where rivers discharge into the gulf. Different community sites are labeled on the map. Familiarize yourself with the map by locating the following landmarks. Place a ✓ by each landmark you locate.

___ Spoonbill's Marina
___ Shrimp Stadium
___ Pelican Park
___ Courville Cattle Company
___ Midden Dump
___ Chachere Crawfish Pond
___ Belle View Pier
___ West Bay
___ Shell Beach East Bridge
___ Oyster Island
___ State University

____ Redfish Road
____ Hospital
____ State Park
____ Shell Beach
____ Giant's Water Park
____ East End Pier
____ East Bay
____ West Bay Oil Rig
____ Shell Beach West Bridge
____ Landry's Laundromat
____ C'est La Vie Ship

Part Two: Shell Beach and the surrounding area is a popular recreation spot. Here, visitors enjoy beach activities such as swimming and fishing as well as area attractions: Giant's Water Park and Jaws Souvenir Shop. Unfortunately, Shell Beach has a problem. Trash litters the beach and debris floats in the surf. Concerned, community leaders decided to organize a coastal cleanup. Volunteers were recruited to help clean Shell Beach.

Students, T-Boy, Boudreaux, and Hebert, volunteered to help with the cleanup. They were assigned a half-mile area near Shell Beach East Bridge where they were instructed to pick up litter. The boys were asked to document their trash by completing a **Volunteer Ocean Trash Data Form**. The boys did a GREAT JOB collecting trash but forgot to complete the data form. These forms are important because they help identify the type, origin, and abundance of trash littering our beaches. Please **record the trash** collected by the boys on a Volunteer Ocean Trash Data Form.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Trash collected by T-Boy, Boudreaux, and Hebert

- Broken Crab Trap
- Red Solo Cup
- Empty Ice Bag
- 2 Plastic Grocery Bags
- Flip Flop
- Empty Chip Bag
- Styrofoam Meat Tray
- Dead Sea Turtle Tangled in Fishing Line
- 5 Plastic Water Bottles
- "Get Well" Balloon
- Bread Wrapper
- Plastic Spoon
- 5 Plastic Bottle Cap
- 5 Cigarette Butts
- Hard Hat
- Fishing line
- 2 Plastic Straws
- Metal Bottle Cap
- 3 Soda Cans
- Cast Net

Part Three: T-Boy, Boudreaux, Hebert and other volunteers enjoyed participating in the Shell Beach Coastal Cleanup Day. Add interest to the map by **sketching the boys** and other volunteers picking up litter.

Part Four: Some of the trash collected by T-Boy, Boudreaux, and Hebert began locally. Some came from far away and traveled great distances before arriving at Shell Island. **Select an ocean trash card**. Each card lists a trash item, its starting point, and the distance it traveled before reaching Shell Island. Imagine the pathway your trash took. How did your trash get outside? What forces of nature moved your trash through the environment? How long did it take for your item to get to Shell Beach? **Write 2-3 creative paragraphs detailing your trash's journey.** Use the map to help write your story. Be prepared to share your story with the class.

Part Five: Use recent US Coastal Cleanup/Ocean Trash Index reports to answer **Too Much Trash** worksheet.

Part Six: Ocean trash can kill marine life, injure beachgoers, and get caught in the propellers of boats and ships. Besides participating in coastal cleanups, there are other ways to minimize the problems of ocean litter. Brainstorm and create a list of 5 or more easy ways you can help reduce litter and keep it out of oceans. Be prepared to share your ideas with the class.

TOO MUCH TRASH

Name________________________________ Class__________ Date____________

Each year, an International Coastal Cleanup Day is held on the third Saturday in September. On this day volunteers come together to collect and document trash littering our world's coastal areas. Since the first International Coastal Cleanup in 1986, nearly 13 million people have collected over 250 million pounds of trash polluting our world's beaches and waterways. Data from completed Volunteer Ocean Trash Data forms is complied and published in an annual Coastal Cleanup/Ocean Trash Index Report. This report helps pinpoint the source of litter so something can be done to prevent it. Use recent US Coastal Cleanup/Ocean Trash Index reports and the Imaginary South Louisiana Parish Map to answer the following.

1. List some of the most commonly collected items from Louisiana beaches this past year.

2. What kind of material were these items made of? (paper, plastic, metal, vegetable matter, etc?)

3. What are some possible ways these items got on the beach?

4. How do you think ocean litter affects marine animals and their habitats?

5. How can actions such as picking up litter, participating in beach sweeps, recycling, limiting single use plastics, etc have an impact on ocean health?

6. How many Louisiana volunteers participated in the most recent Coastal Cleanup?

7. How does Louisiana compare with other states in terms of volunteer numbers?

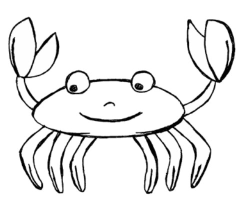
8. Look at data for an "interior state" lacking a coastline such as Idaho or Kentucky. Often, "interior states" have a surprising number of cleanup volunteers. How can their efforts make a difference in ocean health if they do not live near a coastline?

9. When is the next coastal cleanup date and where in Louisiana is this event being held? ? This information can be found at www.oceanconservancy.org/cleanup by typing "Louisiana" in the "Search for Cleanups" window.

10. Locate **Oyster Beach** on the map. As was the case with Shell Beach before the cleanup, Oyster Beach is covered with debris. Unfortunately, there were not enough volunteers to clean both beaches. So, the boys and their families are planning an Oyster Beach trip to pick up trash. According to a recent Coastal Cleanup/Ocean Trash Index Report, what are the top 10 items they will most likely collect on their trip? **Write the names** of these items on the map along Oyster Beach.

Ways To Reduce Litter And Keep It Out Of Oceans

Name______________________________ Class______________ Date__________



TRASH COLLECTED

Citizen scientist: Pick up all trash and record all items you find below. No matter how small the items, the data you collect are important for Trash Free Seas.®

EXAMPLE: (TOTAL #)

Plastic Bags: ~~||||~~ ||| = 8

Please DO NOT use words or check marks. Only **numbers** are useful data.

MOST LIKELY TO FIND ITEMS:

	TOTAL #
Cigarette Butts:	=
Food Wrappers (candy, chips, etc.):	=
Take Out/Away Containers (Plastic):	=
Take Out/Away Containers (Foam):	=
Bottle Caps (Plastic)	=
Bottle Caps (Metal)	=
Lids (Plastic) :	=
Straws/Stirrers:	=
Forks, Knives, Spoons:	=
Beverage Bottles (Plastic):	=
Beverage Bottles (Glass):	=
Beverage Cans:	=
Grocery Bags (Plastic):	=
Other Plastic Bags:	=
Paper Bags:	=
Cups & Plates (Paper):	=
Cups & Plates (Plastic):	=
Cups & Plates (Foam):	=

FISHING GEAR:

	TOTAL #
Fishing Buoys, Pots & Traps:	=
Fishing Net & Pieces:	=
Fishing Line (1 yard/meter = 1 piece):	=
Rope (1 yard/meter = 1 piece):	=

OTHER TRASH:

	TOTAL #
Appliances (refrigerators, washers, etc.):	=
Balloons:	=
Cigar Tips:	=
Cigarette Lighters:	=
Construction Materials:	=
Fireworks:	=
Tires:	=

PACKAGING MATERIALS:

	TOTAL #
6-Pack Holders	=
Other Plastic/Foam Packaging:	=
Other Plastic Bottles (oil, bleach, etc.):	=
Strapping Bands:	=
Tobacco Packaging/Wrap:	=

TINY TRASH LESS THAN 2.5CM:

	TOTAL #
Foam Pieces	=
Glass Pieces	=
Plastic Pieces	=

2.5cm (actual size)

DEAD/INJURED ANIMAL	STATUS	ENTANGLED	TYPE OF ENTANGLEMENT ITEM
	Dead or **Injured**	**Yes** or **No**	

ITEMS OF LOCAL CONCERN:

1.
2.
3.

CLEANUP SUMMARY (circle units)

Number of Trash Bags Filled: ____ **Weight of Trash Collected:** ____ lbs/kgs **Distance Cleaned:** ____ miles/km

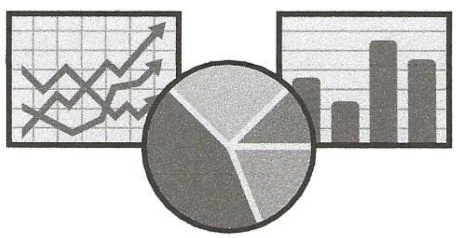
VOLUNTEER
OCEAN TRASH DATA FORM

Ocean Conservancy

Ocean and waterway trash ranks as one of the most serious pollution problems choking our planet. Far more than an eyesore, a rising tide of marine debris threatens human health, wildlife, communities and economies around the world. The ocean faces many challenges, but trash should not be one of them. Ocean trash is entirely preventable, and data you collect are part of the solution. The International Coastal Cleanup is the world's largest volunteer effort on behalf of ocean and waterway health.

HERE IS HOW IT WORKS:

1 CLEAN UP TRASH & COLLECT DATA



2 ORGANIZE & ANALYZE DATA

3 PUBLISH RESULTS

4 REDUCE OUR IMPACT

SITE INFORMATION:

Cleanup Site Name: SHELL BEACH

State or Province: LOUISIANA

Zone or County: SOUTH LOUISIANA

Country: USA

Nearest Crossroad or Landmark: EAST BRIDGE

NUMBER OF VOLUNTEERS WORKING ON THIS CARD:

adults	children (under 12)
	3

MOST UNUSUAL ITEM COLLECTED:

TYPE OF CLEANUP:

Land: ☐ Underwater: ☐ Watercraft: ☐

Please return this form to your area coordinator.
If you are unable to do so, please mail or email it to:

Ocean Conservancy
Attn: International Coastal Cleanup
1300 19th Street, NW, 8th Floor
Washington, DC 20036
cleanup@oceanconservancy.org

Trash Free Seas: www.oceanconservancy.org/cleanup
Be a Green Boater: www.oceanconservancy.org/do-your-part/green-boating
Sponsors: www.oceanconservancy.org/cleanupsponsors

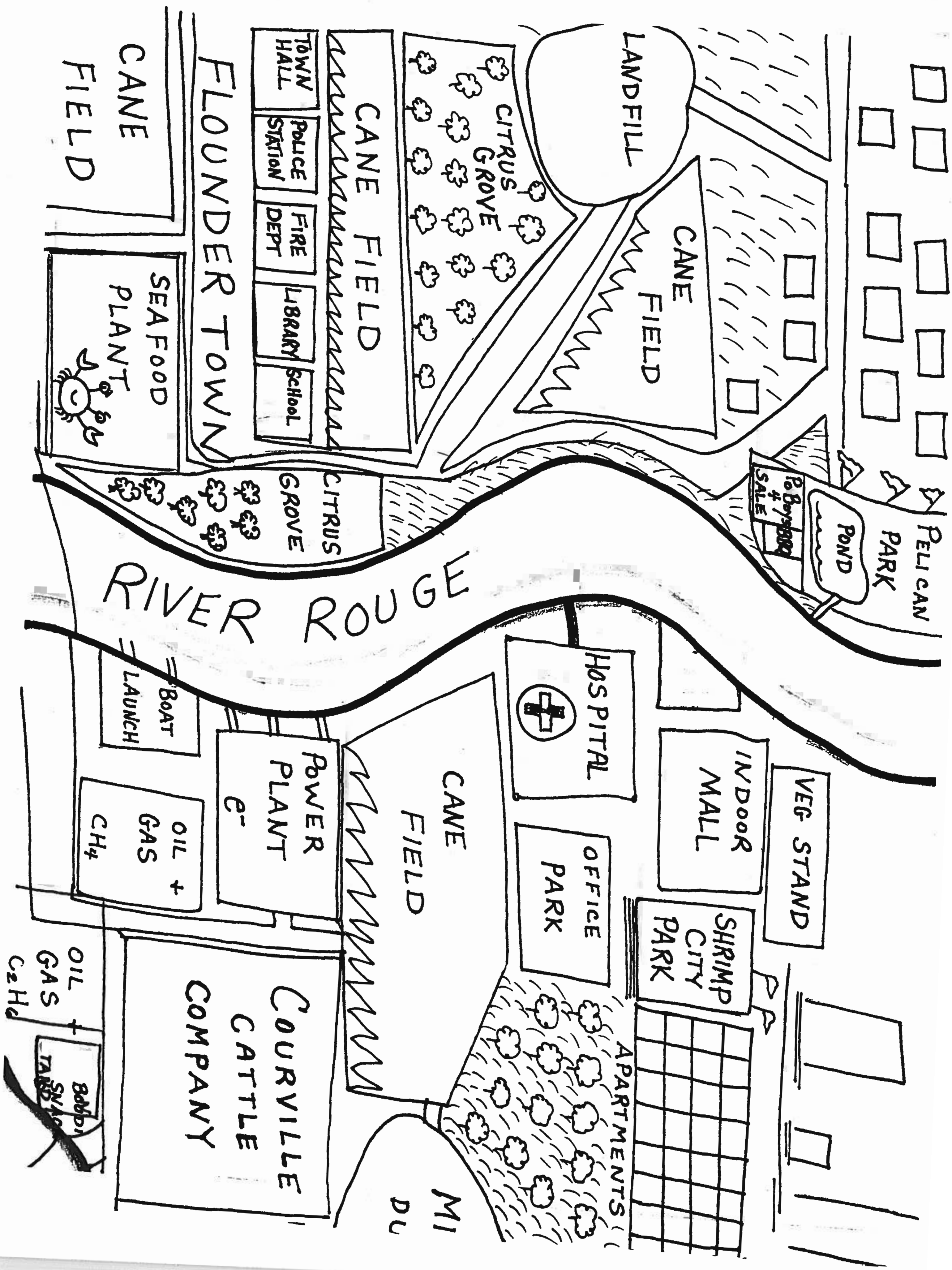
International COASTAL Cleanup

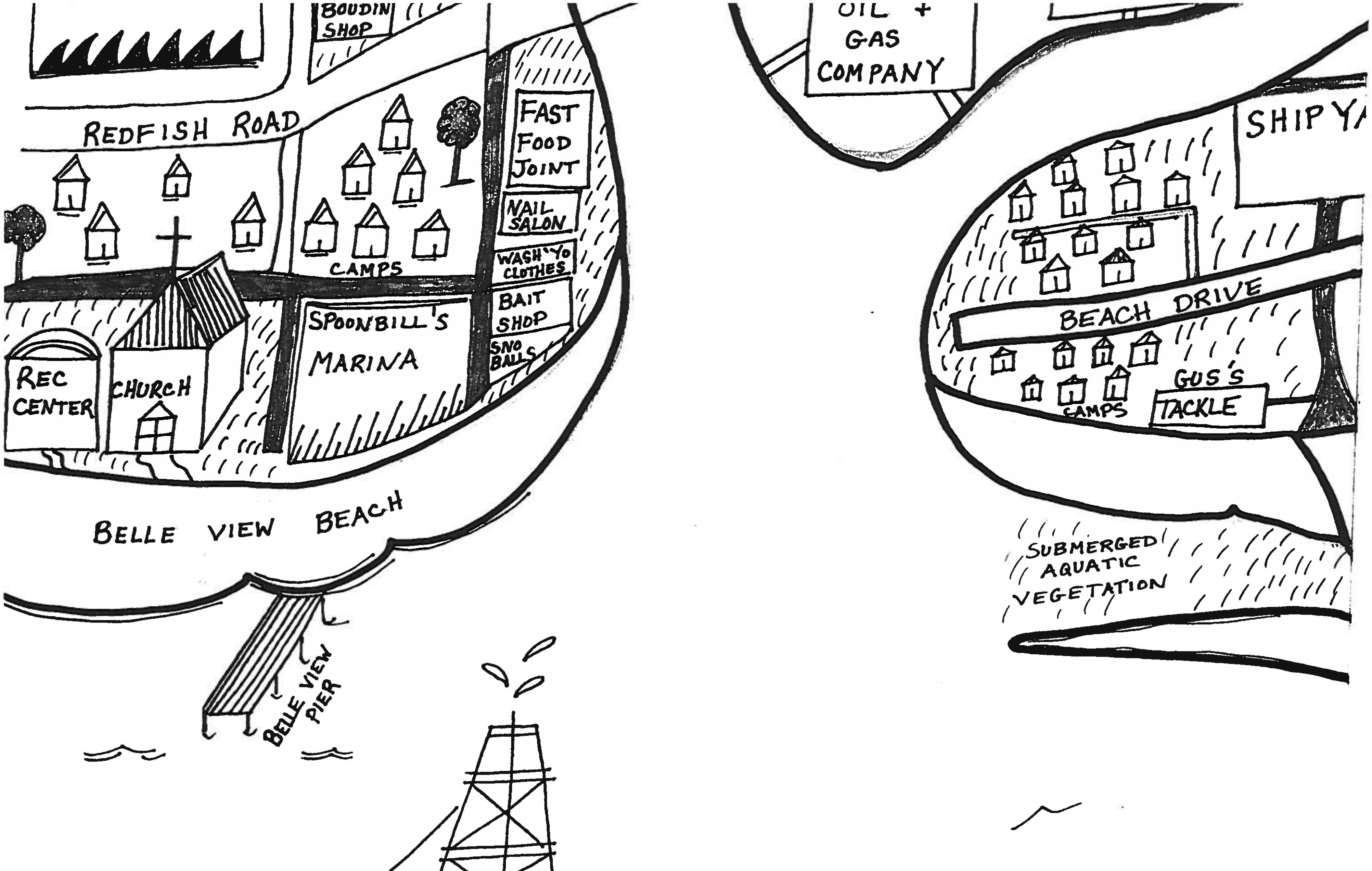
Ocean Trash Cards

Trash: Broken Crab Trap	**Origin:** Spoonbill's Marina	**Miles Traveled:** 12 miles
Trash: Red Solo Cup	**Origin:** Shrimp Stadium	**Miles Traveled:** 120 miles
Trash: Empty Ice Bag	**Origin:** Pelican Park	**Miles Traveled:** 100 miles
Trash: Plastic Grocery Bag	**Origin:** Courville Cattle Company	**Miles Traveled:** 80 miles
Trash: Flip Flop	**Origin:** Midden Dump	**Miles Traveled:** 82 miles
Trash: Empty Chip Bag	**Origin:** Chachere Crawfish Pond	**Miles Traveled:** 70 miles
Trash: Cast Net	**Origin:** Belle View Pier	**Miles Traveled:** 4 miles
Trash: Hard Hat	**Origin:** West Bay Oil Rig	**Miles Traveled:** 5 miles

Trash: **Plastic Water Bottle**	**Origin:** **Redfish Road**	**Miles Traveled:** **4.5 miles**
Trash: **"Get Well" Balloon**	**Origin:** **Hospital**	**Miles Traveled:** **95 miles**
Trash: **Bread Wrapper**	**Origin:** **State Park**	**Miles Traveled:** **7 miles**
Trash: **Plastic Spoon**	**Origin:** **Shell Beach**	**Miles Traveled:** **1.5 mile**
Trash: **Plastic Bottle Cap**	**Origin:** **Giant's Water Park**	**Miles Traveled:** **3 miles**
Trash: **Cigarette Butt**	**Origin:** **C'est La Vie Ship**	**Miles Traveled:** **22 miles**
Trash: **Cigarette Butt**	**Origin:** **Shell Beach**	**Miles Traveled:** **2 miles**
Trash: **Fishing Line**	**Origin:** **Oyster Island**	**Miles Traveled:** **5 miles**

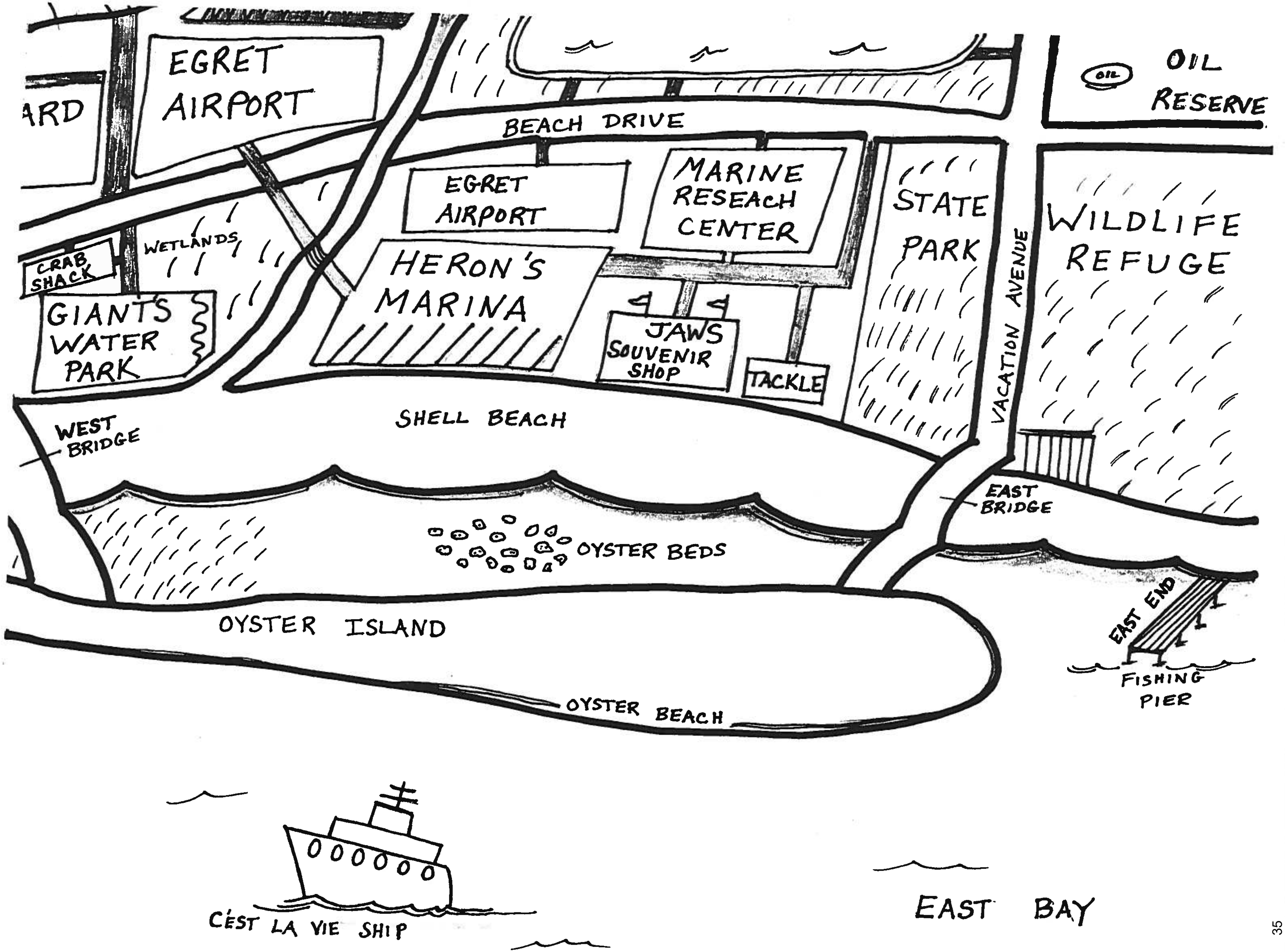
Trash: **Styrofoam Meat Tray**	**Origin:** **Shrimp Stadium**	**Miles Traveled:** **135 miles**
Trash: **Dead Sea Turtle Tangled in Fishing Line**	**Origin:** **East End Pier**	**Miles Traveled:** **2 miles**
Trash: **Plastic Straw**	**Origin:** **Midden Dump**	**Miles Traveled:** **72 miles**
Trash: **Metal Bottle Cap**	**Origin:** **State University**	**Miles Traveled:** **130 miles**
Trash: **Soda Can**	**Origin:** **Landry's Laundromat**	**Miles Traveled:** **55 miles**

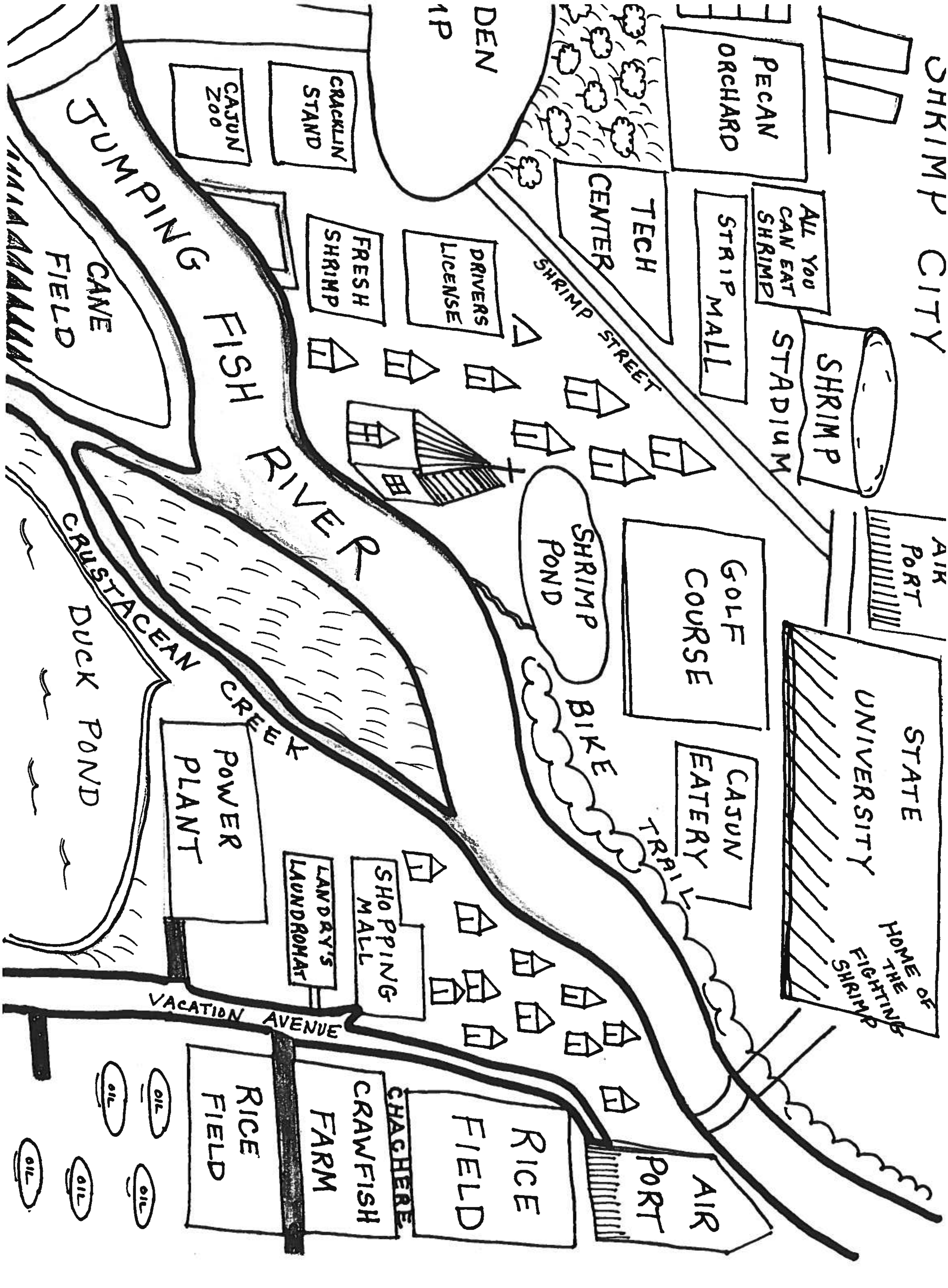

LANDFILL
CITRUS GROVE
CANE FIELD
TOWN HALL
POLICE STATION
FIRE DEPT
LIBRARY
SCHOOL
FLOUNDER TOWN
CANE FIELD
SEAFOOD PLANT
CANE FIELD
CITRUS GROVE
RIVER ROUGE
PELICAN PARK
POND
SALE
HOSPITAL
BOAT LAUNCH
POWER PLANT e^-
OIL + GAS CH_4
CANE FIELD
INDOOR MALL
VEG STAND
OFFICE PARK
SHRIMP CITY PARK
APARTMENTS
COURVILLE CATTLE COMPANY
OIL + GAS C_2H_6

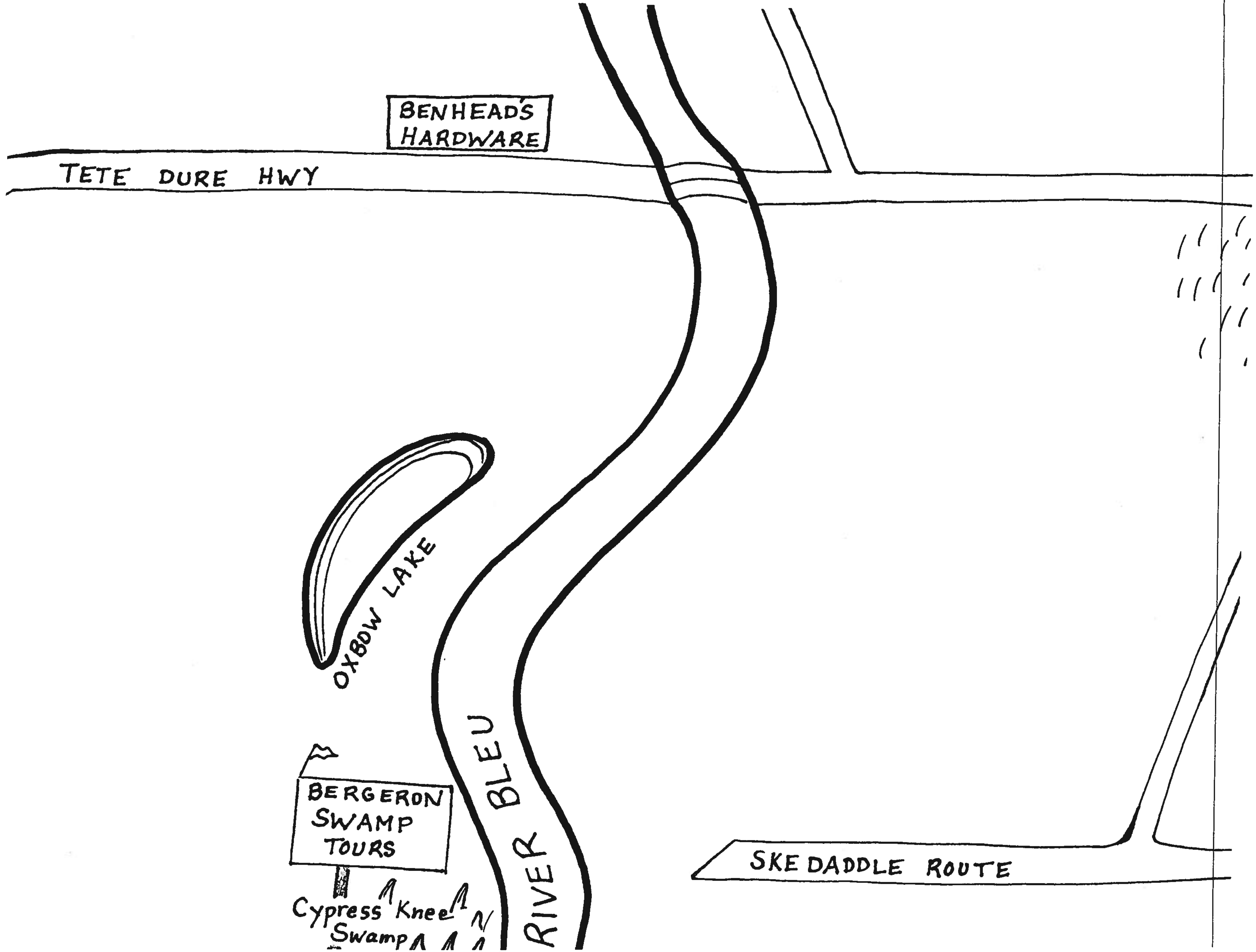


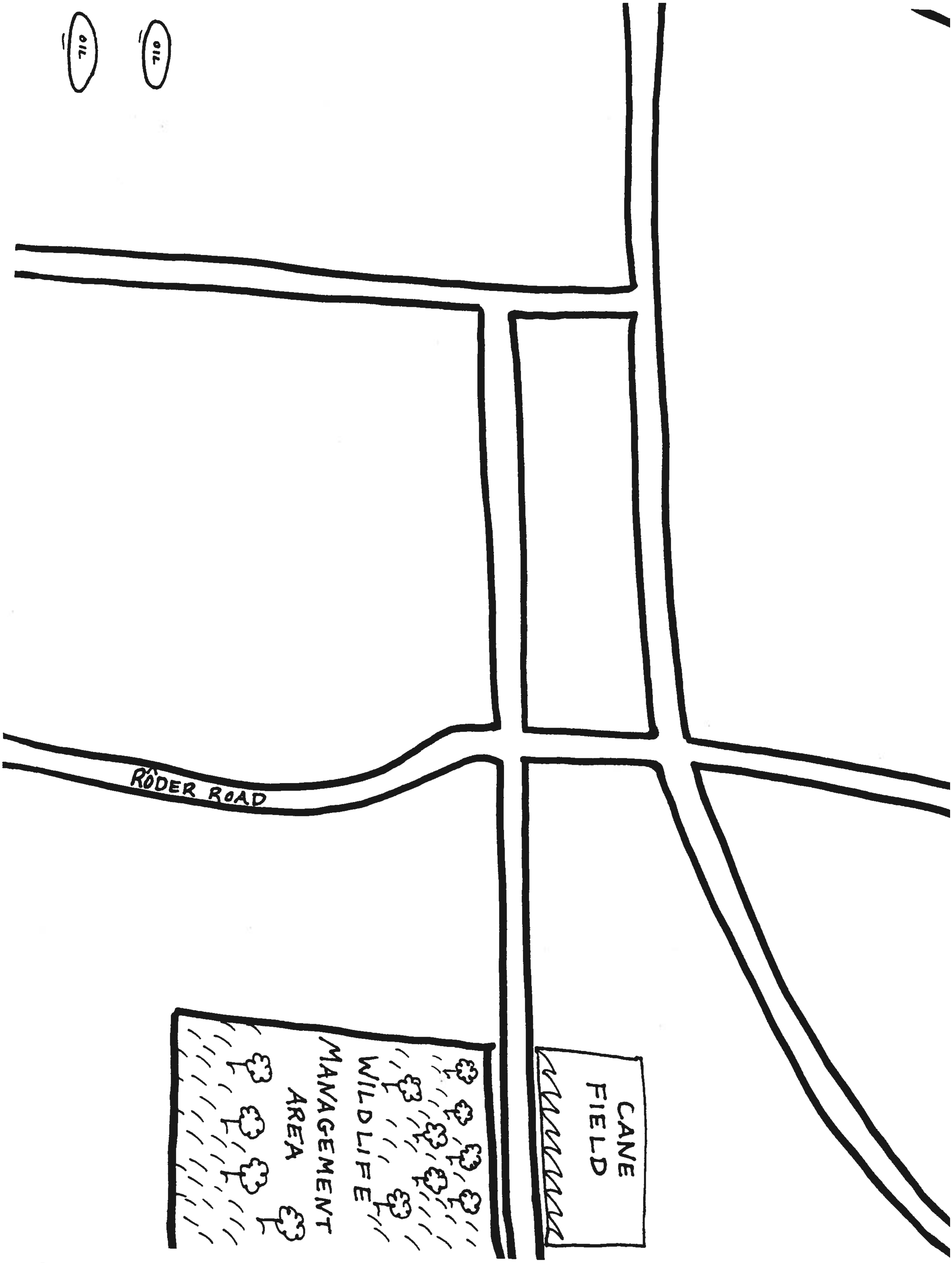
Map of Imaginary South Louisiana Parish

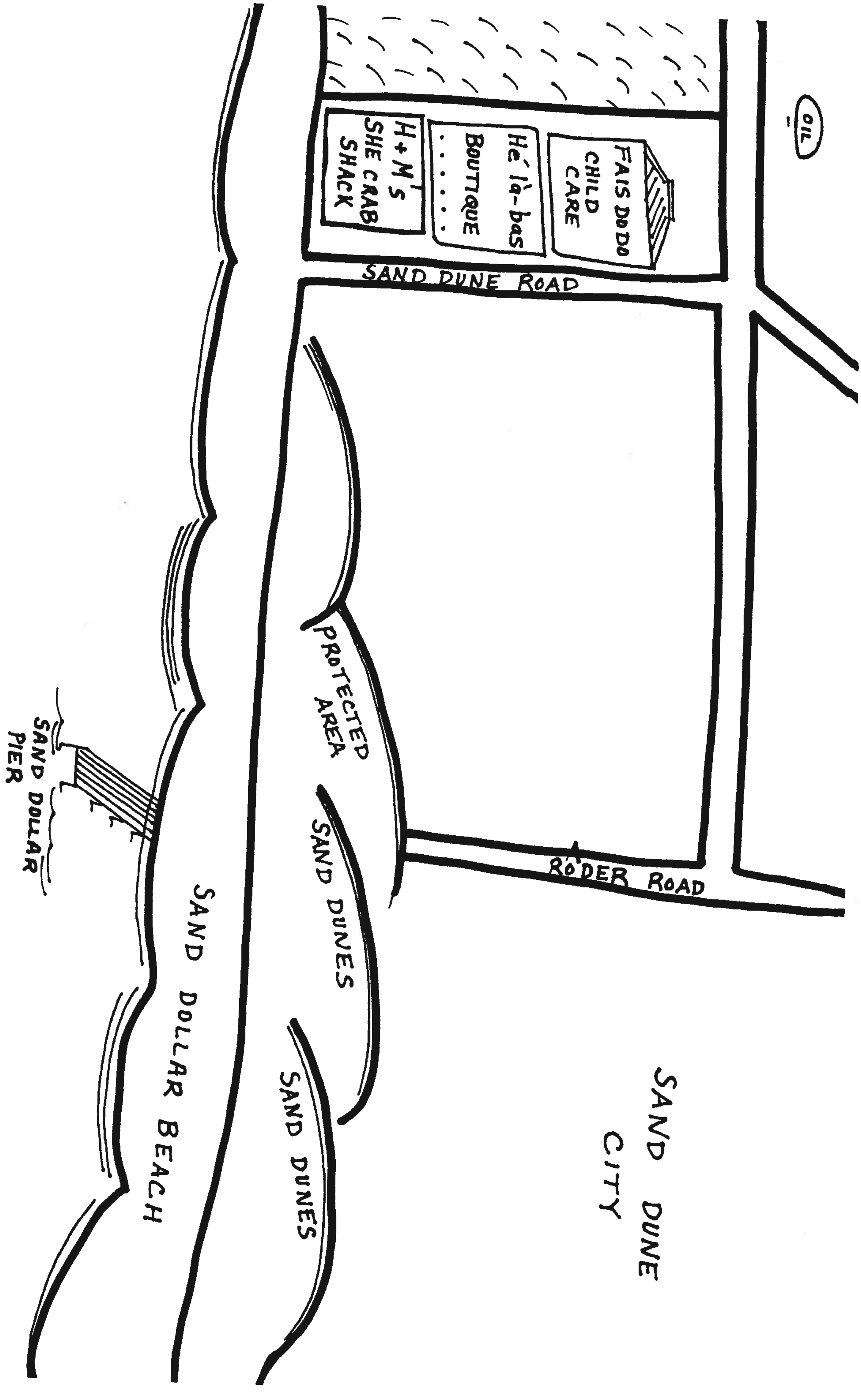
Parish Name:

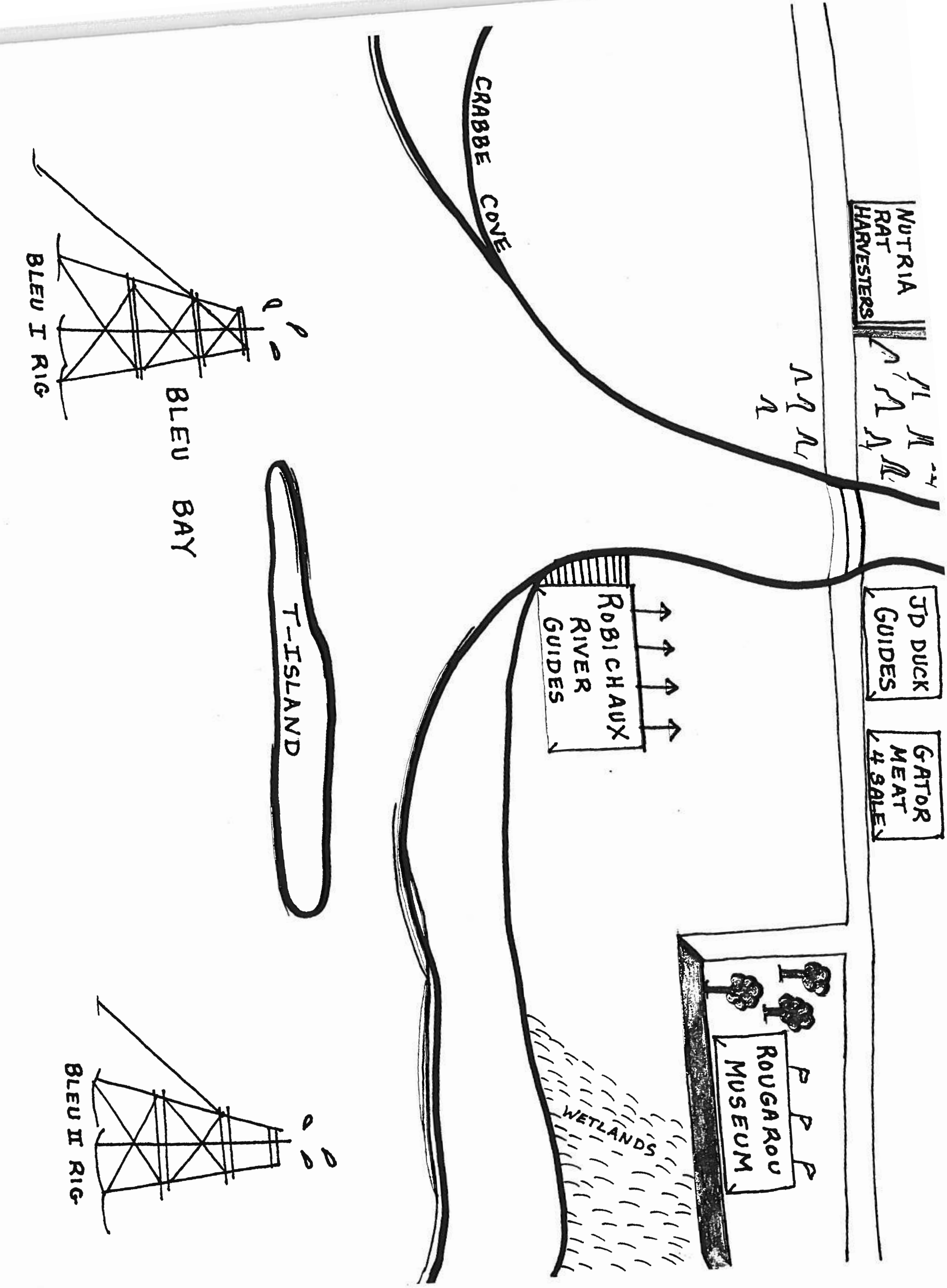

ARD
EGRET
AIRPORT
BEACH DRIVE
OIL
OIL
RESERVE
EGRET
AIRPORT
MARINE
RESEACH
CENTER
STATE
PARK
WILDLIFE
REFUGE
VACATION AVENUE
CRAB
SHACK
WETLANDS
GIANT'S
WATER
PARK
HERON'S
MARINA
JAWS
SOUVENIR
SHOP
TACKLE
WEST
BRIDGE
SHELL BEACH
EAST
BRIDGE
OYSTER BEDS
EAST END
FISHING
PIER
OYSTER ISLAND
OYSTER BEACH
CÉST LA VIE SHIP
EAST BAY


SHRIMP CITY
DEN
1P
PECAN ORCHARD
CAJUN ZOO
CRACKLIN STAND
JUMPING FISH RIVER
CANE FIELD
TECH CENTER
ALL YOU CAN EAT SHRIMP
STRIP MALL
FRESH SHRIMP
DRIVERS LICENSE
SHRIMP STREET
SHRIMP STADIUM
SHRIMP POND
GOLF COURSE
AIR PORT
STATE UNIVERSITY
HOME OF THE FIGHTING SHRIMP
CRUSTACEAN CREEK
DUCK POND
BIKE TRAIL
CAJUN EATERY
POWER PLANT
LANDRY'S LAUNDROMAT
SHOPPING MALL
VACATION AVENUE
RICE FIELD
CRAWFISH FARM
CHACHERE
RICE FIELD
AIR PORT
OIL


BENHEAD'S HARDWARE
TETE DURE HWY
OXBOW LAKE
RIVER BLEU
BERGERON SWAMP TOURS
Cypress Knee Swamp
SKEDADDLE ROUTE


OIL
OIL
RÔDER ROAD
WILDLIFE
MANAGEMENT
AREA
CANE
FIELD


OIL
FAIS DO DO CHILD CARE
Hé là-bas BOUTIQUE
H+M's SHE CRAB SHACK
SAND DUNE ROAD
PROTECTED AREA
SAND DUNES
SAND DUNES
RODER ROAD
SAND DOLLAR PIER
SAND DOLLAR BEACH
SAND DUNE CITY


NUTRIA
RAT
HARVESTERS
CRABBE COVE
JD DUCK
GUIDES
GATOR
MEAT
4 SALE
ROBICHAUX
RIVER
GUIDES
T-ISLAND
BLEU BAY
BLEU I RIG
ROUGAROU
MUSEUM
WETLANDS
BLEU II RIG

Station Rotation

Name____ **Class**_________________ **Date**___________

Answer each station question in the space provided.

Station 1	**Station 2**
Station 3	**Station 4**
Station 5	**Station 6**

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 1 Photo Prompt

What doesn't belong?

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 2 Photo Prompt

Suggest 3 possible ways the plastic cap got there?

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 3 Photo Prompt

Who is responsible for picking up litter on the beach?

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 4 Photo Prompt

What do you think will happen to the bottle cap if no one picks it up?

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 5 Photo Prompt

A. How many plastic bottle caps were picked up in Louisiana at the last Coastal Cleanup?

(See Ocean Conservancy-Ocean Trash Index)

B. Besides bottle caps, what other kinds of litter were picked up in Louisiana at the last Coastal Cleanup?

(See Ocean Conservancy-Ocean Trash Index)

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Station 6 Photo Prompt

What can we do to prevent plastic trash on our beaches?

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

EXIT TICKET

Name____________________________ Class____________ Date_________

Describe 3 or more ways trash gets into oceans.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

EXIT TICKET

Name____________________________ Class____________ Date_________

Describe 3 or more ways trash gets into oceans.

Section 3: How Long Until It's Gone?

Students explore how long it takes for litter to breakdown by constructing a trash timeline.

They learn different ways that litter breaks down and why plastics are so persistent in the trash landscape.

Barataria-Terrebonne National Estuary Program

2018

5E Lesson: How Long Until It's Gone?

Objectives
• *Identify biodegradable and non-biodegradable trash.* • *Explain how different materials break down.* • *Understand that some materials degrade more quickly than others.* • *Describe the process of plastic fragmentation.*
Engagement & Exploration
• **How Long Until It's Gone Activity***: Students engage as they build a timeline to explore rates of litter degradation.* • *Students read "How Long Until It's Gone" Background Sheet and participate in class discussions.* • **Demonstration***: Plastic Fragmentation: How do plastics break down?*
Explanation
• **Trash Timeline Worksheet**: *Students answer questions to explain principles of trash degradation.*
Elaboration
• *Have students design projects that test degradation rates of various biodegradable and nonbiodegradable products. See project example on YouTube: Pumpkins Decomposing –Time Lapse (turtlesandthomas 4:49)*
Evaluation
• **Exit Ticket:** *Explain why its possible for every piece of plastic ever made to still exist today.*

Standard: Earth and Human Activity 8-MS-ESS 3-3

Performance Expectation: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.

Science & Engineering Practices:
1. Ask questions.
2. Developing and using models.
3. Constructing explanations and designing solutions.
4. Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process, or system.
5. Obtaining, evaluating, and communicating information.

Disciplinary Core Ideas: Human activities, globally and locally, have significantly altered the biosphere, sometimes damaging or destroying natural habitats. (MS.ESS3C.a)

Crosscutting Concepts: Relationships can be classified as casual or correlational, and correlation does not mean causation.

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

HOW LONG UNTIL IT'S GONE? (Lesson Plan)

Standard: EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3

Overview: Students explore how long it takes for litter to breakdown by constructing a trash timeline. They also learn different ways litter breaks down and why plastics are so persistent in the trash landscape.

Objectives:

1. Identify biodegradable and non-biodegradable trash.
2. Explain how different materials break down.
3. Understand that some materials degrade more quickly than others.
4. Describe the process of plastic fragmentation.

Duration:

1 class period

Materials:

- Approximately 12 feet of rope, string, or whiteboard
- Time cards
- Debris cards
- Tape, Paper Clips, Clothes Pins, etc for attaching cards to rope/white board

Video:

- *Pumpkins Decomposing –Time Lapse (4:49 min, YouTube, TurtlesandThomas)*

Student Handouts:

- Trash Timeline Worksheet

Advanced Preparation:

1. Make copies for **each student**.
   a. Trash Timeline Worksheet
2. Cut out 1 set of Time Cards and 1 set of Debris Cards.

Activity:

1. Use a length of rope or draw a line on a whiteboard to represent 1000+ years of time. Attach the time cards to the rope or draw them on the whiteboard.

2. Group students into teams and divide 1 set of debris cards among the teams. Have teams discuss how long they think it takes for their items to fully degrade (break down) in the marine environment. Then have the teams place their debris cards next to the appropriate time.

3. After all teams have placed their debris cards, read out the correct degradation times. If teams placed an item incorrectly, move the item next to the correct time. Degradation times are best-guess estimates. Stress that chemical composition, size, thickness, light exposure, temperature, moisture, and location in the environment (floating in water, buried in sand, etc.) can influence break down time.

Answers:

Time	Debris
2 - 6 weeks	Paper towel
2 - 6 weeks	Banana peel
2- 6 weeks	Saints football ticket
2- 5 months	Cardboard crawfish tray
2- 5 months	Apple core
2- 5 months	Cotton rag
1- 20 years	Cigarette butt
80- 200 years	Aluminum soda can
400- 1000 years	Plastic bag
450 years	Plastic water bottle
550 years	White shrimp boot
600 years	Monofilament fishing line
500 years- forever?	Styrofoam ice chest

4. Have students look at the timeline for degradation trends. Students should recognize that the organic items such paper and banana peels degrade quickly. Man-made items such as plastic take a very long time to degrade.

5. Discuss different ways litter breaks down. Refer to background section for information on biodegradation and photodegradation. Emphasize the fact that plastics do not decompose but simply fragment into smaller and smaller pieces.

6. **Demonstrate Plastic Fragmentation:** Hold up a piece of paper and ask students to pretend that the paper is plastic. Tear the paper in half. Then tear each section in half. Continue dividing until the paper fragments are about the size of a single Mardi Gras bead. Plastic pieces 5 mm or smaller in size are called microplastics. Explain that this demonstration mimics how plastics break down in the ocean. Plastic continues to break down into smaller and smaller pieces called microplastics.

7. Have students complete Trash Timeline Worksheet. Review worksheet responses with class.

8. Conclude lesson with Exit Ticket, "Explain why it's possible for every piece of plastic ever made to still exist today"

Extension:

Have students design projects that test degradation rates of various biodegradable and nonbiodegradable products. See project example on YouTube: Pumpkins Decomposing –Time Lapse (turtlesandthomas 4:49).

How Long Until It's Gone? (Background)

Plastics are some of the most useful materials ever created by man. They are versatile, lightweight, strong, moisture resistant, durable, and inexpensive to produce. However, their durability, combined with man's appetite and over consumption of plastic goods, has contributed to a litter problem. All around us, in cities, country sides, and waterways, plastic litter is abundant in the form of old bottles, shopping bags, straws, cigarette filters, food containers, and such. These plastics aren't going away anytime soon. That's because no natural processes decompose plastic. **Decomposition** is the process where materials are broken down into simpler components by chemical or physical processes. In **biodegradation**, decomposing organisms convert organic substances into raw materials that become part of the soil. For example, bacteria and fungi decompose bodies of organisms shortly after their death. Something is biodegradable if it can be broken down by decomposing organisms. **Biodegradable** substances include food scraps, cotton, wool, wood, animal wastes, and manufactured products based on natural materials such as paper and vegetable-oil based soaps. Biodegradation is a fairly quick process (days, weeks, months). Temperature, moisture, oxygen concentrations, and other factors influence biodegradation rates.

Plastics are made of synthetic, petroleum-based **polymers**. Polymers are large chains of molecules and are too large and complex for decomposers to break down. Decomposers have evolved to attack certain types of bonds common in nature. They chew up paper, wood, banana peels, and apple cores with ease in order to gain energy. Decomposing organisms do not recognize the chemical compounds in plastics as food and therefore, don't break them down. In other words, plastics do not biodegrade. Instead, nonliving interactions with the environment are responsible for plastic decomposition. Energy from the sun cause plastics to become brittle, crack, and fall apart in a process called **photodegradation**. In photodegradation, plastic polymer chain bonds are broken. Over time, this can turn a big piece of plastic into lots of little pieces called **microplastics**. Microplastics are less than 5 mm long or about the size of a Mardi Gras bead. The chemical composition of parent plastic and its microplastic offspring are identical; synthetic and unrecognizable to decomposers. Because microplastics continue to fragment instead of converting into usable components that can be returned to the soil, they last forever. Plastics can also undergo **mechanical degradation.** This occurs when physical stresses cause breakage and fragmentation. Imagine what would happen to a plastic bottle if an ocean wave repeatedly tossed it against a rock jetty! This is an example of mechanical degradation.

How Long Until It's Gone? (Vocabulary)

Biodegradable: Capable of being broken down by bacteria or other living organisms.

Century: A period of one hundred years.

Decade: A period of ten years.

Decomposers: Organisms such as bacteria or fungi that break down dead plant and animal material.

Decomposition: The process of rotting or decay.

Degradation: The deterioration or breaking down of a substance.

Fragmentation: The process of breaking down or tearing into smaller or separate parts.

Mechanical Degradation: The breaking down of a substance due to forces such as waves, erosion, etc.

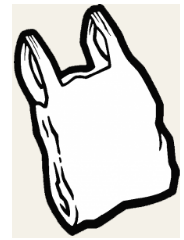
Microplastics: Extremely tiny pieces of plastic 5 mm or smaller in size.

Nonbiodegradable: Unable to be broken down by decomposing organisms.

Photodegradation: The process of objects breaking down by ultraviolet light.

Polymer: A substance made up of a large number of smaller molecules that link together to form larger molecules. Plastic is an example of a synthetic polymer.

How Long Until It's Gone? Worksheet



Name___________________________ **Class**______ **Date**______________

1. What kinds of trash items degrade fairly quickly?

2. What kinds of trash items take a very long time to degrade?

3. Why do plastic litter items last a long time in the environment?

4. Explain how microplastics form.

5. Compare the processes of biodegradation and photodegradation by completing the following chart.

	Biodegradation (Yes/No)	Photodegradation (Yes/No)
Decomposers needed		
Sunlight needed		
Polymers broken		
Products become part of soil		
Slow process		
Fast process		
Happens to a banana peel		
Happens to a plastic bottle		
Microplastics produced		
Bacteria and fungi help		
Decades , centuries, or forever		
Happens to a dead organism		

6. What surprised you most about the amount of time it takes for various items to breakdown?

Time Cards

2 - 6 weeks
2- 5 months
1- 20 years
80-200 years
400-1000 years

450 years
550 years
600 years
500 years – forever?

Debris cards

Paper towel
Banana peel
Saints football ticket
Cardboard crawfish tray
Apple core

Cotton rag
Cigarette butt
Aluminum soda can
Plastic bag
Plastic water bottle
Monofilament fishing line

Styrofoam ice chest

EXIT TICKET NAME______________________________

Explain why it's possible for every piece of plastic ever made to still exist today.

EXIT TICKET NAME______________________________

Explain why it's possible for every piece of plastic ever made to still exist today.

Section 4: Hanging in the Gulf

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

What happens when plastic enters the Gulf of Mexico (GOM)? To answer this question students learn about plastics and investigate their densities.

They construct a water column display to explore feeding strategies and locations of various gulf sea life. Students use information from these activities to predict how plastics impact GOM food chains.

Barataria-Terrebonne National Estuary Program

2018

5E Lesson: Hanging In The Gulf

Objectives

- Identify resins associated with plastic recycling codes.
- Determine densities of different plastic resins.
- Describe how the density of plastic trash affects its location in the gulf water column.
- Identify feeding strategies and water column locations of various gulf sea life.
- Understand how ocean forces fragment plastics into microplastics
- Explain how plastic trash can disrupt food webs.
- List and describe human impacts on ocean environments.

Engagement

- Students use **photo prompt** (What Do You See?) to identify their current knowledge and create a list of questions for future learning.

Exploration

- **Videos:**
  - BBC Earth Unplugged: How Much Plastic Is In Our Oceans? (5:10 min) (www.youtube.com)
  - Trash Talk Video: How Does Marine Debris Impact The Ocean, Animals, and Me? (1:30 min)
- **Class Discussions:**
  - Students record ideas on "Helpful Information" graphic organizer.
- **Student Activities:**
  - **Sea Life Hangouts**: Students construct a water column model to explore feeding strategies and locations of various marine organisms.
  - **Float, Sink, or Suspend?** Students investigate densities of different plastic resins.
  - **Plastics in the Water Column**: Students explore the location of plastic litter in the ocean water column and predict its impact on marine organisms.
- **Demonstrations:**
  - Plastic Fragmentation
  - Microplastics in the Water column

Explanation

Students use handouts: Sea Life Hangouts and Float, Sink, or Suspend? to explain lesson concepts.

Elaboration

- Have students research diets of various marine organisms and describe garbage items that may look like their food.

Evaluation

- **Exit Ticket**
  - Explain why some plastics float in ocean water while others sink.
  - Plastic trash that sinks and settles on the ocean bottom would have the greatest impact on _____feeding organisms. (pelagic, surface, benthic)

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Hanging In The Gulf

Standard: EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3

Performance Expectation: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.

Science & Engineering Practices:
1. Ask questions.
2. Developing and using models.
3. Constructing explanations and designing solutions.
4. Obtaining, evaluating, and communicating information.

Disciplinary Core Ideas: Human activities, globally and locally, have significantly altered the biosphere, sometimes damaging or destroying natural habitats. (MS.ESS3C.a)

Crosscutting Concepts: Relationships can be classified as casual or correlational, and correlation does not mean causation.

Hanging In The Gulf

Standard: EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3

Overview: What happens when plastic enters the Gulf of Mexico (GOM)? To answer this question students learn about plastics and investigate their densities. They construct a water column display to explore feeding strategies and locations of various gulf sea life. Students use information from these activities to predict how plastics impact GOM food chains.

Objectives:

1. Identify resins associated with plastic recycling codes.
2. Determine densities of different plastic resins.
3. Describe how the density of plastic trash affects its location in the gulf water column.
4. Identify feeding strategies and water column locations of various gulf sea life.
5. Understand how ocean forces fragment plastics into microplastics
6. Explain how plastic trash can disrupt GOM food webs.
7. List and describe human impacts on ocean environments.

Duration: 3 class periods

Materials:

- Set of GOM Sea Life Cards (35 in set)
- Scissors & Tape
- 3 standard size poster boards
- Tall transparent containers filled with water such as aquariums or large flower vases
- Paper towels
- Containers for collecting plastic trash
- Sheet of paper for Fragmentation Demonstration
- Snow Globe for Microplastic Simulation

Student Handouts:

- Sea Life Hangouts
- Float, Sink, or Suspend?
- What Do You See?
- Helpful Information
- Plastic Zone Cards

Videos:

- BBC Earth Unplugged: How Much Plastic Is In Our Oceans? (5:10 min)
  (www.youtube.com)
- Trash Talk Video: How Does Marine Debris Impact The Ocean, Animals, and Me? (1:30 min)
  (www.youtube.com)

Advanced Preparation:

1. One week prior to activities, encourage students to bring clean plastic items that would typically be discarded or recycled. Examples include straws, water bottles, caps, baggies, CD cases, cutlery, etc. Place collection containers, labeled with recycling numbers 1-6, in classroom. Have students place plastic items in appropriate containers as they bring them in.

2. Make a long Gulf of Mexico (GOM) Water Column classroom display (22in x 60 in) by taping 2 standard sized poster boards together. Sketch a wavy water surface near the top of the display and a smooth seafloor near the bottom. Title the display, "Gulf of Mexico Water Column" and label the feeding zones: surface, pelagic, and benthic.

3. Make copies for **each student**.
   a. Sea Life Hangouts
   b. Helpful Information
   c. Float, Sink, or Suspend
   d. Know Your Plastics

   Make copies for **each group of 2-3 students.**
   a. Plastic Zone Cards
   b. What Do You See?

4. Cut out 1 set of GOM Sea Life cards.

Day 1: Sea Life Hangouts

1. **Engagement**:
Engage class with photo prompt handout: "**What Do You See?**" Have students answer handout questions. Discuss answers and summarize responses on poster board. Display posters for future reference.

2. Divide class into groups of 2-3.

3. Distribute materials.

Each Student:	**Each Group:**
Sea Life Hangouts	Tape & Scissors
	Set of GOM Sea Life Cards divided evenly among the groups.

4. **Set up** the Gulf of Mexico (GOM) Water Column classroom display. Tell students that they are going to decorate the display with organisms common to the GOM. Introduce the concept of feeding zones: surface, pelagic, benthic.

5. Have groups use information on the GOM Sea Life Cards to complete the "Sea Life Hangouts" handout. Instruct groups to cut out and **tape their sea life pictures** in the correct zone on the water column classroom display.

6. The GOM Water Column should remain on display as it will be used in later.

Day 2: Float, Sink, or Suspend?

1. Divide class into groups of 2-3.

2. Distribute materials.

Each Student:	**Each Group:**
Helpful Information Handout	Plastic Zone Card Handout
Float, Sink, or Swim? Handout	Access to containers filled with plastic items
	Paper towels
	Tall transparent container filled with water

3. Foster a **whole class discussion**. Have students complete the "Helpful Information" handout during the discussion.
   - Discuss how common oceanic debris items are made of plastics. In 2018 the Ocean Conservancy reported the most common items collected along LA coastlines as cigarette butts, plastic food wrappers, plastic bottle caps, plastic beverage bottles, beverage cans, plastic straws and stirrers, glass bottles, plastic grocery bags, metal bottle caps, and Styrofoam packing.
   - Discuss reasons why plastics are common in oceanic debris. They are abundant, long-lasting, strong, and nonbiodegradable. Many plastics float and are easily transported by rivers to oceans. Have students imagine how easy it would be for the Mississippi River to transport an empty water bottle from Memphis, Tennessee to the Gulf of Mexico.
   - Explain that plastics do not biodegrade. In biodegradation, decomposing organisms such as bacteria and fungus break apart chemical bonds releasing elements back into the environment. Biodegradable items are associated with life. Apple cores, banana peels, bones, wood, and leaves are examples of items that biodegrade. Biodegradation is a quick process on the order of weeks or months. Plastics are manmade products with chemical bonds that decomposers are unable to break. Plastics breakdown when physical stresses and sunlight exposure cause them to become to become brittle and fragment into smaller pieces. It can take decades, centuries, and millennia for plastics to break down into their elemental form.

4. **Demonstration: Plastic Fragmentation.** Hold up a piece of paper and ask students to pretend that the paper is plastic. Tear the paper in half. Then tear each section in half. Continue dividing until the paper fragments are about the size of a single Mardi Gras bead. Explain that plastics this small are called **Microplastics**. Rivers and oceans are full of microplastics. Scientists are currently the impacts of microplastics on sea life.

5. **Explain** that plastics are often stamped with a recycling number officially known as a SPI Resin Identification Code. SPI stands for **S**ociety of the **P**lastic **I**ndustry. These numbers indicate the type of resin or chemical the plastic was made from. Have students use the internet or other resources to identify resin names/abbreviations associated with numbers 1-6. Students **record information** on Float, Sink, or Suspend?

6. Discuss the **concept of density**. Explain that plastics can have different densities depending on their chemical composition. These densities determine whether plastics float, sink, or suspend in water. If the density of plastic is less than the density of water, the plastic will float. If the density of plastic is greater than the density of water, the plastic will sink. If the density of plastic matches the density of water, the plastic will suspend. Share that the density of water is 1.00 g/mL and the density of seawater is 1.03 g/mL.

7. Have students complete **"Float, Sink, or Suspend"** activity. Densities of various plastic resins are tested by submerging plastic items underwater to see if they float, sink, or suspend.

8. Distribute "Know Your Plastics" handout to each student. Have students **compare** their results with information on the handout.

9. Review Float, Sink, or Suspend questions/answers.

Day 3 Plastics in the Water Column

1. **Begin** with Trash Talk Video: How Does Marine Debris Impact The Ocean, Animals, and Me? (1:30 min)

2. **Focus attention** on the water column display and tell class they are going to add plastics to the display. The Ocean Conservancy estimates there is 150 metric tons of plastic debris littering the oceans. Considering density and the ability to float, sink, or suspend, have students think about plastic distribution in the water column. How does plastic impact surface, pelagic, and benthic sea life? For example, because the density of most plastic baggies is 0.94 g/mL, baggies tend to drift in the surface zone. Sea turtles feeding in this zone can mistake the bags as jellyfish and accidently eat them. Another example, monofilament fishing line tends sink to benthic regions because its density is 1.78 g/mL. Benthic feeders such as hammerhead sharks could become entangled in the line as they search for prey.

3. Groups **complete Plastic Zone Cards** for each item experimented with during the Sink, Swim, or Suspend activity. Then, they tape cards in the correct zones on the water column display.

4. **Demonstration: Microplastics In The Water Column.** Ask students to recall what a microplastic is. Discuss how the oceans are filled with microplastics. Show the class a snow globe and tell students that glitter in the globe represents microplastics in the ocean. Shake up the snow globe and have students watch the glitter fall. Just like shaking the snow globe, ocean turbulence promotes plastic movement in the water column.

5. Wrap up with 5:10 min Video BBC Earth Unplugged How Much Plastic Is In Our Oceans?

6. Use the **Exit Ticket** to close the lesson.

What Do You See?

1. **OBSERVE:** Look closely at the picture. What do you notice about it? What details stand out?

2. **THINK:** What do you already know that might help explain an aspect of this picture?

3. **WONDER:** What questions do you have? What related ideas would you like to research?

Hanging In the Gulf of Mexico (Vocabulary)

Benthic Feeder: An organism that feeds on or near the bottom of a body of water.

Biodegradable: Capable of being broken down by bacteria or other living organisms.

Density: The compactness of a substance measured by its mass per unit volume.

Fragmentation: The process of breaking down or tearing into smaller or separate parts.

Microplastics: Extremely tiny pieces of plastic 5 mm or smaller in size.

Nonbiodegradable: Unable to be broken down by decomposing organisms.

Pelagic Feeder: An organism that feeds in open water regions away from ocean bottoms and the shore.

Photodegradation: The process of objects breaking down by ultraviolet light.

Resin: The type of chemical plastic is made from.

SPI code: A set of symbols placed on plastic items to identify the resin type that the items were made from. The system was developed in 1988 by The **S**ociety of the **P**lastics **I**ndustry (SPI).

Surface Feeder: An organism that feeds at or just below the water surface.

Float, Sink, or Suspend?

Some plastics float, others sink, and some remain neutrally buoyant. Density is a property that influences the location and buoyancy of plastic in water. It is the ratio of a material's mass to its volume and can be calculated by dividing an object's mass by its volume. (d=m/v). In other words, density measures a material's compactness. It is the same value for a certain type of material, regardless of its size. For example, a small plastic straw and a large plastic straw will have the same density if they are both made of identical types of plastic.

Plastic is a common debris item littering the earth's water bodies. The type of plastic and density of water influence the location of plastic trash in the aquatic environment. If an object's density is less than the surrounding water the object will float. An object will sink if its density is greater than water and if the object's density matches its aquatic surroundings, the object will remain neutrally buoyant.

1. Use reference materials to look up the plastic names (resin) and abbreviations associated with recycling codes 1-6. The name tells you what kind of chemical compound or resin the plastic is made of. Record the information on the chart below.

2. Select plastic items with recycling codes 1-6. Submerge the items in water to see if they float or sink. Record your data below.

Code	Name/Abbreviation	Plastic Item (Bottle, baggie, etc.)	Float/Sink/Suspend	Density $>H_2O$ or $<H_2O$
1 PET				
2 HDPE				
3 PVC				
4 LDPE				
5 PP				
6 PS				
6 PS - E				

3. Select a plastic item that can be easily cut with a pair of scissors. Identify its code, name/abbreviation, and measure its mass. Submerge the item in water and note where it falls in the water column. Cut the same item into smaller pieces. Select one piece with an interesting **size** and **shape**. Measure the piece's mass, submerge in water, and note where it falls in the water column. Record your data in the chart below.

	Code	**Name/Abbreviation**	**Mass**	**Position in Water**	**Density: >H2O or <H2O**
"Whole" Plastic Item					
Plastic "Piece"					

4. How do the densities and position in the water column of the "whole" and "piece" plastic items compare? Experiment with other plastics to see how differences in mass, size, or shape impact density? What are your conclusions? What is your evidence for supporting this claim?

5. The density of fresh water is 1.00 g/mL. Environmental conditions cause seawater density to fluctuate but it usually averages at 1.03 g/mL. Why do you think sea water is more dense than fresh water?

6. Suppose you are boating one mile offshore in the Gulf of Mexico. Your vessel begins to sink. You are not wearing a life jacket and you are not a good swimmer. You see 6 **large** plastic blocks with recycling codes 1-6. What 3 blocks should you grab and why?

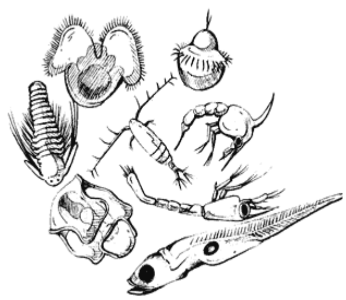
7. Suppose PETE and PP resins are blended to make a water toy. Predict how this product would behave in water.

	Position in Water	**Density: >H2O or <H2O**
Water Toy		

Clean Up:

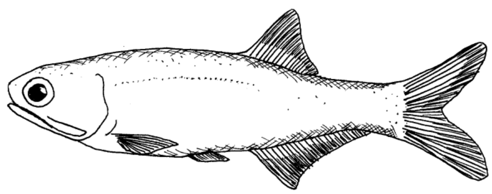
Please leave your work area(s) clean and neat and recycle all appropriate plastic items. Thank you!

Gulf of Mexico Sea Life Cards



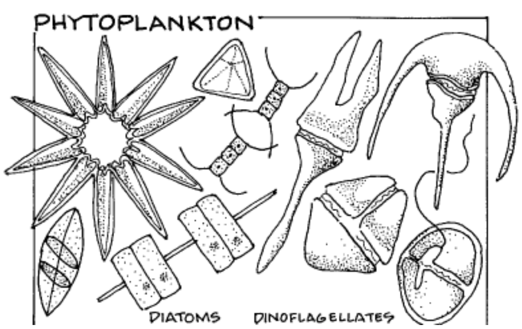
Zooplankton

Zooplankton are small or microscopic organisms such as protists, bacteria, and jellyfish that float or drift in great numbers in the ocean's currents. Zooplankton feed on phytoplankton, other zooplankton, and tiny eggs and larvae in the ocean's surface and pelagic regions. Zooplankton are an important food source for fish and other marine organisms.



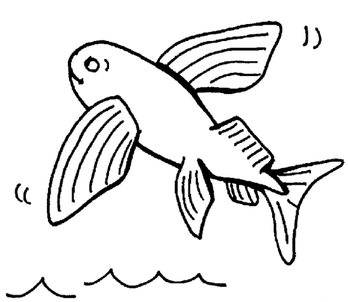
Anchovy

Anchovies are some of the more common forms of small finfish in the Gulf of Mexico. They generally are found in shallow or nearshore waters and rarely exceed 4 to 5 inches in length. Anchovies filter feed the near surface on phytoplankton (microscopic plants) and zooplankton (microscopic animals, fish eggs, and larval fish). They are commonly eaten by larger fish and are a major component of the oceanic food web.



Phytoplankton

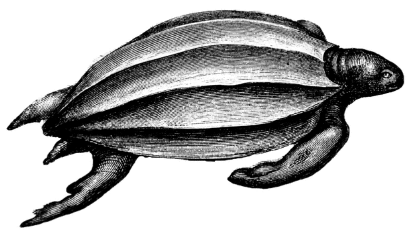
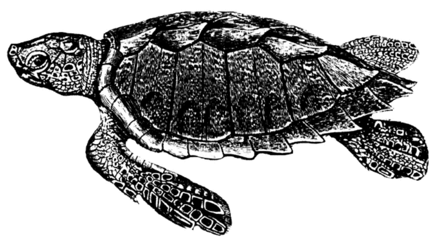
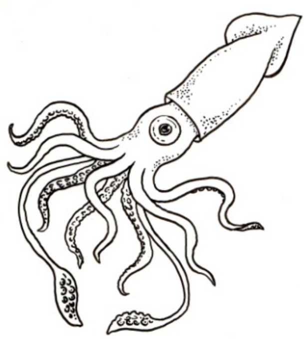
Phytoplankton are tiny photosynthetic organisms that inhabit the ocean's upper sunlit layers. Most are too small to be seen individually with the naked eye but when present in large numbers, they are observed as colored patches on the ocean's surface. Phytoplankton account for about half of all photosynthetic activity on Earth. In photosynthesis, phytoplankton absorb energy from the Sun and nutrients from the water to produce their own food. In this process phytoplankton release oxygen. It is estimated that between 50% and 85% of the world's oxygen is produced via phytoplankton.



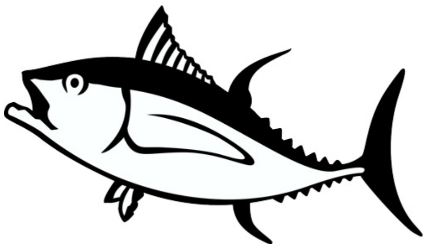
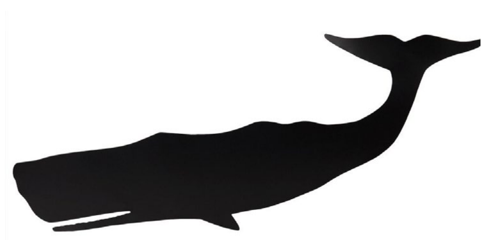
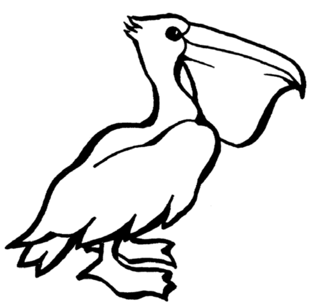
Flying Fish

Flying fish are small, with adults generally less than a foot in length. Flying fish launch themselves into the air by beating their tail fins very fast, then spread their abnormally large pectoral fins to glide in the air just over the waters' surface. They have been observed to "fly" distances in excess of a football field in length to escape predators such as marlin, tuna, swordfish, and mackerels. Flying fish consume phytoplankton (microscopic plants) and zooplankton (microscopic animals, fish eggs, and larval fish) near the ocean's surface.

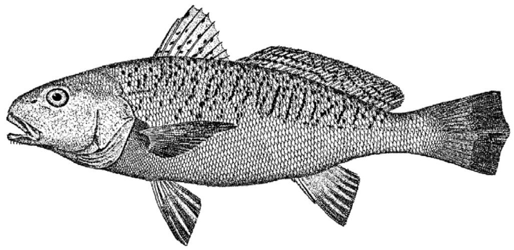
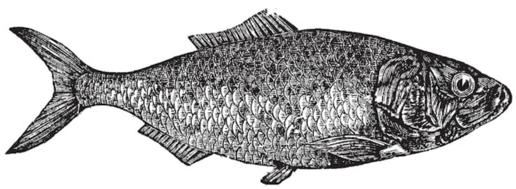
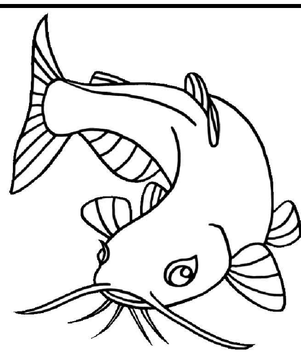
Gulf of Mexico Sea Life Cards

 **Leatherback Sea Turtle**	The **Leatherback Sea Turtle** is the largest of all sea turtles. Adults can reach an impressive size of 9 feet in length. Instead of shells, these turtles are covered with thick leather-like skin. That's why these turtles are called leatherbacks! Leatherbacks are commonly found in open waters near surface and pelagic regions where they feed on small fish and their favorite food; jellyfish.
 **Loggerhead Sea Turtle**	The **Loggerhead Sea Turtle** is a marine reptile with a log shaped head, massive set of jaws, and an enormous appetite. Loggerheads spend much of their time feeding near the bottom of the ocean where they eat bottom swelling invertebrates such as crabs, clams, and whelks. Adult loggerheads can reach 3 feet in length.
 **Squid**	There are four species of **Squid** in the Gulf of Mexico, ranging in adult size from five inches to 24 inches in length. They are actually mollusks and more closely related to snails, clams and oysters than fish. Squid are voracious feeders. They are equipped with tentacles for capturing prey and sharp mouths for dining on fish, shrimp, crabs, and other squid. Squid are commonly found in the benthic and pelagic regions of oceans. Animals that feed on squid include sperm whales, tuna, shark, other squid, birds, and man. Ever heard of calamari?
 **Octopus**	The **Octopus** is an impressive oceanic predator. They use their 8 legs, called tentacles, to catch anything that looks tasty. They are commonly found near the ocean bottom preying on crabs, lobsters, fish, worms, whelks, and clams. The octopus can change its colors to match its background. This helps them to hide from the sharks and large fish that like to eat this soft shelled, many legged mollusk.

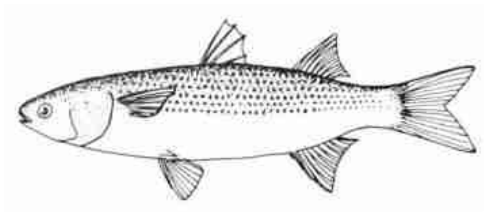
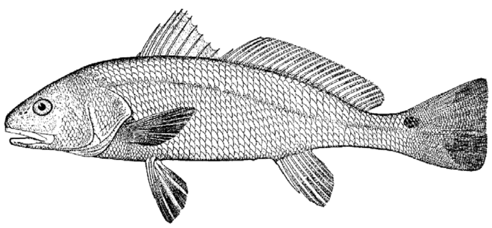
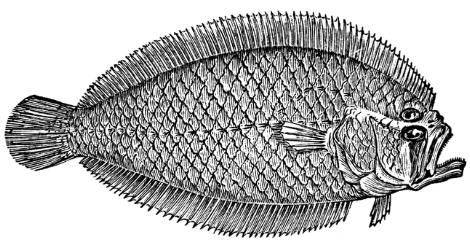
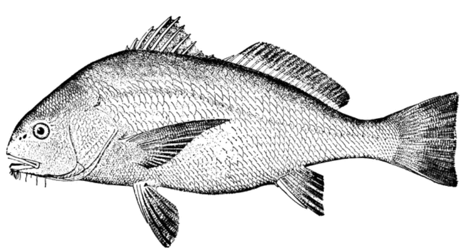
Gulf of Mexico Sea Life Cards

 **Tuna**	**Tuna** are some of the most popular species sought by recreational fishers in Gulf of Mexico pelagic waters. The largest species, the bluefin tuna, can exceed 10 feet in length and in excess of 800 pounds. They are highly prized for human consumption, often for sushi. Tuna are among the fastest open ocean predators and as adults primarily dine on fairly large fish and invertebrates. However, as young they eat zooplankton and are eaten by other fish that specialize on eating zooplankton.
 **Sperm Whale**	**Sperm whales** can be found in the Gulf of Mexico, primarily offshore of the Mississippi River delta. They were commercially hunted for their oil and other products until the early 1900s. Sperm whales are carnivores and dine near benthic areas primarily on medium size squid, and a variety of fish species. They have been known to hunt giant squid that live on the ocean bottom at great depths.
 **Brown Pelican**	**Brown Pelican** The brown pelican is the Louisiana State bird. Unfortunately, this bird had completely disappeared from Louisiana by 1963 due to widespread use of DDT, a chemical pesticide. DDT made pelican egg shells very thin and breakable. Adult pelicans would literally destroy their eggs during incubation. An effort to transplant brown pelicans from Florida eventually resulted in the return of breeding populations of this bird to Louisiana. Brown pelicans consume surface and upper pelagic fish as well as fish scraps discarded by humans.

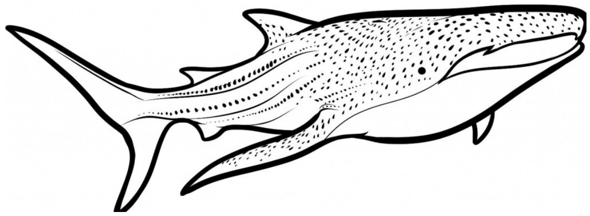
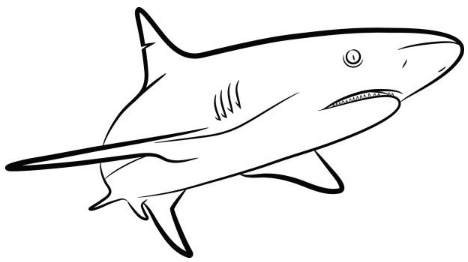
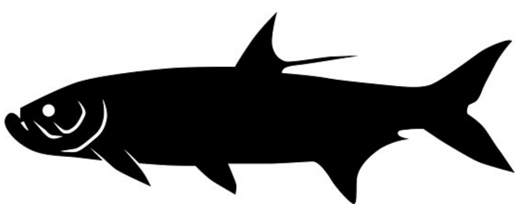
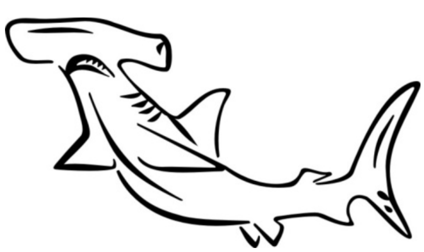
Gulf of Mexico Sea Life Cards

 **Croaker**	**Croakers** are bottom feeders which primarily feed on small shrimp, polychaetes (worms) and mollusks. As adults, they rarely exceed 12 inches in length and are preyed upon by larger fish. They are commonly used as live bait to capture speckled seatrout. These fish "croak" by vibrating their swim bladders. This behavior helps to attract females. Commonly captured on hook and line using dead shrimp, recreational fishers often experience their distressed croaking.
 **Menhaden**	**Menhaden** are filter feeding fish which consume plankton in surface and pelagic waters. By weight, more pounds of menhaden are caught in the commercial fishing industry off Louisiana than any other species. Menhaden are primary prey for larger fish species such as tuna and marlin as well as mammals such as whales and dolphins. They are processed to create fish oil and fish meal. After the 2005 hurricanes off Louisiana, the cost of poultry rose because the hurricanes impacted menhaden processing plants in coastal Louisiana.
 **Hardhead Catfish**	Saltwater fishermen would probably agree that **Hardhead Catfish** are the most commonly captured but least desired fish to see at the end of a hook. They are very common in nearshore brackish and saline waters along the Louisiana coastline. Hardheads get up to one foot in length and feed on anything they can find on the bottom, including dead crabs, fish, and shrimp. They are generally considered not good to eat. One must be careful removing them from a hook because they have serrated spines in their dorsal and pectoral fins which can leave nasty painful wounds.
 **Stingray**	If you are walking in shallow water along the Louisiana coastline, it is best to shuffle your feet to avoid stepping on a **Stingray**. Their barbed tail can cause a serious wound. Stingrays are closely related to sharks, having a cartilaginous skeleton. Stingrays often sit on the bottom and cover themselves with sand and mud to hide from sharks, their main Gulf predators. Stingrays eat clams, shrimp, and mussels in ocean benthic regions.

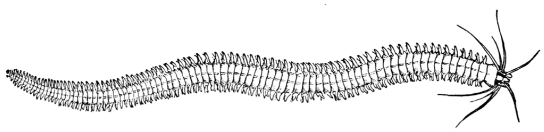
Gulf of Mexico Sea Life Cards

 **Mullet**	**Mullet** can be found in any body of water having a connection to the Gulf of Mexico. They can be found as adults in completely fresh water to nearshore Gulf waters where they spawn. If you have seen a fish jump in such areas, it likely was a mullet. These fish graze on the bottom, consuming microscopic animals and eggs (zooplankton), detritus, and dead plant matter. They are consumed by larger fish, marine mammals, birds, and in some areas, humans.
 **Red Drum**	The **Red Drum** or redfish is a popular sport fish targeted by recreational anglers. The popularity of blackened fish many years ago led to over harvesting of this species and eventual protection from all commercial netting. Redfish are predators and are known to consume crabs, shrimp and smaller finfish. They generally feed near the bottom but will move into the water column on occasion to harvest small fish.
 **Flounder**	The **Flounder** is a flat fish that buries itself in the bottom sediments and ambushes prey such as minnows and shrimp. Very young flounder have eyes on both sides of their heads, but one eye will migrate to the other side as they grow older so that both eyes will be looking "up". Predators of adult flounder are sharks, dolphins, and of course, humans. They are good to eat.
 **Black Drum**	**Black Drum** live in coastal estuaries and nearshore habitats. They are benthic (bottom) feeders and consume marine worms, shrimp and crabs when young. Commercial oyster producers hate black drum due to their penchant for grazing on oyster beds as adults. Black drum have highly developed teeth in its throat which can crush mollusks. Black drum are consumed by sharks, dolphins and humans.

Gulf of Mexico Sea Life Cards

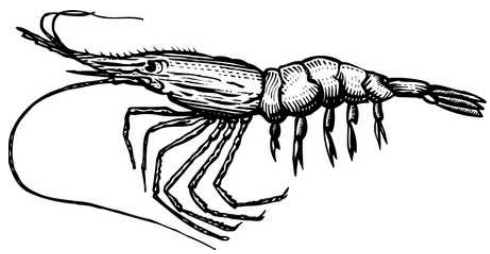
 **Whale Shark**	**Whale sharks** are the largest fish on the planet, reaching up to 46 feet in length. However, their diet consists of the smallest of animals and plants, specifically plankton. When feeding, whale sharks swim with their mouths open filtering plankton, and anything else in their path. They feed in surface and pelagic waters. In Mexico, there is a tourism industry which allows you to swim with whale sharks. Only sharks and killer whales are known to consume small whale sharks.
 **Bull Shark**	**Bull sharks** generally grow up to eight feet in length. They have been known to attack humans and are extremely tolerant of fresh water. As a matter of fact, they are known to have travelled up the Mississippi River as far north as Illinois. Their ability to tolerate fresh water is due to special body adaptations which allow them to retain salt within their bodies. Bull sharks dine primarily on fish and small sharks, but also consume turtles, birds, dolphins, and sting rays. They hunt primarily in murky pelagic and bottom water where is it is hard for prey to see them coming.
 **Tarpon**	**Tarpon** are an ancient species, having changed little over the past 125 million years. Although they spawn in deep water habitats far offshore, they enter shallow brackish habitats as young. Adult tarpon can reach 8 feet in length and feed primarily on small fish, shrimp and crabs; they also scavenge the bottom for dead fish
 **Hammerhead Shark**	**Hammerhead sharks** can exceed 15 feet in length and 1,000 pounds in weight. Their unique head shape allows them to see better than other sharks. Hammerhead sharks love to eat stingrays and smaller fish and crustaceans found near the bottom of the ocean. These sharks can travel in schools and are in more danger from humans than we are from them. This is because these sharks are regularly caught in nets and their fins are used to make shark fin soup, an expensive delicacy in Asia.

Gulf of Mexico Sea Life Cards



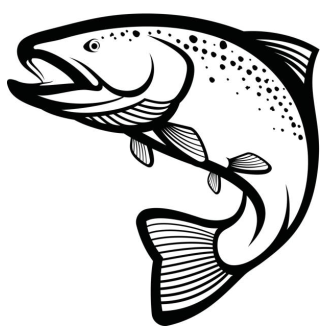
Polychaete
(Marine Worm)

Polychaetes are worms that live in the soft bottoms of the gulf. There are hundreds of species of of polychaetes and are the numerically dominant animal in the bethos. Despite their prevalence, most are not noticed. Have you ever seen a small sand straw tube covered with shell bits lying on the beach? If so, you have found a casing that once held a polychaete. Polychaetes feed on suspended food particles and are a major food source for shrimp and bottom dwelling fish such as flounder.



Shrimp

There are two main types of economically important **Shrimp** in Louisiana – brown shrimp and white shrimp. Very young shrimp (called postlarvae) consume microscopic plants (phytoplankton) and animals (zooplankton) in the Gulf;s surface and pelagic regions. Juvenile and adult shrimp are grazers consuming marine worms (polychaetes), detritus, and algae near the bottom, Main predators of shrimp are finfish of all ages and, of course, humans.



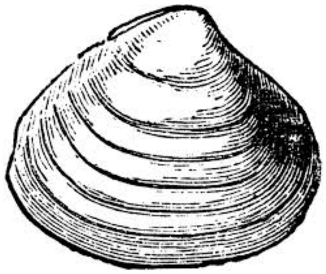
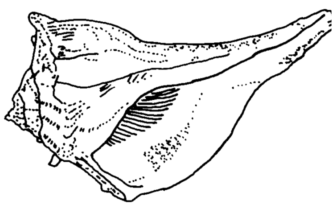
Speckled Trout

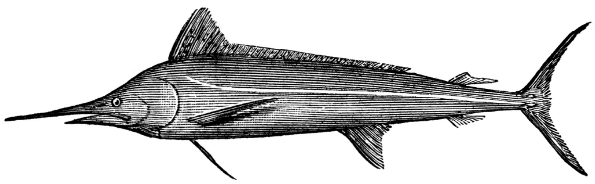
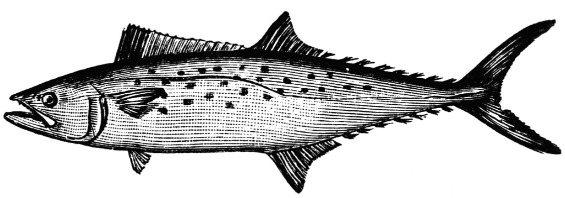
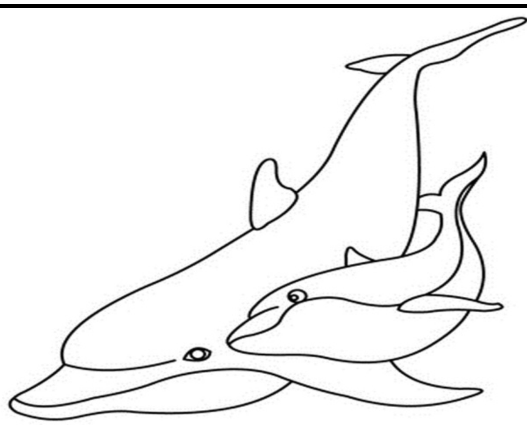
Also known as spotted seatrout, this carnivorous fish is a prized catch among recreational fisherman. Depending on their ages, **Speckled Trout** consume small crustaceans, shrimp, and small fish in all regions of the water column. They are primarily found in bays and in nearshore waters along our coastlines. If they move further offshore, they are more susceptible to predation from sharks, dolphins, and large fish like marlin.

Oyster

Oysters are bivalve mollusks common in Louisiana coastal waters. Adults anchor themselves to structures under water like rocks, pilings, and boat and filter feed plankton from their marine environment. Predators include snails (called oyster drills, moon snails, and whelks), crabs, black drum, and of course, humans. Some people love them and some hate them. Oysters are not for every palate, but they do attract a devoted following. Most of the oysters eaten in the US come from the Gulf of Mexico.

Gulf of Mexico Sea Life Cards

 **Clam**	**Clams** are marine invertebrates that belong to the bivalve class of mollusks. Bivalves have two hinged shells that house the animal's soft body. Other bivalves include oysters, scallops, and mussels. Clams feed by a process called filter feeding. To eat, clams draw in water and filter out suspended food particles as water passes over their gills. By doing this, not only do they eat but they also help keep ocean water clean. The water-filtering abilities of bivalves are legendary. Some can filter as much as 25 gallons of water each day. Clams live in benthic area.
 **Whelk**	**Whelks** are marine mollusks. There are several species of whelks in the Gulf of Mexico. The most common is the lightning whelk. It gets its name from lightning bolt like patterns that cover its shell. Empty lightning whelk shells are frequently found on Louisiana beaches. All whelks are carnivores that feed on crustaceans and other mollusks. They drill holes in the shells and armors of their prey in order to gain access to their soft interiors. Whelks live on the ocean bottom. Young whelks live on coastal sea floor bottoms. Adult whelks prefer deeper ocean bottoms.
 **Moon Snail**	**Moon Snails** are sea snails that live on ocean bottoms where they plough in search of prey. They feed mainly on bivalve mollusks such as clams but will attack other shelled mollusks they encounter. Moon snails wrap their prey with a muscular foot and then drill a hole through its shell with a sharp mouth part called a radula. Once the shell is bored, the moon snail uses a proboscis to consume the prey's soft flesh. The hole drilled by a moon snail is perfectly circular with sharp beveled edges. Next time you visit a Louisiana beach, look for clam shells with holes. Chances are these holes were drilled by moon snails!

 Fisherman	The recreational **Fisherman** is a top predator in Louisiana. Louisiana gulf watesr are so rich in seafood, that the fisherman often catch more shrimp, crabs, and fish than he can eat. Recreational fisherman will often share their abundant catch with family and friends but will carefully guard fishing secretes such as the location and meaning of capture!
 **Marlin**	**Marlin** are top carnivores in the Gulf of Mexico and the second fastest fish in the ocean behind sailfish. They have an extended bill which they use to strike and stun prey. They are considered a pelagic fish because they spend the majority of their lives in deeper oceanic areas feeding on tuna and mackerel.
 **Mackerel**	There are two species of **Mackerel** in Louisiana waters; spanish and king mackerel. Both can be found in nearshore and offshore waters at specific times of the year and are considered pelagic (liking deeper oceanic areas) like marlin. Mackerel consume all kinds of small fish, including very commonly their own young. They are consumed by sharks, tuna, marlin and man.
 **Dolphin**	The marine mammal found in coastal Louisiana is the Atlantic bottlenose **dolphin**. These mammals travel in groups called "pods" and use echolocation to find food and navigate. Dolphins are carnivore that eat mostly small to medium size fish, but also consume shrimp and squid. They cruise all water column regions in search of food but prefer surface areas where they have access to air and ocean bottoms where tasty prey reside. There are no real predators of bottlenose dolphins in Louisiana. Habitat degradation and pollution are their major threats.

 **Oyster Drill**	**Oyster Drills** are predatory sea nails and a problem in commercial oyster beds. As indicated by its name, oyster drills bore holes through the shells of living oysters and consume them. Oyster drills cost oyster farmers and fisherman millions of dollars in revenue each year. In addition to oysters, drills also feed on clams, mussels, and barnacles. . Their empty shells are often found on Louisiana beaches.

HELPFUL INFORMATION

Name_______________________________ Class________________Date_________

List 5 common trash items collected during coastal cleanups in Louisiana.	
What are Louisiana's coastal trash items typically made of?	
By what process do plastics breakdown?	
Why is there so much plastic trash along our state's coastline?	
What is a SPI Resin Identification Code?	
What are microplastics?	
What is the density of water? What is the density of seawater?	
How does density determine why some plastics float and other sink?	

Code	Name/Abbreviation	Properties	Common Uses
1 PET	Polyethylene terephthalate (PET, PETE)	Clear, strong and lightweight; chemical and shatter-resistant; **sinks in water**; density=1.38-1.39 g/mL.	Water and soft drink bottles; peanut butter and salad dressing containers; vegetable oil containers, mouthwash bottles.
2 HDPE	High density polyethylene (HDPE)	Strong, tough; chemical, moisture, and heat resistant; **floats in water**; **density**=0.95-0.96 g/mL.	Milk and water jugs; detergent, shampoo, and motor oil containers; bleach jugs, flower pots.
3 PVC	Polyvinyl chloride (PVC, Vinyl)	Good chemical resistance, weather durable, high impact strength; transparent, translucent, or opaque; rigid or flexible; **sinks in water**; density= 1.16-1.45 g/mL.	Clear food packaging, some plastic squeeze bottles, garden hoses, vinyl pipes, shower curtains, flooring, home siding, toys.
4 LDPE	Low Density Polyethylene (LDPE)	Tough, lightweight; relatively transparent and flexible; **floats in water**; density=0.92-0.94 g/mL.	Most plastic wraps; bread, frozen food, sandwich, and grocery/shopping bags, dry cleaning bags, six-pack soda can rings.
5 PP	Polypropylene (PP)	Strong, resistant to heat, oil, grease, and moisture; **floats in water**; density=0.90-0.91 g/mL.	Drinking straws, bottle caps, yogurt and margarine containers, takeout/deli food containers, disposable diapers, outdoor carpet, rope, clothing, medicine bottles, plastic pails, auto parts.
6 PS	Polystyrene (PS)	Stiff, clear or opaque; easily mixed with dyes for coloration; **sinks in water**; density= 1.05-1.07 g/mL	Disposable cutlery, CD and DVD cases.
6 PS-E	Expanded Polystyrene (PS-E, EPS)	Lightweight, opaque, insulating, foamed; **floats in water**; density= 0.02-0.06 g/mL	Packaging peanuts, meat trays, foam cups and plates; egg cartons.
7 OTHER	Other	Various properties depending on plastic(s) used.	Products made with plastics other than 1-6 or made of more than one type of plastic; includes polycarbonate, melamine, and acrylic; common items include lids, sports water bottles, plastic baby bottles, clear sippy cups, bullet proof materials, sunglasses

KNOW YOUR PLASTICS

Density of fresh water: 1.00 g/mL

Density of sea water: 1.03 g /mL

Plastic Zone Cards

EXAMPLE **Plastic Item:** *Baggie* **Recycling Code:** *#4* **Density:** *0.92 g/mL* **Sinks, Floats, Suspend:** *Floats* **Water Column Zone:** *Surface* **3 organisms that share zone:** *Whale Shark, Leatherback Sea Turtle, Dolphin*	**Plastic Item:**_____________________ **Recycling Code:**_____________________ **Density:**_____________________ **Sinks, Floats, Suspend:**_____________________ **Water Column Zone:** _____________________ **3 organisms that share zone:** ______________________________
Plastic Item:_____________________ **Recycling Code:**_____________________ **Density:**_____________________ **Sinks, Floats, Suspend:**_____________________ **Water Column Zone:** _____________________ **3 organisms that share zone:** ______________________________	**Plastic Item:**_____________________ **Recycling Code:**_____________________ **Density:**_____________________ **Sinks, Floats, Suspend:**_____________________ **Water Column Zone:** _____________________ **3 organisms that share zone:** ______________________________
Plastic Item:_____________________ **Recycling Code:**_____________________ **Density:**_____________________ **Sinks, Floats, Suspend:**_____________________ **Water Column Zone:** _____________________ **3 organisms that share zone:** ______________________________	**Plastic Item:**_____________________ **Recycling Code:**_____________________ **Density:**_____________________ **Sinks, Floats, Suspend:**_____________________ **Water Column Zone:** _____________________ **3 organisms that share zone:** ______________________________

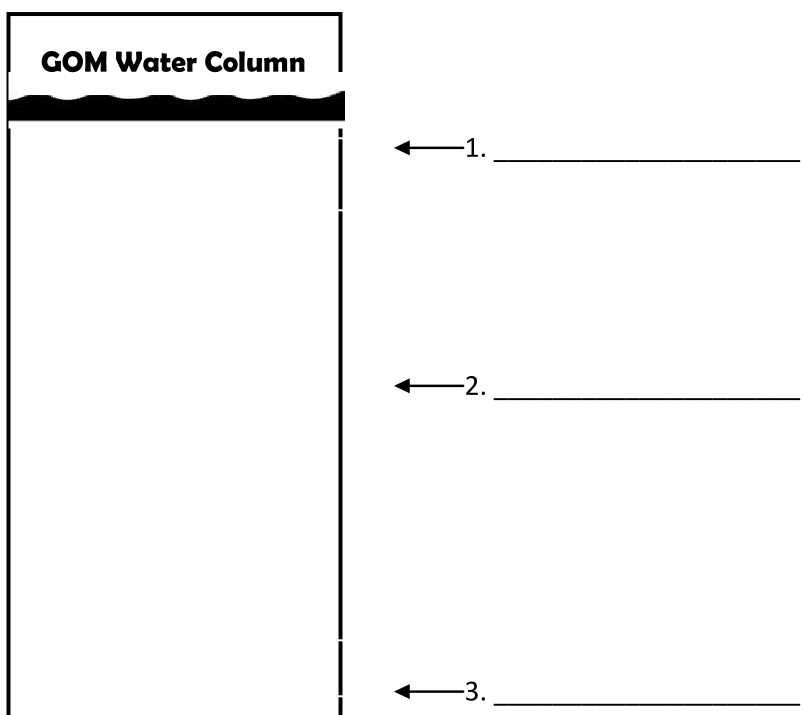
BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

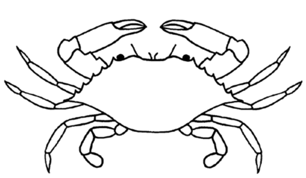
Sea Life Hangouts!

Use your sea life cards to complete the following chart.

Sea Life	**Feeding Zone** (surface, pelagic, benthic)	**Diet**

Identify the water column's benthic, surface, and pelagic zones.





EXIT TICKET NAME________________________________

Explain why some plastics float in ocean water while others sink.

Plastic trash that sinks and settles on the ocean bottom would have the greatest impact on ________________________________ feeding organisms. (pelagic, surface, benthic)

EXIT TICKET NAME________________________________

Explain why some plastics float in ocean water while others sink.

Plastic trash that sinks and settles on the ocean bottom would have the greatest impact on ________________________________ feeding organisms. (pelagic, surface, benthic)

Section 5: A Close Look at Microplastics

The lesson begins with a discussion about microplastics. Students role play how microplastics transport toxins (POPs) into ocean food chains.

Then, “Chains of Knowledge” are crafted to raise awareness of microplastic pollution.

Barataria-Terrebonne National Estuary Program

2018

5E Lesson: A Close Look At Microplastics

Objectives

- *Describe characteristics, cite examples, and identify sources of microplastics.*
- *Model the movement of microplastics through an ocean food chain.*
- *Define persistent organic pollutants and describe their impact on organisms.*
- *Explain how microplastics move POP's from the ocean to the marine food chain.*
- *Define bioaccumulation and biomagnification.*
- *Model how POP's bioaccumulate and biomagnify in ocean food chains.*
- *Identify which organisms have the highest concentration of toxins in a food chain scenario.*
- *Promote microplastic pollution awareness.*

Engagement

- **Demonstration:** *Microplastics in Personal Care Products*
- **Demonstration:** *Microfibers in Laundry Water*

Exploration

- **Videos:**
  - *Plankton munching microplastics (2:00 min, YouTube, Bo Eide)*
  - *Plankton eating plastic caught on camera for the first time (0.50 min, YouTube, New Scientist)*
  - *Microplastic Oceans-Behind the News (3:37 min, YouTube)*
  - *Ocean Confetti (2:57 min, YouTube)*
  - *What are microplastics? Here's what you need to know in less than 1 minute. (0.59 min, NOAA Ocean Service)*
- **Activities:**
  - *Class Discussion: Introduction to Microplastics*
  - *Role Play: Ocean Food Chain Mechanics*
  - *Role Play: How Microplastics Enter A Marine Food Chain*
  - *Role Play: What Happens When Microplastics Introduce Pops Into Marine Food Chains*

Explanation

- *Students use handouts: Microplastics Basics, Microplastics Fact Sheets, and A Close Look At The Water Column to explain concepts of microplastic pollution.*

Elaboration

- *Students construct a* **Chain of Knowledge** *craft to raise microplastic pollution awareness.*

Evaluation

- **Exit Tickets:**
  - *3 Things I learned Today About Microplastics*
  - *Describe How Microplastics Disrupt Ocean Food Chains.*

Take A Closer Look (Lesson Plan)

Standard: EARTH AND HUMAN ACTIVITY 8-MS-ESS 3-3

Overview: The lesson begins with an introduction to microplastics. Students role play how microplastics transport toxins (POPs) into ocean food chains. Then, they craft "Chains of Knowledge" to raise microplastic pollution awareness.

Objectives:

- Describe characteristics, cite examples, and identify sources of microplastics.
- Model the movement of microplastics through an ocean food chain.
- Define persistent organic pollutants and describe their impact on organisms.
- Explain how microplastics move POP's from the ocean to the marine food chain.
- Define bioaccumulation and biomagnification.
- Model how POP's bioaccumulate and biomagnify in ocean food chains.
- Identify which organisms have the highest concentration of toxins in a food chain scenario.
- Promote microplastic pollution awareness.

Time: 3-4 days

Materials:

For entire class

- Personal care products containing microplastics (body wash, foot scrub, etc)
- Synthetic fabric (polyester, nylon, etc)
- Small jars with lids
- Set of role cards
- Index cards
- Hole punches, staplers/staples, scissors
- String

For each student

- Clothes pin or tape for attaching role cards to clothing
- Markers

Student Handouts:

- Microplastics Basics
- Microplastics and Ocean Food Chains
- Chain of Knowledge Instructions
- Chain of Knowledge Paper Panels
- Microplastics Fact Sheet
- Take a Closer Look at the Water Column
- Chain Links

Exit Tickets:

- 3 Things I Learned Today About Microplastics
- Describe How Microplastics Disrupt Ocean Food Chains

Videos:

- Plankton munching microplastics (2:00 min, YouTube, Bo Eide)
- Plankton eating plastic caught on camera for the first time (0.50 min, YouTube, New Scientist)
- Microplastic Oceans-Behind the News (3:37 min, YouTube)
- How does marine debris impact the ocean, animals, and me? (1:33min,Trash Talk)
- What are microplasts? Here's what you need to know in less than 1 minute. (0.59 min, NOAA Ocean Service)

Advanced Preparation:

1. Cut out 1 set of organism role cards.

2. Make handout copies for **each student:**

Microplastics Basics	Microplastics Fact Sheet
Take a Closer Look at the Water Column	Microplastics and Ocean Food Chains
Chain of Knowledge Instructions	Chain of Knowledge Paper Panels
Chain Links	

3. Make copies of exit tickets.

Part 1: Engagement: Microplastics Demonstrations

1. Demonstrating Microplastics in Personal Care Products

- Select a Personal Care Product (body wash, foot scrub, etc) that lists microplastics on its product label. A product will contain microplastics if one or more of the following appear on its label: **polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), polymethyl methacrylate** (PMMA), **nylon** (PA), and **acrylates copolymer** (AC).
- Place approximately 1 tablespoon of product in a small jar. Fill jar with water, cap and shake to dissolve contents. Set jar down on a dark background and leave undisturbed for a few minutes. Have students observe the liquid. They will notice 100's of floating plastic particles. Tell class these particles are called **microplastics.** The smooth, round particles are **microbeads** while the irregular shaped particles are **microfragments.**

2. Demonstrating Microfibers in Laundry Water

- Put a 2 x 2 in piece of synthetic fabric (polyester, nylon, etc) in a jar, add water, and shake to "wash." Set the jar down. Have students observe the laundry water. They will notice 100's of tiny floating threads. Tell the class these threads are called microfibers and are a type of microplastic. Treatment plants are unable to completely remove microfibers from water because they are so small. As a result, microfibers are released with effluent into watersheds. Our oceans are teeming with microfibers.

Part 2: Introduction to Microplastics

1. Hold an "Introduction to Microplastics" discussion with handouts:
   a. Microplastics Basics
   b. Microplastics Fact Sheet
2. Have students complete worksheet "Take A Closer Look At The Water Column," then review with class.
3. Reinforce concepts with videos:
   a. What are microplasts? Here's what you need to know in less than 1 minute. (0.59 min, NOAA Ocean Service)
   b. Microplastic Oceans-Behind the News (3:37 min, YouTube)
4. Conclude with Exit Ticket: 3 Things I Learned Today About Microplastics

Part 3: Modeling Ocean Food Chain Mechanics

1. Discuss the concept of food chains.
2. The class will be actively demonstrating the mechanics of a food chain. Arrange students in the following formation. This formation is based on a class size of 30 but can be modified to fit your class size.

• (1) Man

• • (2) Tuna

• • • • • (5) Mackerel

• • • • • • • • (8) Anchovies

• • • • • • • • • • • • • • (14) Zooplankton

3. Distribute role [illegible] their shirts with tape, clothes pins, etc.
4. Give each "zooplankton student" a blank index card.
5. Instruct the "anchovies" to take the index card from then "zooplankton" in front of them. This represents anchovies feeding on zooplankton.
6. Next, have the "mackerel" feed on the "anchovies." Then, have the "tuna" feed on the "mackerel."
7. Finally, have the "human" feed on all of the tuna. The human should have accumulated all of the index cards.
8. Discuss how this activity demonstrates a food chain in action.
9. Reinforce concepts with video:

Part 4: Modeling how microplastics enter a marine food chain.

1. Discuss what zooplankton feed on. Zooplankton consume phytoplankton, other zooplankton, tiny eggs, larvae, etc.

2. Again, with students in formation and assuming their roles, give each "zooplankton" a blank index card. Explain that the zooplankton are hungry for "eggs." As zooplankton hold their index cards, mark **half** the cards with a **green dot** and the other half with a **red dot**. Tell the zooplankton the dots represent eggs.

3. Repeat the food chain demonstration with the "dotted" cards. The plankton will pass their dotted cards to the anchovies. Then, the mackerel will pass their dotted cards to the tuna. The tuna will pass to the human. The human will receive all of the marked index cards at the end of the demonstration.

4. Tell the class that the green dots were delicious shrimp eggs and provided the food chain with valuable nutrients. The red dots were microplasts that resembled fish eggs.

5. Write down the number of red dots that were initially marked on the zooplankton cards. Compare that to the number of red dots in the human. Discuss how this activity demonstrates the way microplastics bioaccumulate and biomagnify in the food chain.

6. Reinforce concepts with these videos….
   a. Plankton munching microplastics (2:00 min, YouTube, Bo Eide)
   b. Plankton eating plastic caught on camera for the first time (0.50 min, YouTube, New Scientist)

Part 5: Modeling what happens when microplastics introduce POPs into marine food chains.

1. Re-distribute cards marked with red and green dots to the "plankton." Now, in a dramatic way, place black x's on the red microplastic eggs.

2. Instruct the "plankton" to pass their cards to the "anchovies." Then, have "anchovies" pass their cards to the "mackerel." Next, "mackerel" pass their cards to the "tuna." Finally, "tuna" pass their cards to the "human."

3. Tell class that the black x's represent POPs. Discuss how microplastics transfer POPs from the environment into the food chain. Explain that POPs tend to attach plastic surfaces. When an organism ingests plastic, POP's detach from the surface and deposit in the organism's fat tissue.

4. Have students compare the number of black x's marked on zooplankton cards with the number of black x's consumed by the human. Discuss how this activity demonstrates the way POPs bioaccumulate and biomagnify in the food chain.

5. Reinforce lesson with videos:
   Microplastic Oceans-Behind the News (3:37 min, YouTube)
   How does marine debris impact the ocean, animals, and me? (1:33min, Trash Talk)

6. Close with Exit Ticket: Describe How Microplastics Disrupt Ocean Food Chains

Part 6: Chain of Knowledge Craft

1. Encourage students to think of creative slogans, graphics, etc that would effectively raise awareness of microplastic pollution. Tell class that they are going to use their ideas and microplastics knowledge to create "Chains of Knowledge." Show the teacher example.

2. Distribute supplies.

Each student:	**Entire class:**
Instruction sheet	Art supplies
1 set of chain links	Scissors, stapler/staples, hole punch
2 paper panels	String

3. Have students craft their "Chains of Knowledge."

4. Show off the student achievement by displaying their "Chains of Knowledge."

Microplastics Basics

Microplastics are plastic particles 5 mm or smaller in size. Nonbiodegradable and highly persistent, microplastics have been found in oceans, rivers and lakes, in sea salt and tissues of sea organisms. These tiny plastic particles are classified as either primary or secondary microplastics.

Primary microplastics are manufactured to be small. They include **microbeads** and **nurdles**. **Microbeads** are spherical shaped, often colorful, plastic particles used in personal care products as scrubbing agents. They are common in facial cleansers, foot scrubs, toothpastes, and body washes. Because of their tiny size, treatment facilities have difficulty removing them from waste water. As a result, trillions of microbeads are discharged into water bodies each year. Microbeads are often mistaken for food by aquatic organisms because they resemble tiny fish eggs. Scientists have discovered that organisms can suffer from starvation, impaired digestive and reproductive systems, and other health problems when they ingest microbeads. In an effort to protect US waterways, the 2015 Microbeads-Free Water Act was passed making it illegal to sell and distribute rinse off products containing microbeads. Although microbeads have been banned, rinse off personal care products still often contain microplastic "grains." Ingredient labels that list polyethylene or polypropylene indicate the presence of microplastics in a product.

Nurdles are raw-plastic pellets used to make plastic goods. They are usually shipped to manufacturers by ship, rail car, and truck. Accidentally spilled nurdles are easily swept through watersheds to rivers, lakes, and oceans. They are quite common on beaches. Most people don't notice them because they look like large spherical shaped grains of sand. Like microbeads, nurdles resemble fish eggs, are mistaken for food, and consumed by fish, birds, sea turtles, and marine mammals. Nurdles and other plastics in the marine environment tend to adsorb and concentrate persistent organic pollutants (POPs). POP's such as PCB's, DDT, and dioxins, are common in seawater and can be transferred to food chains when microplastics are consumed by marine life.

Secondary microplastics form when plastic breaks into tiny pieces. Microplastic fragments and microfibers are examples of secondary microplastics. Sun and mechanical forces like waves weaken plastic, causing it to fragment into smaller pieces. **Microplastic fragments** are common on beaches around the world. When synthetic fabrics such as polyester and nylon are laundered, fabric treads called **microfibers** are shed in wash water. Microfibers are flushed into rivers and oceans because treatment facilities are unable to completely remove them from waste water. Bivalves such as oysters and clams are particularly sensitive to microfiber pollution. They feed by sucking up seawater and removing and digesting any food particles present. Microfibers present in seawater are also removed and taken in by bivalves. Bivalve health declines when they live in oceans contaminated with microfibers.

Microplastics function like toxin magnets and cause problems in marine food chains. Poor waste management practices have polluted the oceans with toxins known as **persistent organic pollutants** or POPs. Examples of POPs include organochlorine pesticides, polychlorinated biphenyl (PCB's), and dioxins. Dangerous to animal and human health, POPs have been linked to reproductive, immune, and endocrine system disorders along with cancer and birth defects.

Molecular attractions cause POPs to stick and concentrate in great numbers on the surface of marine microplastics. When marine animals ingest microplasts covered with POPs, the POPs leave the plastic surface and settle in the organism's fatty tissues. Once deposited in fatty tissue, bioaccumulation and biomagnification begin.

Bioaccumulation refers to the process where organisms take in toxins faster than their bodies can eliminate them. This means that the amount of toxin accumulates in their bodies over time. When the toxin level inside of the organism is higher than the concentration of the surrounding environment, bioaccumulation has occurred. **Biomagnification** is a process where toxins accumulate up a food chain. Toxin residues in smaller organisms are transferred to larger organisms that eat them. This usually means that the organisms at the top of the food chain will have the greatest toxin concentration in their systems.

Many people around the world are dependent on oceans for their main protein source; seafood. According to UN News, "as many as 51 trillion microplastic particles- 500 times more than stars in our galaxy**- litter** our seas, seriously threatening marine wildlife." Because every marine microplastic is capable of bringing toxins to ocean food webs, it is important to find ways to remove and prevent microplastic pollution.

A Close Look At Microplastics Vocabulary

Bioaccumulation: the buildup of toxic substances in an organism.

Bivalve: a mollusk having a soft body enclosed within two hinged shells. A clam is an example of a bivalve.

Biomagnification: the process where concentration of toxins increase as you move up the food chain.

Degradation: the process of breaking down.

Filter feeders: animals that eat by collecting small particles of food from the water. Oysters are filter feeders.

Food chain: a series of plants and animals linked by their feeding relationships.

Microplastics: extremely tiny pieces of plastic 5 mm or smaller in size. Microplastics pollute the environment.

Microfiber: tiny piece of synthetic thread often shed during textile laundering.

Microplastic fragment: plastic piece broken down from a "parent" plastic.

Nonbiodegradable: unable to be broken down by decomposing organisms.

Nurdle: very small plastic pellet used as raw material in the production of plastic goods.

Photodegradation: the process of objects breaking down by ultraviolet light.

Primary microplastic: Plastic product intentionally produced to be small. Examples include microbeads and nurdles.

Phytoplankton: microscopic plants which drift and float in the sea.

Persistent Organic Pollutant: enduring chemical that accumulates in fatty tissue of organisms.

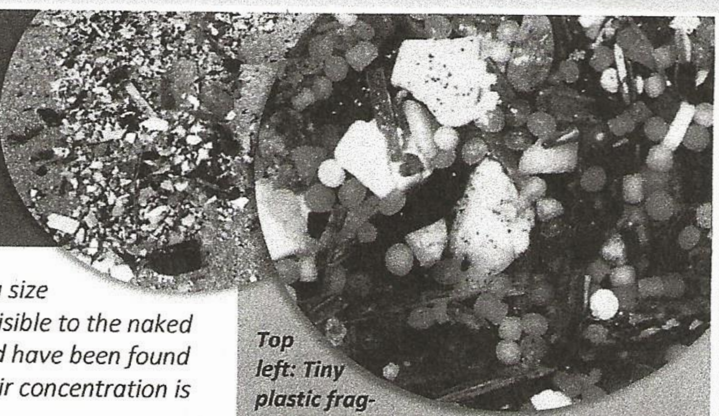
Personal Care Product: a non-prescription product used for personal hygiene or beauty

Secondary Microplastic: small plastic piece resulting from the breakdown of a larger plastic item.

Toxin: a chemical substance that damages an organism.

Zooplankton: microscopic animals which drift in the sea.

Microplastics



Top left: Tiny plastic fragments litter the sand like confetti. Top right: Mistaken for fish eggs, plastic resin pellets are often ingested by animals, blocking their guts or leading to starvation since the animal feels full. *Credit: Blue Ocean Green Earth Project; onemoregeneration.org*

Microplastics are tiny fragments, pellets or fibres of plastics with a size of ≤ 5 mm. Most of them are smaller than a grain of sand and invisible to the naked eye. They are the most abundant form of solid-waste pollution and have been found in all oceans, on all continents and even in the deep sea where their concentration is now four times higher than in coastal waters.

Ingredients of the plastic soup

When **plastic debris** degrades into smaller fragments (***below left***) it releases toxic additives such as plasticizers, dyes, flame retardants or bisphenol A (BPA) into the water.

Many **cosmetics** such as face scrubs, body washes or toothpaste contain microbeads as abrasive scrubbers (***below centre***). These tiny plastic particles cannot be filtered out by sewage plants and are washed into rivers and oceans.

Plastic resin pellets (***below right***) are the raw material in the manufacture of plastic products. At the factories and during the transport they are often spilled in large numbers and end up in the ocean where they are a major contributor to marine debris and almost impossible to clean up.

Credit: Tangaroa Blue Foundation; Green Spa Network; Paul L. Nettles

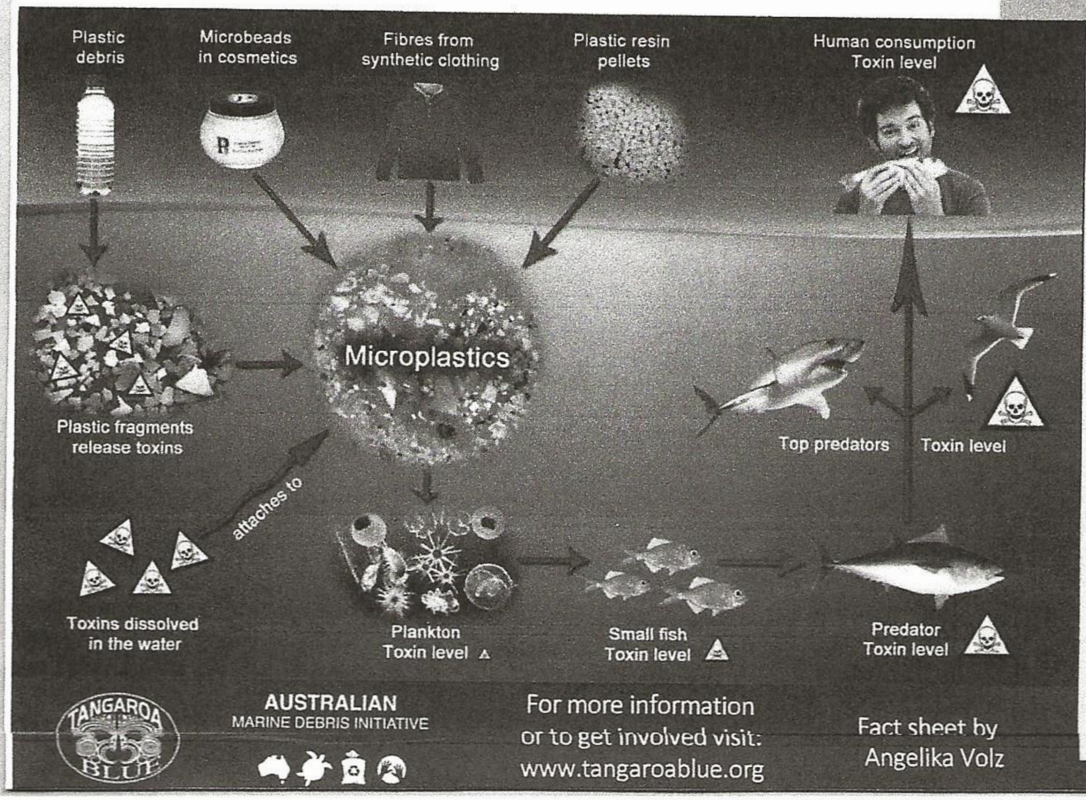
Fast Facts

An average consumer discards 2.4 mg of microplastics daily.

Four billion minute fibres could be littering each square kilometre of some of the world's deep seas.

Plastic resin pellets can be up to **1 million times more toxic** than the surrounding seawater.

Every time a synthetic garment is washed, it releases about **1900 microplastic fibres** that bypass sewage filters and end up in the ocean.



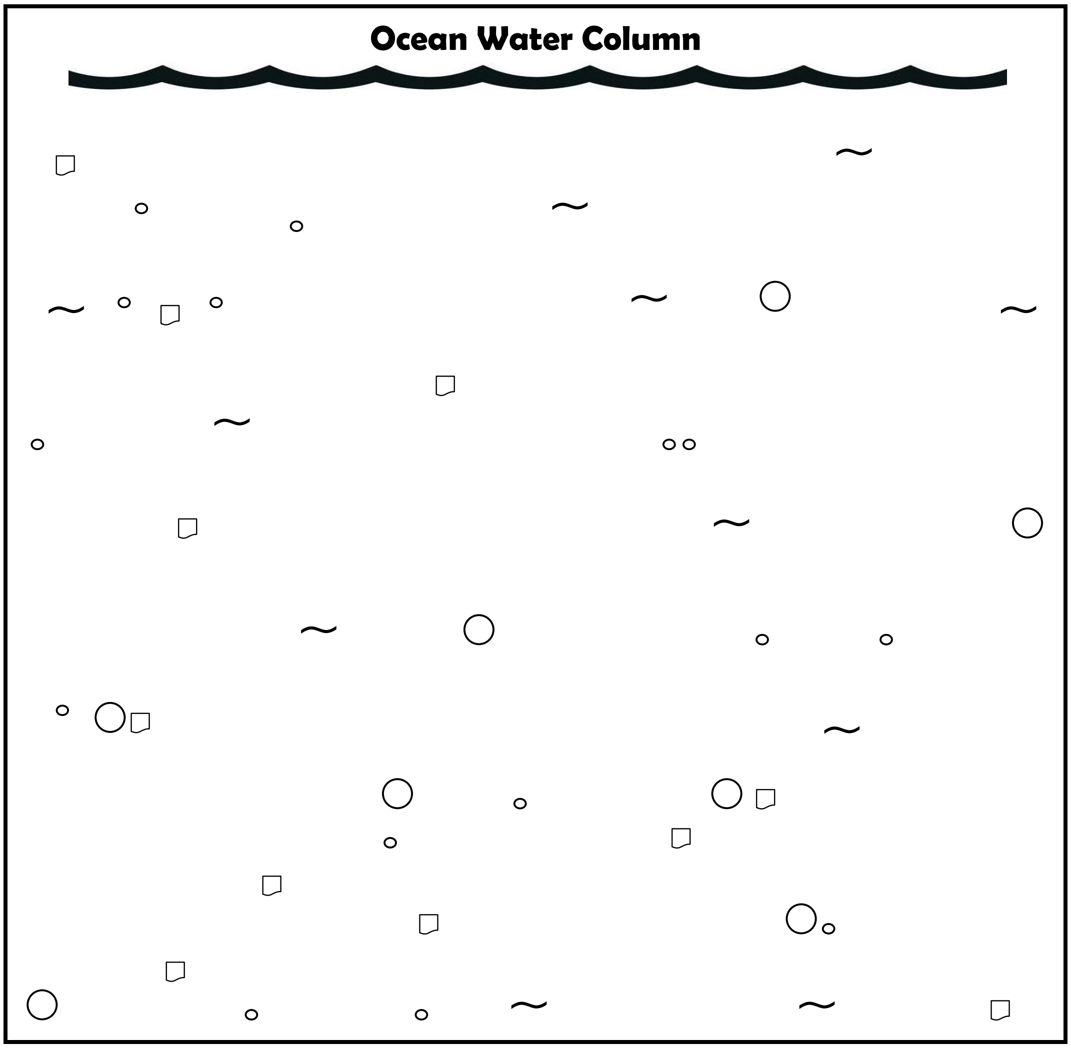
Toxic carriers

Fragments of plastic debris, microbeads, synthetic fibres and plastic resin pellets form a plastic soup. In addition to the toxins that are released by degrading plastics, microplastics also adsorb chemicals from the sea water such as pesticides and detergents on their surface, making them highly toxic particles. When eaten by plankton, crabs, mussels or small fish these chemicals enter the food chain, leach into the tissues of the animals and can accumulate. Predators and eventually humans could then ingest high levels of toxins, possibly causing cancer or damage to the nervous system and several organs. *Credit: Angelika Volz*

A CLOSE LOOK AT THE WATER COLUMN

Colors

- •Microbeads: yellow
- •Microfibers: brown
- •Nurdles: blue
- •Fragments: green



Answers

1. What are microplastics? ____________________

2. What size are microplastics? ____________________

3. Where can microplastics be found? ____________________

4. Use checks to identify the microplastics as primary or secondary.

MICROPLASTIC	PRIMARY	SECONDARY
Microplastic fragments		
Microbeads		
Microfibers		
Nurdles		

5. Why do marine organisms sometimes ingest microbeads? Sketch a marine organism ingesting a microbead on the water column diagram.

6. Why do marine organisms sometimes ingest nurdles? Sketch a marine organism ingesting a nurdle on the water column diagram.

7. On the water column diagram, sketch a bivalve filter feeding microfibers from sea water.

CHAIN LINKS

Microplastics are…
Examples of microplastics include…
Microplastic fragments are…
Zooplankton often mistake microplasts for…
People should be concerned about microplastic pollution because…

CHAIN LINKS

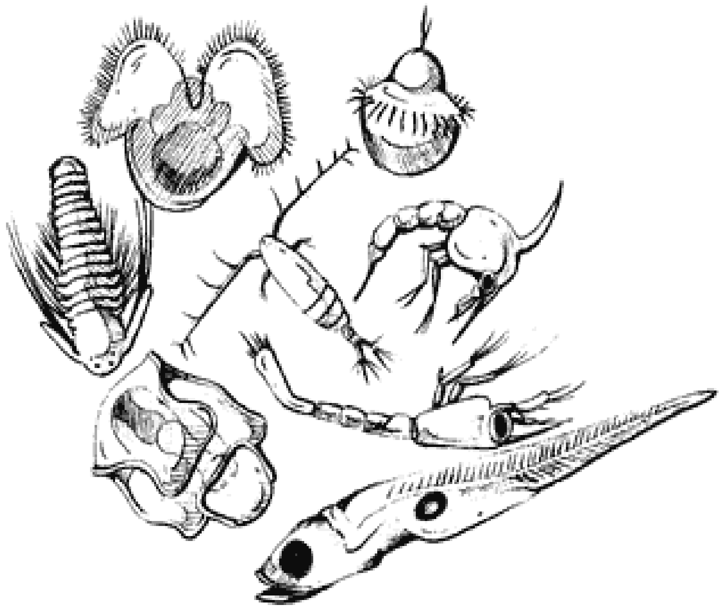
Microplastics play a role in biomagnification by…
Something interesting I learned…
Microplastics are bad for the food chain because…
Tuna are at the top of the food chain because…
Plankton are at the bottom of the food chain because…

CHAIN LINKS

BTNEP
BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Example

✂



BOTTOM OF THE FOOD CHAIN

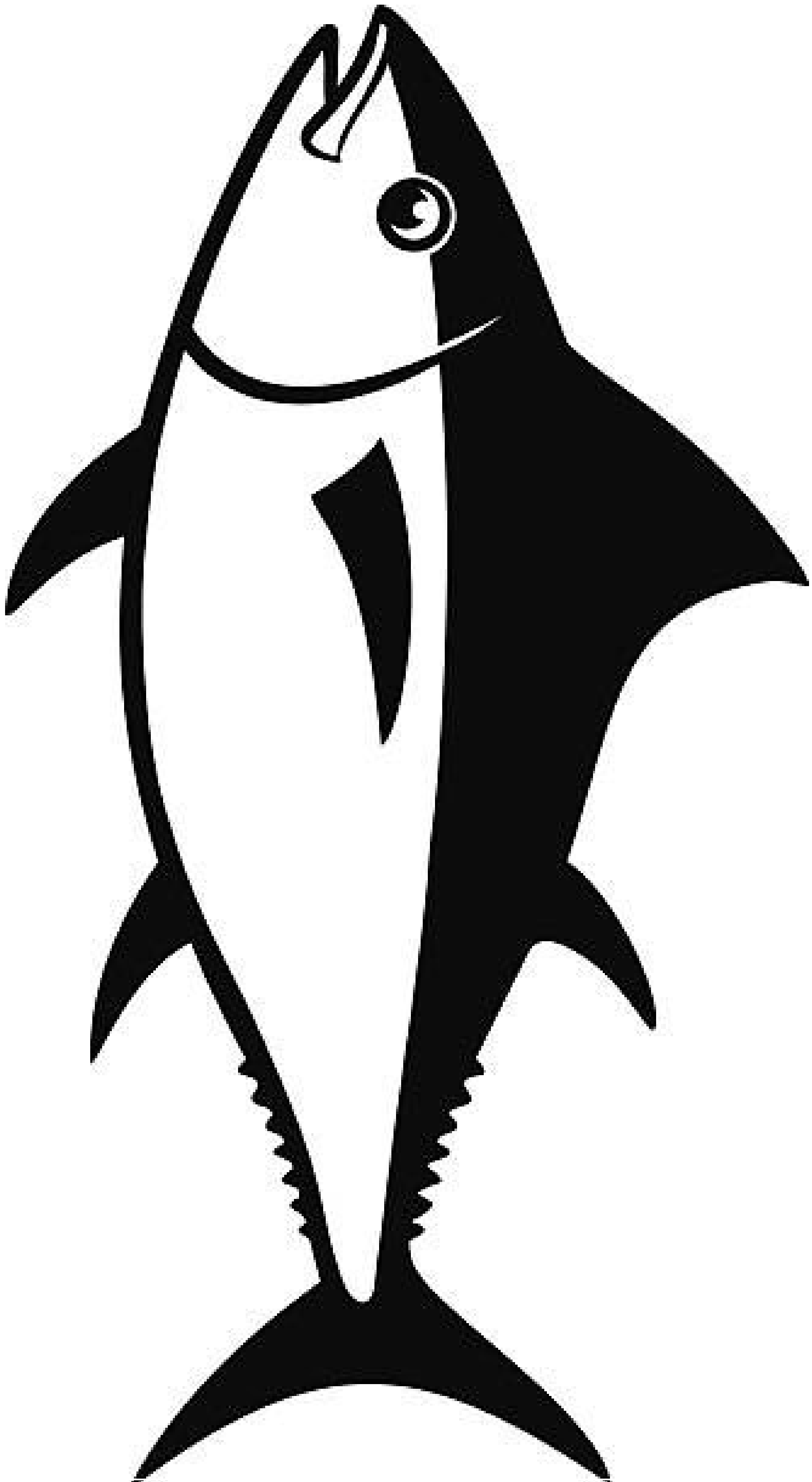
____

MICROPLASTICS

BAD FOR THE FOOD CHAIN

Example

✂



TOP OF THE FOOD CHAIN

CHAIN of KNOWLEDGE-Instructions

Materials: 1 set of chain links, 2 paper panels, art supplies, scissors, stapler/staples, hole punch, string

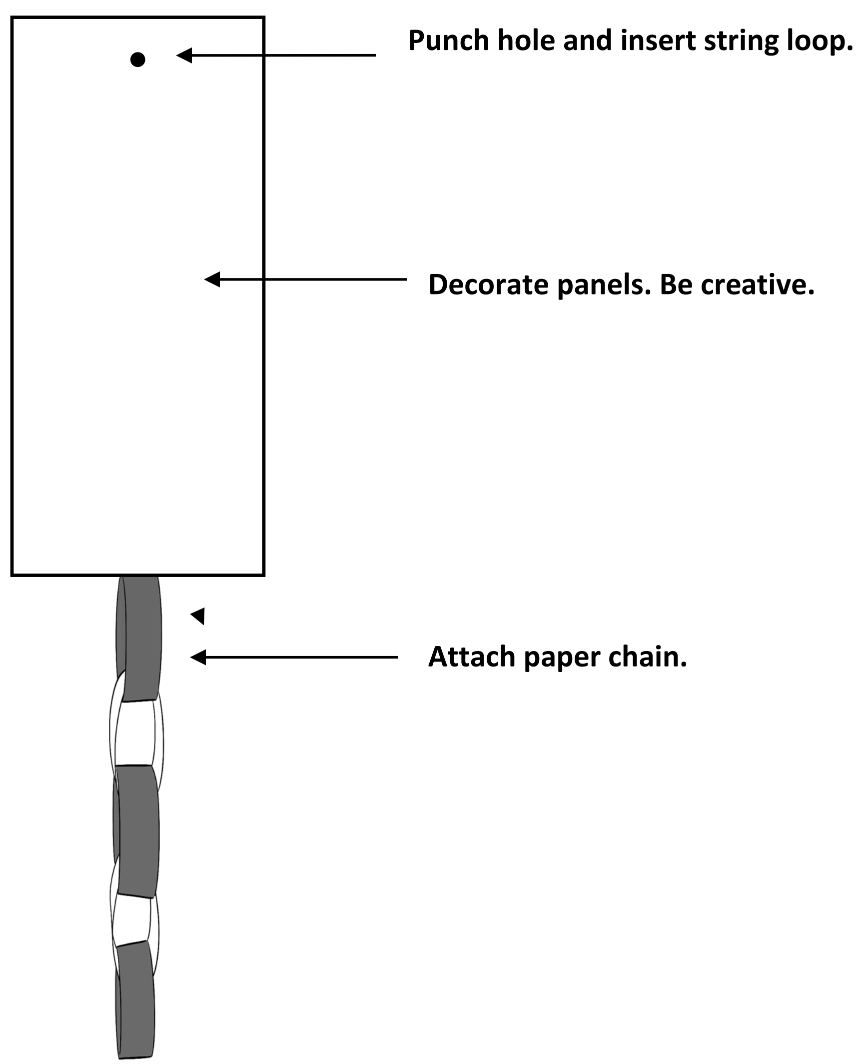
Instructions:

1. Show off the **IMPORTANT THINGS** you learned and raise microplastic pollution awareness by making a "Chain of Knowledge."

2. Decorate both paper panels with slogans, graphics, etc. that will help raise microplastics pollution awareness. Cut out the paper panels and staple them together with decorations facing out. Punch a hole near the top and insert a sting loop.

3. Complete the chain links with the **IMPORTANT THINGS** you learned. Cut out the links and fashion them into a paper chain. Attach the chain to the bottom of your decorated paper panels.

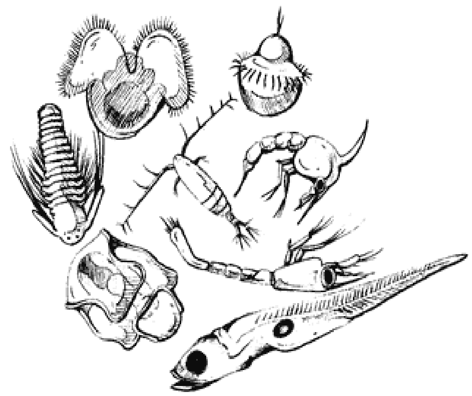
4. Display your **Chain of Knowledge** for others to see. Thank you for learning and sharing information about microplastics with others!



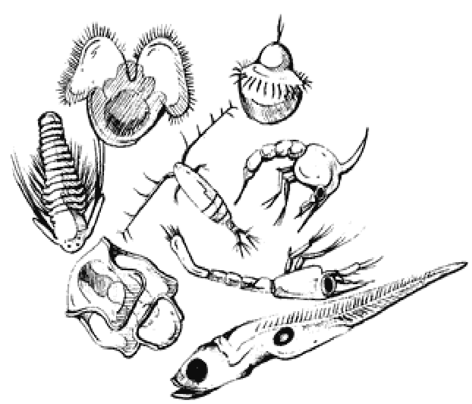
Cut out paper panel. ✂

Cut out paper panel. ✂

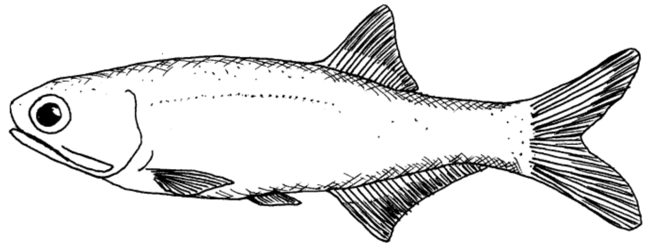
ROLE CARDS



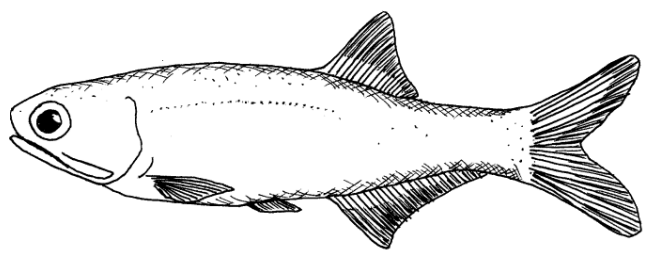
PLANKTON



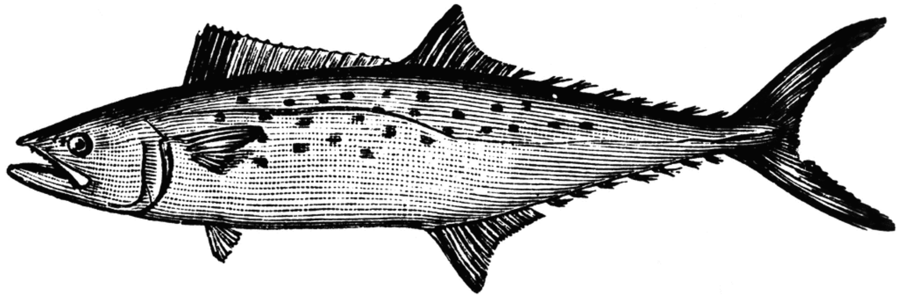
PLANKTON



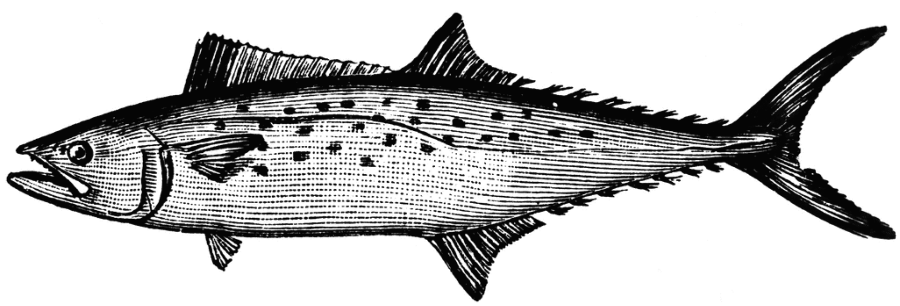
ANCHOVY



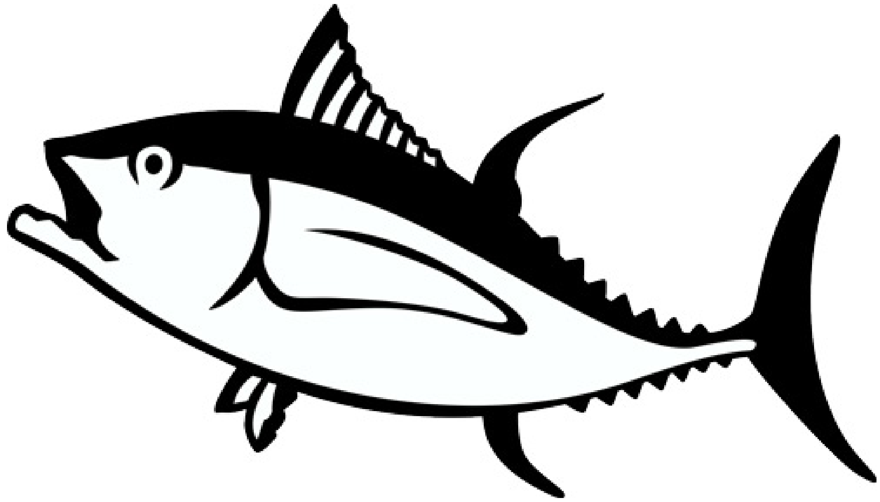
ANCHOVY



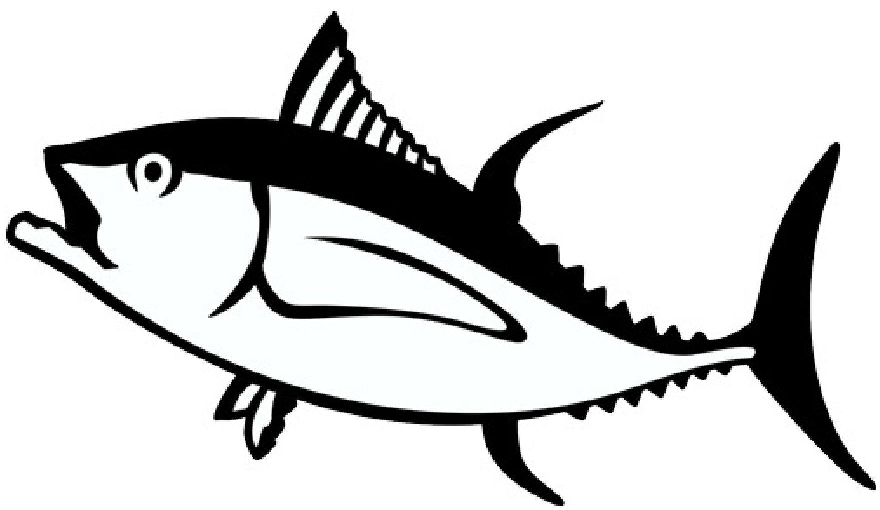
MACKEREL



MACKEREL



TUNA



TUNA

TOP PREDATOR

EXIT TICKET **NAME**______________________________

3 Things I Learned Today About Microplastics

EXIT TICKET **NAME**______________________________

3 Things I Learned Today About Microplastics

BTNEP
BARATARIA-TERREBONNE
NATIONAL ESTUARY PROGRAM

For additional lessons visit:
www.BTNEP.org

Barataria-Terrebonne National Estuary Program

2018