



LESSON 11: Saving Our Seas: A Lesson on Marine Debris

OVERVIEW

Students will have a greater understanding of ocean-based and land-based marine debris, and the impacts on the ecosystem.

Materials Needed

- Rivers of the US map
- Wet Erase Markers
- Rubber bands - 1 per student
- Paper plates - 1 per group
- Fragments of plastic (cups, bags, and beads)
- Three spoons - Per group
- Three cups - Per group
- One and one-half cups dry rice - Per group
- Stopwatch

Background Information

The 2,000 miles of U.S. coastal shoreline along the Southeast and Gulf of Mexico regions offer unsurpassed natural beauty and opportunities for living and recreation. Each year, more than 20 million residents and millions of visitors are enjoying coastal communities and cities in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana. The economy of these coastal communities depends upon a clean coast, because families have the option to choose other beaches or activities for their vacations.

We share our coasts with wildlife. The beaches, estuaries, and tidal creeks are home to a tremendous diversity of animals. Turtles, birds, crabs, dolphins, and fish use coastal and estuarine habitats for shelter and for places to find food, as well as for many parts of the life cycle. We all depend on a clean and healthy ecosystem for a high quality of life. People can diminish the beauty and safety of the beaches and coasts if they irresponsibly dispose of litter, abandon boats, or lose recreational or commercial fishing gear in the environment. Marine debris is a serious problem, but it is preventable.

There are two main sources of marine debris.

Ocean-Based Sources:

- Fishing Vessels: Fishing gear such as fishing lines and traps can be lost from fishing boats (referred to as derelict fishing gear).
- Recreational Boaters: Trash and fishing gear can fall overboard if not stored properly.
- Stationary Platforms (Oil and gas drilling platforms): Hard hats, gloves, pipe protectors and 55 gallon drums can all be lost from platforms.
- Cargo and Other Vessels: Ships caught in rough seas can lose a variety of items that are being transported, including entire shipping containers. Shipping containers carry many products long distances from where they were made to where they will be sold. Products from sneakers to bath toys have been lost from cargo ships.

Land-Based Sources:

- Litter: Any trash that is not properly disposed of can end up in waterways and eventually in the ocean.
- Trash cans or recycling containers may not be readily available, which can lead to inappropriate disposal. Some people simply do not put trash where it belongs. Examples of littering include: leaving food wrappers at the park or releasing balloons into the sky.
- Littering can also be accidental. Examples include: a plastic grocery bag flying out of a car window or losing a ball at the beach.
- Dumping: Disposal facilities for large or hazardous items may be difficult to find, or they may charge fees. Rather than pay these fees, people may dump large materials such as construction materials, appliances, furniture, mattresses and hazardous waste near creeks or rivers.
- Storm Water Discharges: Storm drains carry litter and runoff to waterways that lead to the ocean. Any trash left along the street can easily wash into storm drains and eventually make it to the ocean.
- Poor Waste Infrastructure: In some parts of the world, there are no landfills or recycling centers for peoples' trash. In fact, in many places, trash cans do not exist and trash is simply piled on the street or in dry riverbeds. Without a confined place for trash, it is very easy for waste to end up in the ocean.
- Natural Disasters: Events such as tornadoes, hurricanes, floods and tsunamis can scatter debris into the marine environment.

Trash Travels Through Watersheds

To show how trash travels from inland waterways to the ocean, participants first need to understand the concept of a watershed.

- How do you think trash travels to the ocean?
 - Trash is carried from its original resting spot via wind or rain to storm drains.
 - Storm drains carry trash directly to waterways like streams and rivers.
 - Following the path of their watershed, those rivers transport the trash to the ocean, resulting in marine debris (EPA).
 - Gauge participants' understanding of the term watershed.
- As a group, can we come up with a definition for the word watershed?
 - "A watershed is the area of land where all of the water that falls in it and drains off of it goes into the same place" (USGS). Watersheds come in all shapes and sizes. They cross county, state, and national boundaries. In the continental U.S., there are 2,110 watersheds; including Hawaii, Alaska and Puerto Rico, there are 2,267 watersheds (EPA).

ACTIVITY

Trace the Trash: Participants will demonstrate how trash travels through an inland watershed and reaches the ocean.

Materials: Laminated map of the rivers of Louisiana and wet erase markers.

Instructions:

1. Ask volunteers to come up to the map and point out where they were born, their favorite place to visit or a location they really want to visit (or any other spot on the map).
2. Using the wet erase marker, have the participant imagine that a piece of trash was dropped on the map and have them trace the path the piece of trash would take by following the paths of the watershed.

3. The participant should eventually trace a path that leads to the Gulf of Mexico.
4. Have multiple participants volunteer to trace their trash.
5. End with a brief discussion about how easy it is for inland trash to wind up in the Gulf, even if that is not where it was intended to go. If you have access to a computer and wish to dive deeper on this topic, check out the USGS website to pin point your groups' watershed (https://water.usgs.gov/wsc/map_index.html), and use the interactive map to trace your unique inland to ocean journey (<http://nationalmap.gov/streamer/webApp/streamer.html>).

Ocean Surface Currents: The Marine Debris Highways

Surface ocean currents are mainly driven by global wind patterns. You can think of wind as a solid object that scrapes along the top of the ocean and pulls water in the direction that it's blowing. Ocean currents are made more complex because of land masses, the uneven heating of Earth, and the fact that Earth spins about its axis. (NOAA)

- Currents are important because they carry nutrients and organisms throughout the ocean, sustaining countless marine habitats and wildlife.
 - Currents are also important because they regulate Earth's climate. The Gulf Stream Current brings warm water from the equator along the east coast of the United States and eventually toward England. This current keeps Northern Europe much warmer than many places as far north.
 - Currents, both at the surface and deep within the ocean also carry trash. Circular currents cause the accumulation of marine debris in specific areas.
 - Gyres, or large rotating ocean currents, can trap trash and marine debris at their centers. Gyre currents rotate clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Worldwide, there are five major subtropical oceanic gyres: the North and South Pacific Subtropical Gyres, the North and South Atlantic Subtropical Gyres, and the Indian Ocean Subtropical Gyre. (NOAA)
- Has anyone ever heard of the "Great Pacific Garbage Patch"?
- What do you think this "garbage patch" looks like?
 - The name "Great Pacific Garbage Patch" has led many to believe that this area is a large and continuous patch of easily visible marine debris, like an island that is visible from space. This is not accurate. Higher concentrations of trash items can be found in this area, along with other debris such as derelict fishing nets, but most of the debris are actually very small pieces of plastic (NOAA).
 - The garbage patch is not so much an island as it is a plastic soup. Imagine the garbage as the vegetables and the ocean as the broth. Just like in soup, the pieces of trash in the gyre collect at different levels in the water column, not just at the surface. The debris is continuously mixed by wind and wave action and widely dispersed both over huge surface areas and throughout the top portion of the water column (NOAA).
 - The North Pacific Gyre is well known for the debris that has gathered at its center; however it is not the only plastic soup—marine debris accumulates in every ocean gyre.

Impacts of Ecosystems

- Now that we have talked all about marine debris, why should we care about the issue? Why is marine debris a bad thing for our ocean?
 - Talk about the negative impacts of marine debris to the environment, animals and humans. This is called ecosystem impacts.

- The formal definition of impact is: the effect or influence of one person, thing, or action on another (Oxford Dictionary).
- Entanglement is one of the major issues caused by marine debris. Entanglement is when something becomes twisted or trapped by something else. Marine debris can easily entrap animals and cause serious problems.
- Nets, ropes, lines, fishing gear, ribbons, 6-pack rings and many other types of marine debris can entrap marine species, limiting their ability to move, eat and breathe.
- Entanglement can result in injury, illness, suffocation, starvation and even death.
- Animals spend valuable time and energy trying to escape from entangled trash on their bodies, but they are often unable to do so.

ACTIVITY

Rubber Band Entanglement

Materials: A rubber band for each participant. The rubber bands should be an average size; they will go once around the hand.

Instructions:

1. Each participant should hang the rubber band around his/her pinky finger of one hand.
2. Each participant should then stretch the rubber band across the back of their hand, and hook the rubber band on their thumb.
3. Have participants place their other hand (without the rubber band) behind their back.
4. Have participants now attempt to free the hand "entangled" in the rubber band without using their opposite hand, teeth or any other body part.
5. Allow participants 15 seconds to attempt to free their hands of the rubber bands.

Discussion:

1. Were you able to free your hand from the rubber band? How did you feel while trying to remove the rubber band?
2. Explain that this activity mimics what it may be like for many marine animals when they become entangled in pieces of marine debris. Two common examples include seabirds becoming entangled in fishing line and sea turtles becoming wrapped in line, rope or other fishing gear. Explain that these animals, unlike us, do not have fingers or opposable thumbs that easily allow them to remove items.

Ingestion

- Ingestion is another way marine debris can hurt the ocean ecosystem and the animals living within the ocean ecosystem.
- Ingestion is when something, such as food, is taken into the body. More or less, ingestion is the same thing as eating something.
- Many marine animals, such as fish, birds and sea turtles have been known to ingest marine debris by accident.
- Marine debris is often mistaken as a food source or is attached to a food source and ingested by an animal.

- Debris ingestion poses a serious health hazard and can lead to “loss of nutrition, internal injury, intestinal blockage, starvation, and death.” (NOAA)
- Plastic debris is found along our beaches as fast food containers, foam coolers, plastic foam surfboards, and beverage bottles. These eventually break down into fragments.
- Oceanic currents carry these tiny plastic particles all over the globe, where they collect inside circular currents (eddies) or drift onto beaches. Seabirds feed in a frenzy over schools of bait fish. Often the plastic is swallowed quickly along with the food. Seabirds also bring these plastics back to the nest to feed their chicks. These plastics can build up in their digestive systems, causing harm to adult and young seabirds.

ACTIVITY

Ingestion of Marine Debris

Materials: One paper plate, fragments of plastic (cups, bags, and beads), three spoons, three cups, one and one-half cups dry rice, stopwatch

Instructions:

On each paper plate, mix rice with a 1/2 cup of the plastic pieces.

1. Students divide into groups.
2. Each group of students gets a plate with the rice and plastic mixture, three spoons and three cups.
3. Spoons represent the bird’s beak and the cups represent the bird’s stomach. The rice represents food such as bait fish.
4. Three students in each group pretend to be birds and their spoon beaks to feed from the container. They place the food into their “stomach” cups.
5. One student in each group is the timer. The timer indicates to his or her group when to start and stop feeding. Each group feeds for 30 seconds.
6. After “feeding,” each group completes the chart in the observation section.

STUDENT REPORTING TABLE IN EDUCATORS GUIDE TO MARINE DEBRIS

STUDENT “BIRD”	# OF RICE GRAINS	# OF PLASTIC DEBRIS PIECES	TOTAL #OF PIECES
BIRD 1			
BIRD 2			
BIRD 3			
TOTAL			
AVERAGE			

Wrap Up:

- Would you rather visit a beach with trash or one without? Why?
- What are some reasons one beach may have less marine debris than another beach?
- Do you think an ice cream shop on a clean beach or on a beach with lots of trash would have more customers?
- How might a coastal economy fare if its beach is littered with marine debris?
- Can you think of more ways to prevent marine debris? Let's list as many prevention ideas as we can.
- Dispose of trash properly—never leave it on the beach or boat ramp.
- If you see litter, be sure to pick it up, even if it isn't yours.
- Never toss fishing line into the water.
- Report boats or fishing gear that appear to be abandoned or lost.
- Leave only footprints in the sand!

Extensions:

Trash Math: Dive Deeper With Data

Organize a beach cleanup and analyze the data. Analyzing the data can help participants understand the specific marine debris problems in your area and enhance math skills. Once trash data have been collected, participants can use this data to run age appropriate statistics and calculations. They might determine the most common item collected or look at the mean, median and mode of certain items across the group. This data can also be graphed, made into a pie chart, or analyzed with a multitude of different math calculations. Participants can calculate totals, percentages, ratios, averages, probability, etc. For an example math worksheet using the cleanup data, please see the online activity bank.

1. Identify Top 10 Items.
2. For the top 10 items, do you think they are typically from land or sea?
3. These 10 items comprise what percentage of the total?
4. How do you think these items listed in the chart became marine debris?
5. Plan a campaign to reduce, recycle, or reuse the top 10 items.

OTHER RESOURCES:

- **Talking Trash**
- **The Educator's Guide to Marine Debris**
- **Winged Ambassadors: NOAA's Office of National Marine Sanctuaries and Oikonos - Ecosystem Knowledge**

Free lessons and resources available at:

- <http://cordellbank.noaa.gov/education/teachers.html>
- <http://oikonos.org/education>
- <http://papahanaumokuakea.gov/education/wa.html>