

## 5E Lesson Plan

**Center:** The River Center

**Program name:** Ocean Currents and Plastic Voyages

**Date offered:** Year-round

**Subject/grade level:** Science/4-5

### **Benchmarks:**

#### Grade 4 Science Standards

SC.4.L.17.4: Recognize ways plants and animals, including humans, can impact the environment.

SC.4.P.8.1: Measure and compare objects and materials based on their physical properties including mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.

SC.4.E.6.3: Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.

SC.4.N.1.1: Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.

#### Grade 5 Science Standards

SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.5.N.1.6: Recognize and explain the difference between personal opinion/interpretation and verified observation.

SC.5.P.8.2: Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.

SC.5.P.13.1: Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.

SC.5.E.7.2: Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.

#### Language Arts Standards

LAFS.4.RI.1.3, LAFS.4.RI.3.7, LAFS.4.SL.1.1, LAFS.4.SL.1.3, LAFS.4.SL.2.4, LAFS.5.RL.2.6, LAFS.5.RI.2.6, LAFS.5.W.3.8, LAFS.5.SL.1.1

#### Mathematics Standards

MAFS.4.MD.1.1, MAFS.4.MD.2.4, MAFS.5.MD.1.1, MAFS.5.MD.2.2

### **Lesson target:**

- I can identify sources of marine debris.
- I can describe the potential effects of plastic waste on aquatic wildlife and habitat, specifically the coastal shorelines of Jupiter, Florida.
- I can determine specific actions citizens can take to help remedy the problem of marine debris.

**Differentiation strategies to meet the needs of all students:**

- Working in a group setting to explain vocabulary
- Use of open-ended questions
- Relate topic to their everyday life
- Hands-on instruction
- Use of visuals
- Modification of text or curriculum

**Vocabulary:**

Biodegradable, debris, solid waste, sewage, entangled, ingest, litter, plastic, pollution, microplastic, biomagnification, bioaccumulation, disposable, petroleum, stormwater, runoff, Clean Water Act, recycle, reuse, reduce, water supply, shoreline, currents, tides, wrackline, water column, swamp, estuary, ocean, freshwater, saltwater, brackish water

**Background:**

The U.S. produces over 250 million tons of trash every year, and the amount continues to increase. Disposing of all that waste negatively affects wildlife. Although the production of cheap and disposable plastics has made life more convenient, it is of great concern regarding litter and quantity of waste. 12% of waste produced each year in the U.S. is plastic (30 million tons) and on 8% of this plastic waste is recycled. The rest go into landfills or in the environment. Plastic waste is a large component of marine debris.

While most of the waste produced today in the U.S. is recycled or deposited in landfills, this was not always the case. Much trash was deposited into the open oceans until the Clean Water Act passed in 1972. Many other countries still deposit waste directly into lakes, rivers, or directly into the ocean. Over time, this has resulted in a tremendous amount of garbage in every ocean around the world that can travel incredible distances with the currents.

Because the ocean is so vast, there is no current estimate on the amount of trash it contains, but the majority of marine debris recovered is plastic. Plastic does not degrade so once it reaches the ocean it is there to stay. It will breakdown into smaller pieces, even microscopic (Microplastics). This happens through sun exposure, wind and wave action, and salt from the water.

**Engage:** (to be completed in classroom before visiting)

**Question 1:** How does trash and plastic litter get into the ocean and onto the beach?

1. Rainwater washes plastic into streams where it is then carried out to sea.
2. Tides carry trash off the beach into the ocean and carries marine debris from the ocean onto the beach.
3. Storm drains and sewage overflows into local waterways.
4. Boats such as fishing boats, cargo ships, cruise line ships, and oil platforms leave trash, equipment, nets, and other debris behind.
5. Waste that escapes from the landfill process.
6. Industrial oil spills and large human catastrophes.
7. Natural Disasters.

**Question 2:** Why is trash and plastic litter harmful to wildlife?

- It is harmful to wildlife because of the potential for entanglement and ingestion. The highest number of animals harmed are sea birds and sea turtles.

**Question 3:** Why is trash and plastic litter harmful to humans?

- Humans can be cut from trash and plastic litter on the beach and in the ocean.
- Humans can become sick from bacteria.
- Humans can become sick from contaminated plastic waste.

**Question 4:** What are some challenges with trash and plastic litter that get into the ocean and onto the beach?

- There is a challenge to remove these tiny fragments without harming wildlife.
- Litter is found throughout the water column. Even when it is not visible on the water's surface, it can be found farther down.
- It is concentrated in large, circular ocean currents known as gyres (ex. Great Pacific Garbage Patch).
- Future generations will only see a reduction in marine debris if all countries and organizations collaborate together to both prevent and clean up plastics.

**Explore:** (Completed during visit with River Center staff)

1. Welcome, introduction to the River Center, overview of today's field trip, and safety/rules talk
2. Divide the students into 2 groups to rotate through 3 different activities
  - a. Lovin' the Loxahatchee River Tour – focusing on habitats, human impacts on these habitats, habitat destruction and restoration
  - b. Ocean Current and Plastic Voyages hands-on activity (See below)
  - c. Water resources discussion
    - i. Where does our water come from?
    - ii. How we use water in our everyday lives?
    - iii. Where it goes once it flows down the drain?
    - iv. What is the process of wastewater treatment?
    - v. How can I help? Water conservation
3. Touch tank demonstration

**Explain:** (Completed during visit with River Center staff)

Have student name some common items that are made out of plastic. Talk about marine debris and litter that is washed onto our beaches. Discuss ways in which plastic can become ocean trash. How did the plastic they have at home end up in the ocean or another body of water? How could they keep plastic from becoming aquatic debris? Discuss ways plastics might negatively affect aquatic animals if they are not disposed of properly.

Students will work together as teams to collect as much trash off their beach (sand container) as they can. After the first round, have the students sort the trash they were able to collect on the table and review what the different items represent. What did they notice when they were collecting the trash? What was the easiest way to get the trash? What were the easiest and hardest items to collect? Was there trash buried that you did not see?

We cannot rake the beach with large-scale machines because of sea turtles, the wrackline, shorebirds, and dune plants that are protected. Students will try again, but this time they will use only trash grabbers (clothes pins) which is more realistic. Did they recover all the items? If not, why? What obstacles did they face? Can you suggest more efficient ways to recover the items from the sand?

Plastics can be distributed throughout the water column. Ask the students how they would collect the items from an aquatic environment. How would it be different than the sand? What obstacles might they face? How would they remove small plastic pieces from the deepest parts of the ocean? How would they remove plastic without disturbing marine wildlife?

**Elaborate:** (Completed with River Center staff if time allows or in the classroom after visiting.)

Students will brainstorm what can be done to keep plastics out of the ocean and freshwater environments and ways to reduce, reuse, recycle, rethink, and respect. Students will create a solution to the pollution. They can invent something that cleans up trash on the beach, in the rivers, the ocean, or their community. Older students can label and write about their inventions.

1. Have students design their inventions on paper including materials needed, concept ideas, purpose, and models.
2. Students will build a prototype of their designs. Students can use a variety of materials such as recycled items, Legos, Playdough, computer renderings, etc.
3. Have the students present their inventions to the other teams in the class. Facilitate a student led discussion on potential challenges, questions, thoughts, ideas, suggestions to help each team improve on their design and see it from another's perspective.

**Evaluate:**

- Participation in the activity.
- Write about your experiences at the Loxahatchee River Center.
- Grade assessment and participation of the pre and post activities described in the Engage and Elaborate sections.

**Making STEM Connections:**

Science

- See standards above.

Technology:

- Have the students do some more research on marine debris and plastic pollution. Once they have completed their research they will get in the same groups and revise their design. Once their design is complete they can make a PSA using the following suggestions:
  - a. Skit
  - b. iMovie
  - c. Poster
  - d. Commercial

Engineering:

- There are several different countries, companies, non-governmental organizations, and individuals that are developing and creating ways to clean up the ocean. Research technology is being designed and used today to help clean the oceans.
- Review the engineering, design, and physics on how these different concepts and inventions would work cleaning up the oceans or not.
- Find one and design a model.

Mathematics

- See standards above.

**Making Loxahatchee River District Connections:**

- Solid waste
- Stormwater
- Water supply
- Sewage

**Making River Center Exhibit Connections:**

- Wild & Scenic – Introduction to the federal designation of the northwest fork of the Loxahatchee River and how the Loxahatchee River District is helping to preserve this portion of the river through wastewater treatment solutions for the community. This is also where students will understand that freshwater wetlands in Florida are directly connected not only to drinking water through aquifers, but it also continues downstream eventually leading into the ocean.
- Estuary – Introduction to how pollution and waste can travel down river eventually reaching the ocean and can contribute to marine debris
- Dock Piling – Introduction to positive and negative human impacts related to plastic waste
- Coral Reef/Deep Marine – Example of a healthy ecosystem that could be impacted by pollution and waste