



North American Marine Environment Protection Association

NAMEPA

MARINE ENVIRONMENT PROTECTORS & COMMUNITY STEWARDS PROGRAM

LESSON GUIDE





North American Marine Environment Protection Association

NAMEPA

The North American Marine Environment Protection Association (*NAMEPA*) is an independent, marine industry-led entity that brings together industry, government, regulatory, conservation, and education organizations to provide access, collaboration, and participation in preserving the marine environment. NAMEPA is a non-profit organization committed to preserving the marine environment by educating seafarers, students, and the public about the need and strategies for protecting global ocean resources.

The NAMEPA Marine Environment Protectors and Community Stewards Program goal is to provide educational services related to marine science, ocean literacy, human impacts on water quality and ocean health, and post-secondary education and career exploration opportunities to students who rarely access their coastline for enrichment activities. NAMEPA uses STEM, Ocean Literacy Principles, and Next Generation Science Standards (NGSS) while implementing inquiry-based learning methodology through hands-on activities utilizing the natural environment to increase ocean literacy and inspire participants to become environmental stewards.



NAMEPA has received funding from Cargill to implement the Marine Environment Protectors and Community Stewards Program as an afterschool enrichment program for youth in grades 6-8 in underserved communities in the greater Miami area to educate and activate students to be Marine Environment Protectors. The project will help Save Our Seas by inspiring this generation to become stewards of the marine environment through hands-on educational programs and projects.



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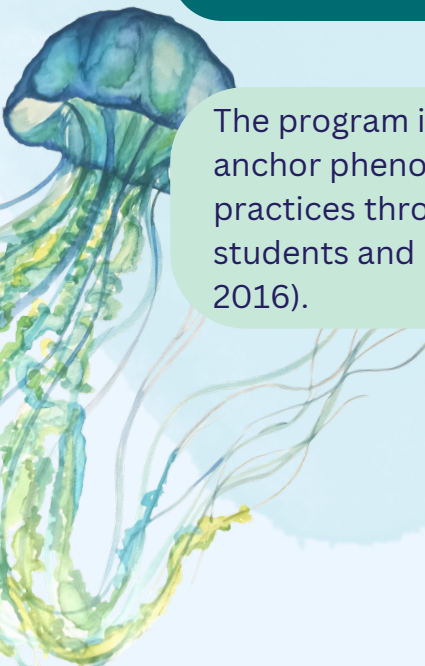


PROGRAM GOALS

- Increase ocean literacy among members of the greater Miami community through hands-on education utilizing the natural environment, scientific instrumentation, and classroom instruction.
- Highlight workforce development by exploring careers in marine conservation and the maritime industry.
- Encourage underrepresented students to be life-long learners and to be proactive in protecting and advocating for the marine environment.

IMPLEMENTATION

The Marine Environment Protectors Program can be implemented during classroom instruction or as an enrichment program. The lessons encourage participants to dive deeper into ocean literacy by using the local marine environment as a perspective lens for a more meaningful approach.



SCOPE & SEQUENCE

The program introduces an instructional sequence with natural scientific anchor phenomena for students to engage in science and engineering practices through hands-on lessons. The phenomenon is observable to students and is of relevance to the stakeholder community (Penuel and Bell, 2016).

PROGRAM OUTLINE

To this day, the ocean remains a largely uncharted and unexplored frontier. We have only discovered 5% of the ocean and know about outer space. As the United Nations has proclaimed a Decade of Ocean Science for Sustainable Development (2021-2030) with the need for transformative ocean science solutions for sustainable development for the ocean we want by 2030. The ocean is home to some of the most biologically diverse ecosystems on the planet not to mention as the world's largest carbon sink, the ocean acts as a climate regulatory. Understanding the ocean's influence on you – and your influence on the ocean (National Marine Educators Association) is a fundamental step towards developing sustainable science solutions needed to protect the ocean.

As famous oceanographer Sylvia Earle wrote in her book, *The World is Blue*, “Everyone, everywhere is inextricably connected to and utterly dependent upon the existence of the sea” (Earle, 2010).

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INTRODUCTION TO MARINE ENVIRONMENT

SUMMARY

Students will be introduced to the goals of the Marine Environment Protectors Program by using a pre-assessment survey. Then, students will dive into coastal habitats and learn about their local marine ecosystems by exploring local watersheds and waterways. To protect the marine environment, we must first understand how it is connected.

Next Generation Science Standard

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

BACKGROUND INFORMATION

The ocean, which covers 70% of the Earth's surface, is the defining feature of the planet. To explore the marine environment, scientists study the physical, chemical, geological, and biological components that together contribute to the natural systems and processes we observe. It is the overlap of these components that ultimately compose distinctive marine environments.

Wherever you go in Florida, you are never far away from water. Coastal wetlands, coral reefs, and mangrove forests are three unique marine ecosystems that support a variety of species with unique adaptations.

OBJECTIVES

Students will:

- Be introduced to the marine environment in Florida.
- Discuss the unique ecosystems and features that make Florida an important region for biodiversity.



LESSON PLAN: INTRODUCTION TO MARINE ENVIRONMENT

TIME

75 - 90 minutes

MATERIALS

- Coastal Habitats slides
- Map or globe
- Notebook & writing utensil, *or* device
- *Optional: mangrove roots, coral, or wetland plant specimen*

ENGAGE

Begin by showing students visuals of coastal wetlands, coral reefs, and mangrove forests. Ask students to make observations and in a pair-share format, ask students to discuss what they notice or can infer about each ecosystem.

Next, locate wetlands, coral reefs, and mangrove forests on a map or the globe. Ask students to describe the climate or weather patterns in these regions.

EXPLORE

Divide students into three groups: wetlands, coral reef, and mangrove forest. Provide each group with multiple visuals of their ecosystem.

Ask students to list:

- Why do you think the ecosystem is important?
- What physical features do you observe?
- What type of plants or animals would live here?
- What adaptations might these species need to survive?
- How have you used this ecosystem?

EXPLAIN

Have each coastal habitat group share its findings. Emphasize the importance of these ecosystems as regions of biodiversity, protection from erosion, water filtration, and supporting the local economy through tourism and recreation.

EXTEND

Have students work in small groups, or individually, to create a poster, cartoon, slide, or other creative projects that demonstrates the ecosystem's importance and characteristics, especially adaptations.

Optional: If you have specimens, students can make observations and determine how these specimens have to adapt to the ecosystem.

EVALUATE

Conclude the lesson by reviewing the importance of these ecosystems, biotic and abiotic interactions, and how they are similar across the different ecosystems. Assess student understanding with a formative assessment, such as an exit ticket.



ECOSYSTEM HEALTH: WATER QUALITY

SUMMARY

Marine ecosystems are defined by environmental factors and the community of organisms living there. The ocean offers vast living space and diverse habitats from the surface through the water column to the seafloor. Students will be introduced to abiotic factors that explain how ocean life is not evenly distributed. They will use these abiotic differences to explore how physical, chemical, and biological components can influence populations.

Next Generation Science Standard

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

BACKGROUND INFORMATION

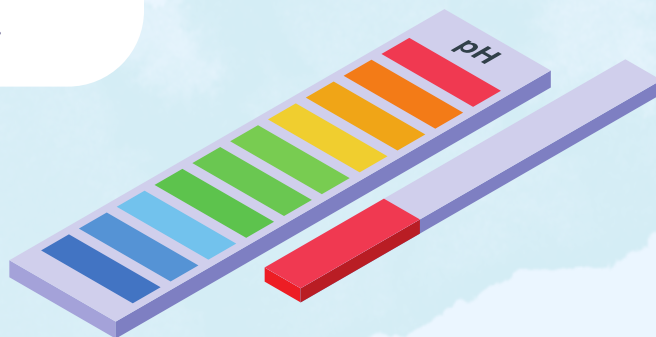
As the human population continues to increase, the exploitation of natural resources increases as well. To continue to provide people with food, places to live, energy, water, etc., once undeveloped land is converted for human use. Land development specifically coastal development can lead to habitat loss, sedimentation of rivers and streams, increased runoff, and water pollution. These impacts can negatively affect ecosystems and species populations.

When deciding what to do with a piece of land, many factors must be taken into consideration, including ecosystem services and how local species may be affected. When determining the impacts on the marine environment, water quality is assessed.

OBJECTIVES

Students will:

- Understand the importance of water quality for ecosystems.
- Conduct water quality testing using appropriate tools and methods.
- Analyze and interpret water quality data to draw conclusions about the health of a water body.



LESSON PLAN: ECOSYSTEM HEALTH - WATER QUALITY

TIME

75 - 90 minutes

MATERIALS

- Water quality testing kit
- Guide for zooplankton identification
- Data collection sheet or notebook
- Microscope or hand lenses

ENGAGE

Prior to this lesson, take students to a local body of water to collect samples including a plankton tow, or bring in samples.

Begin by discussing the importance of water quality for ecosystems and human health. Review that species in wetlands and the roots of mangroves play an important role in filtering water and protecting the coastline.

Explain that water quality refers to the physical, chemical, and biological features of water and can affect the functioning and health of an ecosystem.

Then, discuss components such as temperature, pH, dissolved oxygen, and nutrient levels.

EXPLORE

Set up stations around the classroom for students to complete different water quality testing: pH, temperature, dissolved oxygen, nitrate, and nitrite levels.

Prepare a microscope slide and set up for students to observe plankton or bacteria.

Have students record their data.

EXPLAIN

Together, analyze and interpret student data. Discuss as a class the results of water quality and make inferences for the health of the body of water. Ask students what human activities may or may not contribute to the observed results. Ask students how long these effects may be felt. For example, fishing or building along the coastline.

EXTEND

Then, have students work in small groups, or individually to sketch what they see under the microscope.

Optional: If you have zooplankton, see if students can identify the type using an identification guide.

EVALUATE

Conclude the lesson by reviewing how the different physical, chemical, and biological features of water influence the type or abundance of species found in an ecosystem.

To assess students, have them draw a picture of a body of water with one of the following:

- High temperature
- Low dissolved oxygen
- High or low pH
- High nitrate



CONSTRUCTING A FOOD WEB

SUMMARY

Ecosystems are biological communities of interacting organisms with their physical environments. Organisms can only survive when their needs are met (food, water, space, and shelter). Food chains show how energy is transferred from one organism to another while a food web shows the interconnectedness of feeding patterns and how energy flows through the entire ecosystem.

Next Generation Science Standards

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations or organisms in an ecosystem.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

BACKGROUND INFORMATION

Healthy, well-balanced ecosystems are made up of many interacting food chains, called food webs. In most ecosystems, organisms can obtain food and energy from more than one source and commonly have more than one predator.

A food web is one way of representing predator-prey relationships and the energy flow in a system. Looking at a food web is a great way to see the interactions between organisms and how these connections determine the health of an ecosystem. If there is an imbalance, every organism in the food web may be affected.

OBJECTIVES

Students will:

- Understand the concept of a food web and its importance in ecosystems.
- Identify & classify organisms into different trophic levels.
- Analyze and interpret the flow of energy and matter in a food web.

LESSON PLAN: CONSTRUCTING A FOOD WEB

TIME

75 - 90 minutes

MATERIALS

- Food web slides
- Food web cards
- Yarn/string
- Scissors
- Tape

ENGAGE

Begin by asking students to define a "food chain." Explain to students that a food web is a combination of food chains. Ask students what type of components play a role in food chains.

Remind students that producers receive their energy from the sun, consumers receive their energy from producers or other consumers, and decomposers feed on dead or decaying matter.

EXPLORE

Have students stand in a circle and hand out an organism card to each, telling them to take note of what type of organism they are, their predators, what they eat, and if they are threatened or endangered. Explain to students what threatened or endangered means. Have students tape their card to their shirt or hold it in front of them.

Let students know that one organism card represents humans which can be a threat to any type of organism on the food web.

Have one individual play the role of the sun. This person will start with the yarn/string and hand it to any of the producers. Continue passing the yarn/string to a consumer who eats the producer. Continue until all students have interacted. *Don't forget about the decomposers!*

Next, have students with "threatened" or "endangered" cards sit down and cut their pieces of string. Ask students to observe what other organisms are impacted.

EXPLAIN

Ask the students some things they noticed or observed during the activity. What happens to the food web when threatened or endangered species are no longer a part of it? Mention if some omnivores were removed, specific producers would start to flourish, and top predators may dwindle without enough food. Ask students what organisms may have the greatest impact if removed. Explain to students that producers are vital to the food chain and without them, the ecosystem can collapse. Explain to students that every organism plays an important role in the food web - their niche.

EXTEND

Ask students to develop a model of a food chain that depicts how they received the energy they have today. Remind students to include photosynthesis, a producer, consumer, and themselves. *Optional: Include a bacteria as a decomposer.*

Have students create a model of their niche. What role do they feel they play in their families or community?

EVALUATE

Conclude the lesson with a discussion about ecosystems and the importance of biodiversity. The more biologically diverse an ecosystem, the more resilient - in other words, it can respond better to change.

Assess student understanding with an exit ticket on how an ecosystem may be impacted if a species were removed from the food web.

LESSON 4: EXPLORING MARINE ECOSYSTEMS

SUMMARY

In this immersive lesson, students will explore their local coastal area on a scavenger hunt for items commonly found at the seashore. This activity is a way to introduce students to the flora and fauna that can be found along the coasts and to help participants explore what it means to be coastal citizens.

Next Generation Science Standard

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

BACKGROUND INFORMATION

Living in the greater Miami community, we are fortunate to live in a robust coastal community! Miami-Dade County is internationally recognized for its beaches.

Along the coast are sensitive ecosystems including coral reefs, the Biscayne Bay, Everglade marshes, and coastal wetlands. These natural resources support fisheries, recreation, and tourism while also reducing erosion and flooding. Observing the local fauna and flora is a way to visualize our impact and influence on these ecosystems.

OBJECTIVES

Students will:

- Understand the concept of human impact on ecosystems.
- Investigate and collect evidence of human impact on the local beach.
- Construct an evidence-based argument on how activities affect the local beach.



LESSON PLAN EXPLORING MARINE ECOSYSTEMS

TIME

Part A: 90-120 minutes

Part B: 60 minutes

MATERIALS

- Scavenger hunt sheet
- Ruler
- Pen or pencil
- Clipboard
- Property cards

Part A: ENGAGE

Begin this activity by asking students to describe their local beach. What kind of things are there to do and see? Ask them about the different types of organisms they have encountered at the beach. Species may include shellfish, birds, seaweed, jellyfish, algae, seaweed etc... Explain to students that they will be participating in a scavenger hunt at a local beach. *Optional: Encourage students to take photos of their findings.*

Part A: EXPLORE

Divide students into teams. Each team should have their own clipboard with the scavenger hunt sheet, ruler, and writing utensils. *Optional: If you want students to collect trash as well, bring gloves & bucket to collect trash.*

When you arrive at your location, explain the boundaries for students. Make it a competition, the first group to complete the scavenger hunt, or collect the most items, wins. Have students record the data on their collection sheet. Remind students they are not collecting items, but observing them. *Observe, don't disturb!*

Part A: EXPLAIN

Once you're back in the classroom, ask each group to get together and present their findings to the rest of the class. Encourage students to take turns explaining why they chose each item to fit the corresponding description. Ask students where along the beach they found these items by showing them a visual of the intertidal, sublittoral, and coastal zones. Have students share any thoughts and discoveries made during the activity.

Part A: EVALUATE

Ask students to analyze the types of items they found. Have them create a short story of how one of these items made of debris ended up along the coast. The main character can be an empty bottle, fishing line, aluminum can, plastic bag, or other marine debris items. Have the students include the role a human plays in their story.

LESSON PLAN EXPLORING MARINE ECOSYSTEMS

TIME

Part A: 90-120 minutes

Part B: 60 minutes

MATERIALS

- Watershed map
- Property cards
- Pen or pencil
- Clipboard
- Property cards

Points for groups to consider:

- *Future use of the property*
- *Will the value of the property increase or decrease?*
- *Will you make money from your decision?*
- *How could this decision potentially impact local wildlife?*
- *How could this decision impact the other properties or the local community?*

Part B: ENGAGE

Start the lesson by asking students how they observed human impacts on their scavenger hunt.

Ask students if they know the difference between conservation and preservation. After taking answers, make sure students know that preservation refers to leaving land untouched and in its natural state, whereas conservation refers to responsibly managing land for human use. Ask students how do humans impact ecosystems.

Describe how ecosystem services are benefits humans obtain from ecosystems such as erosion control, climate regulation, or carbon storage. Ask students if they can give examples of ecosystem services a wetland provides. Answers may include flood control, water purification, or shoreline protection.

Ask students about the freshwater ecosystem in general. What value do they provide humans?

- *Dams for electricity*
- *Water for irrigation and drinking*
- *Food*

Part B: EXPLORE

Divide students into groups. Explain that each group receives a different property, all of which are on the same watershed. Students must decide as a group - will they conserve it or develop it?

Students should make a list of the pros and cons of each, and any potential impacts their decision may have.

Part B: EXPLAIN

Have each group elect a member to present their decision, a list of potential impacts, and a brief explanation of their reasoning.

After a brief discussion, ask the students whether or not they believe ecosystem services should be taken into consideration in the decision-making process. If so, how?

Part B: EXTEND

Optional: After discussing their decisions, have the students create a drawing of their property. What are some things they can do to reduce the impact the development would have on the environment?

Part B: EVALUATE

End the lesson by reiterating how important healthy ecosystems are to humans. Reminding students of the scavenger hunt they completed and their observations. Explain how marine ecosystems offer humans important services. Ask students about ways a developer or homeowner can lessen their impact on the environment.



LESSON 5: BIVALVES & OCEAN ACIDIFICATION

SUMMARY

Bivalves (mussels, scallops, clams, oysters) are a type of sea mollusk that has a compressed body enclosed in a hinged shell. Bivalves effect nutrient cycling as filter feeders by keeping the water clean. Some bivalves can filter up to 25 gallons of water a day. As the concentration of carbon dioxide in the atmosphere increases, bivalves are at risk as the ocean becomes more acidic.

Next Generation Science Standard

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.



BACKGROUND INFORMATION

Living in the greater Miami community, we are fortunate to live in a robust coastal community! Miami-Dade County is internationally recognized for its beaches. Along the coast are sensitive ecosystems including coral reefs, the Biscayne Bay, Everglade marshes, and coastal wetlands. These natural resources support fisheries, recreation, and tourism while also reducing erosion and flooding. Observing the local fauna and flora is a way to visualize our impact and influence on these ecosystems.

OBJECTIVES

Students will:

- Understand what bivalves are & their importance to the ocean ecosystem.
- Understand what ocean acidification is and how it affects bivalves.
- Construct an argument about the potential impact of ocean acidification on the ocean ecosystem.



LESSON PLAN BIVALVES & OCEAN ACIDIFICATION

TIME

45 minutes

MATERIALS

- White vinegar
- Sea shells
- Paper towel
- Glass beakers
- Water
- Heavy books

ENGAGE

Ask students if they know what a bivalve is. Explain to students that a bivalve is a marine animal that has two hinged shells that enclose a soft body. Examples include mussels, oysters, clams, and scallops. Ask students why these animals are important to the marine environment and human beings.

EXPLORE

Lay out non-soaked shells. Have students observe and identify the different species mentioned during the initial part of the activity. Allow students to handle the shells and ask them why the development of shells is advantageous to animals. Explain to students that shellfish are invertebrates and make their protective covering by combining calcium and carbonate, two substances found in seawater. The product is calcium carbonate, the same material chalk is made of.

Divide students into small groups with both a beaker of non-soaked shells and an experimental group of vinegar-soaked shells of similar species. Give each group paper towels and have them label them Control and Acid Washed. Ask students to lay the shells on the proper towels according to the treatment.

Ask students to make predictions about which group of shells will withstand a greater amount of pressure. Have students record the mass of their textbooks before placing them on top of their shells. Have students determine how much mass is required to break the shells soaked in the acid solution.

EXPLAIN

Initiate a discussion and ask students to share the results of their experiments. Have them refer to their original predictions - do the results support or refute their prediction? Did the non-soaked shells break? Explain to students that the calcium carbonate is broken down when carbon dioxide in the water undergoes a series of chemical reactions ultimately forming carbonic acid, which decreases the pH of the seawater. This leads to the calcium carbonate shells to become brittle and dissolve easily.

EXTEND

Calcium carbonate is also the main ingredient in chalk. For a dramatic demonstration, put seltzer water into a glass beaker with a piece of chalk. The bubbles in the seltzer (carbon dioxide) will eat away at the chalk, causing it to dissolve within minutes.

After watching this happen, explain to students that the same substance, carbon dioxide, is produced by burning fossil fuels and is entering the oceans, causing acidification.

EVALUATE

Ask students to brainstorm possible implications of ocean acidification on shell-forming organisms, and problems that could come from the weaker shells. Discuss how a shell protects an organism from dangers such as predation. Have students think about the challenge of surviving with a weakened shell. What does this mean for shellfish populations?

LESSON 6: MARINE DEBRIS

SUMMARY

Despite its prevalence, marine debris is a problem that each individual citizen can help prevent. Education is the first crucial step in mitigation. By exploring marine debris, we can help foster environmental stewardship and create advocates for the marine environment. With every person that participates in a cleanup, uses a reusable bag or water bottle, or spreads the word about marine debris, we move one step closer to creating a more beautiful and healthier marine environment.

Next Generation Science Standard

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

BACKGROUND INFORMATION

Marine debris is a problem that plagues coastlines around the world. In the past, it was considered primarily an eyesore. Today, through research, we know how seriously marine debris impacts marine habitats, marine wildlife, human health, safety, navigation, and the economy. Plastic bags abandoned fishing nets, and other debris can smother sensitive coral reef habitats and benthic ecosystems.

Each year, many marine mammals, birds, and other organisms become entangled in or ingest various forms of debris. Fishing and shipping industries are also impacted by marine debris, as they pay vessel repair costs and must replace any damaged gear. In addition, coastal communities spend millions of dollars cleaning up their shorelines every year.

At NAMEPA we believe we can make an impact with one action at a time. Every individual plays a critical role in educating on the devastating effects of marine pollution, individuals are increasingly making the commitment to the 5 R's: Refuse, Reduce, Reuse, Recycle, and Repurpose. To eliminate as much single-use plastic from your daily lives as possible – the less waste produced, the less waste is at risk of entering our waterways.

OBJECTIVES

Students will:

- Be empowered to change their relationship with plastics
- Identify different types of marine debris
- Collaborate to come up with solutions to prevent and reduce the impact of marine debris.

LESSON PLAN MARINE DEBRIS

TIME

45 minutes

MATERIALS

- Marine Debris slides
- Trashy Timeline Activity
- Life of a Plastic Bag video
- *Optional: Cleaned trash*

ENGAGE

Begin the lesson by asking students if they have heard of the term, "marine debris." Write the words **MARINE** and **DEBRIS** on the board for students to see. Solicit responses from students on what comes to mind when they hear the word "marine" and again for "debris." For example, students may say ocean and garbage. Connect the words so students can make sense of the term marine debris.

EXPLORE

Divide students into groups. Supply each group with the Trashy Timeline cards. Have students compete with other groups by creating a timeline of how long it takes for the trash to breakdown in the ocean.

After groups finish their timeline, share the answers based on how many years it approximately takes for these items to breakdown. Which group had the timeline in the correct order?

EXPLAIN

Ask students if plastic items truly breakdown *completely*. Explain to students how often plastic remains in the ocean as micro or nano-plastic. Have a discussion with students on where plastic comes from (derived from oil) and has a significant impact on marine ecosystems.

EXTEND

Ask students to brainstorm and discuss potential solutions to reduce marine debris, both at individual and societal levels. Encourage creative and realistic ideas that follow the 5 R's: Refuse, Reduce, Reuse, Recycle, and Repurpose.

EVALUATE

Conclude the lesson by discussing how marine debris impacts marine ecosystems. Evaluate student understanding by asking them to write down how marine debris is connected to synthetic materials and natural resources. Ask students to list one potential solution to reduce marine debris.

LESSON 7: EVERY ACTION COUNTS

SUMMARY

With 70% of our planet comprised of water, the ever-increasing issue of marine pollution is of great concern to all life – and can only be successfully addressed by action at every level – from the individual up through global coordination.

Next Generation Science Standard

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

BACKGROUND INFORMATION

From recreation and food to economics and storm protection, marine ecosystems are an essential part of humans' lives. It is clear, a clean ocean is a safe ocean. Marine species are threatened with malnutrition, starvation, entanglement, and even death due to marine debris. Chemicals found in man-made materials are likely to be toxic to the marine environment, and risk bioaccumulation in the food web. With more than 5.25 million macro and micro pieces of plastic in our oceans, every action to reduce and clean up debris is imperative.

OBJECTIVES

Students will:

- Apply scientific principles to implement a beach clean-up to minimize human impact on the marine environment.
- Demonstrate environmental stewardship.



LESSON 7: EVERY ACTION COUNTS

TIME

90 minutes

MATERIALS

- Gloves
- Trash bags or buckets
- Trash collection form
- Clipboards
- Garbage pickers

ENGAGE

Discuss the concept of marine debris and its impact on marine ecosystems with students. Include visuals and videos to illustrate the problem of marine debris.

EXPLORE

In collaboration with NAMEPA corporate members and partners, students will participate in a local beach or shoreline cleanup activities. Have students work in teams with one student recording data for each group. Remind students to avoid picking up sharp or hazardous objects (glass or needles).

After completing the cleanup, weigh the trash collected and record in pounds.

EXPLAIN

After the cleanup, have a discussion with students about the different types of debris they collected, any observations they have, and the impacts these items may have on the marine environment.

EXTEND

Explain to students the value and importance of citizen science. By completing the cleanup and submitting the data to NAMEPA or the Ocean Conservancy, students are empowered to address environmental issues and advocate for the environment.

EVALUATE

Conclude the lesson by having students share their own ideas for minimizing marine debris and human impact on the marine environment, based on their observations and reflections during the cleanup.

LESSON PLAN MARINE INDUSTRY & CAREER DEVELOPMENT

SUMMARY

90% of all consumer goods have spent some part of their journey on a ship, making the maritime industry one of the primary drivers of globalization and trade. Vessels move cargo around the world in far greater volumes more efficiently, safely, and with a lower environmental impact than any other mode of transportation. Increasing awareness about the maritime industry and the industry's dedication to the health and safety of its crew, the environment, and its fleet is a part of NAMEPA's mission.

Next Generation Science Standard

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

BACKGROUND INFORMATION

Since resources around the world are not evenly distributed, countries rely on one another to trade for goods they need. Shipping is the most efficient way to transport goods to where they need to be at the lowest cost.

We define the maritime industry to include any economic activity of or relating to the oceans, rivers, and the Great Lakes. This includes traditional maritime activities such as designing, constructing, manufacturing, supplying, maintaining vessels or parts, operating and managing shipping lines, or crewing ships. It can also include engaging in maritime law, brokerage services, insurance, customs services, fishing operations, marine science, salvage operations, and the operation of ports, shipyards, drydocks, and cruise lines.

OBJECTIVES

Students will:

- Identify potential maritime industry careers.
- Apply an engineering design process to generate and evaluate possible solutions to maritime industry problems.

LESSON 8: MARINE INDUSTRY & CAREER DEVELOPMENT

TIME

45 minutes

MATERIALS

- Maritime Careers slides
- Maritime Adventures Board Game

ENGAGE

Start a discussion with students about the maritime industry by introducing examples of careers such as ship captain, engineer, archaeologist, marine biologist, etc. Provide students with real-world examples related to the maritime industry such as asking students how long transportation by ship has been around. Ask students what design solutions must be in place for ships to limit their impact on the marine environment.

EXPLORE

Have students play NAMEPA's Maritime Adventures Board Game. Students will explore the maritime industry as a ship on a port-to-port journey transporting cargo. Along the way, students will encounter real-world situations which can either help, or hinder, its voyage.

EXPLAIN

Share with students the different career opportunities they can explore in the maritime industry. Remind students that the industry offers extensive and accessible career pathways.

EXTEND

Assign students individually, or in small groups, specific roles in the maritime industry. Have students research these roles and create a slide with information. Use the slides to develop a career opportunity journal for students to reflect on.

EVALUATE

Wrap up the lesson by having students reflect on what they learned about maritime industry careers and the role of engineers in addressing real-world problems in the maritime industry.

SUPPLEMENTAL

- Invite NAMEPA corporate partners or members to guest speak and share their career experiences and insights.
- Participate in the NAMEPA Adopt A Ship program.
- Check out MPSEC on NAMEPA's website

Acknowledgements

The Marine Environment Protectors and Community Stewards program is a collaborative effort between the North American Marine Environment Protection Association (NAMEPA) and Cargill.

Writer and Developer: Molly Dushay, NAMEPA

Editors: Lyn Harris & Meghan Reilly, NAMEPA

For questions concerning this program, please contact NAMEPA Education and Outreach Director, education@namepa.net

