



A Sailor's Environmental Impact

How am I impacting our waters and environment?

Module: 18

Grade Level

Middle School

Subject Areas

Science, Math, Environmental Science

Summary

Students take an in-depth look at their own environmental impact and evaluate ways to change their behavior. In Part II they sail to a “Lunch Spot” and examine their environmental impact as a group. In Part III, students look at environmental impact in different regions and sail centers across the US. In Part IV, students plan a green regatta.

Duration

Preparation time: 1 hour

Lesson Time:

Part I: 40 minutes

Part II: 3 hours

Part III: 1 hour

Part IV: 40 minutes

Skills

Utilizing data to make decisions, collecting and recording data, and arguing from evidence.

Sailing Skills

Navigation, Sailing Preparation, Reflection of Sailor's Impact

Vocabulary

Environmental Impact, Estuary, Mangrove, Sea Grass Bed, Ecosystem,

Setting

At a school or sailing center for Parts I, III, and IV. Sailing in Part II should take place at the sailing center on the water.

Standards

[Click here to view aligned standards.](#)

Objectives

Students will:

- Evaluate their environmental impact
- Plan an event with minimal environmental impact
- Identify and explore our impact as sailors on the ecosystems around us
- Ask questions and define problems about sustainability in relation to sailing

Materials

- White board or Flip Chart paper
- 1 copy per student of Student Sheet 1
- 1 copy per student of Student Sheet 2
- 1 copy per group of Student Sheet 3
- 1 copy of Student Sheet 4 cut into cards (enough for 1 card per group)
- 1 copy per student of Student Sheet 5
- Boats for Sailing
- Computers, tablets, or phones for research
- Individual white boards or Poster paper (1 per group)
- Markers, colored pencils, etc for poster creation

Procedure

Part I: Classroom

40 minutes

Discuss with students, “Today we going to learn about the impact we all have on the environment. As sailors, we use the earth’s natural water ways, oceans, and shorelines in our sport every day. We all like to sail on clean rivers, lakes, and oceans, so it is in all of our best interests to investigate our impact on the environment and learn new ways to reduce our negative and increase our positive impact.”

Background Information: *According to the American Boating Association, America's first serious legislative attempt to clean up our act on the nation's ponds, lakes, and waterways was enacted into law in 1972. The goal of the Clean Water Act and subsequent legislation has been to protect our drinking water, wildlife, and recreational resources and to make these waters fishable and swimmable by the turn of the century. Back in 1972, many lakes and rivers were so badly polluted by uncontrolled sewage discharge and septic run-off that fecal bacteria were counted in the millions per gallon. Many New England rivers were the color of whatever dye was being used in the local textile mills that day. In Cleveland, Ohio, the Cuyahoga River caught fire from the ignition of industrial discharges floating on the surface.*

So, how are we doing? Well, we have been very successful in reducing or eliminating point source discharges from sewage plants, industrial sites and other institutional sources of pollution. We can now boat, fish and swim in many of those waters without fear of poison or disease. Even the once infamous harbor area where the Cuyahoga River meets Lake Erie is now bustling with pleasure boaters and tourists.

Nonpoint sources of pollution - including agricultural runoff, tainted storm water, near-shore septic tanks and mobile sources such as boats - are another matter. Even seemingly small sources of pollution can have a big impact on water quality. For example, bacteria in shellfish beds in Buttermilk Bay, near Cape Cod, were traced to dog feces washed there from surrounding yards by rainstorms. Pollution from boats and marinas includes litter, fish waste, sewage, fuels and lubricants, contaminated bilge water, boat-maintenance products and storm water runoff. Each boat and marina may represent only a tiny fraction of the total, but 94 million people boat and/or fish each year and there are more than 10,000 U.S. marinas and millions of boats.

The future successes or failures in reducing our environmental impact are up to us. The environmental impact will be controlled only when individuals change old habits and make the extra effort. Boaters in particular, as primary beneficiaries of clean waters, are morally and legally responsible for their actions on the water, at the dock, in the marina and at home. In addition to educating ourselves in clean boating and improving our own practices, we should share information with others.

Explain to students that once we go boating, we will be or already are all part of the 94 million people that boat or fish each year. Collect some quick class data. Select a student to be the recorder and go to the board to record our class data. Write Fishing on the board. Ask the students that have fished in the

last year to stand. Have the recorder write the number of students standing on the board under Fishing. Now ask how many students Powerboat, Sail, Kayak, etc. and write each number on the board. Last, ask how many students have never been on the water before?

Now, we will do some work individually. Please take the next five minutes to complete the Environmental Impact Self-Assessment: **Student Sheet 1**. If a student has never been on the water before, ask them to think of ways boaters could reduce their environmental impact.

Once the students are finished, organize them into working groups of 4 or 5. Each group should assign a group leader to lead the discussion and keep the group on task and data recorder to record the group data and action items.

Group Questions Presented by Group Leader:

1. On a scale of 0-5, zero being not at all and 5 being that you make every effort possible to have a minimal environmental impact, how would you rate your personal environmental impact efforts as a sailor? Please explain why.
2. If you could do one thing to reduce you environmental impact what would it be and why?

Ask the data recorder average the group’s data for question one and post the average and the top answers provided by the group to question 2 on the class data sheet (White board, Flip Chart paper, or chart hanging where each group can post their data.)

Group Data	
Group Member Name	Personal Environmental Impact Score (0-5)
<i>Total/ total possible points = Group Average</i>	
Top Actions to Reduce Environmental Impact: <ol style="list-style-type: none"> 1. 2. 	

Now that we have looked at our individual efforts, let’s look at our sailing center or school’s environmental efforts. What can we do together to make change? Working in the same groups, ask students to Brainstorm: Think about the environmental impacts of our sailing center or school in the following areas: Water, Energy saving and resource efficiency, Waste & Recycling and Wildlife. Ask

each group to write the following on the top of their white board or flip chart: Things we are good at and Things we are bad at. Give each group 10 minutes to brainstorm their lists.

Environmental Impacts of Our Sailing Center (on flip chart paper)	
What we are doing well:	What needs improvement:

Examples:

- Things they listed that they were good at included: using reusable water bottles instead of single use, turning off lights, growing grass, recycling cans, re-using paper, re-using a steel drum as a barbecue, re-using steel drums as bins down on the pontoon, re-using an old mast as a flag pole, using the fallen trees for fire wood.
- Things that they listed as bad included: turning lights off, spending too long in the showers, washing boats down too long, no solar power, storm drains run into waterway, trash blows in the water.

Lead a class discussion on simple things we can do at the school or sailing center to reduce our impact. There were also many ideas suggested for ways that the club could do better:

Examples: Not wasting energy eg. turning lights off, using alternative energy sources - wind turbines and solar panels, saving water by collecting and using rain water (to wash down boats), not wasting paper, using biodiesel for the powerboats, organizing a beach cleanup, removing the buoys from the water when not being used.

Part II: Sailing

3 hours

Reducing Our Environmental Footprint By Way of Lunch

Students will each chart a course to a “Lunch Spot.” Teachers/ Sailing Instructors will select a specific location for their students to sail to. When they arrive, they will eat lunch and go exploring. The “Lunch Spot” can be a remote beach, coordinate to drop anchor, etc. Before leaving on their trip the students should have a copy of a local chart to navigate to the desired location. Each student should chart their course and make a list of necessary supplies. Together as a class, determine how long it should take to sail to the “Lunch Spot,” how long they will have to each lunch, and how long it will take to sail home. Please give students **Student Sheet 2** to plan and reflect on their journey.

Navigate to a nearby beach –powerboat vs sailboat. Compare and contrast the environmental impact of using a powerboat versus a sailboat.

Part III: Classroom

1 hour

Boaters Protecting Our Waterways

As a boater, you are in a unique position to be a leader in water protection. This information is brought to you by the Ocean Conservancy's Good Mate program.

5 easy ways boaters can protect our ocean and waterways:

1. Be a leader in your community. Talk about marine litter prevention with members of your boating community, from your neighbor in the next slip to boating clubs and marina managers.
2. Offer your time, volunteer in boat and marina cleanup programs, especially at sites only accessible by boat. And participate in a clean-up.
3. Accidents happen. Be prepared with absorbent pads to clean oil or fuel spills. Dish soap doesn't work. It just causes those liquids to sink and contaminate the bottom of the ocean, lake or river.
4. Take it all back to shore. Don't allow trash to go overboard.
5. Set the pace. Recycle everything you can, from beverage containers to propeller snarling fishing line or plastic bags

Background Information:

Of all of Earth's resources, water is the most valuable. Life began in water over 3.5 billion years ago, and life as we know can only survive with the presence of water. Water is critical to practically every biological process in plants and animals, even our own bodies are nearly two-thirds water. Although water covers nearly 75 percent of the Earth's surface, over 99% of this water is either permanently frozen or salty, leaving less than one percent of the Earth's water fit for human consumption.

Water also supports our livelihoods. In the United States alone, commercial and recreational fishing, boating, tourism and other coastal industries provide millions of jobs nationwide and contribute billions of dollars into the U.S. economy.

Divide class into groups of 4. Have each group select a water based ecosystem from Student Sheet 3 (printed and cut into cards) Oceans, Mangroves, Seagrass Beds, Lakes, Rivers, Estuaries, Coastal Waters. Have each group research their topic based on a sailing center in that ecosystem. Sailing Centers can be found at <http://www1.ussailing.org/wheretosail/wheretosail.aspx> or by visiting US Sailing.org searching "Where to Sail". Each group should prepare 10 facts about their ecosystem, areas of concern, and actions we can take to protect the ecosystems using **Student Sheet 4**. Each group should create a poster to share their information with the class.

Set up a time to share your students' research with the sailing center they researched. This can be done via Skype or via video conference.

For Example: Edison Sailing Center, Fort Myers, FL – Sea Grass Beds



Part IV: Classroom
40 minutes

Students will plan a regatta with a minimal environmental impact. This activity can be completed individually or in groups. Hopefully, your sailing center can even integrate a few ideas into their next regatta. Provide each student with a copy of **Student Sheet 5**.

Challenge: Plan a Regatta with a minimal environmental impact.

Areas to Consider:

- Fuel
- Food
- Trash
- Estuary Impact
- Registration
- Speakers
- Awards
- Celebration
- Green Team
- Speakers
- Water Usage
- Beverages

Resources:

Sailors for the Sea: Clean Regattas: <http://www.sailorsforthesea.org/programs/clean-regattas>

RYA Green Blue: <http://thegreenblue.org.uk/News/2015/October/The-Green-Blue-launches-new-university-sustainability-challenge>

Video: Let's Reduce our Environmental Footprint <https://www.youtube.com/watch?v=p9cCFBcVRO4>

Ocean Conservancy, Good Mate for Boaters: <http://www.oceanconservancy.org/do-your-part/green-boating/good-mate-green-boating-for-boaters.html>

RYA The Green Blue, The Green Blue is the environmental awareness initiative developed by the RYA and British Marine Federation (BMF): <http://www.rya.org.uk/programmes/Pages/thegreenblue.aspx#>

American Boating Association: <https://americanboating.org/clean.asp>

Name: _____

1. How do you get to the sailing center? Do you ride your bike, walk, take a bus, skateboard, or come by car?
2. Do you use environmentally friendly products?
3. When you capsize, do you do go back and pick up what fell out?
4. How much water do you think you use daily?
5. How long does it take you to wash down your boat at the end of the day?
6. When you pack your lunch do you use reusable containers?
7. Do you recycle? (Always, Sometimes, Not Usually) *circle one*
8. What do you do with your lunch scraps?
9. After lunch, what is left from your lunch? (*examples: wrappers, plastic silverware, water bottle*)
10. Did you change your cell phone today? How much energy do you think you used?

Reflect: List three things you can do to reduce your environmental impact.

- 1.
- 2.
- 3.

Name: _____

1. Location of the "Lunch Spot": _____
2. Wind Direction/ Weather: _____
3. My course: _____
4. Departure Time: _____
5. Estimated Duration of Time to Sail To the "Lunch Spot." _____
6. Length of Time I have at the "Lunch Spot" to eat and explore: _____
7. Time to Depart the Lunch Spot and head Home: _____
8. Estimated Duration of Time to Sail Home. _____
9. Amount of Fuel Consumed by Instructor Powerboat: _____
10. Amount of trash you have remaining from your lunch: _____
11. Amount of trash from class from lunch (lbs.) or list items (trash inventory): _____
12. Did you hit bottom and disrupt any seagrass, estuary, or marine life? _____
13. If so, please describe: _____
14. Did you rescue any marine debris along the way, Y / N if so please list: _____

15. Did you or your classmates lose any items overboard that were not recovered? Y / N if so please list: _____

16. Wildlife Report: Please list any wildlife you encountered on your voyage:

Found here: <http://www.oceanconservancy.org/do-your-part/green-boating/2014-good-mate-brochure.pdf>

OCEAN

The vastness of our planet's ocean is difficult to comprehend. The enormity of these waters can only be fully seen from outer space. The ocean covers over 70 percent of the Earth's surface, contains 95 percent of all water on Earth and contains 95 percent of the habitat space on the planet. The ocean is home to the world's largest animal, the blue whale, as well as the tiniest microscopic plankton. In 2010, the sea provided 7.9 billion pounds of fish for human consumption.

The ocean touches the lives of virtually all Americans, regardless of whether we live in a coastal community or inland. One out of six jobs in the United States is maritime-related. In 2009, the ocean (and Great Lakes) economy provided 2.6 million jobs and generated \$223 billion. Almost 80 percent of U.S. imports and exports travel through seaports. Coastal and ocean commercial fisheries contribute \$70 billion to the nation's economy each year.

COASTAL WATERS

Coastal waters—areas of ocean extending from the shore to about 5 miles out to sea—are where most of people enjoy their recreational activities, including sun bathing, fishing, surfing and boating. Coastal waters are also very profitable; more than 80 percent of the U.S. economy comes from coastal states. Coastal watershed counties provided 69 million jobs and contributed \$7.9 trillion to the 2007 Gross Domestic Product.

Coastal tourism and recreation supports 1.7 million jobs throughout the country and pumps \$70 billion into the economy. However, as more and more Americans live, work and play along the coast, our activities and actions are creating a greater environmental impact. Today, over half of the U.S. population lives along the coast. Along with increasing coastal populations comes increasing coastal pollution, mainly from pollution runoff.

In agricultural areas, pesticides, fertilizers and animal waste enter waterways and are carried to the coast. In towns and cities, oil, grease and other toxic chemicals—along with litter and debris from our streets and parking lots—are carried off in storm drains, which bypass sewage plants and directly enter our waterways. Large amounts of sediment from construction sites enter our waters each year, which can reduce vital sunlight required by plankton, smother sea grass and clog navigable channels. Sewage from aging and overloaded systems also enters our waterways. All of these pollutants eventually reach our coasts. As a result, in 2013 there were 1,504 beach closures or advisories issued in the country due to high levels of bacteria or pollution.

Estuaries

Estuaries are special transition areas between land and sea formed wherever fresh water from rivers, creeks or streams mixes with salt water from the sea. These areas include bays, lagoons, harbors, inlets, marshes, sloughs, sounds or swamps. A few familiar estuaries include: Boston Harbor, Chesapeake Bay, Puget Sound and Tampa Bay. These unique ecosystems—affected by the tides but sheltered by land—have many important environmental, cultural and economic functions.

Estuaries support tens of thousands of birds, mammals, fish and other wildlife. They act as nurseries for many marine organisms, including the most commercially valuable fish species. Estuaries support wetlands, which filter water draining off the uplands. This reduces the amount of sediments and pollutants that could enter the open ocean and creates cleaner, clearer water.

Estuarine wetlands also protect the uplands, acting as flood control, absorbing floodwaters and dissipating storm surges. They provide cultural, educational and aesthetic benefits and support a host of activities, including boating, fishing, swimming and bird-watching. Estuaries also support the economy in many ways.

While comprising only 13 percent of the U.S. continental land area, estuary regions host 43 percent of the country's population, 40 percent of its employment and 49 percent of the nation's output. They provide habitat for more than 75 percent of America's commercial fish catch and an even greater percentage of the recreational fish catch.

RIVERS

Rivers are bodies of fresh water fed by smaller tributaries flowing from upland sources. There are more than 250,000 rivers in the United States, covering 3.5 million miles. All of this water is carried downhill through river channels that are surrounded on either side by an area known as the floodplain. A river transports not only water from the uplands, but also sediments and pollutants, and deposits them downstream and onto the adjoining floodplains.

The Mississippi River, the country's largest river, carries an average of 436,000 tons of sediment every day and deposits 500 million tons of sediment downstream into the Gulf of Mexico annually. Rivers are home to a large number of plants, animals, fish, amphibians and reptiles. River habitat food webs are greatly dependent upon the surrounding landscape and can be severely affected by human activity. Detritus or decaying plant material, from the land is the primary food source in a river system. Runoff carries detritus into creeks, streams and rivers where plankton consume it. The plankton are eaten by newly hatched fish, crustaceans or water insects, which are themselves food for other commercially and recreationally valuable fish species. Increased runoff due to development or deforestation, or runoff polluted by toxic chemicals, can harm the entire riverine food web. Rivers also provide a great deal of our drinking water. Approximately 65 percent of Americans' drinking water comes from rivers and streams.

Rivers are very vulnerable to polluted runoff. Pesticides, fertilizers and animal waste enter our rivers from agricultural areas, while a toxic brew of oil, grease and other chemicals enters rivers from storm drains and parking lots in urban areas. According to the Environmental Protection Agency's most recent river and stream assessment, more than half—55 percent—of our rivers are in poor condition and do not support healthy populations of aquatic species.

Mangroves

Mangrove forests are also an important coastal habitat. Mangrove trees thrive in tropical salty environments with high rainfalls. They grow along tidal estuaries, in salt marshes and on muddy coasts. They survive in the salty water by excreting salt through their leaves or by blocking the absorption of salt at their roots. Like sea grasses, mangroves benefit the overall ecosystem by trapping and cycling organic materials, chemicals and nutrients. They also stabilize the coastline, reduce the effects of erosion and provide shelter for fish and other organisms.

LAKES

In the United States, lakes and reservoirs cover nearly 40 million acres. These freshwater bodies provide a great deal of our drinking water and supply water for industry, irrigation and hydropower. Lakes support important food webs and are habitats for numerous threatened or endangered species. Lakes are also the foundation of the nation's \$19 billion freshwater fishing Industry; they support numerous tourism industries and provide countless recreational opportunities.

The largest of the lake ecosystems is the Great Lakes Basin, the largest freshwater body in the world. This system contains 90 percent of the United States' supply of fresh water, providing drinking water for more than 40 million Americans and Canadians. The basin supports more than 3,500 plant and animal species and provides critical breeding, feeding and resting habitat for millions of waterfowl, wading birds and many other migratory birds.

Lake ecosystems vary enormously depending on their size, depth and geographical location. Lakes have traditionally been considered closed, balanced ecosystems with water and nutrients constantly being recycled. Small lakes can experience enormous daily and seasonal environmental variations while large lakes present a more stable environment for wildlife. Due to a lake's enclosed nature, it is highly vulnerable to the pollution-generating activities of humans.

Major environmental stresses to lakes include: Excessive nutrient and organic input from fertilizers and sewage Siltation from improper erosion control from construction, agriculture or mining activities, rain contamination from toxic chemicals such as mercury, polychlorinated biphenyls (PCBs) and pesticides.

Sea Grass Beds

Another special coastal habitat is the sea grass bed. Sea grasses, such as eel grass, turtle grass and manatee grass, are flowering plants that live entirely underwater in salt and brackish water. Sixty species of sea grass are found worldwide.

Like land plants, sea grass produces oxygen used by fish and other marine life. Their roots and rhizomes stabilize the bottom sediment, much like land grasses slow soil erosion. The leaves slow water flow, which allows silt to settle on the bottom and trap fine sediments and other particles. Both of these functions help maintain water clarity, which increases the amount of light reaching the sea grass beds.

Sea grass beds also provide habitat for many fish, crustaceans and shellfish. They serve as nurseries for certain fishes and other marine life. The algae and small animals that colonize the leaves provide food for juvenile fish while sea urchins, green turtles and manatees eat the leaves themselves. As the sea grass decays, it becomes food for microbes, shrimp, fish and invertebrates. In Florida's Monroe County, sea grass beds supported an estimated \$13.9 million in stone crab, spiny lobster, shrimp, snapper and blue crab catch in 2010.

Group Members: _____

Date: _____

Name of Sailing Center: _____ State: _____

Ecosystem/ Habitat: _____
(River, Ocean, Lake, Coastal Ecosystem, Sea Grass Beds, Mangroves, or Estuary)

10 facts about your ecosystem:

- 1.
- 2.
- 3.
- 4.
- 5.
- 7.
- 8.
- 9.
- 10.

Areas of concern:

Actions we can take to protect the ecosystems:

Name: _____

Challenge: Plan a regatta with a minimal environmental impact.

Things to consider:

- Fuel
- Food
- Trash
- Registration
- Speakers
- Awards
- Celebration
- Water Usage
- Beverages

Name of Regatta: _____

Boat Classes Invited: _____

Timeline of Events:

Lunch:

Awards: