



Virtual Field Trip On Board the SoundWaters Research Vessel Teacher's Guide and Supporting Materials

Welcome to the SoundWaters Virtual Field Trip on board the R/V SoundWaters.

This Virtual Field Trip focuses on human impact on the environment, and especially on Long Island Sound. The adventure begins with SoundWaters Educator Jess Castoro on the deck of the R/V, and Jess narrates the experience for students. Throughout the Field Trip other SoundWaters Educators present compelling videos about topics such as marine debris, microplastics, runoff, renewable energy, and environmental remediation. To help you organize your lesson plan the order of the presentation and the start and end time of each section, along with the relevant NGSS standards, are listed below.

Also below are resources that you may choose to use with your students. Specifically you will find:

- Video link: <http://bit.ly/swrv6-8>
- Worksheets to reinforce the material presented in the Field Trip.
- A sample quiz.
- A quiz answer key.
- Links to an app and online resources that students can use to enhance their knowledge.
- Links to additional articles and readings to help your students learn more about the way humans impact Long Island Sound.

We trust you will find this Virtual Field Trip to be a valuable learning tool for your students and a terrific way to connect them with the natural world. If you would like to pursue this subject matter in a more significant way please reach out to us to discuss bringing a SoundWaters Educator into your classroom via videoconference. We can customize a program that will support your desired learning outcomes for your students. For more information please contact Olena Czebiniak at olena@soundwaters.org or 203-406-3319.

Content, Timing and NGSS Standards

Marine Debris Video

- Start – 1:17
- End – 7:30
- NGSS – Human Impacts: MS-ESS3-3

Microplastics Video

- Start – 7:51
- End – 13:04
- NGSS – Human Impacts: MS-ESS3-3

Runoff Video

- Start – 13:20
- End – 17:24
- NGSS – Human Impacts: MS-ESS3-3

Renewable Energy Video

- Start – 21:07
- End – 28:32
- NGSS – Human Impacts: MS-ESS3-3; Earth and Human Activity: MS-ESS3-4; Engineering Design: MS-ETS1-2, MS-ETS1-4; Energy: MS-PS3-3

Remediation Video

- Start – 28:53
- End – 35:40
- NGSS – Earth and Human Activity: MS-ESS3-4; Human Impacts: MS-ESS3-3; Engineering Design: MS-ETS1-2, MS-ET1-4



Aluminum Can

Aluminium Can

2 months

50 years



10-20 years

1



450 years

1-5 years

200 y

18-24 years

200 years



Glass Bottle

Glass Bottle



Wool Socks
1-5 years

450 years



Undetermined



Cartoon Shirt
2-5 months

Disposable Diaper

Disposable Diaper

50 years

50 years

400 years



Undetermined

15. *Chlorophyll a*

15. *Chlorophyll a*



Plastic Bottle

Plastic Bottle



Tin Can

Tin Can



Plastic Grocery Bag



Fishing Line



Formed Dury



AppleCare



Skyrtofoom Cup



Cigarette butt



Plastic beverage holder

HOW LONG UNTIL IT'S GONE?

Estimated decomposition rates of common marine debris items



Write the names of the items below/ on the side into the correct circles



MICROPLASTICS



The pipe in this picture is coming from a water treatment plant. Explain what is happening in the picture and what effect it will have on this aquatic environment

What is one thing you can do to help reduce the amount of microplastics going into Long Island Sound?



SoundWaters
Protecting Long Island Sound through Education

MICROPLASTICS



The pipe in this picture is coming from a water treatment plant. Explain what is happening in the picture and what effect it will have on this aquatic environment

Since the pipe comes from a water treatment plant, the "red stuff" is probably microfibers or microbeads.

The fish are swimming around in it so they are probably eating it and will get eaten by a larger animal, so the microplastic will move up the food chain.

Some of the microplastics may also sink to the bottom or stay floating in the water, so it will continue to exist in the aquatic environment.

What is one thing you can do to help reduce the amount of microplastics going into Long Island Sound?

Suggested answers, but there could be more

- Use less single use plastics - if they get into the water, they will break down and become microplastics.
- Do not use any health/beauty products with microbeads in them.
- Pick up trash on the ground so it will not end up in the water as microplastics.



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RUNOFF

Runoff occurs when rain water moves over the earth. When that happens, the rain water can move different materials with it. Permeable and impermeable surfaces can affect the amount of runoff that happens.



How do you think each of these areas will be affected by runoff from a large rainstorm?

RUNOFF

Runoff occurs when rain water moves over the earth. When that happens, the rain water can move different materials with it. Permeable and impermeable surfaces can affect the amount of runoff that happens.



How do you think each of these areas will be affected by runoff from a large rainstorm?

The grass is a permeable surface so it will absorb any water that falls onto it. If there is fertilizer on the lawn and it rains too much, then the rainwater will move the fertilizer toward the river or the storm drain

The road is an impermeable surface and any materials will move from the road to the storm drain, which connects to a larger body of water



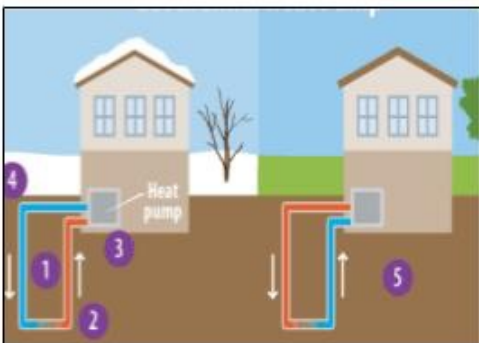
The city is full of impermeable surfaces and lots of cars. As soon as it rains, the stormwater will carry all the chemicals (gasoline, oil, etc) and garbage towards the closest body of water.



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RENEWABLE ENERGY

- 1) What type of energy do these pictures demonstrate?
- 2) How are these items used to generate energy? What do they do?



RENEWABLE ENERGY ANSWER KEY

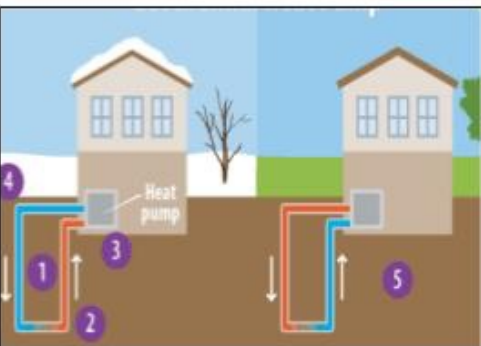
- 1) What type of energy do these pictures demonstrate?
- 2) How are these items used to generate energy?



- 1) Wind energy
- 2) The wind causes the large fans, also known as turbines to spin and the energy taken in by the spinning turbines is used to generate electricity.



- 1) Solar energy
- 2) These are solar panels. They absorb the sunlight and have special cells in the panels that store the energy. That energy creates a current used for energy in houses and buildings.



- 1) Geothermal energy
- 2) There are pipes with water in the ground below the building. The temperature of the ground is different than the air temperature during the seasons so it heats and cools the water in the pipes and that leads to the building.



- 1) Hydropower
- 2) As the water moves over/through the dam and falls into the next area, it causes an underwater fan called a turbine to spin. That energy is turned into electricity by a generator.

REMEDIATION

There are many ways we have impacted the environment. Below are examples of some of those impacts. Describe a remediation technique developed for each impact



It is estimated that the average American generates 4.5 pounds of waste a day, which rapidly adds to the materials in landfills..



The development of roads and structures changes the movement of water, causing erosion.



The addition of impermeable surfaces to the landscape increases the amount of water running off the land, carrying excess nitrogen.

REMEDIATION ANSWER KEY

There are many ways we have impacted the environment. Below are examples of some of those impacts. Describe A remediation technique developed for each impact



It is estimated that the average American generates 4.5 pounds of waste a day, which rapidly adds to the materials in landfills..

Composting
Reducing single use plastic use
Beach cleanups



The development of roads and structures changes the movement of water, causing erosion.

Retaining walls
Building trenches
Planting vegetation



The addition of impermeable surfaces to the landscape increases the amount of water running off the land, carrying excess nitrogen.

Growing kelp!

Million Bottle Cap Challenge

Classroom Tally Sheet

Please email your final bottle cap counts to bottlecaps@soundwaters.org.

[illegible]

TEST YOUR KNOWLEDGE

GRADES 6-8

1. _____ is any type of manmade source of chemicals or garbage that starts on the land and ends up in the water.
 - a. Terrestrial pollution
 - b. Marine pollution
 - c. Air pollution
 - d. Microplastics pollution
2. What is the difference between point and non-point source pollution?
 - a. You can identify exactly where point source pollution comes from, but non-point source can come from multiple places.
 - b. Point source pollution comes from the air and non-point source pollution comes from the land.
 - c. You can identify exactly where non-point source pollution comes from, but point source can come from multiple places.
 - d. Non-point source pollution comes from the air and point source pollution comes from the land.
3. Which of these statements is FALSE about marine debris?
 - a. It does not always get collected and recycled by humans.
 - b. It will break down into smaller pieces.
 - c. Marine debris will always stay in the same place it entered the water.
 - d. It will make its way through the food chain if eaten by an animal.
4. True or False. Marine debris does not affect beaches or boats.
5. How does bioaccumulation occur with marine debris?
 - a. Microorganisms break down marine debris and organic materials.
 - b. Animals get stuck in pieces of marine debris and it changes the way their body grows.
 - c. The sunlight breaks down the marine debris and it moves into a gyre.
 - d. Small animals eat pieces of marine debris and they build up in the animals body.
6. _____ is a tiny piece of plastic less than 5 mm in length
 - a. Marine debris
 - b. Runoff
 - c. Macroplastic
 - d. Microplastic

7. Which if these is NOT a source of microplastics?
- Chemicals from plastic going down a kitchen sink.
 - Sunlight causing photodegradation of plastic on a beach.
 - Microbeads from facewash washing down a bathroom sink.
 - Mechanical degradation of fibers from clothing moving around in a washing machine.
8. What happens to animals when they are in the water with microplastics for a while?
- Animals avoid the microplastics and only eat their food.
 - The animals at the top of the food chain have the most plastic in their stomach, due to biomagnification.
 - The microplastics give animals the same nutrients as their food.
 - The animal has a big enough stomach to consume both food and microplastics.
9. _____ occurs when the land cannot absorb any more water and the extra water ends up in another body of water.
- Marine debris
 - Microplastics
 - Renewable energy
 - Runoff
10. Why are salt marshes important along coastlines, like Long Island Sound, in preventing runoff?
- Salt marshes are an impermeable surface and they act like a wall to block the extra water from going into Long Island Sound.
 - Salt marshes are a permeable surface and they absorb the extra water from runoff so it will not go into Long Island Sound.
 - Salt marshes hold runoff water for birds and animals to drink so it will not go into Long Island Sound.
 - All of the above.
11. What can happen to a water treatment plant if it rains too much?
- Nothing will happen; the water treatment plant can always handle extra water.
 - The water treatment plant turns off so it will not overflow into another body of water.
 - The large containers that hold the water will overflow into another body of water.
 - None of the above.

12. Which of these statements is TRUE about fertilizer getting into a body of water like Long Island Sound?
- a. Fertilizer causes blooms of algae that can eventually lead to fish kills due to low oxygen.
 - b. Fertilizer is the reason that Long Island Sound looks green in color.
 - c. Fertilizer is food for animals that need it to grow and thrive in Long Island Sound.
 - d. Fertilizer makes the water cleaner in Long Island Sound.
13. Renewable energy _____.
- a. Involves sources of energy that can only be used once, like coal.
 - b. Uses natural sources of energy that are found all over the earth
 - c. Contributes pollution to the air and water.
 - d. None of the above
14. Which of these statements is TRUE about wind energy?
- a. Wind energy is a non-renewable source of energy.
 - b. Wind energy uses heated pipes underground to create electricity.
 - c. Wind energy uses turbines and a generator to create electricity.
 - d. Wind energy can only be used in coastal areas.
15. _____ panels absorb energy from the _____ and use it to make electricity for a house or building.
- a. Hydropower; Sun
 - b. Solar; Earth
 - c. Hydropower; Water
 - d. Solar; Sun
16. Why are tides a great source of energy for a coastal area, like Long Island Sound?
- a. Tides are very strong and rush over a dam to create electricity with a turbine
 - b. Unlike wind and solar energy, tidal movement is consistent and happens every day because tides are controlled by the moon
 - c. The energy generated by the large wave action of the tides is stored through a tidal panel.
 - d. Tidal water is stored in pipes that get warmed by the earth to warm buildings.
17. Which of these statements is FALSE about geothermal energy
- a. The heat in the ground varies greatly every day throughout the year.
 - b. Underground pipes with water are heated and cooled by the ground.
 - c. The heated and cooled water is pumped up to a heat pump in a house or business.
 - d. Geothermal energy can get used almost anywhere in the United States.

18. True or False. Humans use non-renewable energy because it is often easier to store and more cost effective than renewable energy.

19. _____ is when humans work to improve damage to the environment

- a. Water treatment
- b. Remediation
- c. Runoff
- d. Renewable Energy

20. Which of these examples is a way to prevent impermeable surfaces from causing extra water from moving through the environment?

- a. Create more concrete paths for the water to travel away from a river or lake.
- b. Install solar panels so the extra water can evaporate off the land.
- c. Add more storm drains on the sides of the road to collect the extra water.
- d. Build a rain garden on the side of a parking lot or road to take up extra water.

21. How does kelp help with runoff?

- a. It filters microplastics from runoff.
- b. It blocks sunlight from the seafloor.
- c. It's a food source for animals.
- d. It takes up extra nitrogen from the water.

22. Which of the following is true about a breakwater or jetty?

- a. They cause the sediment to move to areas that are eroded so they can fill in and protect the ground.
- b. They absorb wave energy, preventing erosion around coastal houses.
- c. They create trenches that divert the flow of extra rainwater.
- d. All of the above.

23. Why is it important to compost?

- a. Composting prevents materials from ending up in a landfill, which creates a greenhouse gas called methane.
- b. Composting allows nutrients to be returned to the soil.
- c. Composting is a method of recycling.
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Apps and Online Resources: Click on the title below to find out more!

- [Marine Debris Tracker App](#)
- [Harmful Algal Blooms](#)
- [Nonpoint Source Pollution](#)
- [NOAA Marine Debris Program – Learn about Marine Debris Online](#)
- [NOAA Trash Talk](#)
- [NOAA Marine Debris Toolkit for Educators](#)
- [NOAA Marine Debris Understanding Marine Debris – Games and Activities](#)
- [NOAA Microplastics Facts](#)
- [Microplastics and Disease in Steelhead Trout](#)
- [Understanding the Movement of Microplastics in River Plumes](#)
- [Blue Crab Babies and Microplastics](#)

BOOKS

- Flush by Carl Hiaasen
- The Last Wild by Piers Torday
- World Without Fish by Mark Kurlansky
- Diary of a Young Naturalist by Dara McAnulty

ARTICLES: Click on the title below to open the article

- [Microplastics Pollution Is Everywhere. Is It Harmful?](#)
- [Plastic Pollution Affects Sea Life Throughout the Ocean](#)
- Skimming the Surface- Stamford Harbor Trash Skimmer (article below)
- [More Plastic in the World means More Plastic in Osprey Nests](#)
- [Small particles of plastic have found a home in Arctic snow, scientists say](#) (Lexile level can be adjusted)
- [Types of Renewable Energy](#) (Lexile level can be adjusted)
- [Water quality improving in Long Island Sound, report says](#)

STAMFORD ADVOCATE

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Skimming the surface

New floating device traps trash from Long Island Sound



Matthew Brown / Hearst Connecticut Media

Sophia Arnaboldi, a junior at Greenwich Country Day School, prepares to skim the surface trash collected in the skimmer at the docks at Harbor Point in Stamford. The skimmer, basically a floating dumpster, collects trash off Long Island Sound and the Mill River inlet.

By Ignacio Laguarda

STAMFORD — Bottles, food wrappers, cigarette butts, and loads of leaves are just some of the items that have turned up in a new trash-collecting contraption installed in Stamford Harbor.

The receptacle, which essentially looks like a dumpster partially submerged in water, is called a skimmer, and was gifted through a grant to Stamford nonprofit SoundWaters to help clean the Long Island Sound.

While its purpose is collecting trash, one skimmer is unlikely to make much of a dent in eliminating debris from the water, according to SoundWaters staff. They see the skimmer as more of an educational tool that will help collect data on the types of trash that float into it.

The skimmer works by sucking in trash, oils and other debris, while

See Skimmer on A8



A group of Greenwich Country Day School students collect trash from the skimmer and sort it to document what type of debris is ending up in the Sound.

SKIMMER

From page A1

pumping oxygen back into the Sound.

Leigh Shemitz, president of SoundWaters, said the skimmer helps people visualize the troubling level of debris that makes it into the water.

"It is mesmerizing," she said. "Watching all these pieces of plastic makes you realize how big the problem is."

Seeing how much trash floats into the structure isn't as easy as walking up to it, as it is covered. How-

ever, SoundWaters hosts clean-up events in which visitors can scoop items out of the skimmer, sort the items and document the type of trash inside.

The skimmer was installed in early October and will be removed next month before the cold sets in. The plan is to return the trash-collecting receptacle to the water around April.

So far, there have been only been a handful of trips to the skimmer to collect trash, sort it, and document it. The most common items found inside were leaves, plastic bottles and caps, packag-

ing, and cigarette butts.

For Shemitz, the message for Stamford residents is simple: "If it's on the ground, it's in the Sound."

The fine for littering in Stamford is \$90 for any material that is less than one cubic foot. Anything larger than that amount can result in a whopping fine of \$1,000.

Some of the items that turn up on the city's beaches and waters are seemingly direct results of local policies and bylaws.

For example, the number of plastic bags found in a recent beach cleanup was 85 percent less than the previous year, a possible indication of the effects of Stamford's plastic bag ban that took effect in May. Additionally, the copious amount of leaves that make it to the Sound appears to be directly connected to how the city handles leaf pickup, by having residents push leaves to the curb, where they often end up in catch basins.

In an email, SoundWaters spokesperson Bob Mazzone said the skimmer would "open our eyes to the pervasiveness of the marine debris problem."

"It will inform us about what detritus from our daily lives we are mismanaging so that it makes its way to the water," he said.

The location for the skimmer was chosen by Harbor Point developer BLT, Shemitz said. The spot, which is just a few feet away from the back of restaurant Mexicue, tends to attract debris, she added.

Ted Ferrarone, chief

operating officer for BLT, said the developer was happy to work with SoundWaters on the project.

"When they brought the opportunity to us, it seemed like an ideal way to educate people on how they can have a positive impact on the quality of the harbor," he said.

The \$12,000 skimmer is the first of its kind in the Sound, Shemitz said.

The grant to pay for the device came from Long Island Sound Futures Fund, which is a combination of funds from the Environmental Protection Agency, U.S. Fish and Wildlife Service and National Fish and Wildlife Foundation.

SoundWaters received roughly \$21,500 from the grant, with a matching fund of about \$19,400 from grantees such as Clean Ocean Access. The description of the grant states the skimmer will remove just over 3,000 pounds of debris from the Sound. Besides the purchase of the skimmer, the grant money will go toward maintenance and research.

Shemitz, who said SoundWaters is always looking for ways to improve the environment, said she wants to add more skimmers in Stamford waters.

She said anyone looking to access the skimmer and help with the trash research project can send a message to volunteer@soundwaters.org.

"It's a great activity," Shemitz said. "It's a chance to see something powerful."

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