HUMAN IMPACT UNIT
LESSON PLAN 6-8 grade

Topics
Earth Systems
Marine Debris
Microplastics
Run off
Remediation

Objectives
Students will be able to:
- Explain what a watershed is and apply the definition to the Long Island Sound watershed
- Identify solutions to runoff
- Construct an explanation for sources of microplastics
- Compare types of marine debris and identify their degradation time
- Evaluate ways to reduce contaminated waterways

Instructional Materials
Topic Video
Vocabulary Flash Cards

Assessment Materials
Video Reflection Worksheet
Video Quiz
Earth Systems Interactions Worksheet (answer PDF available)
Watershed Worksheet (answer PDF available)
Marine Debris Worksheets (answer PDF available)
Microplastics Worksheet (answer PDF available)
Remediation Worksheet (answer PDF available)
Clean-up Worksheet
PSA worksheet (microplastics)

Topic Articles
**Newsela allows you to adjust Lexile level*
https://newsela.com/read/natgeo-freshwater-resources
https://newsela.com/read/plastics-artic-snow/id/55754/

Related Materials
Links to videos and reading material that provides additional information on topics.

NOAA Resources

The National Oceanic and Atmospheric Administration (NOAA) is a partner of SoundWaters. These are additional resources you may use in addition to the other materials included above.

Microplastics
https://oceanservice.noaa.gov/facts/microplastics.html
https://blog.marinedebris.noaa.gov/microplastics-and-disease-steelhead-trout
https://blog.marinedebris.noaa.gov/understanding-movement-microplastics-river-plumes
https://blog.marinedebris.noaa.gov/blue-crab-babies-and-microplastics

Marine debris
https://earthrespect.files.wordpress.com/2015/09/marine-debris.jpg
https://blog.marinedebris.noaa.gov/digital-debris-learn-about-marine-debris-online
https://oceantoday.noaa.gov/every-full-moon/full-moon-trashtalk.html
https://marinedebris.noaa.gov/curricula/marine-debris-monitoring-toolkit-educators
https://marinedebris.noaa.gov/discover-issue/trash-talk
https://marinedebris.noaa.gov/understanding-marine-debris-games-and-activities-kids-all-ages
https://marinedebris.noaa.gov/sites/default/files/publications-files/Be_an_Ocean_Guardian_Activity_Book.pdf

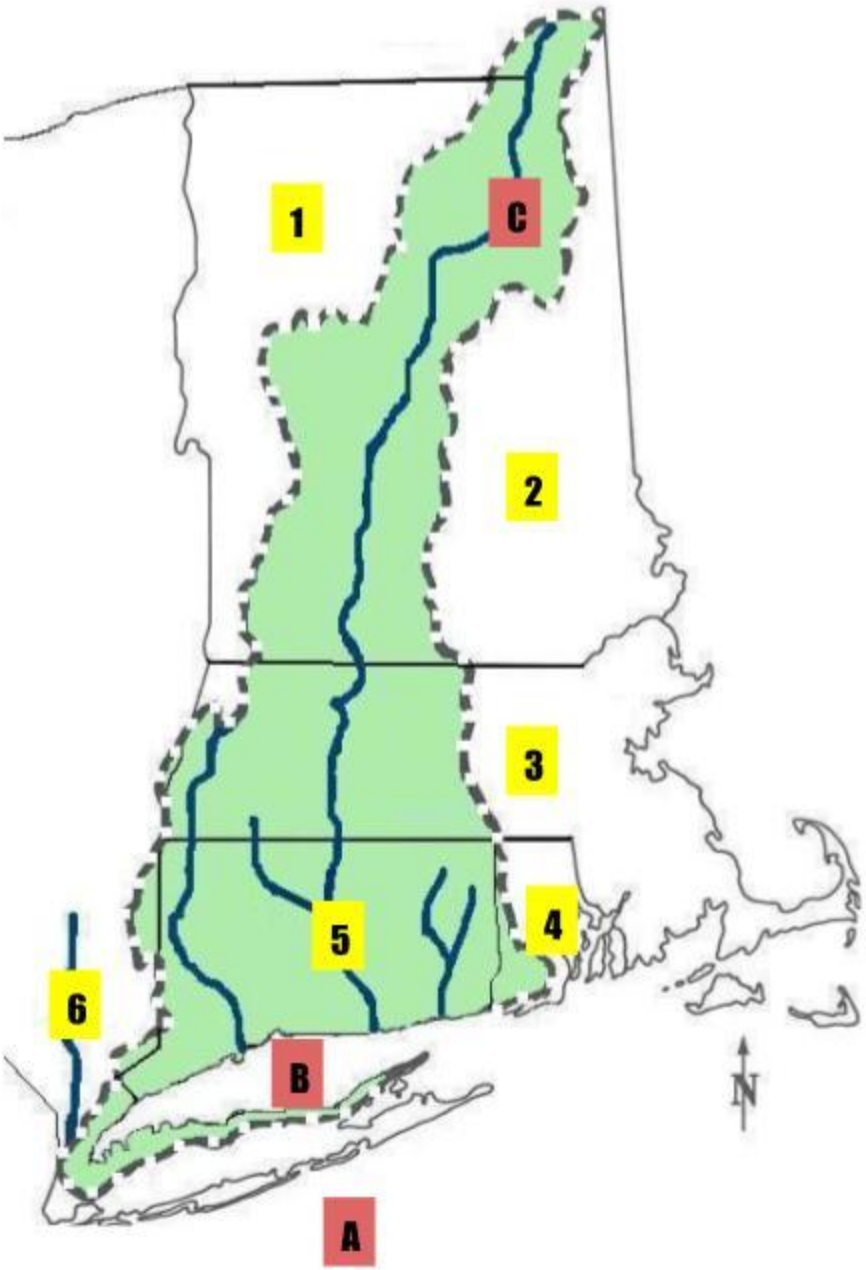
NOAA marine debris tracker app (would have to be downloaded to contribute data)
https://marinedebris.engr.uga.edu/

Point vs Non-Point source pollution
https://oceanservice.noaa.gov/education/kits/pollution/016youcando.html
https://oceanservice.noaa.gov/education/tutorial_pollution/welcome.html

Watersheds/ water movement/water cycle
https://www.noaa.gov/education/resource-collections/freshwater-education-resources/watersheds-flooding-and-pollution
https://www.noaa.gov/education/resource-collections/freshwater-education-resources/water-cycle
https://www.michiganseagrant.org/lessons/
https://coast.noaa.gov/estuaries/curriculum/watershed-in-a-box.html

Algae blooms
https://oceanservice.noaa.gov/hazards/hab/

NGSS Standards
Human Impacts: MS-ESS3-3
Ecosystems MS-LS2-5
Engineering Design: MS-ETS1-4



This is the Long Island Sound Watershed.

What is a watershed?

An area of land that water moves over until it gets to a larger body of water (like LIS)

Label the states in the watershed:

1) Vermont
2) New Hampshire
3) Massachusetts
4) Rhode Island
5) Connecticut
6) New York

Label the bodies of water

A) Atlantic Ocean
B) Long Island Sound
C) (Blue line) River

SoundWaters
Protecting Long Island Sound through Education

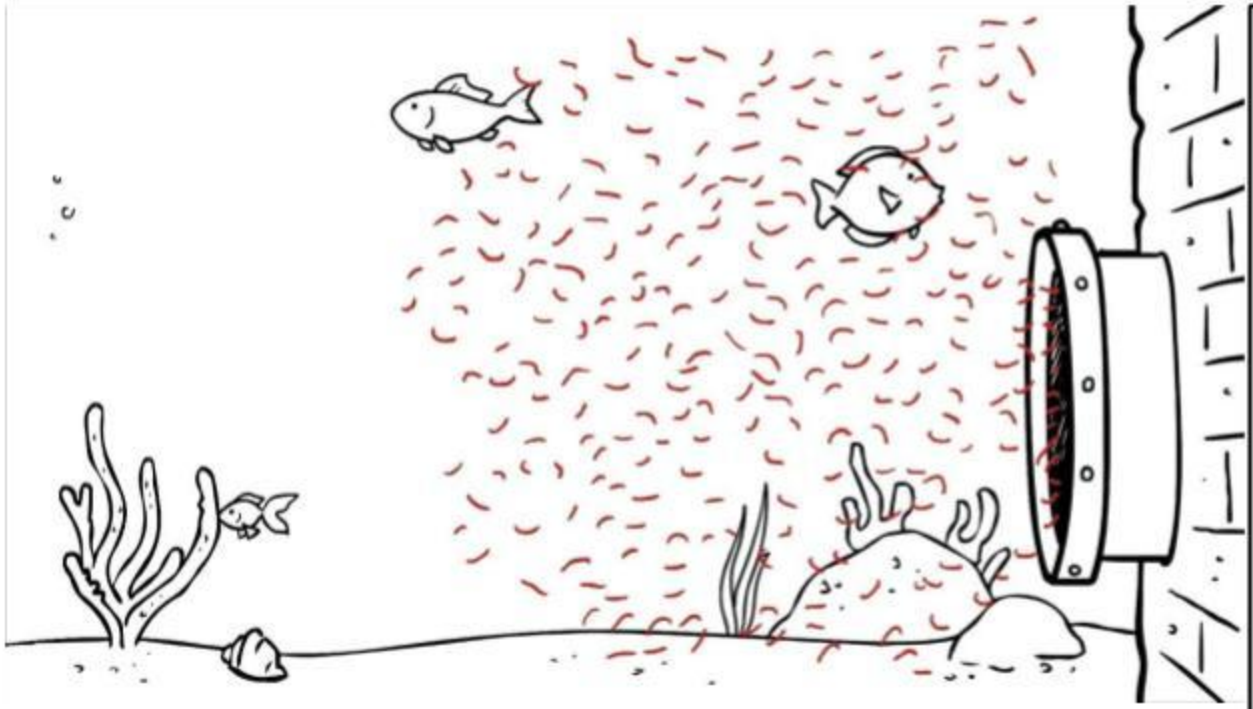
HOW LONG UNTIL IT'S GONE?

Estimated decomposition rates of common marine debris items

Estimated individual item timelines depend on product composition and environmental conditions.

Source: NOAA (National Oceanic and Atmospheric Administration), US / Woods Hole Sea Grant, US
Graphics: Oliver Lüde / Museum für Gestaltung Zürich, ZHdK

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?

SoundWaters
Protecting Long Island Sound through Education

REMEDIATION

SoundWaters
Protecting Long Island Sound through Education

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

It is estimated that the average American generates 4.5 pounds of waste a day, rapidly filling landfills..

Composting
Reducing single use plastic use
Beach cleanups

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

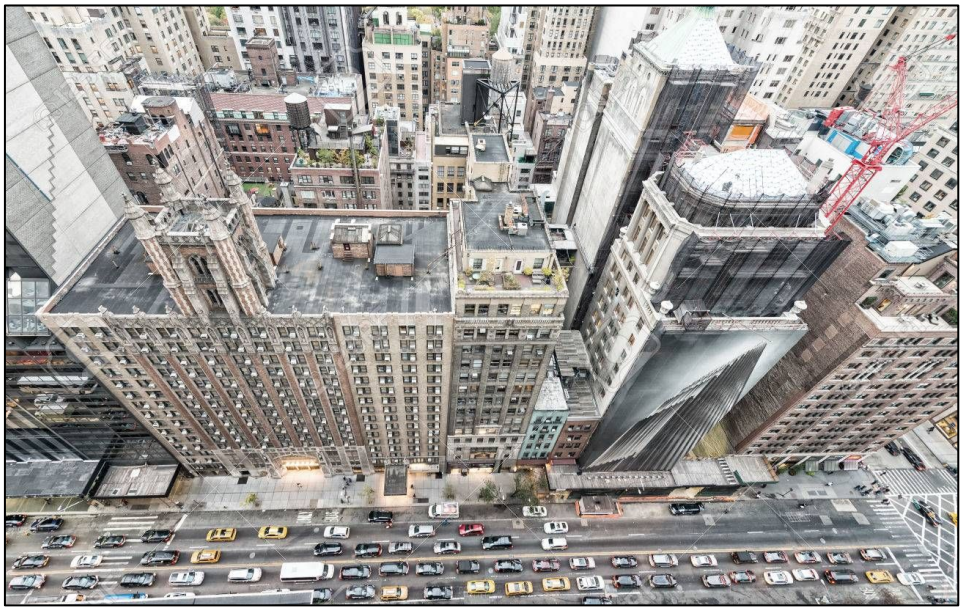
Retaining walls
Building trenches
Planting vegetation

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

Growing kelp!

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.

SoundWaters
Protecting Long Island Sound through Education

EARTH SYSTEM INTERACTIONS

The earth is divided into four major systems: geosphere (G), hydrosphere (H), atmosphere (A), and biosphere (B). These systems interact because they are related to each other.

Which systems are interacting in each one of these situations (use the letters G,H,A,B)

A deer taking a breath and then eating a piece of grass.	B, A
A windstorm in the desert creates dust clouds in the air	G, A
A wave crashes against a coastline and it starts to erode	H, G
A seedling sprouts up in a garden	B, G
A volcano erupts and many trees become uprooted and fall over	G, B
The tide rises causing mussels to open and feed on plankton	H, B
The leaves on a tree going through photosynthesis	B, A
Evaporation from a river that leads to heavy cloud cover	H, A
Daily rainstorms in a tropical rainforest creating a tree canopy	H, B

Earth Systems Quiz Answers

Which of the following is not one of the four systems on Earth?

A. Hydrosphere
B. Lithosphere
C. Atmosphere
D. Geosphere

The biosphere is made up of all the _____ things on Earth.

A. Moving
B. Abiotic
C. Microscopic
D. Biotic

A lot of the oxygen in Earth's atmosphere comes from which of the following marine organisms?

A. Flounder
B. Plankton
C. Oysters
D. Sea Stars

How many states are included in the Long Island Sound watershed?

A. 6
B. 5
C. 4
D. 3

An example of a connection between the GEOsphere and the HYDROsphere is

A. Ocean currents moving fish around the ocean
B. Water evaporating to make clouds
C. Waves eroding rocks on the beach
D. A tree's roots growing into the ground

Marine Debris Quiz Answers

True or False: When a plastic bottle cap enters Long Island Sound it settles and stays in one place.

A. True
B. False

How does marine debris enter the water?

A. Direct input from people
B. Wind and rain
C. Storm drains
D. All of the above

Which of the following is an example of point source pollution?

A. Fertilizer from lawns
B. Drainage pipe from sewage plant
C. Oil and gas on the road
D. Poorly managed construction sites

What process can cause toxins to end up in food we eat from the water?

A. Photodegradation
B. Biodegradation
C. Bioaccumulation
D. Watershed

What does it mean for an object to photodegrade?

A. Eaten by animals
B. Decomposed by bacteria
C. Sink
D. Broken down by light

What can fertilizer runoff cause?

A. Fish kills
B. Hypoxia
C. Algae Blooms
D. All of the above

Microplastics Quiz Answers

Microplastics can come from a variety of sources. Which of the following is not one of the sources we mentioned in the video?

A. The sunlight degrading a piece of plastic debris.
B. Microfibers from washing our synthetic materials.
C. Precipitation bringing microbeads from the clouds.
D. Microfilaments from derelict or abandoned fishing line.

Which of the following can cause a large piece of plastic marine debris to break down in the environment?

A. The sun's rays making the plastic brittle.
B. Physical degradation from the movement of the waves and water.
C. People crumpling up the trash.
D. Both a and b.

President Obama passed the _____ Act, a law banning companies from delivering rinse-off cosmetic products that use microbeads by 2018.

A. Clean Water
B. Microbead-Free Waters
C. Microbead-Ban

A microplastic is a piece of plastic that is _____ millimeters in length, as small as an ant!

A. 3mm
B. 4mm
C. 5mm
D. 6mm

Microplastics are often eaten by animals in the ecosystem. These microplastics are bad for the animals because

A. The microplastics can absorb toxins in the water and make the animal sick.
B. The microplastics don't give the animal any energy.
C. The microplastics make the animal think it is full when it doesn't actually have any food in its stomach.
D. All of the above.

What is biomagnification?

A. The build-up of a toxic chemical in the body of a living organism.
B. When a toxic material increases in amount each time it moves up a trophic level in the food chain.
C. The increase in size of a microplastic to a plastic piece larger than 5mm.
D. The weight increase of an animal after eating a toxic chemical.

Runoff Quiz Answers

Why has the amount of runoff increased?

A. It rains more often
B. There are more storm drain pipes
C. There are more impermeable surfaces
D. There is more salt marsh

What can fertilizer runoff lead to?

A. Harmful algae blooms
B. Hypoxia
C. Fish kills
D. All of the above

Which of the following is a natural source of runoff?

A. A drain pipe from storm drains
B. Fertilizer from lawns
C. Wastewater treatment plant
D. Mill River emptying into Long Island Sound

True or False: Long Island Sound is cleaner than it has been in the past 3 decades

A. True
B. False

How many people can affect the quality of the water in Long Island Sound?

A. 100,000
B. 1 million
C. 4 million
D. 8 million

What harmful substances can be in runoff?

A. Fertilizer
B. Sewage
C. Heavy metals, tire rubber
D. Gas and oil
E. All of the above

Remediation Quiz Answers

What is an example of bioremediation?

A. Digging a trench to redirect water
B. Properly disposing of plastic material
C. Growing kelp
D. Doing a beach cleanup

Which would produce the LEAST amount of runoff?

A. Building a rain garden
B. Paving a parking lot
C. Buying a car to replace your bike
D. Using solar panels

True or False: Vegetation helps prevent erosion by root networks holding the soil into place.

A. True
B. False

What creates erosion on beaches?

A. Tides
B. Wind
C. Waves
D. All of the above

Kelp helps the environment simply by growing! What toxin does kelp remove from the water?

A. Neptunium
B. Nitrogen
C. Sulfur
D. Iron

What can be composted?

A. Metals
B. Organic material
C. Plastic
D. Synthetic clothing