



Human Impact to Coral Reefs

Essential Question: How do products we use on land affect our ocean, coral reefs and beaches, and what can we do to solve this problem?

Lesson at a Glance: Human and natural threats to coral reefs will be introduced to the students and a focus will be made on how marine debris affects coral reefs and its organisms. Students will devise a testable hypothesis about marine debris at a local beach and then create an experimental procedure to test their hypothesis. The students will graph their data, accept or reject their hypothesis, and then as a class compare their data to past studies of marine debris collection at the same beach. Students will also be able to describe how the use of technology has influenced the economy, demography, and environment of Hawaii.

Hawaii DOE Content Standard

Science 1: The Scientific Process: Science Investigation

- Discover, invent, and investigate using the skills necessary to engage in the scientific process.

Science 2: The Scientific Process: Nature of Science: Understand that science, technology, and society are interrelated.

- Understand that science, technology, and society are interrelated.

Grade 4 Benchmarks

4.1.1 Describe a testable hypothesis and an experimental procedure.

4.2.1 Describe how the use of technology has influenced the economy, demography, and the environment of Hawaii.

Learning Objectives

Lesson 6.1

- 1) Students will be knowledgeable about natural and human threats to coral reefs
- 2) Students will be knowledgeable about marine debris in Hawaii.



- 3) Students will be able to describe their reactions to why and how marine debris occurs and how we can decrease the amount of marine debris.

Lesson 6.2

- 1) Students will be able to categorize different types of debris
- 2) Students will be able to determine how a material can influence what becomes marine debris.

Lesson 6.3

- 1) Students will be able to devise a testable hypothesis and an experimental procedure

Lesson 6.4

- 1) Students will learn how to count and record the number of objects they see using a transect line.

Lesson 6.5

- 1) Students will be able to collect and categorize the data they collected using the experimental procedure they created

Lesson 6.6

- 1) Students will be able to formulate and defend conclusions based on the evidence they gathered.

Duration:

Lesson 6.1: 45 minutes

Lesson 6.2: 45 minutes

Lesson 6.3: 1 hour

Lesson 6.4: 45 minutes

Lesson 6.5: 1 day

Lesson 6.6: 1 hour

Materials

Lesson 6.1:

- Background article- Marine Debris in Hawaii brochure from NOAA
- Healthy vs. Unhealthy Reef picture

Lesson 6.2

- Marine Debris Observation Worksheet (1 per student)
- Deep pan
- Sink
- Water



- A variety of trash items
- Beach glass

Lesson 6.3:

- Human Impact and Marine Debris Power Point
- Human Impact Worksheet (1 per student)
- Hawai`i data sheet (1 per team)

Lesson 6.4

- Various items of trash in different numbers (ex. 3 cups, 5 bottle caps, 4 candy wrappers)
- Collecting data using a transect line worksheet (1 per student)

Lesson 6.5:

- Trashbags
- Gloves
- Sun protection for students (sunscreen, hats)
- Dealing with Marine Debris (zerox onto transparency)

Lesson 6.6:

- Human Impact Worksheet from Lesson 6.2

Assessment:

Formative

- Complete Journal entry from Lesson 6.1 .
- Complete the Marine Debris Observation Worksheet
- Complete the Human Impact Worksheet

Summative

- Have students in groups create a project such as a brochure, poster, visual aid, drawings etc. to display to the community the effect marine debris has on the environment, the people and the economy. Use visual aids to show the project in action. Display the art in the community or have students visit classrooms to disseminate their artwork and message.



Lesson 6.1: Background reading and Power point on Marine Debris in Hawaii

Learning Objective:

- 1) Students will be knowledgeable about marine debris in Hawaii.
- 2) Students will be able to describe their reactions to why and how marine debris occurs and how we can decrease the amount of marine debris

Duration: 45 minutes

Materials: Background article- Marine Debris in Hawaii brochure from NOAA, Healthy vs. Unhealthy Reef picture

Procedure for teacher:

1. Make a list with the class on: What destroys a coral reef?
2. Ask the class how they could categorize the items that were listed under a bigger sub heading. Humans? Natural?
3. Read the brochure on marine debris in Hawaii from NOAA as a class
4. Stimulate research questions they might want to ask if they are beach researchers that will later be used to form hypothesis. Example questions you could look for are a) What are the five most common types of marine debris items we will find? b) Will cigarette butts be the most typical item found? c) How does marine debris affect coral reef organisms?
5. As a class, have the students write a journal entry on their reactions to these questions:
 - a. What do students think about plastic in the ocean?
 - b. Where does plastic go?
 - c. Does it go away?
 - d. What types of animals are the most affected?
 - e. How we use plastic in our daily lives?
 - f. How can we reduce plastic waste in the ocean
6. Distribute the Healthy Reef vs. Unhealthy Reef picture and have students draw and color their pictures.

Homework: .Challenge students to keep track of all of the disposable plastic items, including packaging on products, they use during one full day. Have



them list each item and make note of what they do with it when they are finished using the product. Ask students to share with their classmates and describe how they disposed of plastics, including ways that they reduced (used alternative products), reused, or recycled the next day.

Perform these human impact coral dramas with your class:

1. Polyp being stepped on or crushed

-Opened, healthy polyp immediately closing ("Ouch" sound effect)

2. Polyp dying

- ("cough, cough, greasy" sound effect)- symbolize being covered with oil.

- ("hot, hot, hot" sound effect) symbolize sea temperature rise from global warming.

- ("coughing, gasping; I can't feel the sun; Nooo" sound effect) symbolize being smothered by sediment/algae or marine debris



Hawaiian Islands. Several areas of debris accumulation in the Main Point on the Big Island (shown below) and near South Beach on Kaho'olawe (shown above) and near South and environment that many come to see. Kanapou debris affects the beauty and aesthetics of the beaches and tourism is based on tourism and marine Hawai'i's economy is based on tourism and marine



Aesthetics problem that we cannot ignore. trapping marine life, marine debris is a in trash to a *ghost net* continually marine species. From a beach covered boats, and threatens many of our hazard for humans, causes damage to beauty of our environment, is a safety In Hawai'i, marine debris affects the

Effects of Marine Debris

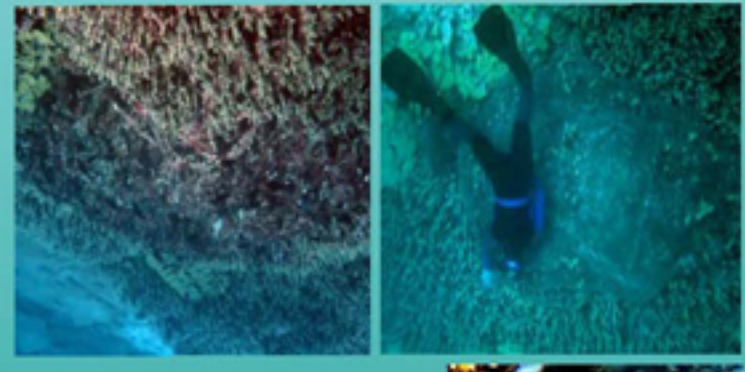
MARINE DEBRIS IN HAWAI'I

Endangered North Pacific humpback whales and threatened green sea turtles are two marine species in Hawai'i impacted by marine debris. Entanglement in debris, primarily derelict fishing gear such as nets, causes damage and may result in death.



Wildlife Entanglement

NOAA diver removing derelict fishing gear from a reef in the Northwest-Hawaiian Islands. Damage to this reef is noticeable once the derelict net is removed.



Coral reefs are the basis of many of Hawai'i's marine ecosystems. Marine debris can break and smother coral. Further damage can be caused with wave action and by blocking needed sunlight to corals.

Habitat Destruction

Marine debris is a transport mechanism for alien species. An invasive intertidal anemone, *Diadumene lineata*, was found attached to a derelict trawl net at Pearl and Hermes Atoll in the North-western Hawaiian Islands. This anemone was not recorded previously in Hawai'i.



Vessel Damage and Navigational Hazard

Large accumulations of derelict fishing gear can damage a vessel, entangle the propeller, and result in a safety risk for those on board. Due to the size of many debris conglomerations, they are also a navigational hazard. Fishermen and other mariners help by removing and returning this trash to port.

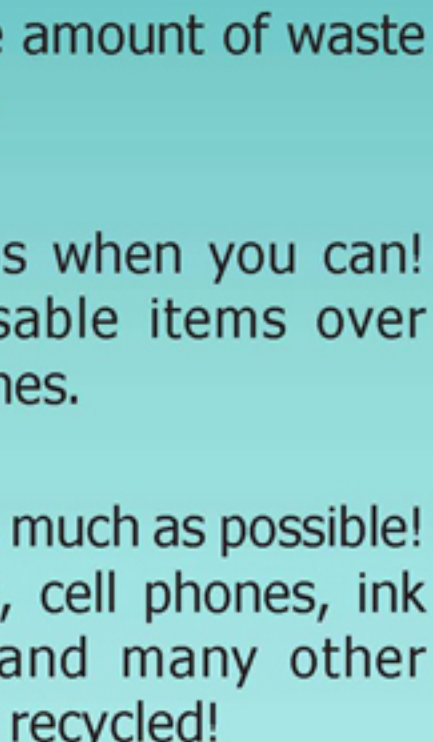


Ingestion

Seabirds ingest marine debris, particularly plastic pieces such as bottle caps. Many times parents will regurgitate the debris to their chicks. Debris accumulates in their stomachs and intestine leading to starvation and even death.



Alien Species Transport



How YOU Can Help

GET INVOLVED! Participate in local cleanups in your area!

REMEMBER that our land and sea are connected.

REDUCE the amount of waste you produce.

REUSE items when you can! Choose reusable items over disposable ones.

RECYCLE as much as possible! Bottles, cans, cell phones, ink cartridges, and many other items can be recycled!



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March 2006

Printed on recycled paper with vegetable ink.

Photos courtesy of James Watt, NOAA Fisheries Service, NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary, State of Hawai'i, Hawai'i Wildlife Fund, and University of Hawai'i Sea Grant College Program.



For more information
marinedebris.noaa.gov

Background

Sources of Marine Debris

Degradation Timeline



The state of Hawai'i is an archipelago of islands, atolls, banks, and shoals extending over 1,500 miles in the Pacific Ocean. Hawai'i is home to endangered Hawaiian monk seals, sea turtles, dolphins, whales, many species of seabirds, and an abundance of coral reefs. Throughout Hawai'i, marine debris continues to present a hazard to marine life and habitat, as well as safe navigation.



Endangered Hawaiian monk seals (*Monachus schauinslandi*) are endemic to Hawai'i and threatened by entanglement in marine debris.

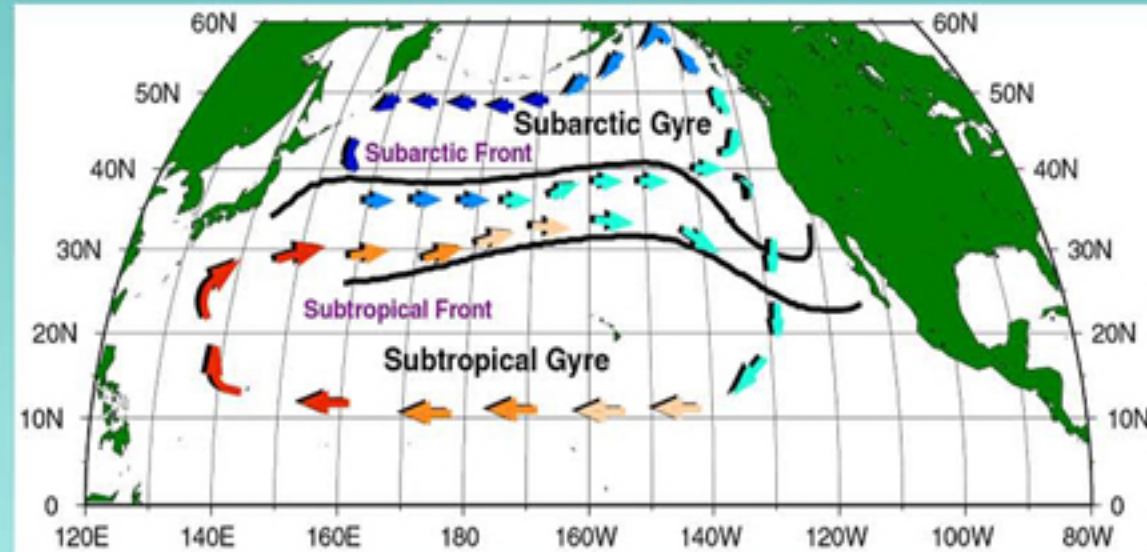


DIRECT from ocean-based sources such as ships and fishing vessels.



INDIRECT from land-based sources when washed out to sea via streams and storm drains.

Movement of Marine Debris



The North Pacific, California, North Equatorial, and Kuroshio currents along with atmospheric winds generate the North Pacific Subtropical Gyre (shown above). Located in the center of this subtropical gyre, marine debris accumulates in Hawai'i (Timmers et al., 2005).

Timmers, M., C. Kistner, and M. Donohue. 2005. Marine Debris of the Northwestern Hawaiian Islands: Ghost Net Identification. Sea Grant: UNIH-SEAGRANT-AR-05-01.

Paper towel
2-4 weeks

Milk carton
3 months

Plywood
1-3 years

Cigarette filter
1-5 years

Plastic bag
10-20 years

Plastic cup
50 years

Rubber shoe sole
50-80 years

Aluminum can
80-200 years

Plastic soda bottle
450 years

Disposable diaper
450 years

Monofilament fishing line
600 years

Glass bottle
1 million years

(From Mote Marine Laboratory, FL)

From TRASH to ELECTRICITY

Removing and Recycling Marine Debris in Hawai'i



Derelict fishing gear, a form of marine debris, is removed from the land and nearshore waters of Hawai'i.



The debris is then hauled on board an awaiting boat.



As much as possible, the derelict net is sourced and identified.

100 tons of derelict net creates enough electricity to power 43 homes for a year!



The debris is brought to Honolulu Harbor where it is off-loaded.



The chopped nets are taken to Honolulu's H-Power facility where they are burned to create electricity.



Once there, the debris is chopped into small pieces suitable for incineration.



It is then taken to Schnitzer Steel Hawai'i Corporation's facility.

Partnerships

The National Oceanic and Atmospheric Administration (NOAA) works with other federal agencies, state and county departments, not-for-profit organizations, industry partners, private businesses, and community groups to ensure the success of all marine debris removal efforts.



Healthy Reef vs. an Unhealthy Reef

Name _____

Directions: Draw a picture of a HEALTHY coral reef in the left hand column. Draw a picture of a UNHEALTHY coral reef impacted by human and natural threats in the right hand column.

HEALTHY

UNHEALTHY



Lesson 6.2: Types of Marine Debris

Learning Objectives:

- 1) Students will be able to categorize different types of debris
- 2) Students will be able to determine how a material can influence what becomes marine debris.

Duration: 45 minutes

Materials:

- "What will become Marine Debris" Worksheet (1 per student)
- Deep pan (1 for each group)
- Sink
- Water
- A variety of marine trash that can become marine debris
- Beach glass

Teacher Procedure:

1. Have the students separate the trash into different piles (plastic, glass, rubber, metal, paper, wood, and cloth).
2. Have the students form into small groups and choose a few items of marine debris to experiment with. Have the students record their observations in the Marine Debris Observation Worksheet for each object that they test.
3. Discuss the impact humans have on their surrounding environment. How do people use plastic items in their daily lives? How do these trash items (ex. plastic, glass bottles, and cigarettes) affect our economy? How do plastics and other forms of debris get into the ocean? How is plastic marine debris different from biodegradable materials? Brainstorm ideas about how people can reduce the amount of debris in our oceans. Every one of us makes daily choices about products we buy, where to discard trash, and if we want to help clean up a mess that someone else left. The debris that is in the marine environment affects different animals and plants depending on the different material, shape and size on the item.



Name _____

What will become Marine Debris?

Make a prediction about each trash item to see if it classifies as marine debris. Will it sink? Float? Is it carried easily by the wind? Write a Y for yes and N for no in each "Prediction" column. Test the item and then record your result again as yes or no under the column titled "Result."

ITEM

SINK?

FLOAT?

*CARRIED BY
THE WIND?*

	Prediction	Result	Prediction	Result	Prediction	Result
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						



DON'T TEACH YOUR TRASH



Lesson 6.3: Research question, Hypothesis and Experimental Design

Learning Objectives

- 1) Students will be able to devise a testable hypothesis and an experimental procedure

Duration: 1 hour

Materials:

- Human Impact Worksheet (1 per student)
- Pictures of a local beach where the cleanup will be held
- Hawai`i data sheet

Procedure for teacher:

Prep the students on the scientific process of how to create a research question, hypothesis, and experimental procedure. Let the students know that they will be doing a marine debris cleanup at the local beach.

Have the students form into small groups and create a testable hypothesis based on marine debris. Show the students the past data from the same beach and have them create a research question and hypothesis based on the past data or from the setup of the beach. Possible hypothesis could be:

- Cigarettes will be the most abundant type of marine debris at the beach (reasoning: based on past data that cigarettes will be found the most again)
- More trash will be found near the shoreline than by the parking lot

After each group has formed a hypothesis, have them think of how they would like to collect repeatable data for their study. Ask them to write down several ways they could collect their data on a piece of scratch paper and then discuss the strategies they thought of. After they have decided upon an experimental design, have them write the final group consensus on their Human Impacts Worksheet.



Name _____

Human Impacts Worksheet

Before Data Collection:

Research Questions: (What do you wonder about marine debris found on the beach?)

Hypothesis: Write a complete sentence of what you think you will find. The key word is "testable". State your answer in a "Ifthen.....because...." format)

Experimental Design: How will you collect your data? (Devise a method to test your hypothesis)



After Data Collection

Data Analysis: What did you find at the beach? Count and categorize your findings. Using graph paper, chart your results. Summarize your results below.

Summary and Conclusions: Review the results and make a decision. Does the data support or refute the hypothesis? Explain

Implications: From your findings, what do you recommend we do to malama (care for) the marine environment? How can we share our results? Think of ideas to share what you learned with your school and community. Do it!



Lesson 6.4: Collecting data using a transect line

Learning Objective:

- 2) Students will learn how to count and record the number of objects they see using a transect line.

Duration: 45 minutes

Materials:

- Various items of trash in different numbers (ex. 3 cups, 5 bottle caps, 4 candy wrappers)
- Collecting data using a transect line worksheet (1 per student)

Teacher procedure:

1. Use a piece of masking tape to create a transect line on the floor of your classroom or somewhere outside.
2. Spread the trash along both sides of the transect line.
3. Have students list and tally the types of trash they notice.
4. Have the students graph their results of the items and number that were counted.
5. Discuss with the class whether each person in the class does or does not have the same count of each item and the importance of repeatability in science.



Name _____

Collecting Data using a Transect Line Worksheet

Item	Number that was collected
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Graph the results from your trash collection





Lesson 6.5: Beach cleanup at a local beach

Learning Objectives:

- 1) Students will be able to collect and categorize the data they collected using the experimental procedure they created

Duration: 1 day

Materials:

- Data collection spreadsheet for each group
- Trashbags
- Gloves
- Sun protection for students (sunscreen, hats)
- Dealing with Marine Debris (zerox onto transparency)

Teacher Procedure:

Have students collect data using the collection strategy in Lesson 6.3. Upon returning to the class, have the students count the trash and categorize it using the spreadsheet provided. Upon completion of counting and categorizing the collected marine debris, cumulate the data from all the groups and demonstrate to the class trends that are seen in the data. Also, weigh the amount of trash the group collected as a whole and calculate the distance the class covered during their collection. On the overhead, display Dealing with Marine Debris and read it as a class. Have students write a journal article for homework on their thoughts about the fieldtrip and the amount of marine debris they collected.

Outreach Activity: Have the students make posters using the trash they found and messages they want to communicate to the public about reducing marine debris. Post the posters around school or town.



Dealing with Debris

Marine Debris Fact Sheet

During a one-day beach clean-up in Hawai'i people picked up 16 tons of rubbish from 82 miles of beach. This weighs as much as 12 Volkswagen Beetles!

Albatross feeding at sea scoop up plastics along with their food and then regurgitate them to their waiting chicks. The plastics can fill the bird's stomach and cause death by starvation.

From 1982 to 2003, 238 Hawaiian monk seals were found entangled in nets and lines in the NWHI. Most were pups that were freed; however, eight seals were found dead. No one knows how many other animals became entangled and drowned.

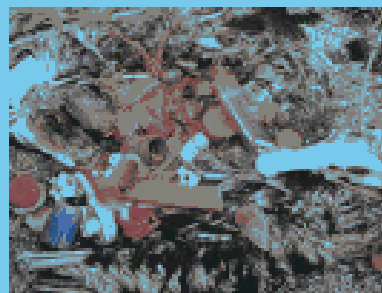
Plastic debris on our beaches and in the ocean can last a very long time. Did you know that it takes a plastic water bottle 450 years to decompose? Recycle it!

Nylon fishing lines and nets can take up to 600 years to decompose. "Ghost-nets" can continue to float through the ocean and trap and kill marine life for years.

A floating plastic bag or balloon can look like a jellyfish meal to a sea turtle. When they eat these plastics, they can suffocate or starve.

Between 1996 and 2003, 364 tons of marine debris was removed from the "kūpuna" islands. This is as heavy as 73 elephants!

Each year, millions of sea turtles, marine mammals, and seabirds ingest plastics that are mistaken as food or become entangled in marine debris. It doesn't have to be this way! Each one of us can help to solve the problem of marine debris!



How does our plastic debris end up in the stomach of an albatross?

*Photo by Robert Shallenberger/
USFWS*

What Can You Do?

- Reduce the amount of disposable plastic products you use.
- Pick up litter.
- Reuse and recycle.
- Volunteer for beach and stream clean-ups.
- Teach others about marine debris.
- Let others know why you should not intentionally release any type of balloon outside.



Leaving fishing nets and lines in the ocean is very harmful to wildlife.

Sources:

- <http://www.pacificwhale.org/childrens/fsdebris.html>
- <http://www.oceanconservancy.org/dynamic/feature/issues/debris/debris.htm>
- <http://www.epa.gov/owow/oceans/debris/>



Lesson 6.6: Results and Conclusions

Learning Objectives:

- 1) Students will be able to formulate and defend conclusions based on the evidence they gathered.

Duration: 1 hour

Materials:

- Human Impact Worksheet from Lesson 6.2

Teacher Procedure

Have the students fill in their findings from their data collection and conclude what they found. Was their hypothesis correct? Finally ask them to write what they recommend we do to care for the marine environment.