

Education



Kure Atoll Beach – State of Hawaii, DLNR

Grade Level

- 6-8, with options for 9-12

Timeframe

- Two 45-minute class periods

Materials

- Chart paper
- Student worksheets
- Clipboards (recommended) - one per group
- Graph paper (optional)
- Garbage bags - one per group
- Recycle bags - one per group
- Gloves (one pair for each student - work gloves preferred, but latex or plastic gloves would also work)
- Lesson 5 Presentation

Key Words

- Watershed
- Marine debris
- Stewardship

WINGED AMBASSADORS



OCEAN LITERACY THROUGH THE EYES OF ALBATROSS

Lesson 5: Campus Debris Survey

Activity Summary

In this lesson, students will go outdoors and examine the potential sources of marine debris on their own campuses. They will analyze what they find and create a campaign to educate other students about marine debris and our own behaviors.

Learning Objectives

Students will be able to:

- Collect and analyze debris on their school grounds.
- Make connections between campus debris, marine debris, and ocean wildlife.
- Define the term 'watershed'.
- Create a poster, brochure, or public service announcement to educate other students about how our own behaviors impact the ocean.

Outline

Engage – Litter and Albatross

Explore – Litter on Our School Campus

Explain – Analyzing Results

Elaborate – Our Litter and Albatross

Evaluate – Spreading the Word

Background Information

The amount of human trash in our oceans is increasing and affects many species, including seabirds and the fish we eat. The majority of marine debris comes from land sources. This includes intentional and accidental littering. Students will study their own school campus, and make connections to International Coastal Cleanup data as well as the albatross boluses that they examined in Lesson 4. The goal is for students to understand that changing our behaviors and choices can result in less marine debris and other pollution.

Preparation

- Gather materials for the campus debris survey
- Print Student Worksheets
- Visit campus locations to determine where you will have students gather debris. During this visit, decide which areas of campus you will send students to, how large of a plot groups should survey, etc.
- Share salient points of Lesson 4 with students, which focus on plastics and other litter consumed by seabirds.

**Note—you may wish to discuss this lesson with the school custodians to determine the days outdoor cleaning is conducted. Consider asking them to forgo cleaning up litter for a week or so to allow students to collect more data and for a greater learning impact.

Vocabulary

MARINE DEBRIS – any persistent non-natural solid material that is released into an ocean or large lake

BOLUS – mass of undigested material regurgitated by albatross chicks

RUNOFF – water flowing on earth's surface into bodies of water.

WATERSHED – the land area that drains into a body of water

Learning Procedure

Engage

(5 minutes)

Ask students to share what they learned about marine debris in Lesson 4.

Explain that today they are going to survey debris on their own campus.

Ask students:



What does litter on our own campus have to do with albatross?

Litter on land travels through wind and watersheds and can become marine debris.



What kinds of items do you think we will find on our campus?

Answers will vary widely.

Record student answers on chart paper in order to later compare findings to their predictions.

Extension

On average, albatross chicks weigh 4,000 grams and are fed 25 grams of plastic in the 4 months before they fledge. To illustrate this amount, create an activity to scale up to a human stomach.

For example: This is equivalent to a high school senior (140 lbs) ingesting the weight of 150 bottle caps (2.5 g). This can be illustrated in a math and unit conversion activity, where students use ratios to make comparisons between albatross and humans.

Alternatively, students can create a model. They can collect the number of bottle caps equivalent to their own body weight and display this in a jar or bag that represents their stomach.

Explore

(35 minutes)

Divide students into groups of about 3.

Explain to students the area(s) that each group will be responsible for and the length of time to spend in each area. The length of time will be of your choosing (suggested: 15 minutes). Leave enough time for a brief discussion before returning indoors.

Distribute gloves and trash/recycle bags, and review safety precautions, i.e., do not pick up anything sharp or potentially unsafe.

Distribute student worksheets and review the term “hypothesis,” as well as the data table. Suggest that they use tally marks to record numbers of items. Remind students that they will be recording data as they pick up litter.

See Student Worksheet (Explore)

As students work in their groups, monitor their progress.

Regroup with students and ask them to share some of their initial impressions of the experience.

Differentiation: With advanced students, consider measuring out equal areas of campus, i.e., quadrats, and calculating a rate of debris collection. This process introduces students to a common field technique used by scientists.

Explain

(30 minutes)

Create a class summary data table on the board and ask groups to record their findings.

Groups should work together to answer the

questions and create graphs. If using, distribute graph paper.

Review the graphs and questions as a class. Ask students to share some of the notes that they recorded while in the field. Point out that students collect both quantitative (numerical) and qualitative (descriptive) data, and that both are important.

Ask students to share their impressions of the data. Were they surprised by their findings? Why or why not?

Elaborate

(15 minutes)

Through discussion and by reading the passage on the student worksheet, help students to make connections between their campus debris survey, marine debris, and marine animals such as albatross.

Review questions 8 and 9 as a class.

Differentiation: Have advanced students analyze topographic maps of your local environment to determine where runoff flows.

? Which collected items might albatross (or other marine animals) eat?

? If your class completed the bolus analysis, did any of the items collected appear in the boluses you analyzed?

Answers may include bottle caps, Styrofoam, etc.

? Which collected items might entangle albatross or other animals?

Answers may include plastic bags, six pack holders, rope or string, etc.

Show students the slides that illustrate data collected by the Ocean Conservancy over the past 25 years, as well as impacts on marine organisms.

Ask students to make comparisons between their data and the data presented.

Ask students to talk with their group and to record some ideas for preventing this much debris from entering the ocean in the first place.

Discuss these ideas as a class. Which are feasible? Which are not?

Discuss the everyday materials that students and their family use.

? What are some things that you use that are only used once?

Answers may include plastic bags, water bottles, plastic utensils, straws, paper or plastic cups.

? Can they be replaced by other items/materials?

Many of these can be replaced, e.g., reusable bags, travel coffee mugs and water bottles.

? What does this have to do with litter and campus debris?

Single-use items are discarded and thrown in a landfill almost immediately. They also more often end up as litter.

Ask students how they might go about educating others about this issue.

Evaluate

(Homework)

Introduce the Evaluate task, to be assigned for homework, which is for students to create a public outreach campaign about litter and marine debris. If possible, work with the technology teacher to create videos, brochures, podcasts, or websites, or art teacher to create posters, sculptures or other means of expression.

See Student Worksheets (Evaluate)

- Students can then share their work with other students and school community members
- Rubric in student worksheet

Extension

- Explore a video about the fate of 3,000 pieces of garbage tracked with similar technology used to follow albatross - Track Trash by MIT: <http://senseable.mit.edu/trashtrack>
- Have students consider how to influence others about the way garbage is managed on the campus, or within your community. Perhaps the student council or an afterschool club could help to work on suggesting and implementing changes.
- Introduce students to Litterati, <http://www.litterati.org/>, a program in which citizens take photographs of litter that they clean up and post them online. These posted photographs become data points used to assess litter on land in diverse areas

Resources

- Marine debris information and education resources:
<http://www.marinedebris.noaa.gov>
- Make a plastic bag rope – video from 5 Gyres:
http://5gyres.org/education_and_exhibits/making_plastic_bag_rope/
- Education resources from Algalita Marine Research Foundation:
<http://www.algalita.org>
- Plastic Pollution Coalition Toolkit
<http://plasticpollutioncoalition.org/projects/plastic-free-campus/educators-toolkit/>

Credits and More Information

These lessons were developed for NOAA's Cordell Bank National Marine Sanctuary and Papahānaumokuākea Marine National Monument, by Meghan Marrero of Mercy College and Oikonos - Ecosystem Knowledge. This lesson cannot be used for commercial purposes. Permission is hereby granted for the reproduction, without alteration, of this lesson for educational use only on the condition its source is acknowledged. When reproducing this lesson, please cite NOAA's Office of National Marine

Sanctuaries and Oikonos - Ecosystem Knowledge as the source, and provide the websites below.

Data integrated into these lessons were provided courtesy of Michelle Hester (Oikonos), David Hyrenbach (Hawai'i Pacific University), Josh Adams (USGS), and David Anderson (Wake Forest University). Data from Tern Island, Kure Atoll and Cordell Bank were obtained in partnership with USFWS, State of Hawaii, and Cordell Bank NMS.

Special contributions of paintings and photography donated by Sophie Webb and high resolution images of albatross bolus contents donated by David Liittschwager.

Content created and reviewed by Meghan Marrero, David Hyrenbach, Michelle Hester, Carol Keiper, Jennifer Stock, and Andy Collins. Tracking and bathymetry maps were created by Pam Michael (Oikonos).

Graphics and design by NOAA, Tara Alvarez, and Greg Hester. We thank the many people who donated photographs, illustrations and video.

Some content was adapted from Oikonos' Albatross and Plastic Pollution Activities for the California Coastal Commission Science Activity Guide: Waves, Wetlands, and Watersheds.

Please contact Oikonos or NOAA to request further use of any images, art, videos, data or text included in the Winged Ambassadors activities.

We appreciate feedback, corrections and questions. Please email WingedAmbassadors@oikonos.org

Free lessons and resources available at:

<http://cordellbank.noaa.gov/education/teachers.html>

<http://oikonos.org/education>

<http://papahanaumokuakea.gov/education/wa.html>

Education Standards

Ocean Literacy Principles

- 1g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean.
- 6g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

California

Grade 6:

- 7a. Develop a hypothesis.
- 7b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- 7c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
- 7d. Communicate the steps and results from an investigation in written reports and oral presentations.
- 7e. Recognize whether evidence is consistent with a proposed explanation.

Grade 7:

- 7a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- 7b. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.
- 7c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
- 7e. Communicate the steps and results from an investigation in written reports and oral presentations.

Hawai'i

Grades 6–8:

2. Develop questions and hypotheses that can be answered through scientific investigations.
 - Design and conduct scientific investigations to answer questions or to test hypotheses.
 - Collect, organize, analyze and display data/ information, using tools, equipment, and techniques that will help in data collection, analysis, and interpretation.
 - Develop conclusions and explanations showing the relationship between evidence and results drawn.
 - Communicate and defend scientific procedure used and conclusion and explanation drawn from evidence.
3. Explain how methods for obtaining and using resources such as water, minerals, and fossil fuel have consequences on the environment.
4. Apply school, classroom, laboratory, and field trip rules, as appropriate, to maintain a safe learning environment.
 - Identify potentially unsafe conditions prior to the activity and explain how accidents can be prevented.
 - Use supplies, chemicals, and equipment as instructed and for the purposes they were intended under teacher supervision.

Education Standards

Next Generation Science Standards (NGSS)

Standards

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

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

Disciplinary

ESS3.C: Human Impacts on Earth Systems

Core Ideas

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Science &

Engineering

Practices

3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence

CrossCutting

Concepts

- Scale, Proportion, Quantity

Common Core State Standards

English

Language

Arts

Reading

CCSS.ELA-LITERACY.RST.6-8.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

CCSS.ELA-LITERACY.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-LITERACY.RST.6-8.9

Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic.

Writing

CCSS.ELA-LITERACY.WHST.6-8.1.A

Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

CCSS.ELA-LITERACY.WHST.6-8.1.B

Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

CCSS.ELA-LITERACY.WHST.6-8.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Education Standards

Common Core State Standards

Mathematics

Practices:

CCSS.MATH.PRACTICE.MP3

Construct viable arguments and critique the reasoning of others.

CCSS.MATH.PRACTICE.MP6

Attend to precision.

6th Grade

CCSS.MATH.CONTENT.6.SP.B.5

Summarize numerical data sets in relation to their context, such as by:

CCSS.MATH.CONTENT.6.SP.B.5.A

Reporting the number of observations.

CCSS.MATH.CONTENT.6.SP.B.5.B

Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

7th Grade

CCSS.MATH.CONTENT.7.NS.A.3

Solve real-world and mathematical problems involving the four operations with rational numbers.

Use random sampling to draw inferences about a population.

CCSS.MATH.CONTENT.7.SP.A.1

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population.

Understand that random sampling tends to produce representative samples and support valid inferences.

CCSS.MATH.CONTENT.7.SP.A.2

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*



Lesson 5: Campus Debris Survey

Name: _____ Date: _____

Explore

1. Hypothesis: We predict that the most common type of debris found on campus will be

Answers will vary

2. Use the data table on the next page to record items that you collect in the NUMBER column.

Use blank rows (create more if necessary) to count additional items, and the NOTES column to record any interesting observations.

It is easiest to use tally marks so you can record data as you go.

You will fill in the CLASS TOTAL column when you return to class.

Name: _____ Date: _____

Campus Area: _____

ITEM	NUMBER	CLASS TOTAL	NOTES
Food Wrappers & containers			
Plastic or glass bottles			
Plastic caps/lids			
Straws/stirrers			
Cigarette butts			
Plastic bags			
Cans			
Utensils , cups & plates			

Name: _____ Date: _____

Explain

3. Complete the CLASS TOTAL section of your table. Then, calculate the total number of items collected by your group and by the class and record them below.

4. Was your hypothesis supported or unsupported? Use data to support your conclusion.

Answers will vary, but be sure that students are using data from their data table to support their ideas.

5. What was the most frequently collected item? Least frequent?

Be sure students are referencing their data.

Name: _____ Date: _____

6. Which areas of campus had the most items? Why?

Answers will vary. Some common areas may include near the cafeteria or parking lot.

7. On graph paper or a separate sheet of paper, create a double bar graph to represent your results and the class results.

Elaborate

During a heavy rainfall, you have probably observed water flowing down the edges of roads. Where do you think that water goes? Rain that falls on the land goes to a few different places. Some of it is absorbed into the soil, where it can flow into plant roots or be stored.

Sometimes rain falls too fast and it cannot be absorbed resulting in flowing water. Water that flows along earth's surface is called **runoff**. The runoff flows downhill until it reaches a body of water, e.g., stream, river, bay, or ocean. Every body of water has an area of land that drains into it, a **watershed**.

Nearly all watersheds on earth eventually lead to the ocean. If you live near the coast, the water flows into local harbors or bays, and out into the sea. For those located inland or uphill, runoff flows into streams or creeks, *kahawai*. Streams flow into rivers and plains, and eventually flow into large lakes or the ocean. Native Hawaiians understand the important connection of mountains to sea, *uka to kai*. In fact, in traditional Native Hawaiian culture, land was divided into areas that stretched from the mountain to the sea, called an *ahupua'a*.

As runoff flows along the land, the water picks up materials. These materials can include loose soil, oil dripped into our streets, chemicals applied to plants, or litter. Next time it rains, pay attention to the runoff. You will probably observe some examples of human-produced materials flowing downhill. Picture these materials, such as the oil or litter, affecting animals such as seabirds.

Name: _____ Date: _____

8. Where (into which bodies of water) do you think your local watersheds lead?

Answers will vary. Help students to check their answers by showing your local area in Google Earth or Google Maps

9. Based on what you know about watersheds, why does the traditional Hawaiian practice of *ahupua'a* land division make sense?

Human activities uphill affect those downhill. So by dividing the land to include the whole watershed, each landowner is responsible for his/her own actions, and no one is receiving the effects of actions farther up the watershed.

10. What are some ways to take care of, *mālama*, the ocean, by preventing litter, such as the items you collected, from entering the ocean?

Answers will vary widely, but stress to students that they suggestion “actionable” ideas that are doable, e.g., work with the school to be sure there are more garbage and recycle bins outside, encourage students to bring their own water bottles to school, stop using straws in the cafeteria.

Non-actionable ideas that are too general include: use less plastic, reduce littering.

Name: _____ Date: _____

Evaluate

11. Create a public outreach message to teach the community about your study of litter and marine debris and ask them to take action.

- Consider using creative means to get your message across. These might include:
 - Artwork
 - A short video “commercial”
 - A podcast
 - A brochure
 - A billboard
 - A poster

- Be sure that your product is professional, i.e., neat, uses correct spelling and/or grammar, etc.

- Be sure to include:
 - an attention grabber
 - a specific action that you are asking your audience to do
 - scientific reasons for taking action
 - scientific data to support your idea

Name: _____ Date: _____

Criterion/ Score	4	3	2	1
Attention Grabber	Product includes an excellent attention-grabber that is well-aligned with the message and scientific data.	Product includes a good attention grabber that is aligned with the message and scientific data.	Attention grabber is unclear or not well-aligned with message.	Attention grabber is missing or inappropriate.
Action	Product includes a clear and specific call to action well-aligned with scientific data.	Product includes a call to action well-aligned with scientific data.	Call to action is unclear or could be better aligned with scientific data.	Call to action is missing or inappropriate.
Supporting Reasons	Product includes several clear supporting reasons for the call to action.	Product includes clear supporting reasons for the call to action.	Product includes reasons for the call to action.	Supporting reasons missing or inappropriate.
Scientific Data	Product includes clear, scientific data that clearly support the proposed call to action.	Product includes scientific data to support the call to action.	Some scientific data is provided.	Scientific data are missing or inappropriate.
Creativity, Message, and Professional Quality	Very creative product includes a clear, well-organized message. Product is very professional using excellent language, grammar, spelling, neatness, etc.	Creative product includes clear message and is professional, using appropriate language, grammar, spelling, neatness, etc.	Product includes some problems in professionalism, such as grammatical or spelling errors or problems with neatness or organization.	Product is not creative or professional for grade level.