

Plastic Garbage Patch Dissection Lesson Plan

1. Garbology Time Line/ Introduction

Objective: Demonstrate that when we throw trash away it doesn't really go "away;" it takes a long time to decompose.

Location: Anywhere that is not windy

Time: 10-20 minutes

Materials: Garbology Timeline Cards

Instructions:

Hand out the Garbology Timeline pictures so each student has one. Before you begin, have the student talk to their neighbors about how long they think the object they were given will take to decompose. Have the students introduce themselves, say what object they have, and how long they think it will take to decompose. Lay the Time Markers on the ground in order, ask students to put the cards in sequential order of decomposition rates. Each picture corresponds to a Time Markers: one picture per marker. *The decomposition rates are based on time first placed in a landfill until it is no longer recognizable.* Give the students time to set up the Timeline.

The order is as follows:

2-4 Weeks- Paper Towel

3-4 Weeks- Banana Peel

1 Month- Paper Bag

3 Months- Cotton

6 Months- Orange Peel (citrus hampers decomposition times)

3-14 Months- Rope Made of Natural Fibers

5 Years- Cardboard Milk Carton (Milk cartons are coated in wax, this adds to decomposition time)

10-12 Years- Cigarette Butt

25-40 Years- Leather Shoe (The leather is treated, adding to decomposition time)

30-40 Years- Clothing Made of Nylon Fabric

200-500 Years- Aluminum Can

450 Years- Plastic Bottle

550 Years- Disposable Diaper

800 Years- Monofilament Fishing Line

Unknown- Glass Bottle

Go through the timeline together and fix any errors; give the students a chance to correct some along the way if they would like.

Debrief Questions:

What were some of the biggest surprises?

Why do you think it takes so long for something like a plastic bottle to decompose?

Is there anything else we can do with this stuff instead of throwing it in a landfill? What?

Why don't people use those better ways to dispose of their trash?

Transition: (Walk and talk) If it doesn't end up in a landfill, where are some places that trash could end up?

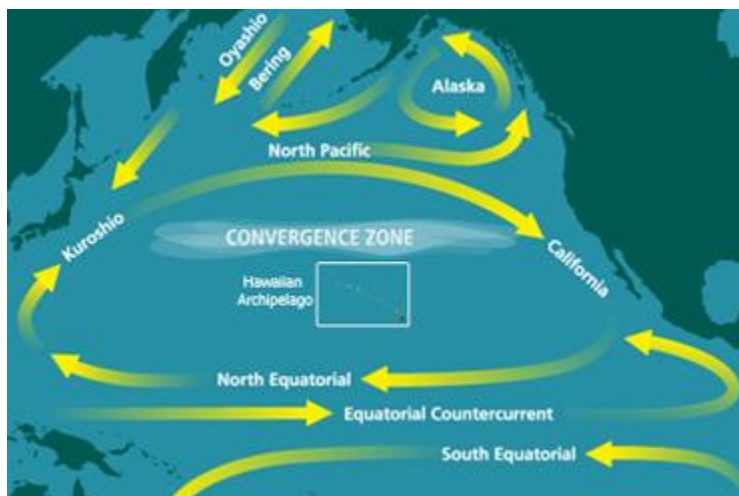
2. Bolus Dissection

Background:

Seabirds that feed on the surface of the ocean (dippers and scavengers), such as the black-footed albatross and Laysan albatross often mistake plastic pieces for food and feed plastics to their chicks. Birds that feed by diving for their food also eat plastic, however, surface feeders eat more plastic than divers.

Albatross chicks usually regurgitate a bolus (much like an owl pellet) right before they leave the nest and go to sea (fledge). Seabirds are ecological indicators in marine ecosystems and diet studies can highlight shifts in prey types and changes in abundance and distribution of prey. Seabirds can also be used to quantify changes in threats caused by increases in human use of coastal and open ocean ecosystems (e.g. plastic pollution).

The black-footed albatross eat flying fish eggs, squid, crustaceans, fish, and pelagic barnacles and take their food by scavenging and dipping at the surface. Laysan albatross also eat squid and both species feed their chicks by regurgitating squid, flying fish eggs, and fish larva into the chick's mouth. The chitinous beaks of squid resist digestion; undigested beaks, along with other indigestible items fed to chicks (e.g. plastic and fishing line) are retained in their stomach, which chicks regurgitate as a compacted mass, the bolus. Albatross chicks regurgitate a bolus when they reach a certain age or size, usually just before they fledge (leave the nest site to venture out to sea). Unfortunately, if the chicks consume too many plastic items before they are able to regurgitate them, they become more vulnerable to starvation. Note: cause of death is generally related to physiological stress due to blockage and satiation. By studying the contents of boluses, much information can be learned about seabird diets, however, we can also learn important information about human impacts on the pelagic, open ocean marine system, far from land.



The intact and dissected samples are actual albatross boluses, collected from Midway and Kure Atolls in the Northwestern Hawaiian Islands.

Plastic Garbage Patch:

Because of the way that gyres work in the Pacific, it creates something like a toilet bowl flush, converging anything that floats without a motor into the middle. The convergence zone shown in this diagram is where the Great Pacific Garbage Patch is located. The Great Pacific Garbage Patch is the world's largest collection of floating

trash and is primarily made up of plastics. It is often described as larger than Texas although there is no solid ground to stand on. You can not see it from space like some people claim. There are a total

of 5 convergence zones where plastic gather in the world's oceans. (*National Geographic, The Ocean Clean Up*)

Microplastics make up 94 percent of an estimated 1.8 trillion pieces of plastic in the patch (about 250 pieces of debris for every human in the world). But that only amounts to eight percent of the total tonnage. Of the 79,000 metric tons of plastic in the patch, most of it is abandoned fishing gear—not plastic bottles or packaging drawing headlines today. (*National Geographic*) The 79,000 metric tons is comparable to 500 jumbo jets (*The Ocean Clean Up*)

79,000 tons was four to 16 times larger than has been previously estimated for the patch. Fishing nets account for 46 percent of the trash, with the majority of the rest composed of other fishing industry gear, including ropes, oyster spacers, eel traps, crates, and baskets. Scientists estimate that 20 percent of the debris is from the 2011 Japanese tsunami. (*Scientific Reports*)

An estimated 100,000 marine animals are strangled, suffocated, or injured by plastics every year. (*National Geographic*)

Fishing nets can be dangerous for animals who swim or collide into them and cannot extract themselves from the net. Interaction with these discarded nets, also known as ghost nets, often results in the death of the marine life involved.

Through a process called bioaccumulation, chemicals in plastics will enter the body of the animal feeding on the plastic, and as the feeder becomes prey, the chemicals will pass to the predator - making their way up the food web that includes humans. These chemicals that affected the plastic feeders could then be present within the human as well.

The approximate environmental damage caused by plastic to marine ecosystems represents 13 billion USD. This figure included the cost of beach cleanups and the financial loss incurred by fisheries. (Julie Raynaud, "Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry")

Objective: To show the effect that plastics have on wildlife.

Location: Poley (somewhere indoors), open grassy area

Time: 30-35 minutes

Materials: Boluses, tweezers, laminated worksheets

Discussion: What are some things you notice/observe about the bolus? What is a bolus? How do you think it is formed? Why do you think we are looking at albatross boluses today? Before starting, form a hypothesis about what percentage of the total number of bolus items consists of plastic.

Instructions:

1. Show photos of Laysan albatross as adults and chicks-explain about pacific garbage patch.
2. Split the students into groups.
3. Give the following directions:
 - a. Write the names of your group members and your hypothesis at the top of the data sheet.
 - b. Carefully, put the contents from the Tupperware onto your sheet.

- c. Using your hands and tweezers, carefully sort items into separate piles: squid beaks, non-natural prey items (all the plastics), and fishing line. If you need to handle the bolus contents, do not touch your face until after you have washed your hands.
 - d. Sort the non-natural prey items into the categories listed on the data sheet.
 - e. Record the number of each item type on the data sheet
 - f. Compute subtotals for natural prey items and plastic items and compute the total number of bolus items. Record your data on the data sheet.
 - g. Compare the relative percentages of natural prey items and plastic present in the bolus. a. To calculate the percentage of natural prey items, divide the subtotal of natural prey items by the grand total and multiply by 100%. b. To calculate the percentage of plastic, divide the subtotal of plastic items by the grand total and multiply by 100%.
4. Review the data they found
 5. Ask the students to clean up their work area by replacing all of the bolus contents in the container. Have the students wash their hands.

Debrief Questions: What surprised you the most? How do you think this ended up in the ocean?

Transition: (Walk and Talk) Ask students to talk about a time that they asked for help because they couldn't do something by themselves. What was that like? What happened?

Discussion: Is cleaning up the oceans a one-person problem? What can we do to help?

3. Garbage clean-up/Survey

Objective: To show students how we can personally make a difference.

Location: Close to a waterway (i.e. delta, spring)

Time: 30-45 minutes

Materials: buckets (about 1 bucket for every 2 students), gloves

Instructions:

Take the students down to the delta or spring to collect trash. Give each pair of students a bucket and two sets of gloves. **Safety:** set boundaries, don't pick up glass or sharps (if they find these things, instruct them to get the teacher to pick it up). After you have collected enough trash, bring the buckets and children to Lower Taft. Empty buckets onto the ground carefully. Have the students sort the objects into three piles: compost, trash, recycling. You may have to review what each of these categories mean.

Debrief Discussion: What type of garbage did we find the most of today? Why do you think that is? What was the weirdest thing you found today? How many of you use some of these things in your daily life? What are some ways we can avoid the littering of our waterways?

Take the students to the recycling bin, talk about what you can and cannot recycle. Then visit the trash and dump your findings there. What were some of the things you found that you can reuse? Finally, go to the compost. Dump compost in, if you have any, and turn the compost.

Transition: How can we replace some of these products with something more sustainable?

4. Recycle Relay

Objective: Students will understand the relative amount of energy that goes into disposing our trash and which items can be recycled.

Location: Large open area

Time: 15 minutes

Materials: Bag of trash and 3 buckets - one labeled “recycle,” one labeled “reusable” and one labeled “trash.”

Instructions: The students will categorize items into either recyclable, reusable, or trash

1. Set up the 3 buckets and the labels before the activity begins. Divide your students into 2 teams. They will be in two parallel lines, facing the three buckets that have been placed on the ground in front of them. The buckets should be in the area in front of where the students will be standing but between the lines of students. Place the “Reduce” bucket closest to the students. The “Recycle” bucket is second and “Trash” should be placed the furthest distance away.
2. Tell the students that they will be sorting the trash into three categories: reusable, recyclable, and trash.
3. Divide them into teams. Place the bag full of items between the first students in the lines. Tell the students that each person will take a piece of trash and decide what category they should put it in. Then they should run to that bucket, put it inside and run back. Once they have reached their team the next person can go and that person goes to the end of the line
4. Once the game is over, bring the students to each bucket. Talk about the items inside and ask why they were placed there. Ask if items could be placed in another bucket.

Discussion: Which bucket took the most energy to place their trash in? Why do they think this is? Can all items be reused? What about recycled? How could they reduce the amount of trash that they produce?

Wrap Up: (Pair Share) What are some things that we can personally do to make a difference? What are some of the biggest surprises about what you learned today?