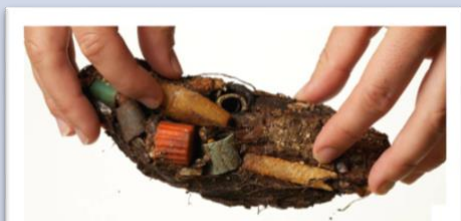


## Education



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### Grade Level

4-7

### Timeframe

1 hour

### Materials

Color printouts of bolus photographs OR ability for students to work at computer screens

### Key Words

- Bolus
- Gyre
- Marine debris
- Plastic pollution

# WINGED AMBASSADORS



OCEAN LITERACY THROUGH THE EYES OF ALBATROSS

## Lesson 4: Bolus Analysis

### Activity Summary

Prior to leaving the nest, albatross chicks regurgitate a mass of indigestible material called a bolus. Boluses give us clues as to the types of food and trash eaten by albatross parents at sea. In this lesson, students will use professional photographs of boluses, donated by David Liittschwager, to perform a “virtual dissection” and analysis. They will compare the amounts of prey and non-prey items found in several boluses. They will consider the sources of these non-prey materials and create a model of a bolus, with which they can educate others.

### Learning Objectives

Students will be able to:

- Explain that prior to fledging, albatross chicks regurgitate a mass of indigestible material called a bolus.
- This bolus provides a record of the items ingested by chicks.
- Note that nearly all albatross boluses include plastics.
- Define the term “marine debris” and indicate its sources.

## Background Information

Raising a chick is a very energy-intensive process for seabird parents. Adult albatross meet on breeding islands in the Northwestern Hawaiian Islands in late summer and fall. During that time, they engage in elaborate mating dances, and then they mate and produce an egg. Albatross pairs often mate for life. In a simple nest on the ground, the parents take turns incubating the egg for about two months, until the chick hatches. The chick remains on or near the nest for five to six months, depending on its parents to provide food from the ocean. The parents have been tracked flying thousands of miles in a matter of days to forage in productive ocean waters for food items like squid, fish eggs, and small fish near the sea surface. The parents produce energy-rich oil from their food, which they deliver in their stomach and regurgitate into the mouth of their chick back at the nest.

Back at the nest, chicks go from fluffy, soft plumage to more adult-like waterproof feathers. When the wind blows, they extend their long wings to exercise their breast muscles. By early summer, they are ready to go to sea for the first time, where they will remain for at least four years before returning to the colony to begin forming pair bonds. In preparation for leaving the nest (called fledging), chicks regurgitate a mass of undigested material collected in their stomach called a **bolus**. Boluses provide a record of the items ingested by the chick, including squid beaks, pumice, and fish bones that came from parents' foraging trips at sea.

Other animals have also evolved similar mechanisms to remove indigestible items from their stomachs. Owl pellets and cat fur balls are familiar examples. Unfortunately, nearly all boluses from Hawaiian albatrosses also include human-made trash such as fishing line and plastics. These floating items concentrate alongside albatross food items, and are scooped up and unintentionally fed to the chicks.

Ingesting trash can harm animals. In particular, scientists are beginning to learn more about how eating plastic can prevent healthy digestion, cause dehydration and increase pollutants in the animal's body. Seabird boluses are dissected to learn what they are eating and to study if the amount of plastic trash is increasing in the ocean. For this reason, albatross and other seabirds are ideal sentinels or bio-indicators of the health of the ocean because they travel across the ocean and sample marine debris along their journeys. By tracking their movements and dissecting their boluses, scientists are learning about albatross plastic ingestion.

### What is a Gyre?

The albatross your students are studying inhabit the North Pacific. Their movements and foraging behavior are greatly influenced by the patterns of wind and water in this ocean basin. For example, large circular systems of ocean currents, called **gyres**, are the result of the wind's push on the surface of the ocean. The wind transports the water (and anything else floating on it or drifting in it) around the ocean, following a circular path.

## Vocabulary

**FLEDGLING** – chick just about to leave (fledge) the nest

**BOLUS** – a mass of undigested material regurgitated by an albatross chick

**MARINE DEBRIS** – any persistent and solid material or item created by people and released (intentionally or unintentionally) into an ocean or large lake

**CURRENTS** – large masses of continuously moving ocean water (e.g., the California Current)

**GYRE** – a ring-like system of surface ocean currents driven by the wind. When water that is being pushed by the wind encounters a continent, the water flow turns to follow the coastline. This way, water travels around the gyre

## Explore

Explain to students that they are going to have the opportunity to analyze the contents of boluses through detailed photographs.

Show students the bolus photographs from the Black-footed Albatross found on the last 4 pages of this document, and ask them to describe what they see. Note to students that the black, hook-shaped items are squid beaks. Squid use their beaks to break up prey much like teeth. These are not digestible, and therefore are a normal finding in a bolus (a prey item).

Explain that students will be comparing the number of prey and non-prey items found in boluses. Students should try their best to identify each item they find in the boluses. As they identify each item, ask them to keep track of the number of each item they find, as well as whether it is prey or non-prey.

Refer to [this PowerPoint Presentation](#) for guidance on how to identify the items you see.

## Explain

Ask students the following discussion questions:

1. What were the most common non-prey items that you observed?
2. Where are the chicks getting the plastics and fishing line?
3. Where are these items coming from?
4. Who is responsible for this pollution?
5. Are you surprised by the amount of plastic found in the boluses?

## Credits and More Information

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