The Laysan Albatross

The Laysan albatross inhabits several islands in the Hawaiian Archipelago including Midway Atoll. It is a smaller species of albatross with a wing span of 195–203 cm. The life span of the Laysan albatross ranges from 40–60 years. Adults are considered to be monogamous and start producing offspring when they are around 8 years old. The courting process of mating pairs involves an intricate mating dance. Mated females typically produce one egg annually and rebuild their nests within a meter of their first nesting site. When eggs are laid, parents switch between taking care of the egg and finding food. They never leave the egg alone. After two months the baby albatross hatches, weighing approximately 190g.

Over the next three to four months, chicks grow rapidly, eventually weighing more than their parents. Parents take turns foraging for food offshore, traveling up to 900 kilometers and returning to feed their chicks every 2-3 days. Parents feed their young by regurgitating their stomach contents directly into the esophagus of their chicks. The Laysan albatross takes its first flight around the age of four months. The weigh of an adult albatross is approximately 2.4 kilograms.

Before they fly away from the colony, chicks regurgitate a mass of indigestible material that has collected in their stomach called a bolus. After the ejection of their first bolus, juveniles typically weigh around 2.0 kilograms and are light enough to fly. They then head out to sea for 3-5 years until they return to the island where they hatched.

Diet

The bulk of the Laysan albatross diet is squid (86cm-150cm). They also consume flying fish eggs, fish, and crustaceans. Scientists discovered that they are active during the day but primarily feed at night using their enhanced nocturnal vision to see shiny objects, including squid that surface at night. Like other sea birds, the Laysan albatross gets water through its food and not through the consumption of water.

Ingestion of Foreign Matter

Due to their nocturnal vision and foraging methods of looking for shiny objects, the Laysan albatross easily confuses and eats non-prey items like plastics, floating pumice stones, and wood. Fortunately, the albatross has a natural mechanism to remove the built-up mass of non-digestible food matter from its stomachs. This process is the creation and regurgitation of a bolus. A bolus is made up of these non-prey items, as well as natural items like squid beaks, shells, and bones. Around the age of four months, an albatross regurgitates its first bolus, which weighs and average of 96 grams.
**Conservation History**

High sea drift nets were responsible for the death of approximately 17,000 Laysan albatross annually. Due to large volumes of bycatch (fish and other organisms caught unintentionally while intending to catch other fish) of Laysan albatross and other organisms, high sea drift nets were banned in 1993. However, longline commercial fishing is still a major problem for the albatross. Baited hooks are ingested, and once hooked, the birds drown. Roughly 20,000 Laysan albatross are killed annually from commercial fishing. Restrictions have been placed on offshore longlines, and fishermen are restricted from placing shallow sets on the West Coast of the United States since 2004.

Plastic, a large source of pollution, is found in 97.6 percent of Laysan albatross chicks, but cannot be linked directly to their death. It is scientifically difficult to determine a correlation between plastic and death rates because of the chicks’ ability to form a bolus and regurgitate it. Scientists believe that chicks and adults suffer from malnutrition because they feel full from the plastics in their stomachs. It has been suggested that juveniles do not beg for as much food from their parents as needed, leading them to be fed less and die from dehydration and starvation. There are, however, clear connections between the negative health effects of sharp pieces of plastic perforating their stomach lining and lead poisoning from paint. The paints’ original source is either from old Midway military buildings or plastic.

Conservation efforts have made large strides in recent years. According to the IUCN (International Union for Conservation of Nature), Laysan albatross were on the *Vulnerable* list in 2008, and have now improved to a status of *Near Threatened*. Despite this development, the health of the Laysan albatross is still a major concern, and conservation efforts will need to continue in order to stop the decline of this species.

**Sources**


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Background Information

Marine debris is any manufactured solid material that enters the marine environment, either intentionally or unintentionally. It has become one of the most pervasive pollution problems facing the world's oceans and waterways. A variety of marine debris, especially plastics, can be found in large quantities throughout the ocean and can cause severe problems for marine organisms, including the laysan albatross, that ingest it. Scientists are learning more about these impacts by collecting and dissecting albatross boluses.

Prior Knowledge

- None

Recommended Prior Activities

- Marine Debris: A Legacy of Litter

Vocabulary

<table>
<thead>
<tr>
<th>Term</th>
<th>Part of Speech</th>
<th>Definition</th>
<th>Encyclopedic Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Pacific Garbage Patch</td>
<td>Noun</td>
<td>area of the North Pacific Ocean where currents have trapped huge amounts of debris, mostly plastics.</td>
<td>Encyclopedic Entry: Great Pacific Garbage Patch</td>
</tr>
<tr>
<td>marine debris</td>
<td>Noun</td>
<td>garbage, refuse, or other objects that enter the coastal or ocean environment.</td>
<td>Encyclopedic Entry: marine debris</td>
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</table>
What You’ll Need

Materials You Provide

- Pencils

Resources Provided

The resources are also available at the top of the page.

Audio & Video

- SchoolTube: The Great Pacific Garbage Patch—Good Morning America
- Bolus Dissection: Breaking the Bolus
- Bolus Dissection: Squid Beaks
- Bolus Dissection: Plastic Pieces

Images

- Bolus Dissection

Handouts & Worksheets

- The Laysan Albatross
- Albatross Bolus-Dissection Activity Sheet

Websites

- National Geographic Education: Encyclopedic Entry—Marine Debris

Required Technology

- Internet Access: Required
- Tech Setup: 1 computer per classroom, Projector, Speakers
- Plug-Ins: Flash

Physical Space

- Classroom

Grouping

- Large-group instruction

Other Notes

Before starting the activity, download and queue up the video and photo galleries.
Subjects & Disciplines

- Geography
  - Human Geography
  - Physical Geography
- Science
  - Biology
  - Ecology
  - Oceanography

Learning Objectives

Students will:

- identify sources and examples of marine debris
- describe how marine debris affects the life and health of the laysan albatross
- predict negative impacts marine debris has on other ocean organisms
- discuss how humans contribute to and help solve problems associated with marine debris

Teaching Approach

- Learning-for-use

Teaching Methods

- Discussions
- Information organization
- Multimedia instruction
- Reading

Skills Summary

This activity targets the following skills:

- 21st Century Themes
  - Global Awareness
- Critical Thinking Skills
  - Analyzing
  - Understanding
- Geographic Skills
  - Acquiring Geographic Information

National Standards, Principles, and Practices

National Geography Standards

- Standard 1:
  How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information
- Standard 14:
How human actions modify the physical environment

• **Standard 8:**
  
  The characteristics and spatial distribution of ecosystems and biomes on Earth's surface

*National Science Education Standards*

• **(9-12) Standard C-4:**
  
  Interdependence of organisms

• **(9-12) Standard F-4:**
  
  Environmental quality

• **(9-12) Standard F-5:**
  
  Natural and human-induced hazards

*Ocean Literacy Essential Principles and Fundamental Concepts*

• **Principle 6d:**
  
  Much of the world’s population lives in coastal areas.

• **Principle 6e:**
  
  Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

• **Principle 6f:**
  
  Coastal regions are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, sea level change, and storm surges).

• **Principle 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.
1. Activate students’ prior knowledge.

Have students brainstorm different types of debris, or trash. List their ideas on the board. Ask:

- *How does trash get into the ocean? Where does it go? How does it travel?*
- *What impact does trash (marine debris) have on the ocean and organisms in the ocean?*

Elicit from students that trash that does not make it to a landfill can become litter found along the sides of roads or in waterways, eventually ending up in the ocean. Emphasize that no matter where litter comes from, wind, streams, and ocean currents carry litter throughout the globe, including the ocean and coasts where it becomes marine debris.

2. Build background about marine debris and the albatross.

Have students view SchoolTube's *Good Morning America* video, "The Great Pacific Garbage Patch" (4 minutes, 30 seconds total; stop after 3 minutes, 30 seconds). As they watch, have students note the types, shapes, and sizes of marine debris they see. Briefly discuss student observations. Next go to the NG Education encyclopedic entry for *marine debris*. Invite volunteers to read aloud a couple of the captions related to marine debris as you click through the photo gallery. Show the albatross carcass image and read the caption to the students. Tell students that they will observe the dissection of an albatross bolus. Explain that a *bolus* is formed from undigested materials that the bird then regurgitates as part of its normal feeding process. Distribute and allow students time to read the provided Laysan Albatross fact sheet. Ask students to share facts that they found interesting after reading about this species’ life history, especially its diet. Explain that albatross are carnivores that feed mostly on squid and fish but also consume floating garbage, either intentionally or unintentionally.

3. Introduce and provide context for the virtual bolus dissection activity.

Distribute the Albatross Bolus-Dissection Activity Sheets. Explain that the albatross bolus is composed of animal parts albatross cannot digest, like squid beaks, and other materials they eat accidentally, like rocks and wood. As trash and plastics accumulate as marine debris, albatross accidentally eat these materials. Marine debris is found with more frequency in regurgitated bolus. Use the worksheet to focus student attention:

- Before viewing the dissection, tell students to record hypotheses about the types of items that they think they will find in the bolus and the reason for their predictions.
• While observing the virtual dissection, tell students to pay close attention to the number of plastic items versus natural items extracted from the bolus, and the size and color of these items.

4. Have students view the virtual bolus dissection flipbooks and photo gallery.

View the dissection media in the following order, allowing students time to complete their worksheets:

• Flipbook: Opening the Bolus
• Flipbook: Squid Beak Extraction
• Flipbook: Foreign Materials Extraction
• Bolus Dissection Photo gallery

5. Have students discuss and draw conclusions about the virtual bolus dissection.

After students have completed the Albatross Bolus worksheet, lead a discussion of their findings and conclusions. First ask students to summarize the ways in which marine debris affects the life and health of the laysan albatross. Then ask:

• Why would plastics be a problem if ingested by the albatross?
• Do you think that the bird that regurgitated this bolus felt full?
• What are the health implications of a bird “feeling full” after eating the materials that were extracted from the bolus?
• What have you heard about BPAs or other plastic leaching agents?
• Could these toxic substances create health problems for the albatross? How? Why?

6. Have students reflect on what they have learned.

Ask:

• Could marine debris and the substances it contains create health problems for other ocean animals? Which ones? What about humans?
• What is being done to combat the global problem of marine debris?
• What can you do to combat the global problem of marine debris?

Informal Assessment
Assess students' completed Albatross Bolus-Dissection Activity Sheets for completion and accuracy.

**Extending the Learning**

Have students go to the [NOAA Marine Debris](https://www.noaa.gov) website to read more about other impacts of marine debris, including wildlife entanglement, alien species transport, and economic threats. Have students research programs and organizations working to combat the negative impacts of marine debris. Ask them to share what they learned with the class.
Name: ________________________________
Date: ________________________________

The bolus used for this virtual dissection was expelled by a four-month-old Laysan albatross on Midway Atoll in Pacific Ocean in the summer of 2010.

Instructions
1. **Hypothesis:** A bolus contains materials the albatross eats that cannot be digested. What kinds of items would you expect to find in the bolus?

2. Look over the data sheet and the type of information you will need to record while viewing the virtual dissection. Pay close attention to the types, color, size, weight, and quantity of the items that are removed from the bolus specimen.

3. Record the following information while viewing the dissection of the bolus.

<table>
<thead>
<tr>
<th>Bolus measurements (before dissection)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (in grams)</td>
<td></td>
</tr>
<tr>
<td>Length (in cm)</td>
<td></td>
</tr>
</tbody>
</table>

| List the materials extracted from the bolus |          |
| Length of a squid beak (in cm)            |          |
| Weight of squid beaks (in grams)         |          |
| Weight of natural non-prey materials such as wood and stones (in grams) |          |
| Weight of fishing line (in grams)        |          |
| Weight of all plastics (in grams)        |          |
| Weight of unidentified debris            |          |
| Length of the piece of a bottle          |          |
| List other plastic items collected near the bolus location |          |
4. **Analysis:** Respond to the following questions.

   a. What colors did you find in the bolus?

   b. How many pieces of plastic were colored and/or shiny?

   c. What percentage of bolus was made of plastic?

   d. What percentage was made of prey items?

   e. What was the weight of all of the unnatural items combined?

   f. What percentage of the total weight of the bolus were the unnatural items?

   g. Do you think this bird ate more squid or more plastic? Why?

5. **Conclusions:** Do you think that the bird that expelled this bolus is well-nourished? Why?