Lesson 4: Bolus Analysis

Name: _____ **Date:** _____

Engage

Read the following information:

Albatross parents are incredibly invested in raising their chicks. On the Northwestern Hawaiian Islands, adult albatross meet on breeding islands in the late summer and fall. They perform elaborate mating dances as they court and then produce an egg. The egg in laid in a nest on the ground. During this time, two parents take turns keeping the egg warm, allowing the chick inside to develop for two months.

Once the chick hatches, it stays on or near the nest for 5-6 months. During this time, the parents take turns flying thousands of miles to gather food for their chicks. Depending on the species, favorite food items include squid, fish eggs, and fish that they catch near the water's surface. Large albatross cannot dive underwater very far so most of their food comes from the sea surface. Chicks stay at the nest waiting for their meals.

As the chicks grow, they lose their fluffy, downy feathers and begin to look more like the adults. They begin testing their wings in the wind and are finally ready to take off to the sea and fend for themselves. Before they leave the nest, or **fledge**, the chicks regurgitate a mass of undigested material from their stomach. This mass is called a **bolus.**

Watch the video of a chick on Kure Atoll regurgitating a bolus.

Black-footed Albatross chick, almost fully grown, begging for food from its parent on Kure Atoll, Northwestern Hawaiian Islands.

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Explore

Your teacher will give your group one or more photographs/projections of dissected albatross boluses. Answer the questions below to guide your analysis.

1. Carefully observe the photographs and describe a whole bolus. Describe what you observe.

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2. Observe the close-up photograph of the squid beak. Write a very detailed description of it.

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Next, you will analyze a bolus that a scientist has dissected.

3. Record the species and colony (where your dissected bolus was found) in the data table.
   BFAL = Black-footed Albatross
   LAAL = Laysan Albatross
   Kure = Kure Atoll Colony
   Tern = Tern Island Colony

4. Observe your dissected bolus carefully. Describe what you see.

_____

_____

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_____

Sort and categorize your bolus and record your findings in the data tables.

Category descriptions:
Plastic Items:
Plastic Fragments – Rigid and hard complete or broken pieces in any shape (caps, broken bottles, toys)
Plastic Foams – Compressible and aerated plastic in any shape (packing foam, rubber)
Plastic Sheets – Flexible, flat and thin sheet of plastic (pieces of plastic bags or tarps)
Plastic Lines - Round single or multi-filament line or rope (unraveled fishing nets)

Prey Items – Hard parts from the food they eat
Squid Beaks – Hard upper and lower beaks of squid
Lenses – Hard eye lenses from fish and squid

Other Items (Non-plastic and Non-prey):
Seeds, Wood, Pumice, or other items that may float (not plastic)

5. a. Count the number of plastic items. Count by type (fragments, foam & rubber, and sheets) or combine all plastic as time allows. Analyze plastic line using a different method described below because it cannot be counted.

   b. Count the number of squid beaks and eye lenses. If this is difficult, devise a way to count in smaller sections or grids (quadrats).

   c. Count the number of "other" items that are not plastic or from an animal.

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Colony: **Species:**				
	Plastic Items Fragments, Foam, Rubber, Sheets * use different method for line	**Prey Items** Beaks, Lens	**Other Items** Seeds, Pumice, Others	**Total**
	Count	Count	Count	Count
Partner or Quadrat Data A				
Partner or Quadrat Data B				
Partner or Quadrat Data C				
Partner or Quadrat Data D				
Total Count Entire Bolus				
% of Total				100%

Name: _____ Date: _____

Colony:

Species:

	Plastic Items * use different method for plastic line			**Prey Items**		**Other Items**	**Total**
	Fragments	Foam, Rubber	Sheets	Squid Beaks	Eye Lenses	Seeds, Pumice, Other	
	Count	Count	Count		Count	Count	Count
Partner or Quadrat Data A							
Partner or Quadrat Data A							
Partner or Quadrat Data A							
Partner or Quadrat Data A							
Total Count Entire Bolus							
% of Total							100%

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6. Plastic line is a difficult category to count. Estimate the amount of plastic line in your bolus by measuring the area (length x width). Area is related to volume in the bird's stomach.

Colony: **Species:**		
	Plastic Line Area (L x W)	**Total** Area (L x W)
Partner or Quadrat Data A		
Partner or Quadrat Data B		
Partner or Quadrat Data C		
Partner or Quadrat Data D		
Total Area of Flat, Sorted Bolus		
% of Total		100%

7. Are there any non-prey items that you can identify the source? If so, list them below:

_____

_____

_____

_____

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Explain

8. Using the class data, calculate the percentage of prey vs. non-prey items in all of the boluses the class observed. Create a data table below in which you record your findings.

9. Using the class data, compare the area/size of plastic line in all the boluses.

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10. Why do you think there are so many plastic items?

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11. Where do you think the plastic items are coming from?

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Elaborate

12. How would you explain what marine debris is, and where it comes from, to a 2nd grader?

_____

_____

_____

_____

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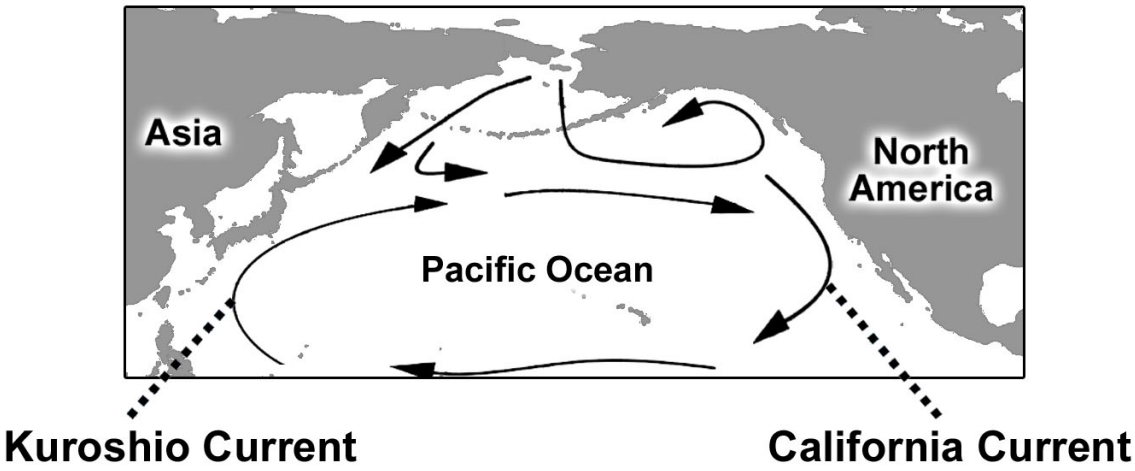
13. What are the major sources of marine debris and plastic?

_____

_____

Observe the slides showing large-scale movement of water in the North Pacific. Large masses of continuously moving ocean water are known as **currents**. At the ocean's surface, winds drive these currents. In the North Pacific, these currents include the Kuroshio Current and the California Current, which are shown on the map below.



As you can see in this example, the ocean currents form several large circulations, **gyres**, around the North Pacific basin. The winds push the water, and everything floating in it, around the ocean in this circular path. The materials traveling around the ocean unfortunately include our trash.

14. How would you describe a gyre to a 2nd grader?

_____

_____

_____

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15. How would you suggest addressing the marine debris problem? Use scientific evidence to support your suggestion.

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16. In several scientific studies since 2008, biologists found that 100% of boluses thrown up by albatross chicks in the Northwestern Hawaiian Islands contained plastic trash and 52–66% of the bolus weight was plastic.

    a. How do these findings compare to your data? Use evidence from your data tables to support your comparison.

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_____

    b. How might eating and storing plastic inside the stomach affect a seabird chick?

_____

_____

_____

_____

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Evaluate

Based on the photograph analysis you did:

Using materials of your choice, build a creative model of an albatross bolus. This model should introduce your audience to the idea of albatross boluses and what they typically contain. Consider using materials from your school or home recycling bin.

Your model must include:

- A placard, similar to what you might see at a museum exhibit, which explains what your audience is looking at. The placard will describe:
    - what an albatross is and where they live
    - what an albatross bolus is
    - why scientists study albatross boluses
    - what albatross boluses contain
    - what marine debris is and why it is a problem
    - a key for others to interpret items in your model

- Be sure your placard is neat and organized, and uses appropriate vocabulary, spelling, and grammar