ACTIVITY 9

Bountiful Birds

Estuary Principle

Estuaries support an abundance of life, and a diversity of habitat types.

Research Question

How have birds adapted to survive in estuary habitats?

Introduction

Our nation's estuaries and wetlands are home to many different bird species. One of the most important estuary habitats for birds is the salt marsh. Birds are drawn to the salt marsh by the abundant food sources found there. Fish, shellfish, worms, shrimp and crawfish, crabs, and other marine organisms that live in the salt marshes are important food sources for many different types of birds.

Many types of birds come to the salt marshes to eat. There are the wading birds, such as the herons and egrets. There are shorebirds, such as the willets. And there are migratory birds that seasonally feed in the estuary, such as ducks and geese. Students will engage in a role-playing activity to model different bird beaks and then compare and contrast the great blue heron and osprey with other birds living in the estuaries.

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This curriculum was developed and produced for:

The National Oceanic and Atmospheric Administration (NOAA) and The National Estuarine Research Reserve System (NERRS)

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TEACHER GUIDE

Bountiful Birds

Research Question

How have birds adapted to survive in estuary habitats?

Content Objectives

Students will understand that:

- Birds have basic needs for air, water, food, protection from predators, and a place in which to breed.
- Estuary habitats, such as the salt marsh and the mangrove swamp, meet the survival needs of many birds.
- Birds have adaptations that allow them to efficiently feed in specific estuary environments. Beaks differ in design depending on where the bird feeds and the function for which the beak is used.

Exercises

Exercise 1: Adaptation Is For the Birds

In this exercise, students engage in a role-playing activity to model different bird beaks. Students will see how differently shaped beaks are needed by birds to acquire the many different food sources found in the different estuary habitats.

Exercise 2: Great Birds of the Estuaries

In this exercise, students compare and contrast the great blue heron and osprey with other birds living in the estuaries. Students will see the different estuary habitats these birds inhabit and the adaptations the birds have evolved to help them survive in these dynamic estuary environments.

Assessment Questions

Assessment questions based on content covered in *Bountiful Birds* can be downloaded on the web page for this activity in the Middle School Curriculum section of the Estuary Education website at estuaries.noaa.gov.

Vocabulary

Adaptation – an inherited change in a living thing that helps it survive better in its environment.

Abiotic – refers to non-living characteristics of a habitat or ecosystem that affect organisms' life processes.

Behavior – the way an animal acts, especially in response to something in its environment.

Biotic – refers to relationships among organisms that affect their survival.

Bird of Prey/Raptor – a predatory bird that uses its beak and talons to catch and eat other animals.

Colony – a group of birds nesting together in the same place at the same time.

Ecosystem – the biotic community and its abiotic environment.

Estuary – a partially enclosed body of water where two different bodies of water meet and mix.

Habitat – the particular part of the environment where a plant or animal naturally lives.

Migration – the movement of living things from one place to another, commonly with changing seasons.

Predator – an animal that hunts, kills, and eats other animals.

Prey – an animal that is hunted, killed and eaten by other animals.

Rookery – A colony of breeding animals, particularly birds.

Watershed – area of land where water is drained by a river or river system, lake or estuary.

Wading Bird – a bird that hunts its prey by wading or standing still in fresh or brackish shallow waters.

Taking It Further

Educate with Drama!

Allow your students to be creative as they craft costumes that depict the many adaptations of great blue herons, ospreys, and other birds! Allow each student to choose a bird species. Next, the student researches the bird's adaptations and creates a costume. But remember, the idea is to be creative! For example, a hook might be used for the beak of an osprey to indicate its shape. A different student might choose to use a set of silverware as the osprey beak to show that an osprey uses its beak to tear its prey apart. The keen eyesight of an osprey could be represented by a pair of binoculars. A hollow cardboard tube attached to a costume's arm could represent the idea of a bird's hollow bones. Choose a day for all of your students to wear their bird costumes and tell the rest of the class the symbolism behind each of their costume's components.

Christmas Bird Count Data

The National Audubon Society's mission is to "conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats for the benefit of humanity and Earth's biological diversity." You and your students can join the Audubon Society's Christmas Bird Count. From December 14 through January 5 each year, tens of thousands of volunteers throughout the Americas take part in an adventure that has become a family tradition for over 100 years. Check out http://birds.audubon.org/ to join in the bird count and find the day your local Audubon Society is conducting its count.

International Migratory Bird Day

The signature program of Environment for the Americas (EFTA), International Migratory Bird Day, is the only international education program that highlights and celebrates the migration of nearly 350 species of migratory birds between nesting habitats in North America and non-breeding grounds in Latin America, Mexico, and the Caribbean. Each year, IMBD explores a different aspect of migratory birds and their conservation. For more information, visit http://www.birdday.org/.

EXERCISE 1

Adaptation Is For the Birds

Estuary Concept

Estuaries are a rich source of food for a wide variety of birds.

Focus Question

How do beak adaptations help birds thrive in different estuary habitats?

Performance Tasks

Students will:

- Model different bird beak designs to see which type of beak is useful to the bird looking for particular types of food.
- Choose an estuary bird and describe how the structure and function of that bird's beak helps identify the habitat in which the bird lives and the type of food it likely eats.

Teacher Background

Beaks are lightweight, multifunctional, bony extensions of a bird's skull. A broad, flattened beak is called a bill. Beaks are useful to the bird for many things, only some of which involve eating. Birds have no teeth. The food they eat, they swallow whole and grind up in their stomachs.

Birds use their beaks like hands to pick things up or to catch or turn things. Beaks can be used to crush or break things. They can be used to strain material out of water or rip things apart. They can be used to drill holes, spear things, and move things aside. Birds use their beaks to build nests, to communicate, to preen their feathers, and to care for their young. Sometimes beaks are used in courtship; sometimes they are used in defense.

The shape of a bird's beak or bill is a clue to how it's used. A short, thick beak is used by seed-eating birds to crush seeds. Insect-eating birds have slender, pointed beaks that allow them to pick up insects or get insects out of wherever they're hiding. Broad bills are useful for straining food out of water and mud. Hooked beaks are useful for tearing apart the flesh of prey. Wading birds, such as herons and egrets, have long sharp bills that are useful for spearing fish and frogs.

Overview

Students will learn about the different functions of a bird's beak to see how bird beaks are adapted to food sources within the different estuary habitats. Students will engage in a role-playing activity to model different bird beaks, allowing them to see firsthand how different-shaped beaks are suited for a variety of food sources in the estuary.

Time Required

One 45-minute class session

Teacher Preparation

Gather the materials listed. Obviously, you can choose to substitute non-food materials for the marshmallows and raisins as long as the alternative material serves the same purpose as a bird food model. For example, large pieces of foam might be used instead of marshmallows; the important point is that the material "stands in" for a type of bird food that a raptor would need to rip apart or shred before eating.

Divide students into groups of four.

Procedure

1. Explain to students that birds, like other animals, need food. Food varies in what it is and where it is found. Bird beaks are adapted for different types of food sources.
2. Each student in the group should choose a beak from the four different beak designs (toothpick, tweezers, etc.). The student will use that "beak" throughout the entire exercise and try to identify which type of bird uses that type of beak.
3. Have all of the groups begin the exercise with the same food source. Students can decide which beak type will go first, but all four beaks will have a chance to "eat" each food type.
4. When you give the signal, the first students will have 30 seconds to try using their beak to pick-up the food in the cup and transfer it to the container with the narrow opening, which is representing the bird's gullet and stomach.
5. At the end of 30 seconds, tell students to stop "eating" and put their beaks down.
6. Repeat Steps 3 and 4 for the other three beak types, each with the same food source as the first beak.
7. Once all four "birds" have tried eating the food source, have students in that group discuss how well each beak functioned with that type of food by answering the following questions:
   - Was your beak well adapted to eating this type of food? Why or why not?
   - Do you think your bird would survive eating this food?
   - If, not how would you adapt the beak so the bird would survive?
8. Now it's time for all of the groups to change to the next food source. Have all students take out the cup with the next type of food. Repeat Steps 3 to 6.
9. Repeat Steps 3 to 6 until students have tried to "eat" all four food sources.
10. Discuss the following question with the class: "How do different beaks help birds get food in different estuary habitats?"

Materials

Per group of students

- Pair of scissors (to represent beak of predatory bird)
- Pair of tweezers or a clothes pin (to represent beak of seed-eating bird)
- A toothpick (to represent the beak of an insect-eating bird)
- A plastic spoon (to represent the beak a bird that strains food from water)
- One large marshmallow (to represent a fish or a small mammal that is prey for raptors)
- A cup of dried beans (to represent seeds)
- A cup filled with shredded paper and raisins (to represent insects in grass or mud)
- Styrofoam packing pieces floating in a cup or deep dish of water (to represent insects at the water's surface)
- Container with narrow opening, such as a plastic Erlenmeyer flask or perhaps a plastic salad dressing bottle. (The opening should be smaller than a whole large marshmallow.)

EXERCISE 2

Great Birds of the Estuaries

Estuary Concept

Bird species have adaptations that allow them to feed and survive in estuary habitats.

Focus Question

How are birds adapted to feeding in different types of estuary habitats?

Performance Tasks

Students will:

- Compare and contrast the great blue heron with the osprey and other birds in estuary habitats.
- Choose an estuary bird and describe how the structure and function of its beak helps identify the estuary habitat where the bird lives and the resources it uses.

Teacher Background

Many different habitats are found in and adjacent to estuaries, including shallow open waters and lagoons, mangrove swamps, salt marshes, mud flats, oyster reefs, beds of sea grass or kelp, sandy beaches and rocky shores, etc. These estuary habitats are varied, but provide for an abundance and diversity of wildlife.

Our nation's estuaries and wetlands are home to many different bird species. One of the most important estuary habitats for birds is the salt marsh. Birds are drawn to the salt marsh by the abundant food sources found there. Fish, shellfish, worms, shrimp and crawfish, crabs, and other marine organisms that live in the salt marshes are important food sources for many different types of birds.

Many types of birds come to the salt marshes to eat. There are the wading birds, such as the herons and egrets. There are shorebirds, such as the sandpipers and plovers. And there are migratory birds that seasonally feed in the estuary, such as ducks and geese.

Overview

In this exercise, students compare and contrast the great blue heron and the osprey with other birds feeding and living in the estuaries. Students will see the different estuary habitats these birds inhabit and the adaptations the birds have evolved to help them survive in these dynamic estuary environments

Time Required

Two 45-minute class sessions

Teacher Preparation

Enlarge the Teacher Master: *Estuary Habitats* to create a poster-sized version of the diagram. One way to do this is to project the image onto white roll drawing paper or butcher paper and to trace the lines with marker. Label the four estuary habitats (mud flat, salt marsh, barrier-island, and mangrove forests). Have a place to hang your poster-sized diagram in your classroom, but don't hang it until students have completed their versions of the map.

Duplicate the Teacher Master: *Estuary Bird Cards*. Cut the estuary bird cards apart and place the bird cards in a small paper bag. Do not place the osprey or great blue heron cards into the bag; you will use those to demo the exercise. Students will be reaching into this bag to randomly choose bird cards during the exercise.

Preview the *Narragansett NERR Osprey* Power Point presentation that you will find on the web page for this activity on estuaries.noaa.gov. This discusses the life of estuary ospreys, including their life history, threats to ospreys, and banding programs and data.

You'll find multimedia and other resources for this activity in the Middle School Curriculum section of the Estuary Education website: http://estuaries.noaa.gov.

Procedure

1. Show your students the *Narragansett NERR Osprey* Power Point presentation. Call particular attention to the discussion of the osprey's habitat within the estuary.
2. Divide the class into teams of two students per team.
3. Give each team a copy of Student Master: *Great Birds of the Estuaries*. Have the student teams read the description of the five major estuary habitats and label the estuary habitats diagram on the Student Master.
4. Hang the large Estuary Habitat diagram on the board and have student teams check their estuary habitat labels against the labels on the large version of the diagram.
5. Show students the bird cards for the osprey and great blue heron. Tape the cards for those two birds onto the estuary habitats diagram. Take the image of the osprey and tape it onto the diagram in the lagoon. Tell students that this is the osprey's preferred estuary habitat for finding and catching its food. Take the card for the great blue heron and tape it onto the diagram in the salt marsh. Tell students that this is the heron's preferred estuary habitat for finding its food.
6. Ask your students why they think the osprey and the great blue heron prefer to feed in these two estuary habitats. Remind students that bird beaks are adapted for different types of food sources. Herons use their long, slender spear-like beaks to "stab" the water for small fish, shrimp, and crabs. Herons like hunting for food along the edge of marshy pools where they can find prey in the shallow water. Ospreys are a different kind of predator. They have sharp, curved beaks for tearing apart fish to eat, as well as special talons to grab the fish out of the water and carry them away to eat or feed to their young back in the nest. Ospreys hunt for their prey in deeper water, sometimes in lagoons or near the barrier islands. Remind students that beaks are not the only bird feature that displays adaptation. Bird feet, wings, color all vary depending on the habitat in which the bird lives and feeds.

Materials

- Enlarged version of Teacher Master: *Estuary Habitats*
- Teacher Master: *Estuary Bird Cards*, cut apart
- Assorted bird reference books containing information on shore birds
- Computers with Internet access for students to use in researching birds

Per student team

- Student Master: *Estuary Habitats*

Remind students that while birds can fly to any part of the estuary and its habitats they do have a preferred location for finding food.

7. Have each student team draw a random bird from your bag of estuary bird cards. Tell the students that they need to research the bird and attempt to identify the bird's preferred estuary feeding habitat.
8. Each team should prepare a short, three-minute presentation to give to the class to tell about the team's bird and that bird's preferred habitats. When each team is done presenting, the team should tape their bird card onto the large estuary habitat diagram to show the habitat in which that bird feeds.

Questions and Possible Answers

Q1. Why do different types of birds feeding in the estuary habitats differ?

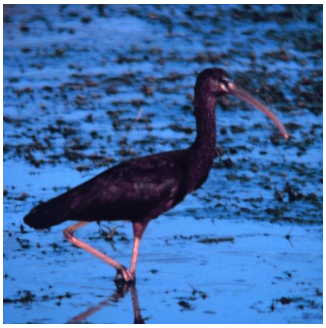
Birds have adapted to the particular habitat. If the habitats are different, the birds will often be different. However, some of the estuary habitats are similar enough that birds can feed in more than one habitat. For example, herons and egrets might be found in salt marshes, mangrove swamps, and along the shores of lagoons and ponds.

Q2. Why do certain birds feed in the habitat you researched but not in others?

Answers to this question will differ depending on the bird the students researched. In general, the bird that feeds in a particular habitat has adaptations, such as beak shape, that allow it to effectively get food in that habitat. A wading bird, such as a heron, would not be suited to finding food for itself in deep water. It is adapted for finding food in shallow water, so that is where it hunts for its food. Shorebirds have shorter legs and feet that are good for walking along the beach, while wading birds have legs long enough to wade through shallow water. A duck can eat sea grass because the duck can hold its breath and turn upside down in the water to reach the submerged sea grass.

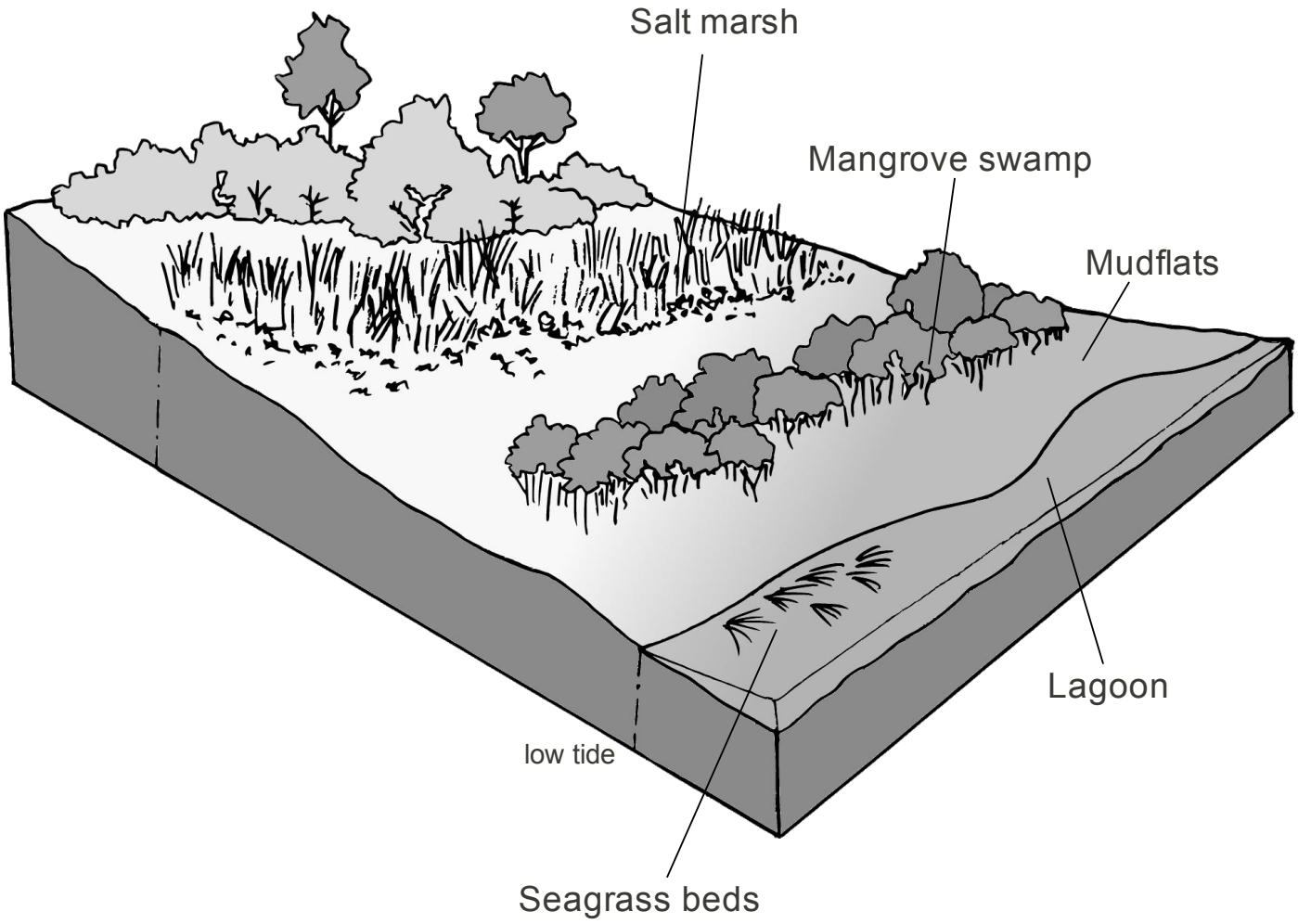
TEACHER MASTER

Estuary Bird Cards

 Great Blue Heron	 Osprey	 Willet	 Roseate Spoonbill
 Great Egret	 Glossy Ibis	 Marsh Wren	 Tern
 Brown Pelican	 Whooping Crane	 Sandpiper	 Avocet
 Woodstork	 Snowy Egret	 Black Skimmer	 Crested Comorant

TEACHER MASTER

Estuary Habitats



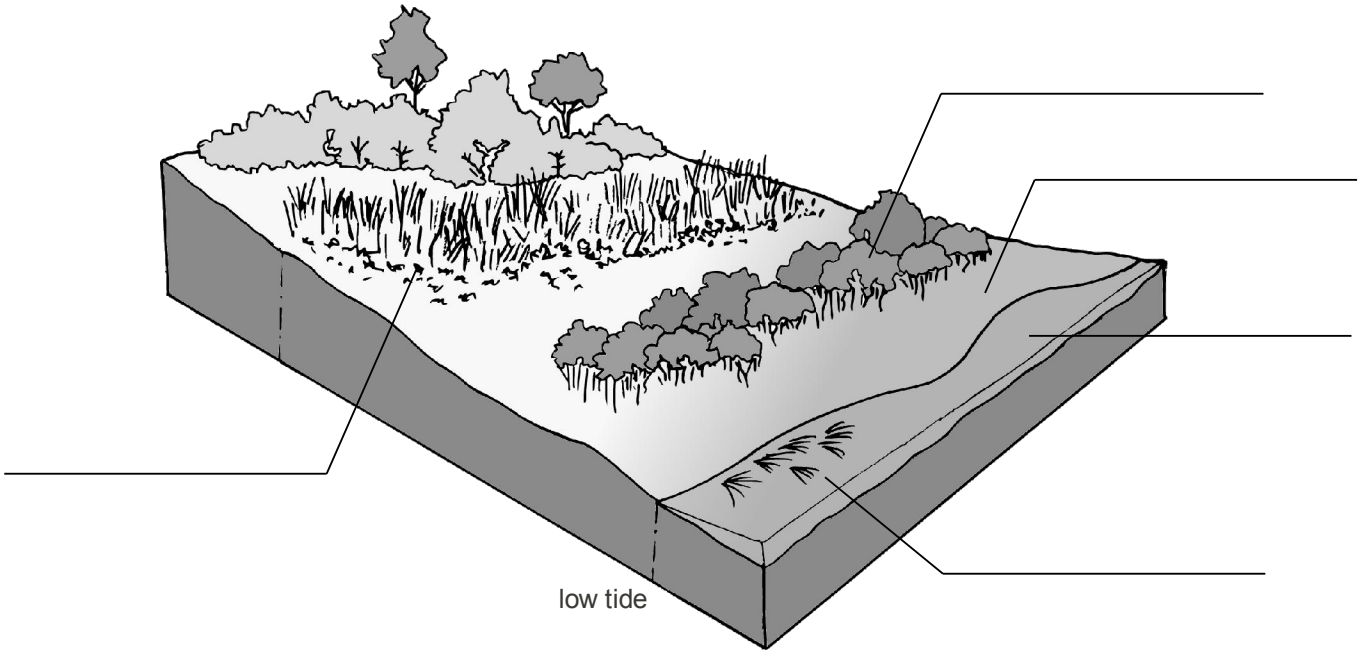
STUDENT MASTER

Great Birds of the Estuaries

Estuaries actually contain a number of different habitats, each better or worse suited for different species of birds, as well as other estuary animals and plants. Here are five of the main estuary habitats:

1. A **lagoon** is an area of shallow, open water, separated from the open ocean by some sort of barrier, such as a barrier island. The water in a lagoon can either be as salty as the ocean or brackish.
2. A **salt marsh** has non-tree plants (grasses, shrubs, etc.) whose roots grow in soil acted upon by tides, but the plants are mostly never submerged.
3. The woody trees that grow in a **mangrove swamp** grow in soil affected by tides. Mangrove trees only grow in estuaries that never freeze.
4. **Seagrass beds** are always submerged underwater. Seagrass is photosynthetic, so it grows in water that is shallow and clear enough for the grass to get sunlight. Seagrass is anchored to the muddy or sandy bottom.
5. **Mudflats** are sometimes also called tidal flats. They are broad, flat areas of extremely fine sediment (mud) that become exposed at low tide.

There are other estuary habitats. A beach or rocky shore can be part of the estuary. Salt ponds, oyster beds, and sand bars are also found within an estuary.



Use the estuary habitat descriptions to label the above image with the correct name of the habitat.

Now follow the procedures below to investigate some of the birds found in our nation's estuary habitats.

Procedure

1. Draw a random estuary bird card offered by your teacher. Use books or the Internet to do research about your bird.
2. At minimum, gather the following information:

   Name of the estuary bird: _____

   Characteristics of the estuary bird (e.g., size, beak shape, what it eats, etc.):

   Where in the estuary (i.e., which estuary habitat) does the bird feed?

   Does the bird nest in the estuary? If so, where?

   What are examples of adaptations that make this bird suited to its preferred estuary habitat(s)?

3. Your team needs to prepare a three-minute presentation for your class that will tell about your estuary bird and its preferred habitat(s). Check with your teacher to see if there is a suggested presentation format.
4. When you are ready to give your presentation, have one of your team members tape the image of your estuary bird onto the large Estuary Habitat diagram your teacher has provided. Be sure to put your estuary bird in its preferred estuary feeding habitat!
5. Once you have heard all of the teams present their birds, answer the following questions.

Questions

Q1. Why do different types of birds feeding in the estuary habitats differ?

Q2. Why do certain birds live in the habitat you researched but not in others?