Build a Shorebird

Adapted from *Learn About Seabirds.* U.S. Fish and Wildlife Service.

Grade level: lower elementary
Duration: one 40 to 60-minute class period.
Skills: vocabulary, discussion, visualization, comparing similarities and differences
Subjects: science and history

Concepts:
- Shorebirds, like other animals, are adapted in three ways to survive: physically, physiologically, and behaviorally.
- Shorebirds have many physical, or morphological, adaptations to help them walk, find food, hide, reproduce, and to fly long distances during migration.
- Adaptations are naturally selected over a long period of time, and specialized animals like shorebirds cannot adapt overnight to habitat damage or alteration.

Vocabulary
- adaptation
- physical adaptation
- behavioral adaptation
- guano
- habitat
- market shooting
- habitat loss
- plumage
- down feathers
- contour feathers
- migration
- camouflage
- invertebrate

Overview
Students will learn about the physical adaptations unique to shorebirds by dressing up a volunteer with bird "adaptations" that gradually transform him or her into a bird-and then into a shorebird. They will discover that shorebirds are a diverse group of birds designed to feed and nest in specific habitats. They will become familiar with some of the most common threats to shorebird survival.

Objectives
After this activity, students will be able to:
- Define the term adaptation
- Describe three adaptations unique to birds
- Describe three adaptations unique to shorebirds
- Name the most significant threats shorebirds face today
- Name two other human related activities harmful to shorebirds

Materials
- Red, yellow, and blue student flash cards (provided in this activity)
- Down jacket or vest
- Pictures of down and contour feathers
- Two large paper bird wings
- Several drinking straws or toilet paper tubes
- Chicken bone
- Balloons
- Camouflage patterned hat, vest or cloth
- Large enough piece of blue felt or paper to stand on
- Spray bottle
- Scissors
- Duct tape
- Cardboard bill or tweezers tied on a string necklace
- Empty baby oil bottle
- M&Ms or gummy worms
- Popcorn
- String (20-40 feet)
- Black paper oil splashes
- Blue paper wetland
- 6-pack can rings or a net
- Clothespins

Optional
- Electric fan
- Rubber boots or waders

Introduction
Most shorebirds are uniquely *adapted* to living in open spaces that also provide an abundant source of *invertebrate* foods. Their adaptations are both *physical* (the way they are built) and *behavioral* (the way they act). This activity focuses on the physical adaptations of birds--and then specifically of shorebirds: their *down* and *contour feathers*, hollow bones, air sacs, long and pointed wings, *camouflage plumage*, long legs and toes, specialized bills, and oil glands.

Migration itself is considered an adaptation that enables shorebirds to take advantage of the abundant Arctic food resources in the spring and summer yet escape to more hospitable southern climates for the winter. Unfortunately, migration also exposes these birds to a wide variety of threats along the way. *Habitat loss*, oil contamination, disturbance, and trash are just a few examples.

For more information shorebird adaptations go the *Shorebird Primer*.

Activity Preparation
1. Gather the materials listed. Consider enlisting help from your students.
2. Assign your students or a parent volunteer to construct:

- one student-sized set of paper wings (to be cut and modified during the activity)
- one blue paper wetland to stand on
- one cardboard bill
- several black construction paper cut-outs of oil spills

3. Photocopy on cardstock and then cut out the activity flash cards (included here) in the colors shown below. There should be enough so that every student except the bird volunteer has at least one card. For large classes, students can share a card; on person reads the card the other attaches the adaptation to the "bird".

- General Bird Adaptation Cards - yellow
- Special Shorebird Adaptation Cards - blue
- Threats to Shorebird Cards - red

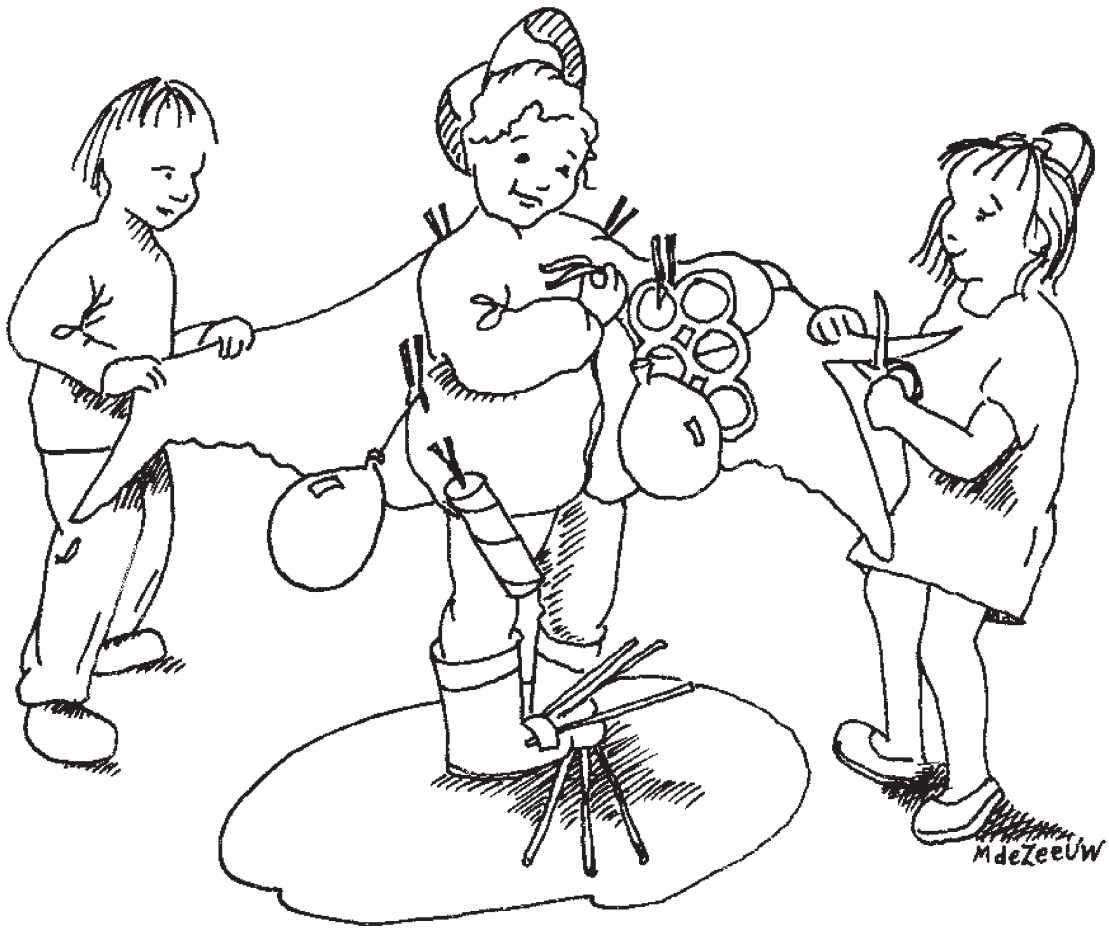
Procedure

1. Explain the term *adaptation* (a physical or behavioral characteristic that has evolved over time to help a species survive and reproduce in the environment where it lives). Tell the students that they will be exploring the world of shorebird adaptations by building a shorebird.

2. Ask for a volunteer. This person will be turned first into a bird, then into a shorebird, and finally into a Western Sandpiper. He or she will also be subjected to some threats a shorebird may face.

3. Distribute all the flash cards to the students. Tell them as you describe what is needed by the bird, they should look at their flash cards and raise there hand if they have the adaptation you are describing. They will place their adaptation on the "bird" using clothespins.

4. Begin to transform your volunteer into a bird with the *yellow flash cards*. Use the Teaching Notes 1-4 to guide the students through the activity. Repeat this process until all the yellow cards have been read and the adaptations added to the volunteer



Teacher Notes: General Bird Adaptations (Yellow Cards)

Adaptation	*Description*	*Material Needed*
1. Down Feathers Ask students to imagine they are birds in flight. How does it feel to be soaring above the earth? Is it cold? Is skin enough to insulate you up there? You will have had to adapt to temperature extremes. How? With feathers. **2. Contour Feathers** What sort of material is strong and flexible enough for the wings and tail to help you fly?	Feathers are a unique adaptation found only in birds. All birds have two kinds of feathers: 1) *Down feathers* — a kind of bird underwear — fluffy, under-feathers for insulation 2) *Contour feathers* — strong outer feathers for flight that are also the bird's clothes and coloration	Dress bird in *down jacket* and *bird wings.* Study *comparison pictures of down and contour feathers.*
3. Hollow Bones Ask students to think about how much they weigh. How much do you think a Bald Eagle weighs? It only weighs between 8–14 lbs. and has a 7–8 ft. wing span.	Hollow bones reduce weight. Most of the bird's weight is in the breast and wings (where the flight muscles are). Our bones are not hollow but instead are filled with marrow for red blood cell production. Birds have marrow only in their breast bone.	Attach *drinking straw* or *cardboard paper roll* to down jacket. Pass *chicken bone* around for the students to examine.
4. Air Sacs Ask a volunteer to stand up and become a crow by flapping his or her wings 20 times in 10 seconds. Does flapping like a bird make you breath faster than just walking? Yes!	Air sacs help birds take in enough oxygen for rigorous flight. Birds have lungs like we do, but that is not enough. Air sacs, like balloons, extend from the lungs, between and into hollow bones. During inhalation and exhalation, air flows through the lungs and the air sacs to maximize the absorption of oxygen.	Attach the *balloons* with clothespins to your volunteer. Each student with a yellow card places one balloon on the bird.

Teacher Notes: Special Shorebird Adaptations (Blue Flash Cards)

Adaptation	*Description*	*Material Needed*
5. Long, pointed Wings Think about the different shapes of bird wings. Why do penguins have short, stubby wings while an eagle has big, broad wings? Do you think that wing shape might be related to the bird's lifestyle?	Shorebirds migrate (fly long distances) between their habitat where they breed and the habitat where they winter. Long, pointed wings help shorebirds fly fast over such long distances. There wings also allow them to do aerial maneuvers to escape predators.	Use the *scissors* to shape the tip of the volunteer's paper wings so they look long and pointed.
6. Camouflage Plumage How can a small bird protect itself from larger predators? Would small shorebirds have much luck fighting with hawks on the beach or with foxes on the tundra?	Cryptic coloration, or camouflage, makes birds less conspicuous. Their brown, black and white plumage blends in well with their habitat--mudflats, beaches, or grassy tundra. Larger shorebirds, like avocets and oystercatchers, cannot hide as easily and therefore are not so camouflaged.	Place the *camouflage clothing* on the bird.
7. Long Legs Do you need long legs to sit in a tree, fly, or walk? How about running from the waves? What do humans use to walk and work in wet conditions?	Shorebirds seldom perch in trees but rather walk or roost on the ground. Many shorebirds walk on shorelines or mud to find food. Having long legs helps them wade through water or mud. (The length of the legs of a shorebird gives a clue to where it feeds.)	Place the *blue material* representing a wetland on the ground for the shorebird to walk on. Optional: Put the *rubber boots/ waders* on the bird.
8. Long Toes What are your toes for? Toes are for stability in walking.	Most shorebirds do not spend much time swimming. Therefore, they do not need webbed feet, just long toes for stability and walking.	Using duct tape, attach three long *drinking straws* to each toe of the bird.

5. Now, explain that the class is going to continue adding adaptations, this time with adaptations unique to shorebirds. Clarify to your students that shorebirds are birds of open spaces that fly long distances (migrate) to between their breeding and nonbreeding habitats.

6. Spray the volunteer lightly with the water spray bottle and have them stand on the blue felt or contruction paper. Our bird is now a wetland-loving shorebird.

7. Continue with using the Teaching Notes 5–11 to guide the class through the *blue flash cards*.

Teacher Notes: Special Shorebird Adaptations (Blue Flash Cards)

Adaptation	*Description*	*Material Needed*
9. Bills What do people use to feed themselves—(forks, straws, chopsticks, fingers, lips, teeth, etc.)? Do you use different things to help you eat different types of foods?	Bills, or beaks, are used for picking up food, nest construction, courtship, preening, and defense. Curlews probe deeply into the ground with their long, curved bills. Plovers and Surfbirds have short, stout bills to pick up prey they spot on the surface of sand or rocks. Sanderlings have tapering, tweezer-like bills to help them "stitch" the sand—(a rapid, repeated probing) to pull up worms and crustaceans right below the surface of the beach.	Attach a *cardboard bill* to the volunteer or tie *tweezers* on a string necklace around the neck of the "bird" to represent the shorebird's bill. Place *gummy worms* in the mouth of the volunteer. These represent the segmented worms or the long, stretchy nemertean worms that some Sandpipers like to eat. You may also feed the bird *M&Ms* or other candy-coated treats, representing crunchy-coated invertebrates.
10. Oil Glands Pour oil (cooking or other colored oil) and water into a beaker and observe the separation. Does the oil get wet? What does "get wet" mean? "Wet" means saturated with water. Ask students how they keep dry in the rain. Is rain gear treated with any special coating? Yes!	The oil glands help keep shorebirds' feathers waterproof. Feathers are kept clean and smooth by constant preening with oil from the oil gland found above the base of the tail. The oil is transferred to the plumage (feathers) with the bill or the back of the head.	Attach the *baby oil bottle* to the back of the down jacket. Ask the bird to try to preen!
11. Guano Imagine all the shorebird droppings left behind by the large migratory flocks of birds! Do you think there is any value to guano?	Guano from shorebirds, just as from other birds and bats, contributes to the chain of life. Tiny plants and animals use guano nutrients. They in turn become food for small fish, crustaceans, and other animals that shorebirds and even people eat.	Sprinkle the *popcorn* around the volunteer shorebird.

Congratulations your class has built a shorebird!

Teacher Notes: Threats To Shorebirds (Red Cards)

Threat	*Description*	*Material Needed*
12. Habitat Destruction Define the term *estuary* and *wetland*. Have you seen any shorebirds around your area? What kind of habitat is it? Is there any threat of it being destroyed? If there is not a local concentration of shorebirds, another well-known local animal can be substituted for the discussion.	Most shorebirds depend on habitat in three areas: breeding, nonbreeding, and migration stopover sites. Wetlands, estuaries in particular, are important stopover sites. They are also very attractive to humans as a source of water or home sites. Water is drained away or its course altered, and bridges, houses, and docks are built. Animals and plants that provide food and shelter for the shorebirds are destroyed.	Restrict the habitat available to the shorebird flock by penning it in with *desks* or by winding *string* around the student birds to tie them together. Now pass out *gummy worms* to all shorebirds that have habitat. What about everyone else? Can we make new habitat? How can we fix ruined habitat?
13. Oil Contamination	Oil spills kill shorebirds and destroy their habitat for many years.	Pin *oil splashes* on the volunteer shorebirds.
14. Disturbance How could disturbance harm a shorebird or flock of young birds? Can you think of some examples of disturbance? (planes, people coming too close to nesting shorebirds, Jet skis, pets)	If flocks are disturbed and cannot refuel with food at their traditional stopover points, they may not have another chance to find enough food for their long migrations.	Have the students make noise to simulate ATVs or motorcycles. Alternatively, turn on the *electric fan* and point it toward the flock to simulate a disturbance.
15. Trash Have you ever seen trash littering our wetlands? Where did it come from? Remember to put trash in cans, cut up plastic rings and long strings, and dispose of tangled fish line at home.	Plastic debris and other trash can be mistaken for food. Shorebirds can also get tangled in discarded fish line and six-pack can rings. Abandoned cars, appliances, and other trash items can leak poisons into wetlands.	Place netting or plastic six-pack rings somewhere on the sandpipers.

8. Now discuss the importance of shorebird scat (guano). Sprinkle the popcorn around the volunteer shorebird. Guano from shorebirds, just as from other birds and bats, contributes to the chain of life. Nutrients from guano area returned to the wetlands that the shorebird uses. The (elemental and molecular) nutrients in guano are made available for manufacture of food by tine plants and plankton. These "food makers" (photosynthesizers) become food in turn for small fish, invertebrates, and other animals. The food web is continued, and eventually includes the shorebirds and even humans. Every organism, and its activities, has a part in the chain of life on our planet.
9. Now turn the volunteer into a Western Sandpiper that is part of a huge flock. Western Sandpipers are very small Arctic-nesting shorebirds familiar to many people because of their huge migratory flocks. Select a few students to join the volunteer shorebird, perhaps holding hands to create a flock of Western Sandpipers. If you do not have Western Sandpipers in

your area (check the Shorebird Profile list in the Appendix), select another flocking shorebird, a Dunlin for example, to create a class flock. *Do not put students still holding red flashcards in the flock.*

10. Even with all these wonderful adaptations, life is not easy for a shorebird! In addition to the difficulties of migrating long distances over the ocean or in bad weather, shorebirds face many human-caused dangers. Market hunting has killed millions of shorebirds in the past. While it is illegal to kill and sell shorebirds today, other threats have grown significantly. Habitat loss is the biggest threat to shorebird survival today.

11. Now guide the students through the *red flash cards* that represent shorebirds threat. Explain to those students how to "carry out the threat" on the flock of students as directed in the Teacher Notes.

12. Wrap-up the activity using the question below.

What Makes a Bird a Bird?
Describe three unique adaptations of birds.
- Feathers
- Hollow Bones
- Air Sacs

Describe three special adaptations of shorebirds.
- Camouflage plumage
- Long, pointed wings
- Legs for walking, wading, and running
- Bill for probing or picking

Why are shorebirds important?
- Add diversity
- Important part of food web, including prey for raptors and their guano fertilizes habitat

What is the most significant threat to shorebirds today?
- Habitat alteration or loss

Name two other human-related activities that can be harmful to shorebirds.
- Oil contamination (oil spills)
- Trash
- Disturbing birds from their nests, or while resting or feeding

Additional Activities

Build a Shorebird, Maya (activity sheet)
Have younger students complete the worksheet Build A Shorebird, Maya. Ask each student to write his or her own story about where Maya lives or develop the story together as a class. Ask them to color Maya so that she is well camouflaged for the habitat she lives in.

Comparing Wings
Have older students look for at least four different wing sizes and shapes found in birds of your area. Some examples might include pheasant, eagle, hummingbird, and tree swallow. Ask them to make drawings of the wing shapes they choose and compare the lifestyles, food habits, and habitat types of these birds.

Plumage Coloration
Have students work in small teams. Have each team select a shorebird from the Shorebird Coloring Pages in the Appendix. Make multiple copies of the coloring pages your students select. Using a bird field guide for reference, have them color a drawing for each of the birds' plumages (adult breeding, adult wintering, and juvenile). When everyone is done, compare the plumages of different species. Which have very different wintering and breeding plumages? Which are very similar? Do females always look like males?

Create Your Own "Super" Shorebird
Ask students to design their own shorebird to fit into the habitat of their choice. Explain to them that this bird does not have to resemble a real shorebird and that it does not have to live in a "natural" habitat. It does, however, have to be well adapted to its surroundings so it can find food, nest, and migrate. Instruct each student to write a brief bird biography that describes where it lives during the breeding and nonbreeding seasons, what it eats, and any special behaviors it has.

Build a Shorebird
Student Activity Flash Cards
Bird Adaptations

(Photocopy back-to-back on yellow cardstock.)

Bird Adaptation	Bird Adaptation
Down Feathers	*Contour Feathers*
Bird Adaptation	**Bird Adaptation**
Hollow Bones	*Air Sacs*

Build a Shorebird
Student Activity Flash Cards
Bird Adaptations

(Photocopy back-to-back on yellow cardstock.)

Bird Adaptation	Bird Adaptation
Strong outer feathers are used for flight. These are also the bird's clothes and coloration.	These are the fluffy under-feathers for insulation (the bird's underwear).
Bird Adaptation	**Bird Adaptation**
A lot of energy is needed to give birds energy to fly. Air sacs come from the lungs, between and into hollow bones. They help increase the amount of oxygen the bird can absorb.	These help a bird keep its weight low so it can fly.

Build a Shorebird
Student Activity Cards
Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Long Pointed Wings	Camouflage Plumage
Shorebird Adaptation	**Shorebird Adaptation**
Long Toes	Long Legs

Build a Shorebird
Student Activity Cards
Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Camouflage helps birds blend in with their surroundings so they are not easily seen.	Long, pointed wings are designed for long and fast flight.
Shorebird Adaptation	**Shorebird Adaptation**
Long legs help keep shorebirds dry as they wade through the mud and water looking for food.	Long toes help birds keep their balance while they walk on wet, slippery mud as they search for food.

Build a Shorebird
Student Activity Cards
Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Bill	Oil Gland
Shorebird Adaptation	**Shorebird Adaptation**
Guano	(blank)

Build a Shorebird
Student Activity Cards
Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
The oil gland, found near the base of the tail, helps keep a shorebird's feathers waterproof.	Shorebirds use their bills for picking up food, building their nests, courtship, preening, and defense.
Shorebird Adaptation	**Shorebird Adaptation**
(blank)	Shorebird droppings, or guano, act like a fertilizer to the mudflats and waters where they feed

Build a Shorebird
Student Activity Cards
Shorebird Threats

(Photocopy back-to-back on red cardstock.)

Shorebird Threat	Shorebird Threat
Habitat Destruction	Oil Spill
Shorebird Threat	**Shorebird Threat**
Disturbance	Trash

Build a Shorebird
Student Activity Cards
Shorebird Threats

(Photocopy back-to-back on red cardstock.)

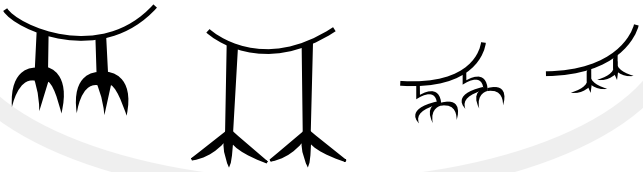
Shorebird Threat	Shorebird Threat
Oils spills can kill shorebirds and destroy their habitats.	Changing or developing wetlands can destroy the plants and animals that give shorebirds food and shelter.
Shorebird Threat	**Shorebird Threat**
Trash kills shorebirds. Some shorebirds confuse trash for food. They can get caught in fishing line, six-pack rings, and old fish netting.	Planes, boats, and people can scare shorebirds away from important feeding areas or chase them away from their nests.

Add the beak, legs, feet and wings to

Build a Shorebird, Maya!

What **beak** would best help a shorebird probe in the mud for food?

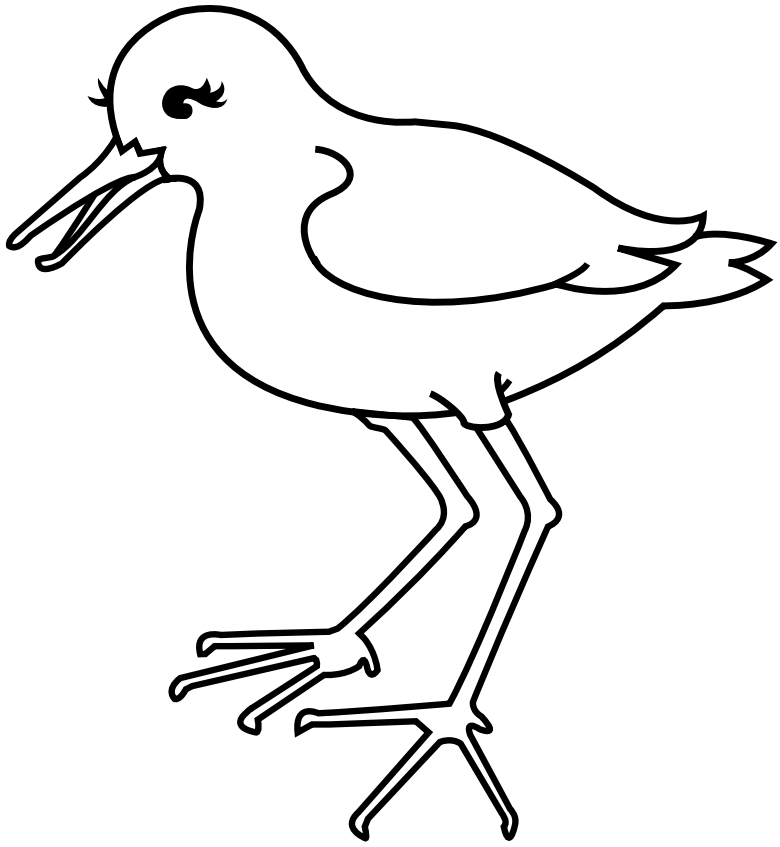
Which **legs** would best suit a shorebird for its wetland habitat?



Which **feet** would best suit a shorebird for walking in its wetland habitat?

What type of **wings** help the shorebird fly long distance and escape quickly from predators?

Maya the Shorebird



Correct bird parts