Science Unit **Bird Diversity**

Lesson 3 ***Why are a bird's wings shaped like that?***

Summary
Students observe how the shapes of five different bird wings affects the way birds fly. Then students create, test and fine-tune a paper bird with wings designed for gliding.

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Grade level	2–3
Class time needed	1 hour and 20 minutes
Delivery date	April 12th, 2017

LEARNING OBJECTIVES

1	Observe the shapes of five different bird wings.
2	Create, test and fine-tune a paper model of a bird with gliding wings.
3	Explore which features improved the flight of our paper bird models.

SUPPLIES

- Photos of five indigenous birds flying in five different ways: soaring, gliding, rapid take-off, high-speed and hovering.
- Stencil of gliding shaped wings (cut-out provided at end of this lesson plan).
- Stiff paper, masking tape, and other supplies (such as light wood craft sticks or dowels, feathers) to make a model bird that glides.

BACKGROUND INFORMATION

Bird wings are thick and rounded on the forward edge and thin on the back edge. This shape helps air travel more easily over the wing, which reduces the pressure above the wing (drag) and increases pressure below the wing (lift).

Wing shape and size further effect what style of flight each species exhibit. For example, larger wings provide more lift than smaller wings. Smaller-winged birds have to fly faster to get the same lift as larger-winged birds. But birds with short, round wings (e.g., songbird, rock dove a.k.a. pigeon) can take off more quickly and maneuver more easily, which helps these birds elude predators. Whereas long-thin wings are less maneuverable but instead allows these birds to cover long distances with less energy (e.g., albatross, gull).

Many raptors use a special type of gliding called soaring to fly with less energy than flapping. Instead of gliding over long distances these birds soar in circles by riding thermals or warm air currents found near cliffs and ocean coasts. To soar these birds have large broad wings, broad tails and slotted feathers at the end of their wings to prevent drag.

Hummingbirds use a unique type of flight called hovering. They keep their bodies at a forty-five degree angle to the ground and their flexible shoulder joints allow their wings to move in a rapid figure-eight pattern. The angle of their body and their rapid wing movements allow hummingbirds to hover in the air as they gather nectar, as well as to fly up, down and backwards. They generate lift both when they move their wings forward and when they move their wings backward.

THE LESSON

The Hook	• Watch videos of five different indigenous British Columbia birds flying in different ways: bald eagle, herring gull, rock dove, peregrine falcon and rufous hummingbird. What did you notice about their flight?
Hands-on Activity 1	• Students create, test and refine a paper bird with gliding shaped wings. They can add a body, feathers and other features as they see fit to improve their birds "glide-ability" • Students test their bird. How well did it glide? What do you think you need to change to help it glide further? • Students refine and re-test their paper model.
Wrap Up	• Discuss: How well did you bird glide before and after your refinements? What refinements did you make? Why did you make those adjustments? Would you make any more changes?

VOCABULARY

Drag	A force that slows an object down.
Gliding	When birds hold their wings at a slight angle to cause lift they can keep moving forward or glide without any movement. There's drag on the body though so the bird will flap or dive down everyone once in a while to keep up its speed. Many birds glide, but birds with long narrow wings are able to glide for longer distances (e.g., albatross, gull).
High-speed	High-speed wings have pointy tips and are swept back (e.g., terns, falcons).
Hovering	Rapid, figure-eight wing movements that allows a bird to remain stationary (e.g. hummingbird).
Lift	An upward force acting on an object.
Rapid-takeoff	Birds with short round wings can take off quickly and maneuver easily (e.g. rock dove, songbird).
Soaring	Soaring is a type of gliding where birds use rising air current called thermals to maintain their height while they stay in one general location (e.g., eagle, vulture). Their broad wings and tails help these birds soar. The slotted feathers at the end of their wings decreases drag.

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REFERENCES

The Cornell Lab of Ornithology. All About Birds. Eared grebe. https://www.allaboutbirds.org/guide/eared_grebe/lifehistory (Accessed May 2017)

The Cornell Lab of Ornithology. 2009. Amazing birds. http://www.birds.cornell.edu/physics/lessons/elementary/pdfs/tm (Accessed May 2017)

The Cornell Lab of Ornithology. 2017. Flight and feathers. http://www.birds.cornell.edu/physics/lessons/elementary/flight (Accessed May 2017)

Ehrlich, P.R., D.S. Dobkin, D. Wheye. 1988. Hovering flight. https://web.stanford.edu/group/stanfordbirds/text/essays/Hovering_Flight.html (Accessed May 2017)

Hawk Mountain Sanctuary. 2017. How to identify hawks. http://www.hawkmountain.org/raptorpedia/how-to-identify-hawks/page.aspx?id=353 (accessed May 2017)

Science Learning Hub. How birds fly. http://sciencelearn.org.nz/Contexts/Flight/Science-Ideas-and-Concepts/How-birds-fly (Accessed May 2017)

Videos:

- Gliding. Herring gull (0 to 14 sec). https://www.allaboutbirds.org/guide/Herring_Gull/videos
- Soaring. Bald eagle. https://www.youtube.com/watch?v=i94QoqvmgrM
- Rapid take-off. Rock dove. https://www.allaboutbirds.org/guide/Rock_Pigeon/videos
- High-speed. Peregrine falcon. http://www.arkive.org/peregrine-falcon/falco-peregrinus/video-00.html
- Hovering. Rufous hummingbird. http://www.arkive.org/rufous-hummingbird/selasphorus-rufus/video-08a.html