

Attracting and Studying Hummingbirds

Invite the dynamos of the bird world into your schoolyard and curriculum

by Kim Bailey

Subject areas: science

Key concepts: habitat, migration, adaptation

Skills: inquiry/investigation, problem solving, observation, technology

Location: indoors and outdoors

Time: ongoing throughout school year

Materials: hummingbird feeders, flowers to attract hummingbirds, red ribbons, observation journals, field guides, computers with Internet connection; see also activities below

After months of winter cold and the illusion of lifelessness, spring is a season full of expectation and excitement. More than anything, I eagerly anticipate the return of hummingbirds. Each day I impatiently check the Internet to see how much progress the tiny birds have made on their miraculous journey northward. I hang my feeders early and hope that maybe this year I'll be lucky enough to sight and report the first hummingbird to arrive in my area. (By submitting the date and location, I can document my discovery with a dot on the on-line migration map at <www.hummingbirds.net>). Every year, someone else nearby has beaten me to that first hummer sighting by at least a few days, but eventually the hummingbirds arrive in my yard, too. For me, spring and another opportunity for learning arrive with them.

Of the approximately 340 species of hummingbirds, all of which live in the western hemisphere, 17 have been known to breed in Canada and the United States. Hummingbirds are found in every Canadian province and American state, except Hawaii. Their spectacular beauty, fearless personality, and astonishing powers of flight captivate our attention and make them among the most beloved of all birds. Because they are relatively easy to attract,

these exceptional birds can be an endless source of interest for students and teachers. This article presents some of the remarkable adaptations behind hummingbirds' beauty, grace, and precision, and suggests a variety of ways to invite them into your schoolyard and your curriculum. Students will be spellbound as they experience hummingbirds up close and observe firsthand their special interactions with plants and natural surroundings.

Hummingbird facts and feats

Pollination: Uniquely adapted for feeding from flowers, hummingbirds are more efficient at dispersing pollen than many insects. Pollen dusted on the bird's bill, throat, or forehead is easily transferred from flower to flower. Hummingbirds are also more reliable pollinators: while insects become inactive on cold or rainy days, hummingbirds visit flowers regardless of the weather. Flowers adapted to pollination by hummingbirds are

often red because this color is not visible to most insects. They also lack a fragrance, since hummingbirds have little or no sense of smell. A tubular shape and the absence of a landing platform are among other adaptations designed to help reserve the flower's nectar for hummingbirds and to discourage insects.

Flight: Hummingbirds are so adept at flying that they have no need to walk. Their small feet serve mostly as retractable landing gear used for perching. They are the only birds that can hover and fly backward, forward, sideways, straight up or down, and even upside down. Their wings can beat 70 to 80 times per second, giving

them an average flight speed of 40 to 48 kilometers (25 to 30 miles) per hour. Hummingbirds must often eat more than twice their weight in nectar and insects every day as fuel for flight. A human with a weight-specific metabolic rate equal to that of a hummingbird would need to take in an estimated 155,000 calories a day!



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Migration: To escape intense competition in the tropics, several hummingbird species migrate to the United States and Canada to breed each spring. It is amazing they make it here at all! Ruby-throated hummingbirds travel all the way from Central America to breeding grounds throughout the entire eastern United States and most of southern Canada. For most, the migration includes a remarkable nonstop flight across the Gulf of Mexico, a trip of 800 to 1,000 kilometers (500 to 600 miles). Weighing only about six grams when they set out (about twice their normal weight), and with a brain the size of a BB pellet, they are somehow able to complete this journey and return year after year to the same territories. Females have even been known to return to the same nest several years in a row. Rufous hummingbirds, which breed as far north as southern Alaska, have the

longest migration route of any hummingbird, travelling up to 4,800 kilometers (3,000 miles) from Central America.

Preparing for hummingbird visitors

Just before the spring migration, hummingbirds gorge themselves on tropical nectar and insects. Some even double their body weight to store enough energy to make the journey north. When they arrive, they survive on insects, the nectar of early-blooming flowers, and even tree sap which they lap from holes made by woodpeckers known as sapsuckers. During this critical time, you can provide food for hummingbirds — and maybe even entice a few to stay — by hanging feeders and planting early-blooming trees, shrubs, and wildflowers that are indigenous to your area.

Hummingbird Feeder Tips

- Use feeders designed to exclude wasps, bees, and ants.
- If spring mornings are cold where you live, use a feeder without perches. Hovering while feeding helps hummingbirds stay warm.
- Always keep feeders clean, and nectar fresh.
- To make nectar, use one part sugar to four parts water. Use ordinary white cane sugar. Do not use brown sugar, honey, artificial sweeteners, flavorings, or anything but 20 percent sugar water! Do not add food coloring to nectar.
- To slow the rate of spoilage, boil the nectar for up to two minutes. Cool the nectar before adding it to the feeder.
- Store unused nectar in the refrigerator for up to two weeks.

Hummingbird inquiry ideas

Hummingbird gardens and feeders arouse curiosity and enable students to design experiments to answer their own questions about hummingbird behavior. Here are some questions and mysteries to get them started.

Which type of feeder is most attractive to hummingbirds?

Test several different types of commercial feeders or make your own. Hang the feeders in similar areas or the same area. Observe birds feeding and measure how much nectar has been consumed from each feeder. Be aware that one dominant bird may guard the feeder it prefers and force others to feed at less preferable feeders.



Do hummingbirds feed more or less often at feeders placed near nectar flowers than at feeders placed far away from them?

Place one feeder in or near the hummingbird garden. Place another feeder of the same type in a distant but easy-to-view location. Observe birds feeding and measure how much nectar has been consumed from each feeder.

Do hummingbirds really prefer red?

Obtain colorless feeders or make your own. Color the feeders with non-toxic paint or tie colored ribbons on them. Place the feeders in similar locations or the same location. Observe birds feeding and measure how much nectar has been consumed from each feeder.

Which flowers are most attractive to hummingbirds?

Observe hummingbirds feeding at different times of the day. Use a stopwatch to record the amount of time a bird spends feeding at each type of flower. Graph and compare feeding times, showing the favorite flowers in order of preference.

Do hummingbirds prefer nectar made from purified water to nectar made from ordinary tap water?

Make two batches of nectar, one using purified water and one using tap water. Use two identical feeders placed at the same location, just a few feet apart, each with a different batch of nectar. Record daily observations. Reverse the feeders and keep recording. Compare results with those at www.naturalinstinct.com/hummingbird_master.html.

Caution: Be careful not to set up an experiment that could possibly harm the birds. For example, never experiment with providing nectars of different concentrations or nectars made from different sugary substances.

— by Kim Bailey

To prepare for your first hummingbird visitors, teach students to use field guides or Internet resources to find out which species are found where you live (see list of websites, page 43). If ruby-throated or rufous hummingbirds migrate through your area, students can predict the first bird's arrival by checking the Journey North website and the <<http://hummingbirds.net>> site to view previous years' and current migration data and maps.

Ideally, feeders should be hung where they can be observed and where they are safe and accessible to hummingbirds. Have students survey the schoolyard to determine the most sheltered places for hummingbirds to feed and how the birds will get to these areas (e.g., whether there is a corridor of trees or shrubs leading to the area). To help attract the attention of hummingbirds, hang red ribbons on the feeders and nearby shrubs. If you live in an area where mornings are chilly, use feeders without perches, as hummingbirds can become hypothermic if they drink very cold sugar water while perching. By hovering while feeding, they warm their bodies and avoid hypothermia.

After the feeders are hung, students can learn more about hummingbirds, come up with additional questions, and plan other ways to make the schoolyard a better hummingbird habitat. They could, for instance, research flowers to be planted to increase the food supply and help catch a hummer's eye. Flowering plants are especially important to sustain the hummingbird habitat over the summer if feeders are not maintained during that time.

Spring is an ideal time to start a hummer habitat project, but hummingbirds can be a terrific curriculum tool at other times of the year. Why not start off the school year with observations of the peak of the southward migration in your area? Fall is the best time to plant many of the perennials, shrubs, trees, and vines that hummingbirds will seek out on their return. In winter, you can engage students in planning habitat areas or even propagating plants from seed indoors. No matter what time of the year

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you start a hummingbird garden, always avoid using pesticides. Chemicals sprayed on flowers could be ingested by the birds and could kill small insects that are an important source of food for hummingbirds.

As in any schoolyard habitat for wildlife, in addition to food, you should provide shelter and water. Do you need more trees or shrubs to create cover, nesting places, or perching spots near feeders? (Hummingbirds spend about 80 percent of their time perching.) How will you provide water? In nature, hummingbirds prefer showers to baths and can often be observed streaking back and forth in the fine spray of a waterfall in order to clean their feathers. Commercial bird misters are available from birdwatchers' supply stores for this purpose. Similar devices that attach to a garden hose are

also sold as plant misters or pool-side "personal cooling systems" and are often less expensive. All use a very small amount of water and can be set on a timer: the birds have even been known to learn a misting schedule and regularly appear just in time for their morning or afternoon shower.

Hummingbirds will also bathe in flight by brushing against or sliding around on wet leaves — what a sight that is! To create this bathing alternative, simply make a small hole in the bottom of a bucket, fill the bucket with water, hang it above a leafy branch, and refill as needed.

When the hummingbirds do arrive in your outdoor classroom, encourage students to make careful observations, keep records of all the hummer happenings, conduct investigations and inquiry projects, continue to improve and expand habitats, and celebrate the hummingbirds in your schoolyard. Explore all the ways hummingbirds can provide natural motivation for learning and integrate all areas of the curriculum. Draw on the

ideas, activities, and resources here to get started. If you and your class are lucky enough to attract an early arriver, don't forget to report your sighting on-line. Maybe you can earn that coveted dot on the hummingbird migration map that has always eluded me!

Territorial Tactics game

Territorial Tactics is an energetic tag game in which students simulate the territorial behavior and survival strategies of hummingbirds. It is designed to teach students tactics used by dominant territorial hummingbirds to guard a feeder or patch of nectar plants, and tactics used by other hummingbirds to try to feed from that protected food source. (The game is like Capture the Flag with a few adaptations.)

Subject areas: science

Key concepts: behavioral adaptations, intra-species competition

Skills: teamwork, problem solving, physical fitness (movement)

Location: outdoors

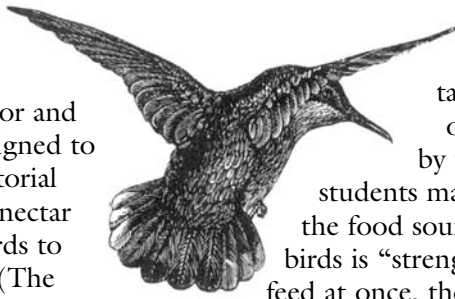
Time: 20 to 30 minutes

Materials: a rope 6 meters (20 feet) long or large hoop 1.5 meters (5 feet) in diameter; boundary markers (e.g., rope or traffic cones); at least 5 food tokens (e.g., red poker chips, red cutouts from laminated paper or foam place mats, or other small objects) per student

Preparation: Near the center of a wide flat outdoor area, lay down a hoop or rope to form a circle about 1.5 meters (5 feet) in diameter that will represent the food source. Place the food tokens inside this circle. Place boundary markers 15 to 30 meters (50 to 100 feet) away from the food source.

Procedure:

1. Choose one student to play the role of the territorial hummingbird who guards the food source by tagging competitors.
2. The rest of the students are competing hummingbirds who try to grab one food token at a time (no hand-fuls) without stepping inside of the food circle and without being tagged by the dominant hummingbird. (The food circle is large enough that students won't bump heads as they lean in to grab food tokens, but remind them to be careful.)
3. Students who are tagged must give up one food token, go outside the territorial boundary, and count to 30 before returning inside the boundary. (This represents a competitor being chased away from the feeder or flower.)
4. The first player to collect five tokens shouts "Territory Turnover" to signal that this round is over. All of the players return their food tokens to the circle. The winner becomes the dominant hummingbird in the next round.



Wrap-up: Ask students to explain the strategies and tactics they used to protect or obtain food. One strategy used by territorial hummingbirds, which students may also use, is to stay very close to the food source. A tactic used by competing birds is "strength in numbers": if many birds feed at once, the dominant bird has a harder time fighting them off. What other tactics did they use? Do hummingbirds use these as well? In nature, do flowers produce a continuous and endless supply of nectar? How might territorial behavior help hummingbirds to survive?

Adaptations:

- Play the first round with only one competing hummingbird, and then play with five, then with ten, and keep increasing the number of competing birds each round. (This increase in competition happens in nature during peak migration periods and toward the end of the breeding season when young birds become mature enough to feed at flowers and feeders.) Ask students how their tactics differ or change.
- After a few rounds, require competing birds to return to the boundary after picking up each token. This will reduce the number of birds feeding at the same time and may be a useful trick for playing the game with larger classes. Ask students how their tactics differ or change.
- After a few rounds, add a second feeding area some distance from the original. (People who wish to accommodate more hummingbirds hang a second feeder out of sight of the dominant bird. It is much harder a for dominant bird to defend two feeders, and often a second dominant bird will claim the other feeder.)

Extension: After playing the game, observe the behavior of hummingbirds feeding at a feeder or patch of flowers. What behaviors do students recognize from the game? If you cannot observe live hummingbirds feeding, several videos are available that include footage of feeding behavior (e.g., *Dances with Hummingbirds*, 1995, Nature Science Network, Inc., 61 min.; and *Watching Hummingbirds*, 1998, Nature Science Network, Inc., 33 min.).

Design a hummingbird flower

In this activity, students design and create a flower adapted for pollination by hummingbirds.

Subject areas: science

Key concepts: physical adaptations, pollination, competition

Skills: problem solving, creative thinking, teamwork/cooperative learning, oral communication, observation (if real flowers are examined)

Location: indoors

Time: One hour +

Materials: chalk and chalk board for planning meeting; real hummingbird flowers or pictures of hummingbird flowers (optional); paper, pencils, and miscellaneous art supplies for creating a flower prototype (e.g., markers, colored pencils, paint, construction paper, poster paper, pipe cleaners, beads, modeling clay, glue, tape)

Preparatory activity: It will be helpful to teach or review the parts of a flower (pistil, stamens, petals, sepals, etc.) using fresh flowers, dissecting tools, and a magnifying lens or microscope. One method that is memorable and fun is to have the students “build” a flower, with students posing and acting as the various parts and functions. For example, ask one student to raise her arms to represent the pistil; this student could also chant “Sticky, sticky, sticky” to demonstrate the sticky stigma which collects pollen at the top of the pistil. A small group of students representing stamens could encircle the pistil and hold their fists in the air to represent the pollen-bearing anthers at the tips of the stamen; these students could chant “Pollen, pollen, pollen” in deep macho-male voices. A larger group of students could encircle the stamens to represent the petals. Facing outward, these students should act very attractive by waving, smiling, and saying welcoming phrases to passing birds, bees, and insects. Finally, a last group of students could represent the sepals that hold the parts of the flower together and attach it to the stem. These students can encircle the petals, hold hands, and act and sound as if they are working very hard to hold the flower together. After acting out the flower parts, students can dissect real flowers as a hands-on way

to identify all the parts. A magnifying lens or microscope can be used to examine each flower part in more detail.

Procedure:

1. Announce to the class that today they are all designers for a product development and marketing company. Since they are so good at their jobs, Mother Nature



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Presenting flower designs at a teachers' workshop.

would like them to do some work for her. She has hired the class to design a new species for her upcoming Spring Plant Kingdom line. Because of the high demand and buying power of her hummingbird customers, the new species should appeal specifically to hummingbirds. The flower should be fashionable to catch the hummingbirds' attention and functional to meet their needs. Since hummingbirds pay for the product with pollination, the flower should also be designed to make as

much profit as possible. In addition, Mother Nature has one other special concern that needs to be considered in the flower design. Since her store is so large (the Earth), she doesn't have time to monitor the shoppers very closely and, unfortunately, shoplifting has become a problem. Certain insects have found ways to steal nectar from flowers without paying in full or at all. They simply take the flower nectar and do not pay by pollinating. Therefore, the new flower should be designed to deter and exclude these shoplifters.

2. Conduct a planning meeting. Have students brainstorm factors to consider before starting the project. List all aspects of the “customers,” “shoplifters,” and “market appeal” that the flower's design must address, but not actual ways to address them. The following are possible topics.

- (a) Consider the customers and their shopping style and needs:
 - Flight: they can hover.
 - Size: they are small but most flowers cannot support their weight.
 - Color: they are brightly colored.
 - Sight: they have good eyesight and see longer wavelengths of light (red) best.
 - Beak: they have long narrow beaks with a long tongue inside.
 - Smell: they have a poor sense of smell.
 - Behavior: they can be territorial and prevent other birds from feeding.
 - Nutrition: they need large amounts of nectar, they need water, and they need protein from insects.



Rusty Trump

(b) Consider the shoplifters:

- Sight: most insects see shorter wavelengths of light best (blue, violet, ultraviolet); insects are also attracted to the color yellow.
- Mouth: they have shorter tongues than hummers but some have mouthparts that can pierce the base of the flower to steal nectar.
- Smell: they have a strong sense of smell that guides them to flowers.
- Size: they are light and often land on flowers they feed from.

(c) Consider ways to maximize profit:

- How to get the hummingbirds to transfer pollen most efficiently and effectively
- How to achieve cross-pollination
- How to attract customers
- How to reward customers

- How to prevent theft
- How to crush the competition (outcompete other flowers)

3. After the brainstorming session, divide the class into teams of designers. To ensure participation and cooperation, teachers sometimes find it helpful to assign specific design roles to team members (e.g., materials specialist, idea note taker, presenter, advertising manager, customer satisfaction specialist, theft-prevention manager). Each team must present an oral report about its proposed flower to explain its advantages. As part of the report, each team must also present a model or full-color drawing of its flower as a prototype.

4. As teams are developing their ideas, walk around and ask questions to stimulate students' imaginations and to remind them of factors they are omitting (e.g., how to exclude "shoplifters").

Characteristics of Flowers Adapted to Pollination by Hummingbirds

- Often the petals of hummingbird plants are fused to form a tubular shape. This excludes many insects that do not have tongues long enough to reach the nectar hidden inside.
- Most birds do not have a well-developed sense of smell, so many hummingbird-pollinated flowers lack a fragrance. As bees and other insects are guided in part by scent, they are not attracted to these flowers.
- Hummingbird flowers often hang away from the plant, leaving space where birds can maneuver. Many also hang pointing down or to the side rather than up and the nectar inside is less likely to be diluted by rainwater. They are also easy for hummingbirds to hover around but difficult for insects to land on.
- Many hummingbird-pollinated flowers have a thickened covering at their bases, or the bases are grouped tightly together in an inflorescence. This prevents bees from piercing the base of the flower to reach the nectar.
- The stamens of hummingbird-pollinated flowers are often positioned to deposit pollen efficiently onto a hummingbird's throat, beak, or head.
- Many of these flowers are red. Most insects do not see longer wavelengths of light (red) at all or as well as they see shorter wavelengths of light (blue, violet, ultraviolet). Red may appear as a dark or black color to insects so they are not particularly attracted to it. However, red is easily seen and distinguished from other colors by birds. Note that a garden does not have to be full of red, orange, or pink flowers with the characteristics listed above in order to attract hummingbirds. Hummingbirds are extremely curious and opportunistic birds that will feed from almost any flower with nectar to which they can gain access, no matter what its color, shape, or size.

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With its tubular, nectar-rich flowers, trumpet honeysuckle is a hit with hummingbirds.

Wrap-up: Ask each team to present its flower model or drawing and to point out or demonstrate its fashionable and functional features. Each team should explain how its flower will attract hummingbirds, how

pollen will be transferred, how hummingbirds will be rewarded, and how nectar will be protected from "shoplifters." Finally, congratulate the teams on a job well done.

Extension: As part of the activity you may want to study hummingbird-pollinated flowers using either real flowers or pictures (Mother Nature's current line!). If you are concerned that this might squelch students' creativity and cause them simply to copy real flowers, you could do it at the end of the activity. If you study actual flowers, note how the stamens on cardinal flower, Indian paintbrushes, and many penstemons are positioned to tap pollen onto the hummingbird's head. Columbine and many other dangling-down blooms get pollen all around the base of the bill. Many of the larger trumpet-shaped blooms deposit pollen on the hummingbird's throat. Other characteristics to note in the real-life flowers are their color (typically red or orange), tubular shape, lack of scent, thickened base, sideways or downward orientation, etc. Use the chart "Characteristics of Flowers Adapted to Pollination by Hummingbirds" (at left) as a reference.

Migration Mishaps game

Migration Mishaps is a game that helps to demonstrate why animals that migrate, such as hummingbirds, are threatened by habitat destruction.

Subject areas: science

Key concepts: habitat, migration, survival, competition, limiting factors, population dynamics

Skills: graphing (extension activity)

Location: outdoors

Time: 20 minutes

Materials: 2 paper plates or pieces of cloth (“habitat havens”) for every 3 students, migration cards (next page); 3-5 soft foam balls (adaptation); wipe-off board and marker (extension activity)

Preparation: Review with students the definition of habitat (food, water, shelter and space suitably arranged) and explain that many factors limit the survival of populations of hummingbirds, including changes in the two habitats on which they depend. Have students research wintering and breeding habitats of hummingbird species in your area. (Ruby-throated hummingbirds winter mainly in Mexico and Central America, while their nesting habitat is in eastern United States and southern Canada).

Procedure:

1. Select a large area up to 20 meters (70 feet) in length. Designate one end of the area as the wintering grounds and the other end as the nesting grounds. Distribute the “habitat havens” (paper plates or cloth pieces) equally in the wintering and nesting grounds.
2. Begin the activity with all students at the wintering grounds, assigning no more than three players to each habitat haven. Explain that at your signal they are to migrate to a habitat haven in the nesting grounds.
3. For the first round, select a migration card that requires removing habitat havens. Read the card aloud and remove habitat havens in the area to which the hummingbirds will be migrating (in this round, the nesting grounds).
4. Give the signal to migrate. If players cannot find space at the new habitat (remind them that only three birds can share one habitat haven), they must die and move to the sidelines temporarily. These “dead” birds may re-enter the game as hatchlings when favorable conditions make more habitat havens available in the nesting grounds.

Safety note: Even though hummingbirds are aggressive and territorial, caution students that there should

Hummingbird True or False

This quick quiz highlights some little-known facts and dispels some misconceptions about hummingbirds. Use the quiz as a pre- and post-assessment. As your class learns more about hummingbirds, let them add their own items to the quiz or create a whole new quiz for another class to take.

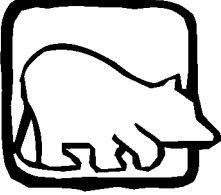

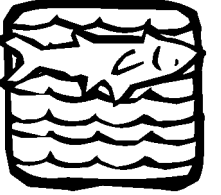
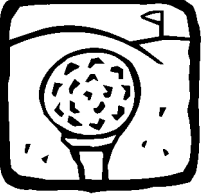

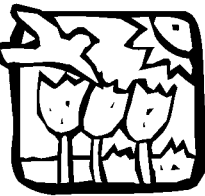

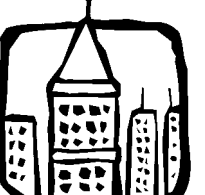




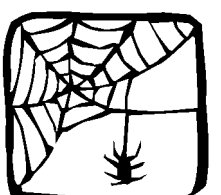
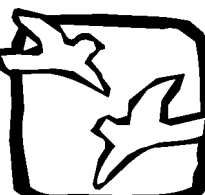


Time: 10 minutes

- ___ 1. Hummingbirds eat only flower nectar.
- ___ 2. Hummingbirds can fly upside down.
- ___ 3. Hummingbirds suck nectar from flowers.
- ___ 4. Hummingbirds migrate on the backs of Canada geese.
- ___ 5. A hummingbird’s heart beats over 1,000 times per minute.
- ___ 6. Hummingbirds search for nectar only from red flowers.
- ___ 7. Leaving up a hummingbird feeder late into fall can slow or prevent migration.
- ___ 8. Hummingbirds are most attracted to flowers with strong fragrances.
- ___ 9. Each hummingbird species makes a different “humming” sound.
- ___ 10. Hummingbirds will attack larger birds such as crows and hawks.

Answers

1. *False.* As hummingbirds need protein, they eat small insects and spiders. They also feed on tree sap and sugar water in hummingbird feeders.
2. *True.* Hummingbirds can fly upside down briefly, by doing a backward somersault.
3. *False.* Hummingbirds do not suck nectar. They lap up the nectar at about 13 licks per second!
4. *False.* Hummingbirds and Canada geese migrate at different times, live in different habitats, and migrate to different areas.
5. *True.* A hummingbird’s heart beats 1,260 times per minute, or 21 times per second!
6. *False.* Hummingbirds are most attracted to red but will feed from any nectar-producing flowers.
7. *False.* Hummingbirds migrate based on changes in day length, not availability of food.
8. *False.* Hummingbirds do not have a well-developed sense of smell. They locate their food by eyesight.
9. *True.* The rush of air created by the wings makes a different humming, buzzing, or whistling sound in each species.
10. *True.* Hummingbirds are fiercely aggressive and are not intimidated by size. They have been observed attacking crows, hawks, and other larger birds.

Migration Cards for Migration Mishaps

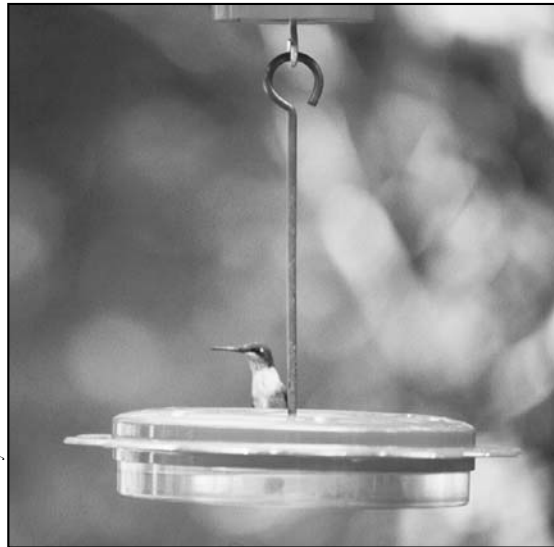
 <p>A large habitat was designated as a wildlife preserve. Gain 3 habitat havens.</p>	 <p>A wetland is filled so a new highway can be built. Lose 2 habitat havens.</p>
 <p>Pollution severely damaged a riverside habitat. Lose 2 habitat havens.</p>	 <p>The construction of a new subdivision and golf course destroys a forest habitat. Lose 3 habitat havens.</p>
 <p>A concerned school group improved a damaged habitat by creating an outdoor classroom and garden. Gain 2 habitat havens.</p>	 <p>A neighborhood creates backyard wildlife habitats. Gain 2 habitat havens.</p>
 <p>Drought killed some flowering plants. Lose 2 habitat havens.</p>	 <p>An apartment dweller plants hanging baskets with hummingbird-attracting flowers. Gain 1 habitat haven.</p>
 <p>Tougher laws are passed to protect bird habitat. Gain 1 habitat haven.</p>	 <p>A homeowner plants a row of trees for shelter. Gain 1 habitat haven.</p>
 <p>Pesticides contaminated the flowers' nectar. Lose 2 habitat havens.</p>	 <p>A late frost killed the first spring flowers. But sap is available through a sapsucker's holes in some trees. Gain 1 habitat haven.</p>
 <p>Insecticides killed insects needed for protein. Lose 1 habitat haven.</p>	 <p>A school hangs up hummingbird feeders. Gain 2 habitat havens.</p>
 <p>Trees used for shelter and nesting are cut down to make paper. Lose 2 habitat havens.</p>	 <p>A city-dweller hangs up a hummingbird feeder. But there are no trees for shelter in the area. Sorry, no habitat haven.</p>

be no pushing or shoving over habitat. You may want to make a rule that students migrate in slow motion by walking instead of running.

5. Play several more rounds, beginning each round by reading a migration card, and adding or removing habitat havens in the habitat to which students will migrate.

Wrap-up: Ask students to summarize what they have learned about some of the many factors that affect migrating birds and their habitat. Discuss what students can do about habitat loss and degradation. What can they do to improve hummingbird habitat?

Adaptation: Hummingbirds face perils along the migration route as well as in wintering and nesting grounds. Soft foam balls can represent such perils as storms or running out of energy. Let students in the “dead bird”



zone take turns tossing the balls into the path of “migrating” students. When a ball makes contact with a migrating student, he/she becomes a “dead bird.”

Extension: Use a wipe-off board and marker to graph the shifting hummingbird population after each round. Students in the “dead bird” zone can help with this while they are waiting to re-enter the game.

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Education in Georgia on-line clearinghouse. At its website (<<http://EEinGEORGIA.org>>), educators can find more hummingbird activities as well as other lesson plans and resources for environmental education.

The Migration Mishaps activity was adapted from “Migration Headache,” Project WILD Aquatic Activity Guide.

RESOURCES

- Newfield, Nancy L., and Barbara Nielsen. *Hummingbird Gardens: Attracting Nature's Jewels to Your Backyard*. Houghton Mifflin, 1996.
- Osborne, June. *The Ruby-throated Hummingbird*. University of Texas Press, 1998.
- Sargent, Robert. *Ruby-throated Hummingbird*. Stackpole Books, 1999.
- Stokes, Donald, and Lillian Stokes. *The Hummingbird Book: The Complete Guide to Attracting, Identifying, and Enjoying Hummingbirds*. Little, Brown & Company, 1989.
- Tyrell, Esther Quesada. *Hummingbirds: Their Life and Behavior, A Photographic Study of the North American Species*. Crown Publishers, 1985.
- Williamson, Shed L. *A Field Guide to Hummingbirds of North America*. Houghton Mifflin, 2001. (A Peterson Field Guide.)

HELPFUL HUMMINGBIRD WEBSITES

- <www.hummingbirds.net> This site lists hummingbird species by state and province, and provides spring migration maps and much more.
- <www.portalproductions.com/> The Hummingbird Web Site includes approximate migration dates by species for the United States and Canada.

- <www.mbr-pwrc.usgs.gov/> The North American Breeding Bird Survey provides hummingbird species distribution maps.
- <www.learner.org/jnorth> Journey North records hummingbird migration tracking and other resources for the study of hummingbirds and other migratory animals.
- <www.rubythroat.org> Operation Rubythroat provides cross-disciplinary hummingbird activities and inquiry project ideas for teachers (K–12).
- <www.naturalinstinct.com> Natural Instinct is dedicated to collecting and distributing information on the flora and fauna of North America's backyards (includes hummingbird investigations).
- <www.hummingbirdsplus.org> Hummer/Bird Study Group is a non-profit organization focusing on the study and preservation of hummingbirds and other neotropical migrants.
- <www.hummingbird.org> The Hummingbird Society is a non-profit corporation dedicated to encouraging international understanding and conservation of hummingbirds.
- <www.nanps.org> North American Native Plant Society includes a list of state and provincial native plant societies that may help you to identify the indigenous plants preferred by hummingbirds in your area.