CLASS TIME: one to two class periods

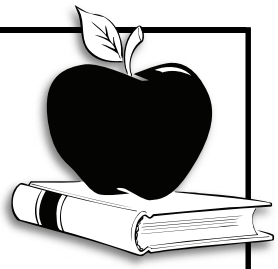
VOCABULARY: migration, fat-loading

MATERIALS: triple-beam balance or other balance; clock with a second hand; student worksheet

COMMON CORE STANDARDS: mathematics 5.MD

NEXT GENERATION SCIENCE STANDARDS: MS-ESS3-4

TEACHER'S GUIDE



ACTIVITY

Avian Olympics

OVERVIEW

By competing in physical activities, students learn about birds' physical abilities and the difficulties of migration.

CONCEPTS

- Some birds migrate to meet their habitat needs.
- Migratory birds depend on habitat in Latin America, the Midwest and along flyways.

OBJECTIVES

Students will be able to: 1) describe some remarkable feats that migrating birds perform; and 2) suggest reasons that individual birds may not survive a difficult migration.

KEY POINTS

- Birds have some unique physical abilities.
- Birds need these abilities to successfully migrate long distances.
- Despite the difficulty and many hazards associated with migration, birds will continue to migrate.

TEACHER BACKGROUND

Birds are amazing animals. Although most birds can fly, those that migrate between breeding grounds in temperate regions and wintering grounds in the tropics are capable of truly remarkable feats on the wing. While some bird species stop and feed during migration, many build up huge fat reserves in preparation for migration and make the trip without stopping. To fully appreciate what these migrants accomplish, consider the amount of energy reserves a bird must build up (fat-loading) in preparation for migration, the distance a bird must travel and how fast it must fly.

In general, Neotropical migratory birds spend up to a third of each year migrating from wintering grounds to breeding grounds and back again. Many embark on a 20-hour-plus nonstop flight over as much as 1,000 kilometers (660 miles) of the Gulf of Mexico to reach the Yucatan Peninsula. Unless confronted by storms or severe cold fronts, migrants make the trip relatively easily. Others take the more circuitous overland route around the Gulf through Texas into Mexico. While this route may be up to three times longer, birds can stop to rest and feed along the way.

Many natural and humanmade obstacles may cause problems for birds during migration. Hazardous storms and strong winds can blow birds off course or provide headwinds that slow progress. Loss of stop-over habitat due to land conversion and deforestation can prohibit birds from getting needed food and rest along the route. Human constructions such as tall TV towers are responsible for many bird deaths due to collisions every year.

PROCEDURE

1. Divide the class into cooperative groups (four to six students per group) to compete against each other in problem-solving, math skills, speed and endurance. The object is to get the most possible points. Hand out a copy of the student worksheet to each group.
2. Weigh-in: The average middle school student's weight is 100 lbs or 45 kg. Ask students: How many grams are in 45 kg? (45,000 g). Compare that weight to the weight of the ruby-throated hummingbird, which weighs 4 grams (0.14 ounces). Each team should try to find an object that weighs 4 grams. (A large index card weighs close to 4 grams.) Test their entries with a triple-beam balance scale. If no team is close, give them all another chance to see how close they can get with different objects. Working together, each team should calculate how many hummingbirds (at 4 grams) it would take to equal the weight of an average middle school student (at 45 kg).
3. Eating like a bird (fat-loading): Each group should select a spokesperson for this math contest. Other group members may help find the answers.

A quarter-pound hamburger and an order of fries is a fairly normal meal for a student. Two or three burgers would be a huge meal. What's the largest number of quarter-pound hamburgers any of the students have ever eaten in a single meal? What percentage of the average weight of a middle school student is this? (assuming a quarter-pound hamburger = 114 grams). The first group with the correct answer gets one point. Compare this with the blackpoll warbler (*Dendroica striata*) that increases its body weight by 50 percent in preparation for its long migration. If an average student weighing 45 kg were going to increase his/her body weight by 50 percent, how much weight would s/he gain? The first group with the correct answer gets one point. How many quarter-pound hamburgers is this equal to?

4. Fast-travel: With each team entering its fastest runner, have a 50-meter dash to determine how long it takes a student to sprint 50 meters (approximately 55 yards). The group with the fastest sprinter gets a point. Calculate how long it would take this runner to cover 1 km. Then, using a map of the world, have students estimate the distance in kilometers from their school to their partner school. Using the two measurements, have students calculate how long it would take the fastest student to sprint directly to their sister country, assuming s/he could run at the same speed in a straight line without stopping. Give a point to the team with the first correct answer. Compare these results with the blackpoll warbler, which is able to migrate 4,000 kilometers (2,480 miles) in 15 days, or sanderlings (*Calidris alba*), which are able to migrate 7,500 kilometers (4,650 miles) in 230 hours, or about 10 days.

5. Wing-flapping: Using a clock with a second hand and one representative from each team, determine the highest number of arm flaps possible in 10 seconds. Give a point to the group whose representative flapped the most. Compare this with the ruby-throated hummingbird, which can flap its wings 120 times per second. Most songbirds flap their wings about 12 to 16 times per second. Using the time from the "Fast-travel" event, calculate how many arm flaps a student would make in a "flight" to the sister country.

6. Nonstop travel: Which student can continue flapping his/her arms the longest? Give that student's team a point. How does this feat compare with the American golden-plover (*Pluvialis dominica*) which flies nonstop for 48 hours as it migrates from Nova Scotia to South America? Which student can run the farthest without stopping? How does this compare with the ruby-throated hummingbird, which flies nonstop for 800 kilometers as it migrates across the Gulf of Mexico, or the snow goose, which can travel 2,750 kilometers (1,700 miles) in 2½ days without stopping?

7. Long-distance travel: Have each team identify which of its members has lived farthest from their current home. Calculate how many kilometers away that is on a map. How does this compare with the Arctic tern (*Sterna paradisaea*) that travels more than 19,000 kilometers (12,000 miles) twice a year from the high arctic regions of Canada and Greenland to the Antarctic Ocean? Many small songbirds may undertake migrations of 9,700 to 11,300 kilometers (6,000 to 7,000 miles). How many kilometers is it from the sister country to Illinois?

8. Fuel-efficiency: Humans burn about 60 calories by running one kilometer. At this rate, how many calories would a student use in running from here to the sister country? If one gram of fat yields nine calories of heat, how many kilograms of fat would this student need to eat before making the trip? Give a point to the team that can calculate this answer first. How does this result compare with the ruby-throated hummingbird, which gorges itself on less than one gram of fat-rich insects, then makes an 800 kilometer (500 mile) nonstop flight across the Gulf of Mexico? Think about how few calories this bird burns per kilometer of flight, or the American golden-plover, which travels 3,900 kilometers (2,400 miles) in 48 hours of continuous flight using less than 60 grams (2.1 ounces) of body fat.

9. Discuss these amazing feats that can be performed by birds but not by humans. Discuss how migration can sometimes be difficult for birds despite their abilities.

DISCUSSION

1. What natural obstïacles or disasters can make migration even more difficult for birds? What human-made obstacles must migrating birds face? What are the benefits of migration, despite these hazards?

MODIFICATION

Set up each competition at a separate site—like centers around the playing field or gymnasium. Have the groups each select a member to participate in each center simultaneously.

EXTENSIONS

1. Conduct a migration obstacle course. Even with all their physical abilities, birds have many obstacles to overcome during migration. Let your students design and develop a migration obstacle course that represents these various obstacles. For mountains, climb the bleachers; to represent a long distance, flap arms and run a lap around the school; dodge a

chair in the path to simulate avoiding TV towers; jump over a pan of water representing the Gulf of Mexico; to simulate lack of water along the route, eat a cracker and whistle before starting; sort through a container of assorted dried beans to find five green peas to represent the need to find food; provide “safe zones” to avoid being eaten by a cat. Make this a relay event so everyone can participate. The fastest group gets a point.

2. Ask officials from your local TV towers, tall buildings, lighthouses, wind turbines and other tall aerial obstructions if they have any data concerning the number of birds killed there during migrations. If they don't, see if they will let you make regular collections or observations of dead birds there during the spring or fall migration. (NOTE: You must have a permit to collect or possess a dead bird, songbird feathers, bird nests or bird eggs. Contact the Illinois Department of Natural Resources, Office of Resource Conservation, at 217-785-8547 for permit information.) See also the *Wildlife in the Classroom* publication at http://www.dnr.illinois.gov/education/Documents/WITC.pdf. How many birds are killed by these obstructions in your area? Although various solutions have been tried, this problem still persists and no one knows how to prevent birds from crashing into tall aerial obstructions. Working to solve this problem could be an action project.

ASSESSMENT

1. Evaluate student groups in their math calculations.
2. Evaluate students' ability to record data accurately.
3. Ask students to write a fictitious account of a bird's difficult migration.

Avian Olympics

STUDENT WORKSHEET

1. Choose a mascot migratory bird for your group name.

2. The average middle school student's weight is 100 lbs or 45 kg. How many grams are in 45 kg?

   Compare that weight to the weight of the ruby-throated hummingbird, which weighs 4 grams (0.14 ounces). Try to find an object that weighs 4 grams. How many hummingbirds (at 4 grams) would it take to equal the weight of an average middle school student (at 45 kg)?

3. What's the largest number of quarter-pound hamburgers any student in this class has ever eaten in a single meal?

   What percentage of the average weight of a middle school student is this amount? (assuming a quarter-pound hamburger = 114 grams)

   Compare this result with the blackpoll warbler (*Dendroica striata*) which increases its body weight by 50 percent in preparation for its long migration. If an average student weighing 45 kg were going to increase his/her body weight by 50 percent, how much weight would s/he gain? How many quarter-pound hamburgers does this equal?

4. How long did it take the fastest student to sprint 50 meters? Calculate how long it would take this runner to cover 1 kilometer.

   Using a map of the world, estimate the distance in kilometers from your school to the sister country. How long would it take the fastest student to sprint directly to the sister country, assuming s/he could run in a straight line at a constant speed without stopping?

   Compare these results with the blackpoll warbler, which is able to migrate 4,000 kilometers (2,480 miles) in 15 days, or sanderlings (*Calidris alba*), which are able to migrate 7,500 kilometers (4,650 miles) in 230 hours or about 10 days.

5. How many arm flaps can your group's representative do in 10 seconds?

   Compare this result with that of the ruby-throated hummingbird, which can flap its wings 120 times per second. Most songbirds flap their wings about 12 to 16 times per second. Using the time from the "Fast-travel" event, calculate how many arm flaps a student would make in a "flight" to the sister country.

6. Which group member can continue flapping his/her arms the longest? How long?

   Which group member can run the farthest without stopping? How far is that?

   How does this result compare with that of the ruby-throated hummingbird, which flies nonstop for 800 kilometers as it migrates across the Gulf of Mexico or the snow goose, which can travel 2,750 kilometers (1,700 miles) in 2½ days without stopping?

7. Which group member has lived the farthest away from their current home? How many kilometers away is that?

   How does this result compare with that of the Arctic tern (*Sterna paradisaea*) that travels more than 19,000 kilometers (12,000 miles) twice a year from the high arctic regions of Canada and Greenland to the Antarctic Ocean? Many small songbirds may undertake migrations of 9,700 to 11,300 kilometers (6,000 to 7,000 miles). How many kilometers is it from your sister country to Illinois?

8. Humans burn about 60 calories by running one kilometer. At this rate, how many calories would you need to run from here to your sister country?

   If one gram of fat yields nine calories of heat, how many kilograms of fat would you need to eat before making the trip?

   How does this result compare with that of the ruby-throated hummingbird, which gorges itself on less than one gram of fat-rich insects, then makes an 800 kilometer (500 mile) nonstop flight across the Gulf of Mexico? Think about how few calories this bird burns per kilometer of flight, or the American golden-plover (*Pluvialis dominica*), that travels 3,900 kilometers (2,400 miles) in 48 hours of continuous flight using less than 60 grams (2.1 ounces) of body fat.