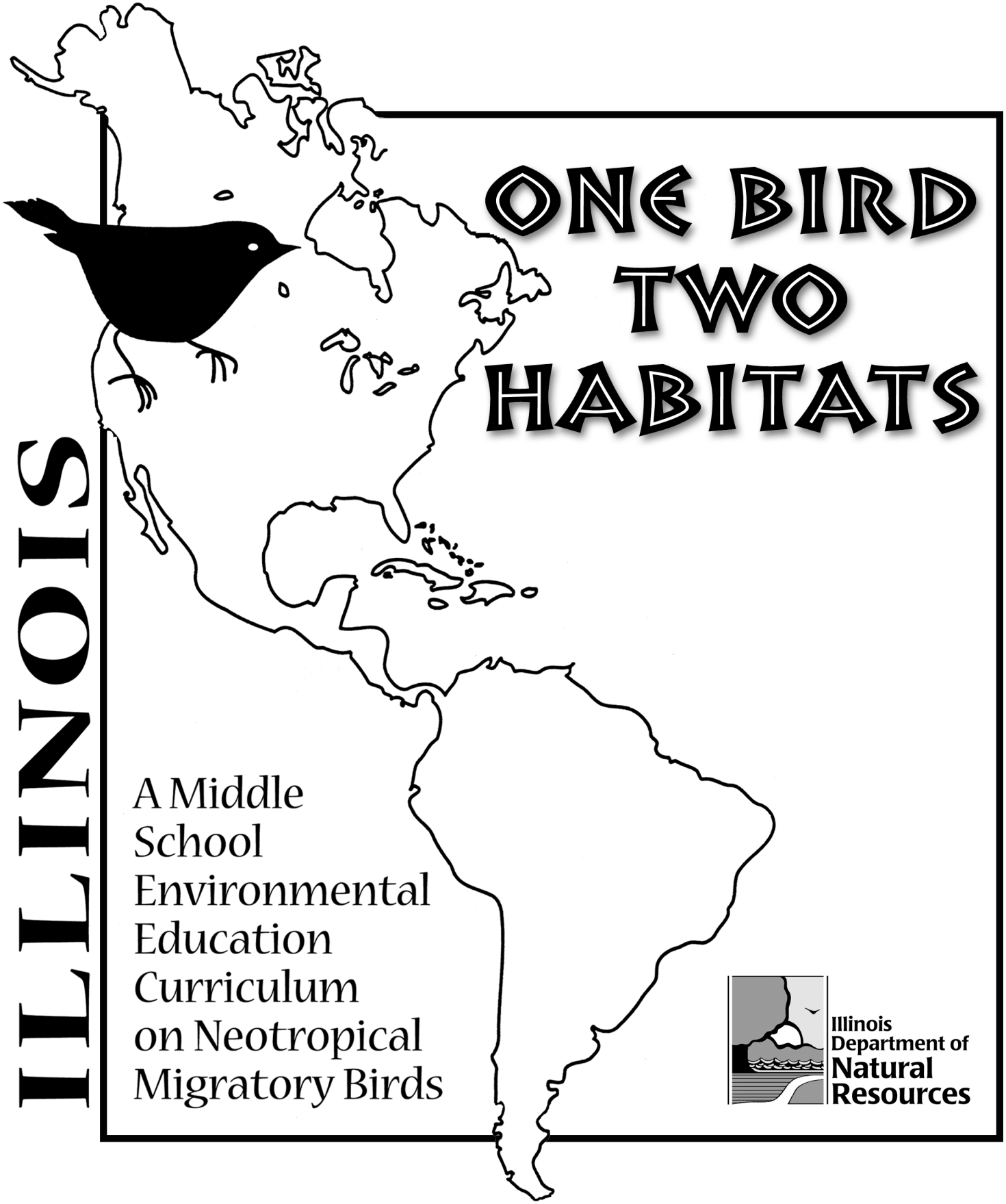
State of Illinois
Illinois Department of Natural Resources



ONE BIRD TWO HABITATS

ILLINOIS

A Middle School Environmental Education Curriculum on Neotropical Migratory Birds

Illinois Department of Natural Resources

ACKNOWLEDGMENTS

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One Bird –Two Habitats

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Introduction

The Theme

One Bird—Two Habitats was developed by the Wisconsin Department of Natural Resources as a three- to six-week environmental education unit for middle school students, **grades six through eight**. Recognizing differences in educational philosophies and environmental education requirements, use of the material as a unit in Illinois classrooms may not be practical. Recommendations for adapting the material to the Illinois situation are included.

The theme is Neotropical migratory bird conservation: a global environmental issue that illustrates the connections between people, birds and forests in different parts of the world. The major theme addressed in the unit is interconnectedness. People and wildlife share similar needs, and it is in trying to meet these needs that we are interconnected. Environmental issues are global and only through global connections among people can we address environmental concerns.

This unit presents one issue, the decline of some Neotropical migratory bird populations and emphasizes the connections between Illinois and Central and South America, to show how people, their actions and the environment are interconnected. A Neotropical migratory bird is one that moves seasonally between temperate regions of the Americas, where it spends its breeding time, and tropical areas, where it spends the winter months. A listing of Illinois Neotropical migrants and species fact sheets on 24 of these birds can be found in Appendices A and B.

The Issue

Researchers and casual bird watchers have observed population declines among some long distance migratory birds. Although grassland and wetland migratory birds are affected by changes in the environment, this unit focuses on Neotropical migratory forest birds. These are the forest-dwelling birds that breed in North America during summer months and migrate to the new world tropics, including Central America, to spend the winter. For various reasons, including increasing human populations, the once vast forests in the Americas—temperate and tropical—have been greatly reduced. The reduction and alteration of these northern nesting grounds and southern wintering grounds are major factors contributing to the decline of some migratory forest bird populations. Other factors have contributed to their decline as well. Predatory species such as raccoons (*Procyon lotor*), blue jays (*Cyanocitta cristata*) and house cats (*Felis catus*) disrupt the nesting of many birds. Pesticides and continuing pollution affect food sources used by birds.

Not all birds migrate. Of the birds that migrate, not all are Neotropical migrants. Some birds are short-distance migrants. Of the birds that migrate from northern North America to the tropics in Latin America, some live in forests, but many live in grasslands, wetlands or along the shore. Those requiring interior forest habitat are only a portion of the birds which inhabit forests. In addition, birds that live in forests during the nesting season may not require the same habitat when they are in the tropics and vice-versa.

Birds and people both depend on forest resources. In order to conserve forest bird populations, land use decisions regarding forests must take into account the impacts of those uses on people, birds and the forest itself. Because migratory birds spend time in North, South and Central America, they are a shared international resource. Their population declines illustrate the global effects of human actions.

The Project

To ensure as much accuracy as possible, the activities and background information have been based on research. The materials were reviewed by experts in ornithology, forestry, Latin America and education. Then, 23 Wisconsin teachers field-tested the curriculum in their classes. Data collected during this pilot indicated the success of the unit: students showed a statistically significant increase in knowledge and understanding related to the unit; and teachers and students both exhibited positive attitudes about the materials. With a research base, activities that teach about research methods, and a rigorous evaluation of its effectiveness, *One Bird—Two Habitats* bridges the gap between research and education.

The Project in Illinois

Because of the curriculum's documented success in Wisconsin, the Illinois Department of Natural Resources (IDNR) sought and was granted permission to revise the materials for use in Illinois. Funding for the revision and distribution of the materials was provided by the IDNR and the Illinois State Board of Education (ISBE) through a Scientific Literacy grant. Two additional activities have been added to the Illinois version, “Interview a Bird” and “Interpreting Data.”

Connections to Central and South America

The National Association of the Partners of the Americas (NAPA) initiated the *One Bird—Two Habitats* project to further NAPA's goals in creating connections between North America and Central America. The Wisconsin Project utilized the Partners of the Americas Program to partner with their sister state, Nicaragua.

NAPA has designated Sao Paulo, Brazil, as the Illinois partner. Many of the Illinois Neotropical migrants do not travel as far south as Sao Paulo. Most Brazilian people speak Portuguese, a language not commonly spoken in Illinois schools, according to a survey conducted by the ISBE listing the top 17 non-English languages spoken in Illinois public schools. For these reasons, less of an emphasis is placed in this document on promoting any one “sister state/country” for participating classrooms to work with.

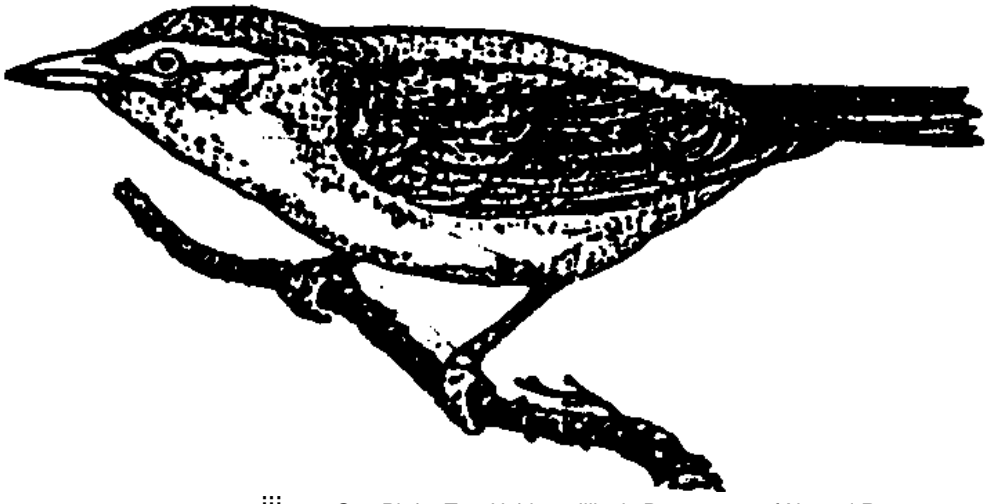
As an educator, you do have the opportunity to utilize local resources and select an alternative sister country. Working with the students and community, you may establish an alternative partnership. Partnerships with a Latin American (including Central and South America) country may already exist through the Foreign Language Department in your school or district, or there may have been foreign exchange students attending school in your area who would be willing to help facilitate a partnership. Other sources of contacts may include members of your community, former Peace Corps representatives or service organizations. Using technology to contact schools in other countries makes the process easier.

Allowing students to select the partner country will give them an opportunity to research the country and interview people in their school or community, thereby enhancing social science learning skills.

Because the original material was devised for the Wisconsin-Nicaragua partnership, many of the activities provide examples of Spanish-based literature from Nicaragua. These samples remain in the Illinois version as the concepts and translations meet the concepts and objectives of the activities.

Scientific Names

The scientific name for the Neotropical migratory birds featured in the text can be found in Appendix A. The scientific name for all other species is shown in the text immediately following the organism’s common name.



How to Use This Guide

One Bird—Two Habitats is a series of interconnected activities, built on a conceptual framework. Activities cover such topics as bird appreciation, habitat, migration, forest management, research and human impact. Some activities build upon knowledge and understanding gained through previous activities. The unit introduces the issue of declining Neotropical migratory bird populations and ends with an activity that encourages students to share information about the issue beyond the classroom. Because the issues related to land use decisions, forest management and Neotropical migratory bird population declines are very complex, it is important that the activities are interrelated through discussion.

Many of the activities require more than one class period to complete. Some require set-up time over several days prior to conducting the lesson. Two sample activity schedules are included to facilitate planning to provide a balance of fun and serious, simulation and discussion, short and long and introductory and evaluatory kinds of activities. One schedule proposes use of all activities while the other is an abbreviated schedule touching on the major topic areas. The order of some activities may be switched. Please review the schedules and note the activities which require prior planning.

Some of these activities require active participation and are interdisciplinary. It is important that a discussion follow each activity to emphasize connections between the activity and the issue and to ensure that learning occurs. To support such discussions, teacher background information accompanies each lesson. Additional background information can be found in the appendices.

This material lends itself very well to interdisciplinary team teaching. There are activities suited to social science and science, as well as foreign languages, physical development and health, mathematics and English language arts (see Appendix H). In team teaching communication is critical to ensure that all the concepts and key points are covered and that the activities are interconnected.

Just as interconnectedness is a major theme in the content of this material, so it has been incorporated in the teaching methods through the use of cooperative learning strategies in some of the activities. Cooperative learning creates interdependence among students in order to reach a learning goal. Each student must be responsible for the understanding of the whole group.

Methods of evaluating student learning are incorporated in each activity. The activities "Town Meeting" and "Tell the World" are designed to serve as indicators of student understanding of the issues. Appendix I offers suggestions for action projects.

The goals of this material are to increase awareness of the need for conservation of Neotropical migratory forest birds and their habitats and to increase understanding of the global aspects of environmental issues. We hope that increased awareness and understanding will lead to conservation action.

SAMPLE #1 SCHEDULE OF ACTIVITIES

Day	Activities
1	Introduce cooperative groups—Interview a Bird
2	Cultural Exchange (begin)
3	Cultural Exchange (complete)
4	Avian Olympics
5	If There Were No Birds... (begin and assign homework)
	Migrateering (begin)
	Defining a Forest (hang first trees)
6	Migrateering (complete)
	Defining a Forest (hang more trees)
7	The Balancing Act
	Defining a Forest (hang more trees)
8	Defining a Forest (hang more trees and discuss)
9	Habitat Squeeze (begin the squeeze)
10	Habitat Squeeze (continue the squeeze)
11	Habitat Squeeze (discuss)
	If There Were No Birds... (discuss)
12	A Round Trip Ticket
13	Migration Migraines
14	Designing Researchers (begin)
15	Designing Researchers (complete)
	Interpreting Data
16	Buddy Banding (introduce)
17	Buddy Banding (discuss)
	Town Meeting (introduce and assign roles)
18	Intelligent Tinkering
19	Territory Tango
20	Cowbird Capers
	Town Meeting (begin)
21	Town Meeting (continue)
22	Town Meeting (complete)
23	Tell the World

SAMPLE #2 SCHEDULE OF ACTIVITIES

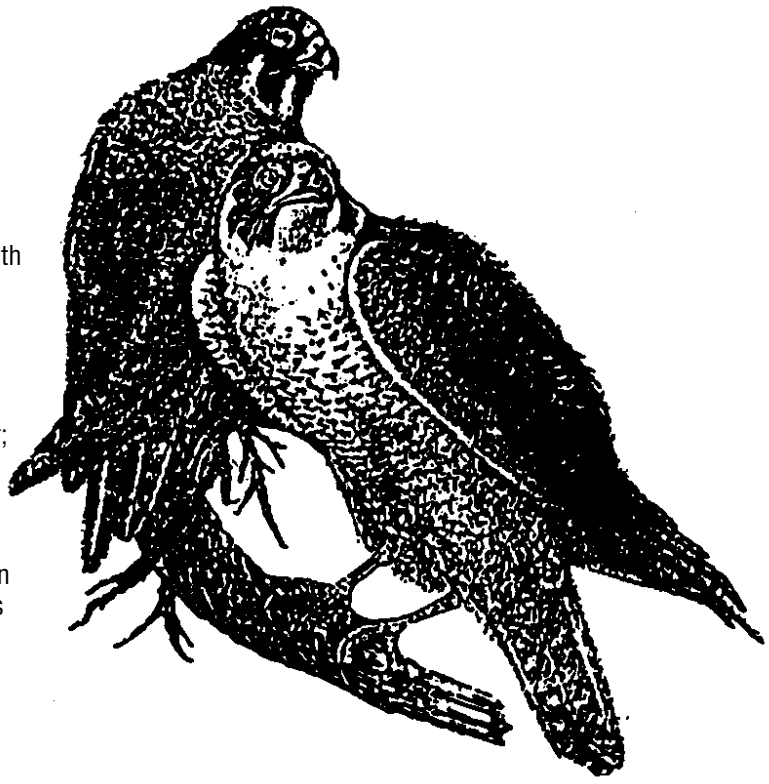
Day	Activities
H1	Introductory homework reading assignment: articles in Appendices C and D
1	If There Were No Birds
H2	Balancing Act (make mobile)
2	Balancing Act (discuss)
H3	Read species fact sheets
3	Habitat Squeeze
4	Town Meeting (start)
5	Town Meeting (finish)
H6	Research Latin American country
6	Cultural Exchange (start)
7	Cultural Exchange (finish)

H = homework assignment

LIST OF MATERIALS NEEDED BY ACTIVITY

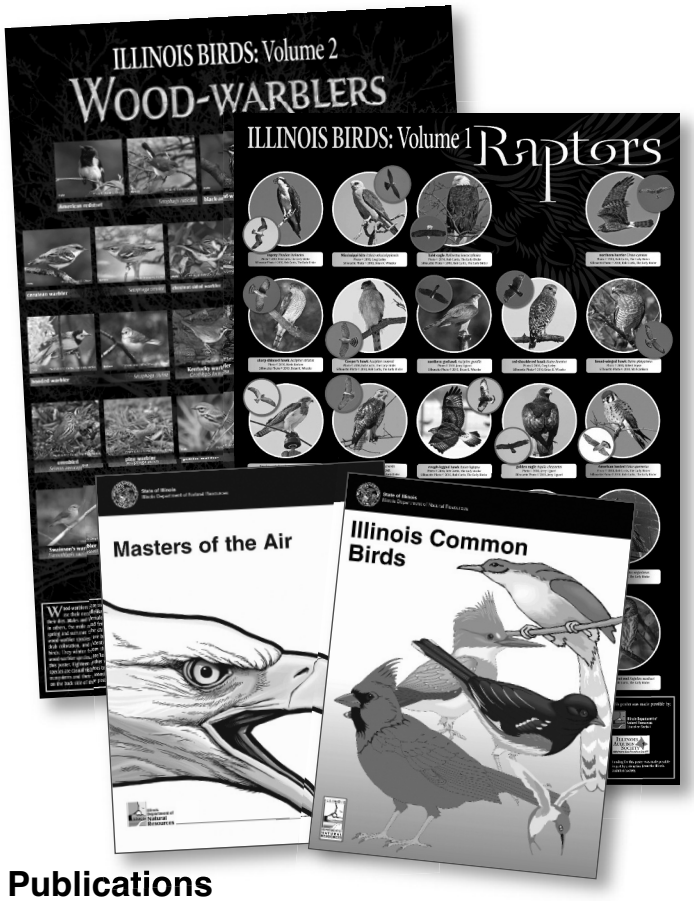
Activity	Materials
Interview a Bird	fact sheets
Cultural Exchange	mailing materials; international money order; funds to cover cost of reply from partner country
Avian Olympics	triple-beam balance; clock with second hand; world map with scale in miles
Migrateering	five compasses; ribbon; index cards; map of the stars
The Balancing Act	string or fishing line; sticks; objects gathered by students
Defining a Forest	paper cut-outs of trees
Habitat Squeeze	rope; off-limits sign
A Round Trip Ticket	copies of map enclosed with activity; colored pencils
Migration Migraines	construction paper; buttons or bottle caps; copies of data sheet enclosed with activity
Buddy Banding	construction paper; masking tape; banding permits
Intelligent Tinkering	old machines; tools
Territory Tango	craft dough; jar lids; jars; waxed paper; table knife
Cowbird Capers	blindfold; paper cups; plastic bowl; string; popcorn
Town Meeting	copies of research article summaries in appendix; copies of role- playing cards enclosed with activity
Tell the World	whatever students require to carry out their projects

No materials needed for activities not listed.



IDNR Division of Education

The Illinois Department of Natural Resources' (IDNR) Division of Education developed this unit on *Illinois Birds* for use in Illinois classrooms. Additional supplemental resources to help you teach about birds in Illinois are also available from the IDNR.

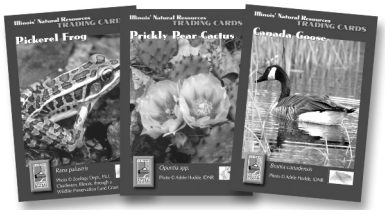


Publications

Posters, activity books, books and other items can be ordered or downloaded through the IDNR Publications page at https://dnr2.illinois.gov/teachkids/.

Illinois Birds Resources Trunk

Posters, field guides, lessons, replica skulls, replica eggs, rubber feet replicas, books and bird songs and calls on DVD are just some of the items contained in this "trunk." The trunk is a large plastic container filled with hands-on resources that will help make bird lessons more meaningful for students. *IIIlinois Birds Resources Trunks* are available for loan from locations throughout Illinois. Visit https://www2.illinois.gov/dnr/education/Pages/ItemsForLoan.aspx to access the list of lending sites and the trunk content list.



Illinois' Natural Resources Trading Cards

The cards provide images and information to be used in a variety of ways in the classroom. Each card contains an image, habitat association, common name and scientific name (where applicable) on the front side with additional relevant information on the back side. Teachers in Illinois schools may request one pack of each of the available sets of cards. Send your request on school letterhead to the address shown on the next page.

Videos

Videos from the Illinois Department of Natural Resources about Illinois birds can be accessed through the Podcast page at https://www2.illinois.gov/dnr/education/Pages/podcasts.aspx or through YouTube.

Field Trip Tips Web Page

Let the IDNR help you plan your field trip with this interactive site. Field trip destinations are correlated with topics that can be studied, lesson plans and supplemental resources. Go to https://www2.illinois.gov/dnr/education/Pages/fieldtrip.aspx to access the Web page.

Illinois Biodiversity Field Trip Grant

Take your students to visit Illinois' natural or cultural heritage with an *Illinois Biodiversity Field Trip Grant*. Visit https://www2.illinois.gov/dnr/education/Pages/grants.aspx for details and an application form.

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CLASS TIME: three classroom periods of 30 minutes each or longer

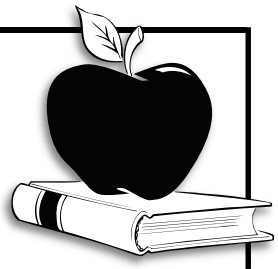
VOCABULARY: interview, reporting, anthropomorphism

MATERIALS: Fact Sheets in Appendix B; writing and research materials

COMMON CORE STANDARDS: English language arts MS Writing 2, MS Writing 3, MS Writing 4, MS Writing 7, MS Writing 8, MS Reading 1, MS Reading 4, MS Reading 6

NEXT GENERATION SCIENCE STANDARDS: MS-LS2-4

TEACHER'S GUIDE



ACTIVITY

Interview a Bird

OVERVIEW

Students will perform research, write a report and conduct an interview to learn more about a Neotropical migratory bird.

CONCEPTS

Birds are similar but there is a great amount of diversity in the requirements species or groups of species have for survival.

OBJECTIVES

Students will be able to: 1) generalize that birds range in size, color, feeding habits and nesting requirements; 2) recognize some traits of Neotropical migratory birds; and 3) recognize that some birds migrate while others do not.

KEY POINTS

Migratory birds have habitat requirements in Illinois and Latin America.

TEACHER BACKGROUND

There are more than 9,900 species of birds in the world. About 800 species have been found in North America, and more than 400 species have been recorded in Illinois. Birds are warm-blooded vertebrates. They have three characteristics which distinguish them from other animals: feathers; hard-shelled eggs; and hollow bones.

As similar as birds are as a group, individual species often have unique characteristics and habitat requirements. All birds require habitat to survive. Habitat consists of food, cover, water and space. While two species may both live in the same forest, one may live in a hollow tree branch and the other on the ground. One may have a long, thin bill to probe tree bark for insects and the other a heavy bill to crack seeds.

The major purpose of this activity is for students to develop a working definition of birds, recognizing that they vary in any number of ways, including color, feeding habits and nesting requirements.

CAUTION: Students may have a tendency to project inapplicable human characteristics to birds, especially because the "interview" format puts the "birds" in a human situation. Assist the students in avoiding anthropomorphism. Stress that they should try to see the world from the bird's perspective.

PROCEDURE

1. OPTIONAL: Invite a local newspaper reporter to talk with your students. Ask him or her to describe what a reporter does and especially talk about the techniques of interviewing and writing used.
2. Have the students brainstorm a list of bird species. Check the list to make sure it includes many different types of birds, including migrants. OPTIONAL: Make available to the students a list of native species and Neotropical migratory species (Appendices A, B) to help them focus on nearby animals they might not have considered.
3. Work with the students to establish a research, interview and reporting format for their use as reporters. Divide the class into groups of two students each.

Example

RESEARCH

Each team of two students should complete the following items.

A. Decide which bird to "interview." Make sure that Neotropical migrants and nonmigratory birds are included.

B. Write a list of questions to ask. Questions could be developed by the two-person teams or as a class project, providing a uniform set of questions.

C. Each team of reporters selects a bird to study. The team will first need to gather information about the bird. They can do that by actually observing the bird, consulting resource materials or both!

D. Use reference materials to take notes for appropriate responses to questions.

INTERVIEW
It's time to conduct the interview! One student asks questions while the other student assumes the role of the wild bird and responds to the interviewer's questions. Interviews may be conducted in front of the class, or just between the partners. Students then switch roles. Remind the students to convey the perspective of the interview bird without projecting inapplicable human attributes.

REPORTING
Now it's time to organize the information gathered through the process of researching and interviewing the bird. Each team should use its notes as the basis for writing a newspaper article about the wild bird they interviewed.

4. Talk about the diversity of birds—including that birds range in size, color, feeding habits and nesting requirements. Ask each student to share some feature of their assigned bird which they felt was unique or interesting.

DISCUSSION

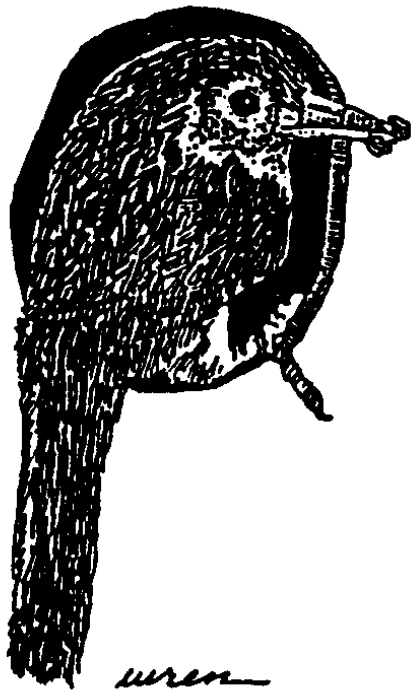
1. Discuss why some birds migrate and others do not.

EXTENSIONS

1. Have students make an artistic representation of their bird.
2. With the newspaper articles complete, either publish a wildlife newspaper for everyone to read and keep or read the articles aloud for everyone to hear.
3. Have the students try to observe their assigned bird in nature. Knowledge regarding behavior and migration times is essential.
4. Obtain pictures of the birds interviewed. Have the students learn to recognize the individual species by sight. You may also want them to learn the songs of these birds.

ASSESSMENT

1. Write a newspaper article of several paragraphs in length which conveys the traits and behaviors of the bird selected for the interview.
2. Name three Neotropical migratory birds.
3. Name three nonmigratory birds.

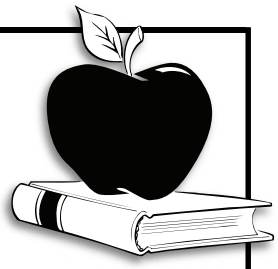


CLASS TIME: two class periods

MATERIALS: pictures and other light items that will represent Illinois; mailing materials; map of sister country; name and address of a teacher in sister country; funds to cover the cost of a reply

COMMON CORE STANDARDS: English language arts MS Writing 4, MS Writing 8, MS Writing 9, MS Reading 1, MS Reading 10

TEACHER'S GUIDE



ACTIVITY

Cultural Exchange

OVERVIEW

Students send a cultural exchange packet representing aspects of life in Illinois to a class in a Latin American school.

CONCEPTS

- People in Latin America and North America have similar needs.
- People can act to help conserve Neotropical migratory bird populations and their forest homes.

OBJECTIVES

Students will be able to: 1) communicate with students in Latin America; and 2) observe commonalities between themselves and their Latin American neighbors.

KEY POINTS

- People in Latin America are similar to people in Illinois in many ways.
- Some of the difficulties in this activity reflect difficulties people encounter in trying to solve global environmental problems.

TEACHER BACKGROUND

Just as birds can fly across borders, so can our thoughts and feelings, building a people-to-people bridge between Latin America and Illinois, creating empathy and showing that we share concern for the environment.

Your class will prepare a cultural exchange package to send to a class in Latin America. While you may receive a letter or package from your partner class, you should reduce the expectation of a response to minimize disappointment if there is none. Explain to the students that it is less a part of many Latin American cultures to respond than it is of North American cultures.

Spanish is the primary language in most of Latin America. It is possible that no one in your exchange school can translate English into Spanish. To explain the cultural exchange idea to the partner class, be sure to enclose the Spanish cover letter provided following this activity. An English version is also provided. Be sure to sign the letter and include your return address. You may wish to build a cooperative agreement with a Spanish teacher to aid in translating any written items you plan to send or hope to receive.

Because packages sometimes are not delivered intact in Latin America, it is advisable that the package consist of those items that can fit flatly in a manila envelope.

We suggest you send visual images, such as drawings and photos, examples of school work, a class photo, the music to a song, maps of the United States and Illinois, pictures from calendars or posters to decorate classroom walls, a paper snowflake, postcards, a picture of agricultural activities, sample forest products that would be useful, such as some pencils and paper, a local newspaper clipping with pictures or a picture of a Neotropical migrant.

Exercise care in sending international packages. We don't want to send any microscopic organisms in plants or soil that might be damaging to Latin American ecosystems or agriculture. If you have any questions about what is acceptable to send, contact the U.S. Postal Service.

The school year is different in many Latin American countries than it is in Illinois. Many school years begin in March and end in December. You may find that your class and its partner class will be in school at the same time only from March to May or from September to December. Students here in September will not likely be together in the same class they were in the previous May. Likewise, the students in Latin America will not be together in the same class in March that they were in just three months previously. The window for communicating class to class is very narrow.

The mail service between Illinois and Latin America may be slow. Explore partnerships with organizations that could carry a package to your partner country. It can take weeks for an exchange package to reach its destination. Plan to send your package early. If a return package arrives after the *One Bird—Two Habitats* activities are completed, it is still important to follow up so that students can see the rewards of their efforts.

Mail service is expensive relative to income in most of Latin America, where many of the people are struggling with poverty. Classes may not send a reply package unless the money to do so is included. If each student contributes $1.00, the cost of sending a large envelope should be covered. If the class prefers a fund-raising project to cover the costs, the fund-raising should be accomplished before the unit. The U.S. Postal Service recommends sending an international money order, which can be obtained at any bank. They also recommend sending the package by registered mail, with a return receipt requested (which will add several dollars to the mailing cost but will add greatly to its chances of reaching its destination). In the event the money order is lost or stolen, the current maximum amount you can receive back from insurance is limited and may be less than the actual value.

PROCEDURE

1. Tell students that they are going to send a cultural exchange packet to a class in Latin America to describe our lives in Illinois. Have students research Latin American countries and make oral and written presentations. Students should make a map of the country selected.
2. Select one country to become the class partner country. Conduct further research about the country and discuss how living there might be different than living in Illinois. What more would we like to know about students there? What might they like to know about our lives?
3. Explore selection of a partner school in the country. Use the Internet and contacts through the Illinois State Board of Education to help you find a school. Have the class brainstorm categories of items to send to their partner school. Some examples are:

- Illinois forests and the ways people use forest products;
- photographs of a Neotropical migrant that nests here and winters there;
- a description of school and the subjects we study;
- what we like to do in our free time;
- a description and photograph of our town and what it's like to live here.
- Make sure a category related to birds is included.

4. Divide the class into groups and assign a category to each group. Tell groups to decide among themselves what kinds of pictures or lightweight items they could send to represent their category and help a student in the partner school better understand life here. Have each group decide on the best items to send.
5. The next day, have student groups share the materials they selected and discuss what images of our culture and environment these items will convey. Compose a brief class letter that contains what the items represent. If possible, find someone to translate the letter into Spanish. Be sure to include your return address.
6. Discuss how people in North America can work together with people in Latin America on problems (such as the declining populations of Neotropical migratory birds) that affect us both. Make the point that some of the obstacles (language barriers, slow mail service, poor transportation, limited telephone service, lack of money, different goals) that we must overcome to successfully complete a cultural exchange with a class must also be overcome by people working to solve global environmental problems.
7. Discuss how each group functioned. Did everyone participate?

DISCUSSION

1. How will the items selected for the exchange packet reflect life in Illinois? What kinds of things do you think might represent life in the partner country? How might these representations be similar or different from each other? How could people in the two countries work together to conserve Neotropical migratory birds?
2. If the class receives a response from the partner school, discuss the commonalities and differences between our culture and theirs. Collaborate with a Spanish teacher for translations.

EXTENSION

1. If some of the students speak Spanish or are studying it, or if a Spanish teacher or more experienced class will help, write letters, poems and stories for the exchange package in Spanish.

ASSESSMENT

1. Write a paragraph describing commonalities between the two countries.
2. Provide an appropriate item to be considered for inclusion in the packet and a rationale for its inclusion.
3. Explain what items were included in the packet and what each represents.

Dear Sir or Madam:

We are a middle school class from your sister state, Illinois. We are writing to share a little bit about ourselves and life in Illinois, and hope that you can tell us something about your lives in return.

This year our class is studying about birds that migrate from Illinois to Latin America. Some of the birds that build nests and raise young in Illinois fly south before the cold winter here. From October to April, they live in your country and then return to Illinois again. An example of one of these birds is the red-eyed vireo (*Vireo olivaceus*), named for its red eye. This bird is like an ambassador that travels back and forth from our country to yours.

We are learning that many of these migratory birds are in trouble. Because of changes in the land and the way it's used in the United States and in Latin America, there is less and less suitable space for these birds to live. Many of their populations are declining.

Because this is a problem that affects people in Illinois and your country, we want to learn more about your country and teach you more about us. We need to work together to conserve birds and the environment. We hope that this package will help you learn more about our lives in Illinois.

In Illinois, most people go to school from kindergarten through 12th grade. Middle school usually refers to grades six to eight. We usually have a vacation from school during our summer, June, July and August. Illinois has much agricultural land, grassland and forests. It is a very green state, except during our winter when everything freezes and there is often a lot of snow. We are known as the "prairie state" because of the prairies that originally covered our state. Most of the people live in towns or cities. Springfield is our state capital, and Chicago is our biggest city.

We would like to receive a letter from your class that tells us about your lives. We hope you will send a response to the address at the top of this letter. Thank you very much.

Sincerely,

Estimado (a) Señor o Señora;

Somos un grupo de escuela intermedia de su hermano estado de Illinois. Les escribimos para compartir un poco con ustedes sobre nosotros y nuestra vida en Illinois. Esperamos que ustedes, a cambio, nos relaten algo sobre su vida en Puerto Rico.

Este año nuestra clase está estudiando aves que migran desde Illinois hacia América Latina. Algunas de las aves que construyen nidos y crian sus polluelos en Illinois, vuelan al sur antes de que llegue el invierno. Estas aves viven en tu pais desde octubre hasta abril y regrasando nuevamente a Illinois. Un ejemplo de una de estas aves es el "Julián Chiví Migratorio" (*Vireo olivaceus*). Este pájaro es como un embajador que viaja de un lado para el otro desde nuestro país al tuyo.

Estamos aprendiendo que muchas de estas aves migratorias están en dificultades. Debido a los usos y cambios en el terreno en los Estados Unidos y Latinoamérica, cada vez hay menos lugares adecuados para que estas aves puedan vivir. Muchas de las poblaciones están disminuyendo. Debido a que este problema nos afecta tanto en Illinois como en tu pais, queremos aprender más acerca de tu pais, así como también enseñarte más sobre nosotros.

Necesitamos trabajar juntos para conservar las aves y el ambiente. Esperamos que este paquete que eniamos les ayude a conocer más sobre nuestra vida en Illinois.

La mayoria de las personas de Illinois van a la escuela desde kindergarten (jardín de infantes) hasta el 12mo. grado. A los grados del 6to. al 8vo. son los que llamamos "middle school." Por lo general, tenemos unas vacaciones cortas en invierno al final de diciembre y una más larga durante los meses de verano, junio, julio y agosto. Illinois tiene mucho terreno agrícola, pastos y bosques. En un estado bien verde, excepto en invierno, cuando todo se congela y a menudo hay mucha nieve. Nos conocen como el "estado de las praderas" debido a las praderas qu cubrian nuestro estado originalmente. La mayoría de las personas viven en pueblos o ciudades. Springfield es nuestra capital y Chicago s nuestra ciudad más grande.

Nos gustaría recibir una carta de tu clase que nos relate algo sobre sus vidas. Esperamos que nos envies la repuesta a la dirección que aparece en la parte superior de esta carta. Muchas gracias.

Atentamente,

Translation by Aileen T. Velazco, Coordinator, Aquatic Resources Education Program, San Juan, Puerto Rico

CLASS TIME: one to two class periods

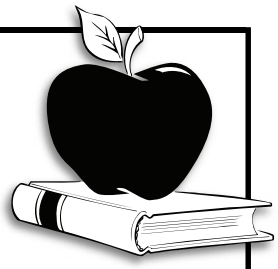
VOCABULARY: migration, fat-loading

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 (*Setophaga 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 https://www2.illinois.gov/dnr/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 (*Setophaga 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?

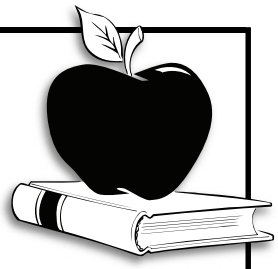
   If one gram of fat yields nine calories of heat, how many kilograms of fat would you need to eat before making the trip?

   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.

CLASS TIME: 30 minutes first day; 20 minutes second day

COMMON CORE STANDARDS: English language arts MS Reading 7, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

TEACHER'S GUIDE



ACTIVITY

If There Were No Birds...

OVERVIEW
Through brainstorming and interviewing others, students hear and express an appreciation for birds.

CONCEPTS
Birds are economically, ecologically and aesthetically valuable.

OBJECTIVE
Students will be able to identify ways birds are beneficial to people and to the ecosystem they inhabit.

KEY POINTS
- People value birds in a variety of ways.
- Birds contribute to the ecosystem they inhabit.
- Research findings depend on the questions asked.

TEACHER BACKGROUND
Birds play an important role in food chains and ecosystem balance. Birds provide aesthetic enjoyment for people and function as indicators of the health of the environment.

Birds fill more than one niche in their food chains. Many birds, including most of our Neotropical migratory birds, are insect-eaters, consuming large numbers of both adult and immature insects and other arthropods (spiders and others). These birds, in temperate regions of North America, contribute to keeping insect populations in check. For example, a breeding pair of warblers can remove caterpillars from over a million leaves in a period of 10 days. Herbivorous birds act as seed dispersers–ingesting seeds, carrying them great distances and finally excreting them far from the host plant. Birds and/or their eggs may also be food for other predators, avian or mammalian.

A bird's role in the food chain is related to its function in maintaining ecosystem balance. Some birds are pollinators for plants and others act as seed dispersers. All birds participate in nutrient cycling in their habitats. For example, a plant grows out of nutrient-laden soil. Larval insects survive on the plant tissues, and the insects are subsequently eaten by an ovenbird. The ovenbird becomes prey for a weasel, and the weasel returns the nutrients to the soil in its excrement.

Birds provide aesthetic enjoyment to many people. Identifying or watching birds is a hobby for a large number of people. There are others who enjoy bird feeding at their homes or appreciate listening to the chorus of bird songs in the spring. Some people enjoy hunting and eating certain birds. Many bird songs are territorial proclamations by males competing for mates. They tell other males to stay away and tell females they are seeking a mate.

Early miners took caged canaries (*Serinus canaria*) into the mines with them. A dead canary would alert the miners to the presence of colorless and odorless lethal gas in time for them to escape. Similarly, wild birds provide an indication of the health of the environment here and in Latin America. Declining bald eagle (*Haliaeetus leucocephalus*) populations led to the discovery of dangerous levels of DDT in the eagle's food. Researchers are using the bald eagle, osprey and common loon (*Gavia immer*) as biosentinels, monitoring their health for signs of pollution in the water and the fishes that compromise a large part of their diet. A decline in suitable habitat for our Neotropical migratory birds is often followed by a decline in bird populations. By studying bird population changes in different areas we can get ideas of habitat preferences of birds, and which habitat changes increase or decrease bird populations. Since migratory birds have certain needs in their breeding grounds, overwintering grounds and along their migratory routes, changes in populations may reflect changes in any or all of those habitats. The information we receive from bird populations can instigate research into the reasons for changes in the environment and promote action to safeguard the environment for human well-being.

PROCEDURE

1. Divide the class into small groups. Ask the groups to discuss various ways to complete this sentence: "If there were no birds left in the world, ..." Compile information from each group to create a class list.
2. Review interview skills. Remind students to accept whatever answer the respondent gives to the question nonjudgmentally. Remind students that interviews are a tool that researchers can use to find answers to questions posed. Role play an interview. For homework, ask students to interview three people who are not class members. For the interviews, they should ask each person to complete the same sentence as above. They are to write down the responses they receive. Stress interviewing a wide range of people: other students; neighbors; bus drivers; store clerks; family members; etc. Encourage everyone to interview at least one person who is retired.
3. Have groups compile three to five other questions for the interview, such as: Do you put out bird feeders, birdhouses or birdbaths?; If so, why do you want to attract birds?; Which is your favorite bird, and why do you like that kind of bird?; Do you like to watch birds?; Did you know that many migratory bird populations are declining?; Why do you think some bird populations are declining?; and What do you think we should do about it?
4. Discuss the effectiveness of the small group so far.
5. After the interviews have been conducted, discuss the interview process and the most prominent responses. Add new answers to the class list envisioning a world without birds. Post this list in the classroom throughout the rest of the *One Bird—Two Habitats* unit. Introduce any bird contributions that have been omitted through discussion.
6. Discuss whether students in Latin America would complete the sentence the same way your students did.

DISCUSSION

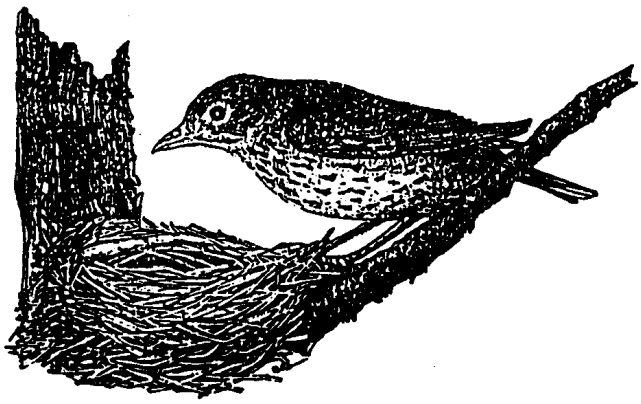
1. What were the most frequent responses to the interview questions? What points were omitted? How would you rate the quality of responses received? What other questions would you pose? What are the key points for persuasion?
2. Discuss how students value birds in relation to other animal groups. Do you think birds, as a group, are more or less important to forests or to us than insects, reptiles, amphibians or mammals?

EXTENSIONS

1. Categorize and graph interview responses. Classify the responses in the most logical categories possible. Calculate the percentages by classification.
2. What if there were no birds, and therefore, no bird songs? Students may want to experiment using earplugs on a bird walk to see what a "silent spring" would be like. Have students write stories, poems or songs to describe a world without birds. Publish a student's story in the local newspaper.
3. Research reasons that birds sing. For fun? For us? To announce their presence to potential mates? To warn others of the same species to stay away? Do birds sing more here or in Latin America?
4. Ask students: If a raccoon (*Procyon lotor*) could complete the sentence, what would it say? Complete the same sentence from an insect's point of view. Did this vantage point change student perspective on birds?
5. Discuss the poem, "The Oropéndola."

ASSESSMENT

1. Students will interview three people outside of class and collect appropriate data on interviewees. Responses should be turned in as a writing assignment.
2. Students will compile a list of 10 ways that birds are beneficial to people and/or the ecosystem.



THE OROPÉNDOLA

By Bosco Centeno
A military commander for the Sandinistas in the 1980s, who fought in the Revolution of 1979.

The oropéndola on
the branch of the genízaro
pecks hungrily
at the red flesh
of a pitaya;
my presence
interrupts her meal
and, startled,
she flies off screeching.

LA OROPÉNDOLA

La oropéndola en
la rama del genízaro
picotea hambrienta
la roja carne
de una pitaya;
mi presencia
interrumpe su comida
y asustada
se aleja chillando.

oropéndola = a large coffee-colored bird with streaks of dazzling yellow in its tail

genízaro = one of the largest trees in Nicaragua, with a corpulent, elephantine base; a favorite shade tree

pitaya = a cactus with red flowers and edible fruit; grows on the limbs of trees and on rooftops

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Reprinted from *Nicaraguan Peasant Poetry from Solentiname* (1988) with permission of the translator, David Gullette, of Simons College, Boston, Massachusetts.

PREPARATION: Mark off migration course.

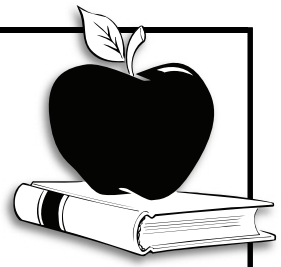
CLASS TIME: two class periods

VOCABULARY: migration, orienteering, magnetic field

MATERIALS: one compass per group; ribbons to mark off orienteering course; index cards; a map of the stars

ILLINOIS LEARNING STANDARDS: physical development and health 21.B.2, 21.B.3

TEACHER'S GUIDE



ACTIVITY

Migrateering

OVERVIEW
By completing an orienteering course, students learn about bird migration.

CONCEPTS
Some birds migrate to meet their habitat needs.

OBJECTIVES
Students will be able to: 1) use a compass to complete an orienteering course; and 2) compare human and bird navigation methods.

KEY POINTS
- Birds use a variety of senses and cues to navigate and orient during migration.
- One way some birds navigate is by orienting themselves in relation to the earth's magnetic field.

TEACHER BACKGROUND
Migratory bird species use different senses and cues to navigate and orient during migration. From banding birds, researchers know that some species can return to the same breeding ground or winter feeding site with incredible precision year after year. In fact, year after year the same individual bird can return to the same patch of forest in Illinois after wintering in Latin America! Others always return to the same region. While scientists don't have concrete answers as to how birds accomplish this amazing navigation, there are several theories.

In general, research supports the idea that birds use a combination of genetic and environmental cues to orient or navigate during migration. First, the sense to migrate in a general direction is, at least in some bird species, genetic. Researchers have studied a phenomenon known as migratory restlessness in some bird species. If confined in experiments when they should be migrating, some species exhibit a frantic behavior indicating their desire to move, to migrate. Often, the birds orient in a specific direction, such as north. Migratory behavior is not learned—many forest species don't migrate as family groups and often the young make their first journey without adults.

Other research indicates that some bird species use landmarks such as mountains and bodies of water, or more recently, city lights, to give them visual environmental cues as to their location. This theory is strengthened when we consider the exceptional vision birds have. In addition, "a bird's-eye view" from above gives birds an excellent perspective from which to see large landmarks. A bird flying high enough may be able to see evidence of the advance of seasons, such as where ice has melted from lakes. However, at least for some species, this theory is problematic because there would be no way for young birds to know these visual cues prior to their first journey.

Some researchers theorize that birds can sense geomagnetism. According to this theory, the birds sense changes in the earth's magnetic field and its relationship to the earth's surface over some distance and navigate according to those changes.

Since approximately 80 percent of all migratory birds fly at night, many scientists believe that birds use the stars as celestial cues to location, much the same way humans have used them for navigation. By knowing the configuration and placement of certain stars and constellations and knowing how they move across the sky, a bird flying at night can use the stars to fly in the direction it wants to go.

The most likely scenario is that different bird species use different ways to orient or navigate during migration. Each species probably uses one or more of these methods, and the birds may rely primarily on one method and use the others only if necessary. Our uncertainty as to the precise methods used by migratory birds is well put by Illinois bird researcher Sam Robbins:

> It is well known that large numbers of birds, after traveling hundreds of miles, flying mostly at night, succeed in reaching the exact location where they spent the previous summer. What is not well known

is the type of guidance mechanism birds use in migration. Visual images? Auditory images? Memory? Orientation to the stars? Orientation to the earth's magnetic field? My prediction: scientists, philosophers and poets will still be asking these questions years and years from now.

Compass Use

The class will need one compass per group, ideally the type with a flat, plastic base. The arrow (or red end of needle) always points to magnetic north. Hold the compass level in front of you with the arrow on the base plate pointed in the direction you want to travel. Turn the compass housing so that "North" lines up with the arrow inside the housing. Walk in the direction you want to travel, keeping the arrow lined up with "North" on the compass. The direction you want to travel is your **heading**, and it is measured in degrees. If you would like more information, consider the handbook *Be Expert with Map and Compass* by Bjorn Kjellstrom.

Map out a simple (three- to five-point) orienteering course for the class outside in the schoolyard, if possible. Tie brightly colored ribbons around various markers such as trees, flagpoles, basketball goal posts and the front door of school. It will be best if you cannot see all of these places from the starting point. On each ribbon, hang an index card.

Go through the course yourself. Begin with your back to the starting point and determine the compass heading in degrees of your first landmark. This heading is the direction you want to travel to reach the first landmark. Record this heading so that you can give it to students as they begin the course. Students will begin by turning the compass housing so this heading lines up with the direction of travel arrow. They will then turn their bodies so the magnetic needle lines up with the north sign.

Walk to the first landmark. Next, put your back to that landmark, face the second landmark and take a compass reading. Mark this heading on the index card at the first landmark. This heading will tell students which direction to go next. Continue through the course, writing compass headings on index cards at each landmark. Students will use these headings to locate successive landmarks.

As a way to check that students have reached each landmark, put the letters of a scrambled word, such as "Migration," on the index cards. After you've mapped out the course, go around to each index card and put a letter or two from this word on each card. The students will have to record the letters as they get to each landmark and then unscramble the word at the end.

You may want to place a few "false" landmarks with index cards to make the course more challenging. This will insure that students use compass headings to find the landmarks and not just visual cues.

PROCEDURE

1. Ask students how they know how to get from one place to another. Answers and discussion should include experience (memory), vision, verbal directions from someone else, signs and other landmarks, maps, compasses, etc. Ask them how a bird knows where to fly. Answers may include some of the same ways people find direction, such as memory, vision, landmarks, etc. But what about direction for migration? How does a bird travel to a place it's never been before? Tell the students they are going to take an imaginary migration.
2. Divide the class into five cooperative groups. Demonstrate use of a compass to the class. Give each group a compass and have them practice with each other. Tell them to practice by finding a particular landmark, like a flagpole or basketball goal post, and determining its compass heading (e.g., 224 degrees, 90 degrees, etc.). The groups are responsible for making sure each member understands compass use.
3. Have student groups, one group at a time, complete the course as quickly as possible. Explain that they will be competing with the other groups for the migration time. Give the first compass heading at the starting point. One group member is responsible for reading the compass and orienting the group to the first landmark. Tell them to record the letters of the scrambled word on the index card. Pass the compass to another group member and move the direction indicated to the next landmark.
4. Continue until the end of the course.
5. After the migration, bring students together for a discussion. Ask how escaping slaves made their way north to freedom without a compass. On a star map, ask students to point out the North Star. Relate this star to bird migration at night.
6. Ask students how this orienteering activity relates to bird migration. Discuss the different ways birds determine which way to go when they migrate, including the use of the earth's magnetic field.
7. Ask students to relate how they functioned in cooperative groups.

DISCUSSION

1. In what ways is it easy to navigate like a bird? How is it similar or different than navigating like a person? Would a map have helped? Do you think you

could migrate faster a second time?

2. How does a bird's position in the sky give it an advantage during migration? How would the trip have been easier if they could have "looked down" on their route prior to starting?
3. Ask students to relate their experiences in moving as a cooperative group. Could any one individual have accomplished the migration as quickly?
4. Ask the question: "If you were alone in a boat in the middle of an ocean (you don't know which ocean), would you rather have a compass or a map to find your destination?" (Neither will get you there—you need both. Birds have the equivalent of both!)

ASSESSMENT

1. Students should, in one written paragraph, compare human and bird navigation methods.

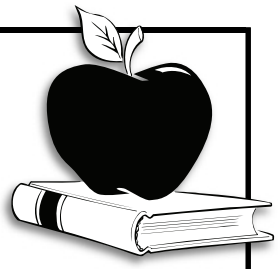
CLASS TIME: one class period

MATERIALS: string or fishing line; short, straight sticks, five to 10 inches long (dowels, coat hangers, sticks); a variety of objects gathered by students to represent different life needs of Neotropical migrants and needs and wants of people; old magazines to search for pictures that represent needs

COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

NEXT GENERATION SCIENCE STANDARDS: 3-5-ETS1-1

TEACHER'S GUIDE



ACTIVITY

The Balancing Act

OVERVIEW

Students will create a mobile to demonstrate the balance between people and nature.

CONCEPTS

- People and some birds depend on forests for their needs.
- Birds are part of forest ecosystems.

OBJECTIVES

Students will be able to: 1) create a mobile representing the balance of nature as it applies to the needs of birds and the needs of people; and 2) recognize that people and birds share similar needs.

KEY POINTS

- Both humans and birds have needs, some of which are conflicting.
- People have additional things they want to make their lives more comfortable.
- These human needs and wants should be balanced with bird needs.

PROCEDURE

1. Read the poem, "The Chocoya," by Mauricio Chavarrío. Discuss the meaning of the poem and apply it to the unit. Tell students they'll be creating an image of a balance between bird needs and human needs today, only in a different medium.
2. Divide the class into cooperative groups. Have each group discuss and record: 1) the various things they think migratory birds need to survive; 2) the various things people need to survive; and 3) things they feel people want and use to make their lives more comfortable.
3. Have members of each group gather or make objects to represent each one of these needs or wants. For example, bird food could be represented by a seed, a dead insect or one made out of construction paper, toothpicks and glue. Human food could be represented by a picture of a piece of fruit, a plastic replica, an empty milk container or a peanut shell. Nesting habitat could be represented by twigs, a bunch of grass or other nest material, while human shelter could be represented by a photo or drawing of a house. Wintering habitat could be represented by a tree leaf or a picture of the sister country, a safe migration route by a map of the western hemisphere with the migration route indicated or a picture of clear skies. Nesting success could be represented by down feathers, a picture of eggs or a fledgling or an eggshell, while human reproduction could be illustrated by pictures of a crib and baby food, a teething ring or a baby rattle. Human **wants** could be illustrated by a picture of a television or an empty soda can. Students should be allowed to choose their own representative objects.
4. Using these objects, each group is to construct a physically well-balanced mobile. Everything **needed** by birds and humans **must** be represented. The more things that are added to the mobile, the harder it will be to balance. The groups must then decide if it is necessary (or possible) to include all of their human wants.
5. Assign a member of each group to be a Checker to be sure that all the members understand why each item is being included or left out. Have each group member sign the mobile when they are sure they understand it.
6. Choose one group member from each group to explain their mobile to the rest of the class. Discuss the balance desired between the needs of birds and human wants and needs. Point out that human decisions affect the balance and may help or harm birds.
7. Discuss these words from the journal of the famous preservationist, John Muir**: "When we try

to pick out anything by itself, we find that it is bound fast by a thousand invisible cords...to everything in the universe."

8. Ask how the group process functioned.

DISCUSSION

1. Discuss what kinds of things the groups decided to include as "conveniences" and those they decided to leave out.
2. Was it easier to balance the mobile with less needs? Were there any human needs that conflicted with bird needs? Can people make decisions that will affect the balance so as to harm the birds? To help the birds?
3. How does this mobile illustrate the balance of nature, particularly birds and their habitat? How do humans affect the balance? Who created the mobiles? Do birds have the power to make decisions that affect the balance of the world they live in? Do humans? How many human needs could be met through forest resources? For birds, which needs could be met through the forest? Move one piece of a mobile by lifting it up or swinging it noticeably. Did affecting one factor in the balance affect others? Can people in the Midwest make decisions that affect people in Latin America or birds in Latin America?

MODIFICATION

Student groups could be instructed to build their mobiles such that the things they feel are most necessary to bird and/or human survival have to be placed near the top, the less necessary, luxury items at the bottom of the mobile.

ASSESSMENT

1. Students should complete mobiles.
2. Students should explain, either orally or in a written report, how their mobile works.

**Muir, John. 1911. *My First Summer in the Sierra*. Houghton Mifflin, New York.

THE CHOCOYA

By Mauricio Chavarría

Mauricio was a 10-year-old Nicaraguan boy when he wrote this poem.

One day I went up the mountain

and I saw a mango tree

and a chocoyo eating a ripe mango

and my mouth began to water

and I climbed the tree and started to pick mangos.

EL CHOCOYA

Un día fui al monte

y vi un palo de mango

y un chocoyo comiéndose un mango maduro

y se me hizo agua la boca

y me subí al palo a cortar mangos.

chocoya = a kind of parakeet; it flies in noisy flocks

Reprinted from *Nicaraguan Peasant Poetry from Solentiname* (1988) with permission of the translator, David Gullette, Simons College, Boston, Massachusetts.

PREPARATION: Make and hang trees prior to the class period each day for three days preceding discussion

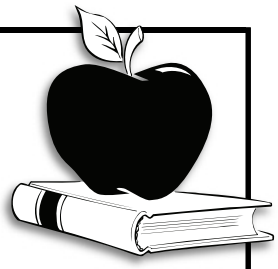
CLASS TIME: 20-30 minutes

VOCABULARY: forest, ecosystem, forest interior

MATERIALS: large paper cut-outs of different-sized trees and shrubs (students can make these)

COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Reading 7, MS Reading 10

TEACHER'S GUIDE



ACTIVITY

Defining A Forest

OVERVIEW
Through simulation and discussion students define a forest.

CONCEPTS
Forests are complex ecosystems.

OBJECTIVES
Students will be able to describe some of the complexities of a forest ecosystem.

KEY POINTS
- Forests are dynamic and complex.
- Forest ecosystems include all living and nonliving components.
- Forest ecosystems differ in significant ways from tree plantations.

TEACHER BACKGROUND
Forests are diverse communities of plants; they contain animals and inanimate parts of our environment such as water, air, light and soil. Within these diverse communities, plants and animals live and die in a cycle of competition and harmony. Forest communities provide many indispensable ecological services: they recycle wastes; help maintain the chemical composition of the atmosphere; provide a home for wildlife; and play a major role in determining the earth's climate. Forest ecosystems are dynamic and constantly changing. Trees continually change through their life cycle from germination of a seed, through the maturation of a seedling into a large tree and eventually death. Throughout this process, trees modify the surrounding environment by their physical presence and biological processes. Since they are living organisms, they have physiological or normal living functions, such as respiration, nutrient and moisture intake, water evaporation from plant tissues (transpiration), food production (photosynthesis) and reproduction. As the trees live and associate with other organisms and the abiotic (nonliving) environment, the competition for life constantly influences and perpetuates the change.

A majority of Illinois' wildlife, including many Neotropical migratory bird populations, depend heavily on the forest resource for food and shelter. While Neotropical migrants can be found in grasslands, wetlands and forest edges, many species spend most of their time in the forest interior. Each species belongs to a particular feeding guild, such as seed-eating, ground insect-feeding, foliage-gleaning (searching foliage for invertebrates and fruit) or sap-sucking. Birds use different parts of the forest structure, searching for food in different layers of the forest. The ovenbird walks along the forest floor as it methodically inspects the leaf litter for insects. The wood thrush forages on the ground, picking up insects and, occasionally, fruit. Above them, American redstarts hover while they glean foliage and try to catch the insects they flush. Vireos frequenting the same branches as the redstarts slowly search for larger insect prey. The magnolia warbler (*Setophaga magnolia*), with its tail fanned, rapidly hops between branches, picking insects from the bottom surfaces of leaves.

These birds also utilize different parts of the forest structure for nest sites. Ovenbirds construct their oven-shaped nests on the forest floor. Female wood thrushes build cup-shaped nests six to 50 feet high in tree branches. Both male and female magnolia warblers contribute to building their nest in tree or shrub branches just one to 10 feet from the ground.

Just as they do in temperate forests, wildlife in tropical rain forests use different layers of the forest. In forests there are four layers: emergent; canopy; understory; and forest floor. In the tropical rain forest, most of the plants and animals live just below the canopy in the protection of the understory. For example, Wallace's flying frog (*Rhacophorus nigropalmatus*) finds its food and water in bromeliad plants and large leaves of the understory. The crested wood partridge (*Rollulus rouloul*), on the other hand, a plump green bird resembling a pheasant, runs along the forest floor in search of large fruits, seeds, beetles and ants.

In addition to utilizing forests for their own needs, wildlife contribute many things to the forest ecosystem. Each animal plays a role in the function of the forest. Squirrels are familiar agents of seed dispersal, integral to the forest as they collect and disperse acorns and other nuts. Likewise, some birds act as seed-dispersing agents for certain vegetation, like berries, by eating the seeds with the fruit, then leaving the seeds in their droppings some distance away from the source plant. The majority of Neotropical migratory forest birds feed on insects. In temperate regions of North America, these birds may control certain defoliating insects, like the spruce budworm (*Choristoneura fumiferana*) in some stands of young trees. In the rain forest, complex interrelationships between the plants and animals show strong interdependencies among species. Some ant species, for example, raise their young and grow fungus gardens inside the branches of a tree. In return for this shelter, the ants protect the tree from other insects and browsing animals. Brilliantly colored male orchid bees obtain food from orchids while transporting pollen necessary for the orchid's reproduction.

These descriptions begin to reveal the complexity and diversity of forests. When trees are planted for harvest in pine plantations, much of this natural diversity is lost. The trees in a plantation are often of the same size, age and species. The structure is similar throughout the forest and does not provide the varied habitat layers evident in a natural, uneven-aged forest. Other plant and animal life is therefore less diverse.

People who manage forests must consider different kinds of birds and their needs, as well as the needs of other plants and animals in the forest. Through careful consideration we can manage the whole forest ecosystem, with all its complexities and interdependencies.

PROCEDURE

1. Cut out large paper silhouettes of different-sized trees and shrubs ahead of time. (You may ask students to do this task.) Hang a couple from the ceiling in the middle of the classroom prior to class. Say nothing about them to the class.
2. During the next three days add more trees until you have a symbolic replica of a small forest and student curiosity is piqued.
3. On the fourth day ask why the trees are hanging from the ceiling and what they represent. What constitutes a forest? Have students brainstorm definitions of a forest and write their ideas on the board.
4. Have one student stand up. Tell the class this student represents a tree. Ask: Is this one tree a forest? Have a few more students stand and represent more trees. Ask: Is it a forest now? Make the point that a small woodlot will work as habitat for some wildlife, but some, like the ovenbird, need a bigger tract of forest that has an "interior." What do we need to do to make it a forest? Invite students to suggest and role play any parts of a forest, including other plants, animals and inanimate objects. If students are stuck, brainstorm all the things that are in a forest. Make the point that forest ecosystems include all living and nonliving components.
5. Ask whether all the trees are the same size. The same age? Have students representing trees try to make themselves the same height and stand in rows. Discuss how a plantation or an orchard is different from a natural forest. Provide students with background information on how different birds use different parts of the forest structure.

DISCUSSION

1. What purposes does a forest serve to the environment? To wildlife? To people? What do some birds obtain from the forest? What services do birds provide the forest?

EXTENSIONS

1. Make the point that forests are dynamic. Have one student stand up with arms outstretched, representing a species that thrives in an open area and needs lots of sunlight. It reproduces and more trees grow in the area. Have more students stand up. When there's no room for more students to stand with arms outstretched without touching, point out that after a while, the species that needs lots of light won't be able to reproduce. Trees that can grow in shade will take over and gradually another type of tree will become dominant. This represents the dynamic change of species composition in a forest.
2. Take the students out to a wooded area near school. Let them explore the area and examine the structure and diversity of life in it. What birds do they see or hear? Take them to an area recently cleared for a subdivision or similar land conversion. What birds do they see or hear?
3. Have student groups use water colors or pastels to develop a visual image of various forest settings.
4. Discuss how the poem, "It's Five-Thirty," by Nicaraguan poet Felipe Peña, defines the forest.

ASSESSMENT

1. Ask students to write a paragraph on what a forest is. They should define it as a complex ecosystem, including plants, animals and other organisms.
2. Students should be able to explain a contribution birds make to the forest.

IT'S FIVE-THIRTY

By Felipe Peña

It's five-thirty in the afternoon, the weather is calm
no sound of the spotter plane that patrols the border
only the mumblemumble of some compañeros talking in their lean-to
and birdsongs from the mountain as the evening closes in -
the dove, the guás
the partridge that whistles like someone lost in the woods
the choschos
the howler monkeys chanting con con con
the woodpecker pecking a dead limb
and the monkeys having fun in the leafy trees
shrieking and throwing dry sticks.
This afternoon the crickets are all turned on
they sing ririri as though to announce the rain that starts to fall.
The mountain has clouded over, some of us are going to take up our posts,
others are going to sleep without their supper.

SON LAS CINCO Y MEDIA

Son las 5 y media de la tarde, el tiempo está sereno
no se oye el sonido de la avioneta que vigila la frontera
sólo el gurún gurún de los compañeros que hablan desde sus champas
y el canto de los pájaros en la montaña al atardecer
la gongolona el guás
la perdiz que silba como persona perdida en los bosques
el choschós
los congos que cantan con con con
el pájaro carpintero picotea en un palo seco
y los monos que hacen gracias en los árboles frondosos
chillan y botan ramas secas.
Esta tarde más que las otras se han animado más los grillos
que cantan ri ri ri como si anunciaran la lluvia que empieza a caer
la montaña se ha oscuredico, nosotros vamos a hacer la posta
los otros a dormir sin haber cenado.

guás = a long bird; makes a raucous cry

choschos = a small flycatcher with a bright yellow breast

Felipe was captured in 1977 during a raid against Somoza's guard because he stayed in position to cover the retreat of his friends. He was tortured and held in prison for almost a year and then later died in battle. Reprinted from *Nicaraguan Peasant Poetry from Solentiname* (1988) with permission of the translator, David Gullette, Simons College, Boston, Massachusetts.

PREPARATION: Rope off a portion of the room and expand this restricted area before class daily for three days.

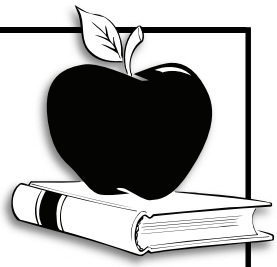
CLASS TIME: t20 minutes

VOCABULARY: habitat, carrying capacity

MATERIALS: rope to stretch across the classroom; sign reading "Off-limits—Do Not Enter!"

COMMON CORE STANDARDS: English language arts MS Writing 4, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

TEACHER'S GUIDE



ACTIVITY

Habitat Squeeze

OVERVIEW
Through a simulation, students experience habitat loss over time.

CONCEPTS
Human use and management of forests affects bird populations.

OBJECTIVES
Students will be able to: 1) define carrying capacity; and 2) recognize that reduced size and quality of a habitat adds stress to birds and other wildlife populations.

KEY POINTS
Reducing size and/or quality of forest habitat reduces the carrying capacity of the forest for interior forest birds.

TEACHER BACKGROUND
Carrying capacity is defined as the population that a given area, such as a forest, will support without either the area or the population undergoing deterioration. It is a dynamic equilibrium established between any life form and its environment. For example, a particular forest may be capable of providing **habitat** (nesting site, food resources and water) for 100 birds of one species. If the population is slightly under 100, neither the birds nor the forest will suffer. If the population exceeds 100, the forest ecosystem is strained, and each bird is subject to stress with the possible death of some individuals.

Many factors can change an area by either increasing or decreasing the carrying capacity. Some factors are related to the size of the habitat; others are related to the quality of the habitat. For example, an increase in understory shrubs may provide habitat for a particular bird species or group of birds, increasing the carrying capacity of the forest for that bird population without increasing the size of the forest. In another example, a bird species may be dependent upon a stream going through the forest for its water supply. If the stream flow is decreased or eliminated so that it no longer travels through the forest, that forest then has a decreased carrying capacity for that bird species.

Human habitat may be considered in terms of carrying capacity as well. A researcher may indicate that a particular region has a carrying capacity of 10,000 humans. However, people often modify their surroundings in order to increase the carrying capacity of an area, for example, importing food from outside the area. Some people think we have exceeded the earth's carrying capacity for the human population, the result being disease, starvation, war and environmental degradation. A population exceeding the area's carrying capacity may continue to exist with both the area and some individuals being stressed. In the long run, a population that exceeds the carrying capacity of an area is considered unsustainable.

Much of the reduction of interior migratory forest bird populations is the result of the loss of forest habitat for these birds, both here and in their wintering grounds. As suitable forest habitat is reduced, the carrying capacity of the land is reduced for those birds dependent on the forest interior. Birds that depend on fields or forest edges may experience an increase in carrying capacity if forest cover is reduced and not built over.

A picture of forest cover across the United States at four periods in time shows the national changes in large tracts of forests (Appendix F). As the maps show, large tracts of forest cover declined nationally from the year 1620 to a low around 1920, but since then, they have been increasing. Illinois maps show a similar trend. These maps include all tree coverage, small woodlots and savannas, not just large tracts. In Illinois, forest habitat acreage has continually increased from a low of less than one million acres in the early 1900s to nearly 15 million acres today.

One present concern regarding loss of forest habitat for forest interior birds is the reduction of large tracts of forest, especially in southern Illinois. In addition, those areas deforested consist of land that for the most part is being or has been converted to other nonforest uses, such as urban development, subdivisions and farms. These land conversions generally have a long-term effect on the

landscape and the habitat available for a variety of birds. Aside from loss of habitat area, these conversions reduce the quality of habitat for birds that nest in forests. This decrease in habitat size and quality contributes to bird population declines by allowing predators to access songbird nests. For example, suburbanization opens up the forest to nest predators that are associated with human populations, such as raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), Virginia opossums (*Didelphis virginianus*) and house cats (*Felis catus*), plus avian nest predators such as American crows (*Corvus brachyrhynchos*), blue jays (*Cyanocitta cristata*) and common grackles (*Quiscalus quiscula*). Even in the country, free-ranging cats are associated with human populations and are considered a threat to bird populations. One study indicates that 14 million birds are killed by rural free-ranging cats in Illinois each year.

While land conversion away from forests represents the loss of habitat for forest birds, it may simultaneously increase the carrying capacity of Illinois for people and other nonforest wildlife species, including some birds. The question becomes, is there a balance that is sustainable for birds and people?

PROCEDURE

1. Before students enter the classroom, stretch a rope across one small corner of the room and hang the "Off-limits—Do Not Enter" sign on it. (Use an area that is not absolutely essential for the functioning of the class.) Any furniture that can be moved should be removed from this area and crowded into the rest of the room.
2. When students ask about the rope and the sign, explain that it's part of an experiment, and you'll discuss it later in the week. Explain that, until then, the area behind the rope is, indeed, "off-limits," and no one is to enter it for any reason. The students will simply have to learn to function in a slightly smaller space than they are used to. Continue your normal day's activities.
3. Before the students enter the class the next day, move the rope to slightly enlarge the restricted area. Remove any objects from the restricted area and crowd them into the rest of the room.
4. Continue this process for the next two days or least long enough to cause everyone to feel cramped.
5. Ask students how they felt about the rope and the expanding restricted area. Ask why the rope was there. Discuss the effects of the rope. At what point did it interfere with student activities? How much more could the off-limits area have been expanded before it fully impaired the class' function?
6. Introduce the phrase "carrying capacity." Ask how the rope affected the carrying capacity of the classroom. If their numbers exceed the carrying capacity of their habitat, how would birds be affected? How might habitat loss in one part of the world affect another part of the world? Make the point that solving these kinds of problems requires a global perspective.

DISCUSSION

1. Did the size of the off-limits area on one side of the room affect students on the other side of the room? When? How? Where would students have gone then? What effect would moving out of the classroom have on other people and on the way the class functioned?
2. Do birds that depend on one type of habitat always have the option of moving somewhere else?
3. What will birds do if there is not enough nesting territory or food to sustain them? Humans may be pushing forest bird populations to the limits of survival by removing larger and larger sections of suitable habitat. What are people using the land for when forest is removed? Are these human actions increasing or improving habitat for other birds or wildlife species?
4. Is there a carrying capacity for people in the classroom? In a city? In Illinois? In Latin America? In the world? How much loss of habitat is allowable? How much is too much?

EXTENSIONS

1. Have students research how much change has occurred in forests in their community over the last 200 years. County environmental organizations might be able to provide information about pre-European-settlement vegetation in the area. Topographic maps and aerial photos made years apart will show changes in forest cover. Another source of interesting first-hand information about how the land use of the area has changed over several generations can come from the elderly community. Have students visit nursing homes or senior centers and interview the residents to determine if they remember more or less forest intact when they were young. See if they have noticed any changes in the abundance of birds and other wildlife.

ASSESSMENT

1. Have students write a brief explanation of why the "Keep Out" rope marked off part of the classroom (i.e., why you did this activity).
2. Students should be able to write a reasonable definition of carrying capacity.

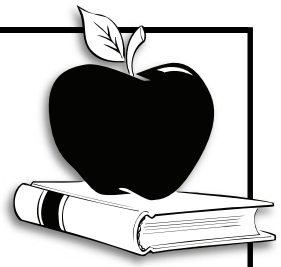
CLASS TIME: one class period

VOCABULARY: flyways

MATERIALS: copies of the Americas map included in this activity; colored pencils

COMMON CORE STANDARDS: mathematics 5.MD

TEACHER'S GUIDE



ACTIVITY

A Round Trip Ticket

OVERVIEW
Students plan a migration route for a Neotropical migrant to learn about 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 the possible migration patterns of their Neotropical migrant; and 2) generalize about the migration patterns of other Neotropical migrants.

KEY POINTS
- There are several key migration routes for Neotropical migratory birds.
- Maintaining suitable habitat all along these migratory routes is an important component of bird conservation.

TEACHER BACKGROUND
Why would a bird migrate more than 2,000 miles to Illinois each spring? During the trip the bird faces a myriad of natural and humanmade hazards—storms, predators, aerial obstructions, pollution—that endanger its life. A successful trip requires an enormous amount of precious energy. Add to that the energy resources (food) and habitat resources (such as shelter and nesting materials) needed to find and defend a new territory, build a nest and raise young. And then, after spending only a couple of months here, the bird repeats its long and hazardous journey to return to Latin America! Most of the birds that winter in Latin America and migrate to Illinois undertake this journey to and from North America every year. We often speak of these birds as "our" birds. In fact, they spend less than one-third of every year in Illinois and the rest of their time is spent in migration or the tropics.

The benefits birds receive by leaving the tropics to breed more than 2,000 miles away in Illinois must more than compensate for the energy expenditure and risks associated with migration. The reasons for this regular, seasonal migration are varied but can be summarized as follows: birds have adapted to seek out suitable environments during each part of the year. Latin America may provide much of what a bird needs to breed, but resources and habitat are better and more numerous in Illinois. Additionally, fewer competitors and predators in northern breeding grounds make it more suitable than the tropics for nesting.

The overriding reason for migrating south in the fall is the climate and its effect on a bird's ability to obtain food. Many bird species avoid the long, cold winter in the north, where food is scarce and daylight hours necessary to find food are limited. Some bird species such as northern cardinals (*Cardinalis cardinalis*) and chickadees (*Poecile* spp.) are adapted to our northern winters, but most songbirds make the long journey south to points such as Mexico or South America where winters are comparatively mild. Warmer temperatures reduce a bird's food demands because it is less costly to maintain body temperature in the tropics. Also, tropical food resources such as plants and insects are more plentiful and accessible during the winter.

While overwintering without the pressure of obtaining breeding territories and extra resources required for reproducing, migratory bird species can reside in the smaller geographic area of the tropics. However, during breeding season, species have greater energy and territorial demands. Males expend energy finding and defending a territory to provide those resources. Mating pairs need materials and energy to build a nest. The female needs extra food resources necessary for developing eggs. And the pair, together or individually, must have enough food for their young. Although areas in the tropics may provide the food resources birds need to successfully breed, there is not enough for all bird species to do the same. Since places like Illinois become hospitable and produce plentiful resources in the warmer months, many species spread out over a

larger geographic area and come here to reproduce, giving them a greater chance of finding and obtaining the resources needed for reproductive success.

Many migratory birds don't take a straight route. They follow land patterns for navigation and stay close to resources. There is very little data on the exact migration routes of most birds. We don't know the exact route many Neotropical migrants take, or if they take the same route flying south as north. Some species migrate at night. Not much is known about the speed of flight of most species during migration. One study suggests that ovenbirds travel at approximately 64 km per hour. Not all migratory birds that nest in forests spend the winter in forests, but the ovenbird does.

A bird migrating from Canada across the United States to Central America might hear three human languages. Here are some basic words in each language.

English	Spanish	French
bird	ave or pájaro	oiseau
forest	selva or bosque	forêt
tree	arbol	arbre
friends	amigos	amis

PROCEDURE

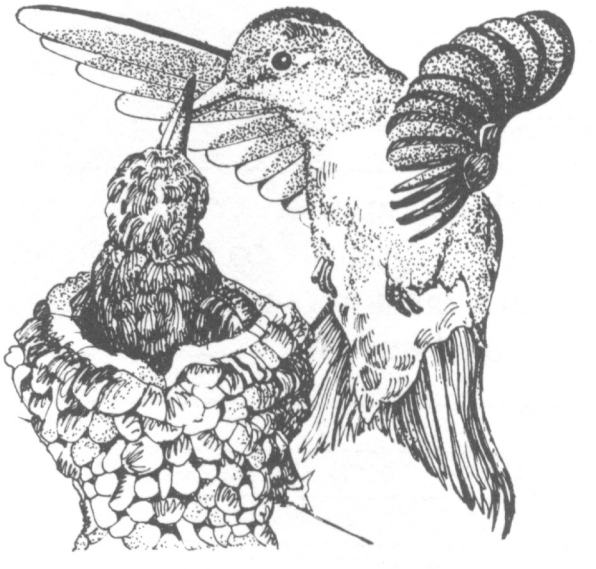
1. Distribute a copy of the map and colored pencils to each student.
2. Ask students what they remember about Neotropical migrants and their migration. Ask students why these birds spend their breeding season in North America, including Illinois, and winter in Latin America. On a map, point out the generalized breeding and winter ranges of the species.
3. Have each student select a Neotropical migrant and on the map draw its breeding range with one color and its wintering range in another. You may want to allow students to use Appendix A to gather Neotropical migrant information.
4. Have the class plan a travel route for a species that breeds in Illinois and winters in Latin America. Instruct the students to estimate the distance their bird travels via this route, using a class map with a mileage scale. Assume this species can fly at 64 kilometers per hour (40 miles/hour), ask students to calculate the amount of time a bird must spend in flight during one year's migration.
5. Have some students share the route they have determined and explain why they chose that route.
6. Have students list the states and nations through which their migrating bird passes. Using the range maps of the species, identify the different languages that might be spoken in various countries. In these languages, what is the word for bird, forest, tree and friend?
7. Have students calculate how long it would take a person to travel the distance their bird travels by walking (4.9 km/hour or 3 miles/hour) or by car (105 km/hour or 65 miles/hour).
8. Emphasize the points that many migratory birds travel a long distance and that there are several key migration routes. Maintaining these migration routes for the birds is an important part of any Neotropical migratory bird conservation plan.

DISCUSSION

1. What is the shortest route? Is this the easiest route, or does it require long flights over water? What do birds need along their migration route? Do you think each species uses the same route during the spring and fall migration? Why or why not?

EXTENSIONS

1. Use information gathered from library research to do this activity with a number of species of migrants. Compare the ranges and migration patterns of these species.
2. Paint or use chalk to make a scale map of North and Latin America on a large parking lot or paved playground area. Walk along the migration routes of the birds. Use the map to demonstrate locations of Illinois, Latin American countries and migratory flyways to elementary school children or others.



CLASS TIME: one to one and one-half class periods

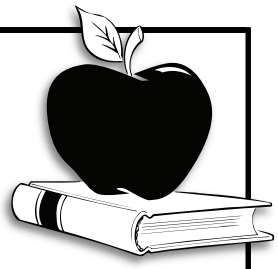
VOCABULARY: flyways, habitat

MATERIALS: construction paper bases; buttons, bottle caps, pasta or similar items; copies of population data sheet; paper for population graph

COMMON CORE STANDARDS: mathematics 5.MD

NEXT GENERATION SCIENCE STANDARDS: MS-LS2-1

TEACHER'S GUIDE



ACTIVITY

Migration Migraines

OVERVIEW

By simulating migration on a playing field, students see increases in human populations correlated with decreases in bird habitats and populations.

CONCEPTS

- Bird populations are affected by human impact on their habitats.
- Some birds migrate to meet their habitat needs.
- Migratory birds depend on habitat in Latin America, the Midwest and along flyways. Human actions that impact the forest environment have a global effect.

OBJECTIVES

Students will be able to: 1) describe natural and human-induced factors affecting bird populations; and 2) explain how increasing human populations can have a negative effect on some bird populations.

KEY POINTS

- When humans alter forests on the wintering ground, the breeding ground or at stopover points, migratory bird populations are affected.
- As human populations increase, suitable bird habitat decreases.

TEACHER BACKGROUND

Migratory birds require suitable habitat and environmental conditions in breeding grounds, wintering grounds and along migratory flyways. A reduction in quantity or quality of habitat in any one of these areas may lead to population declines in the birds dependent upon them. The birds that depend on forests for their northern nesting ground may live in scrub or some habitat other than interior forests in the wintering ground. The ovenbird is one species that requires forest habitat in both places.

People and some migratory birds depend on forests for their needs. In addition to forests, people need farms, cities, highways and housing. To meet these needs, we have often deforested land. However, this land conversion can conflict with the needs of those birds that depend on forests. In Latin America, forests were highly disrupted by the Maya civilization. However, that was a thousand years ago and reforestation has occurred. In North America, forests were most severely disrupted in the late 1800s and early 1900s. They are now slowly recovering. While the stories of Paul Bunyan were pure exaggeration, the logging industry had a profound effect upon the land at the time. As human populations continue to increase, changes in land use, road construction and expansion of cities and farmlands continue to affect our forests. In Latin America, where the human population is increasing at a rapid rate, deforestation is occurring at an incredible speed. Forest ecosystems are always in a state of change, and bird populations are always in a state of flux. But just as it takes many years for forests to regenerate, so it takes many generations for a species to adapt to habitat changes. When so many changes happen so fast, the birds and other wildlife cannot adjust. Sustainable, wise use of forest land is required to conserve these birds and their forest homes. Conservation becomes more challenging as human populations increase.

There are many factors, natural and human-induced, that contribute to making habitat more or less suitable for migratory birds. Some natural factors are short-term. A year of low rainfall causing short-term drought or a temporary decline in insect populations that provide food for birds may cause a temporary strain on migratory bird populations. A year of plentiful rainfall or an insect outbreak may be beneficial to birds. Other natural factors may be long term, such as habitat destruction from large storms or fires or reduction in the quality of a food source through disease. Favorable climatic trends might affect bird populations positively over the long-term.

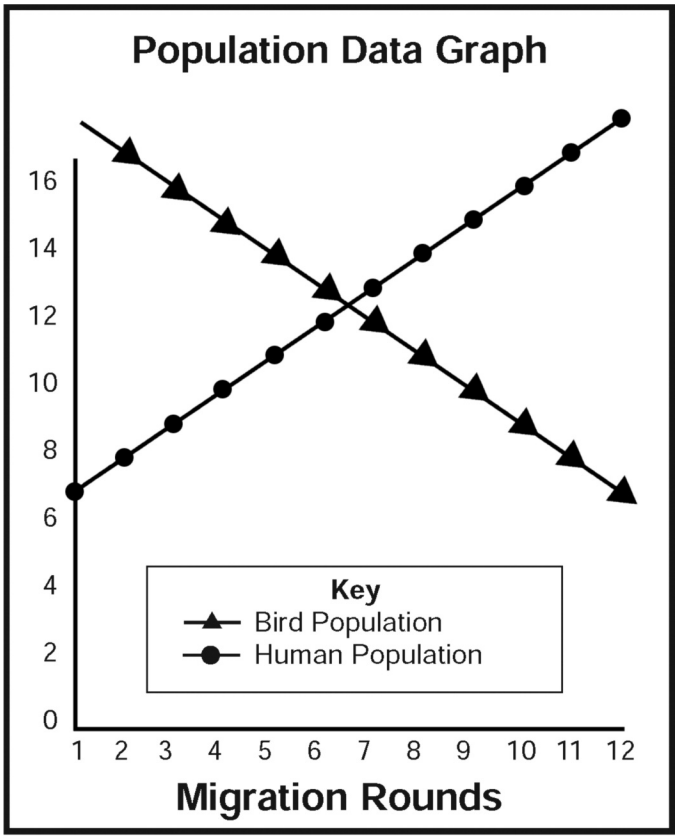
While natural factors are generally beyond our control, there are many human-related factors affecting migratory bird populations. Negative factors might be short-term, such as illegal hunting pressure, or long-term,

such as contamination of a water supply through pollution or land conversion and deforestation. People also can have beneficial effects on migratory birds through habitat protection, management and restoration. Research about migratory bird habitat needs can provide valuable information to implement conservation strategies in all the Americas.

While migratory birds comprise a large portion of the birds in North America, they only comprise a small percentage of the birds in Latin America. The migratory birds that winter in Central America may have to compete with large numbers of resident birds both for habitat and human acknowledgment of importance. The perspective on the fate of Neotropical migrants may also be different in Latin America because deforestation there frequently occurs for human subsistence needs—for agriculture, cattle grazing or firewood—or for export of timber for national income. In a war-torn nation, such as Nicaragua, people are likely to focus more on rebuilding their own lives than in worrying about the demise of a few seldom-seen birds. Yet research indicates that disruptions in habitat both in North and Latin America are affecting many of the Neotropical migrants adversely.

PROCEDURE

1. Discuss the need for breeding, wintering and flyway habitats for migratory birds. Brainstorm factors affecting habitat, including those that are positive and negative, natural and human-related and short- and long-term.
2. Have students count off by fours. Groups 1, 2 and 3 will be "ovenbirds." Group 4 will be “people.” Divide the "people" into two groups: North American and Latin American. Each group of "people" should appoint an individual responsible for recording the number of birds that survive the migration (successfully find a base) as well as the number of "people" in the group at each round of the activity. Give each of these recorders a copy of the "Population Data Sheet" found at the end of this activity.
3. Create a playing field for the students with exactly one green paper base for each bird at each end. Explain that each base represents forest habitat for one bird. Designate one end the North American breeding ground and one the Latin American wintering ground. Place the bases closer together on the wintering ground to represent the smaller land area available for migratory birds. In between, place several bases to represent stopover points during migration. At the beginning of each round deposit buttons, bottle caps, pasta or similar items by the stopover points to represent food. At first, make sure there are enough “food” pieces for each "bird" to retrieve one.
4. Start the activity with "ovenbirds" in the wintering ground in Latin America. Each bird must have one foot on a base to indicate that it has found adequate habitat. No more than one “bird” may have its foot on a base at a time.
5. At your signal, the birds must "fly" by running and flapping their arms to the breeding ground. As ovenbirds, they should say "teacher, teacher, teacher" as they fly. They must land at one stopover point and say "teacher, teacher, teacher" before continuing on. Only one bird may be at a stopover base at one time. Each bird must pick up a button (or whichever item you used) at a stopover point. At the breeding end in North America, each bird must put a foot on a base.
6. While birds stop at the stopover base en route north, the "people" in North America must confer to name a human-related cause of deforestation (such as to build houses or furniture, to make paper products, to build highways and roads, to create farmland, to build factories, to build shopping malls). Their land-use decision reduces the forest habitat in the breeding ground, according to the number of "people" in the group. Remove one base for three people, two bases for four to six people, three bases for seven to nine people or four bases for 10 to 12 people in that continent. Have birds migrate to North America. Those that do not find a base are dead and become people, to represent the human population growth as the benefit from use of the forest land.
7. To even the number of bases in Latin America, announce that a hurricane has destroyed some forest in Latin America: remove one base. Anytime it's necessary to remove an extra base to limit the habitat more so some birds will "die," the teacher can inject a natural disaster into the game and remove a base or two while the "ovenbirds" are at the other end of the playing field.
8. Then tell the "people" in the wintering grounds to confer to name a human-related cause of deforestation (such as farming, cutting firewood, raising cattle, building houses and villages, selling timber for furniture and other products) and remove the number of bases corresponding to their population. Have the "ovenbirds" migrate again. The birds that cannot find a base when they migrate die and become people.
9. When the forests are being rapidly reduced, add the option of making land-use decisions that increase or protect forests. When students choose one of these options, add a base, and the corresponding number of students may return as birds; however, if there is not adequate habitat at the other end of the migration, the bird population will decrease again rapidly.



10. Continue the migrations until it becomes evident that the human population is growing at a rapid rate, and the birds are threatened by lack of habitat. Point out that the land-use decisions we make as humans can significantly affect bird populations, even though natural factors cannot be controlled.
11. Have the students who recorded the human and bird populations consolidate their data and fill in the last column on the Population Data Sheet. They should then plot the numbers on a graph. The graph should show that, as the people increased in numbers, the birds decreased in numbers.

DISCUSSION

1. How did changes in the forest affect the birds? Which affected the birds first: changes in nesting, wintering or stopover areas? Can people always control habitat changes?
2. How did growth of human populations affect the availability of forest habitat and therefore bird populations?
3. Who generally makes land-use decisions? Who looks out for the interests of birds? Why do people sometimes make land-use decisions that adversely affect bird populations? What effect does human population growth have on these decisions? Compare reasons for deforestation between North and Latin America. Are they similar?

MODIFICATION

After the correlation between increasing human populations and decreasing bird populations has been demonstrated, add another obstacle to migration: place less food on stopover points to represent degradation of flyway stopover habitat. Or, stop the migration in mid-flight to remove a stopover base (and the bird resting there), either by human or natural cause. Any bird that cannot obtain food from a stopover cannot migrate successfully and must wait on the sidelines.

If bird populations decline quickly, start over, this time reducing only one habitat area (North America, Latin America or stopovers) and point out that the end result is basically the same to migratory birds because they depend on habitats in more than one place, thus the title of the unit: *One Bird—Two Habitats*.

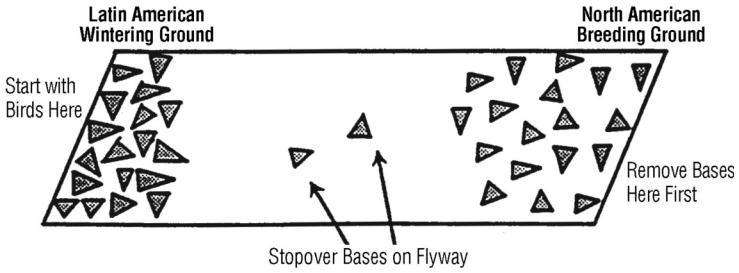
EXTENSION

1. Have students list some reasons why humans alter habitats in ways that may hurt migratory bird populations. Have them do research and then graph human population growth in the United States and Latin America over the last 200 years. Which of the reasons for changing bird habitat that the students listed can be directly related to human population growth?

ASSESSMENT

1. Students should be able to analyze the graphed data and explain what it means.

Migration Migraines Playing Field



POPULATION DATA SHEET

ROUND	LATIN AMERICA	NORTH AMERICA	TOTAL NUMBERS
Start	# people _____ + # birds _____	# people ______ = # birds __0__	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____
Round #_____	# people _____ + # birds _____	# people _____ = # birds _____ Reason for habitat loss ____________________	# people _____ # birds _____

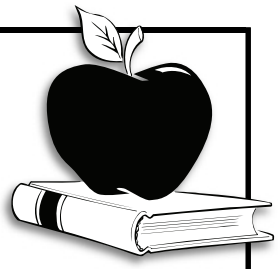
Photocopy enough sheets to complete the activity.

CLASS TIME: two class periods

VOCABULARY: scientific inquiry

COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

TEACHER'S GUIDE



ACTIVITY

Designing Researchers

OVERVIEW

Students practice scientific inquiry by proposing a research design to study populations of Neotropical migrants.

CONCEPTS

Scientific inquiry, including posing problems, solving problems and persuasion can be used for the study, management and conservation of bird populations and forest ecosystems.

OBJECTIVES

Students will be able to: 1) state the components of scientific inquiry; and 2) propose a research design to study the distribution of a species of Neotropical migrant.

KEY POINTS

- Scientific inquiry includes posing problems, solving problems and persuasion.
- There are different ways to gather scientific information about birds.

TEACHER BACKGROUND

In this activity, students review the process of scientific inquiry and the "Three Ps:" problem posing; problem solving; and peer persuasion.

Have students recall a Neotropical migrant that they have already been introduced to that lives in the forest. Their task will be to devise potential ways to determine the location and number of this bird in their county. Students don't have to carry out the actual research but can share their proposal with class members. The emphasis here is on scientific inquiry. Encourage students to be creative in making proposals to find the answers. Place little emphasis on what you know about population censusing and allow students to speculate.

To estimate the number of birds in a particular area, monitoring is done over a period of time, such as 10 days. Different methods are then used to census birds in the area. Integral to any census is detailed, accurate journal-keeping.

A point count is considered an efficient method for counting birds in forested habitats. At a specified time of day (usually between 5:00 a.m. and 9:00 a.m.), an observer stands in one spot for a specified amount of time (such as three minutes) and records all birds heard or seen within a certain distance. This process is repeated at many spots, over the course of several days. The data are recorded on a map.

Strip transects are another common method for censusing birds. Strip transects are similar to point counts, but the observer is moving along a specified path while recording birds seen or heard within a certain distance from the path. This method is more effective in open spaces.

Bird census methods are not infallible. Different researchers may have different abilities to hear or see birds. In addition, bird identification skills vary with the individual. The time of year is important for identifying birds by sound, since birds are more noticeably vocal during the spring mating season. It cannot necessarily be assumed that every male calling is successfully mated, either. Some birds continue to call in search of a mate. Hearing one bird does not necessarily mean that more are present. Not hearing any birds does not necessarily mean that none are present. It just means that none happen to be vocal or visible during that bird observation time. It is also difficult to ensure that the same bird is not identified more than once, at different times or different places or by different observers. Despite these difficulties, bird census techniques continue to be a relatively successful way to estimate bird populations.

Group proposals should include an introduction (a brief description of the question) and a methods section (detailed procedures for answering the question). For example, one group's proposal might be to select a

sample of forest areas in the county, schedule visits to the sample forests over a 10-day period and count the number of birds in the sample forests by walking through the forests and stopping every 100 paces to listen for these birds. Peer review of this proposal might include questions such as: What time of year should this be done?; Are you also collecting data on the size and type of forests you visit?

PROCEDURES

1. Review the process of scientific inquiry with students. You will be giving them a research question (problem posing), and they will need to propose a research design to answer the question (problem solving) and then present the proposal to the class for peer critique (peer persuasion).

2. Divide the class into groups of four to five students each. Tell students they will be taking the role of researchers. Have groups propose a method to address the following problem: “Research has indicated that (insert bird species) populations may be declining in some places. To understand more about where these birds live and what may be happening to them, we need data. Your problem is to determine where these birds are found in your county and to determine approximately how many there are.”

3. Student groups should think through this problem and write a proposal for their research. Make it clear that students will not have to actually conduct the research, so they can think beyond their own immediate resources. Questions such as "How can you tell when there's a (insert species name) in the woods?" may help prompt student thinking. Students may suggest ways to survey different woodlands around the county to listen for these birds. How would they know where forest plots are located in their county? What time of year would they conduct this research? What time of day? Where might they look to find any previous research? They may suggest looking for last year's nests during the winter. How would they know what the nest of this bird looks like or where it would be found in the forest? Encourage creativity.

4. Give students the rest of the period to design their research proposals. Suggest that they use study halls or time after school to conduct any background research.

5. The next day, have student groups write a formal proposal, then present their ideas to the class for review. Reviewers should be able to point out potential flaws in the research designs, and presenters should be able to persuade the class that their design will work.

6. Discuss how the data to be collected might aid researchers in bird conservation. Show how this activity follows a process of scientific inquiry necessary for any research. Incorporate information on bird censusing techniques into the discussion.

DISCUSSION

1. What other kinds of information would students need to study this bird? Did this activity generate more questions?

2. How varied were the research designs? What other ways could researchers census bird populations?

3. How easy or hard was it to create a proposal as a group? What kind of expertise would your group need to actually carry out this research? Was it difficult to persuade other class members that your research design had merit?

EXTENSIONS

1. Using the tables on the following pages, have students graph trends of some select migratory bird populations in Illinois from 1966-1994. Some graphs could include a bar graph showing all birds, birds with population decreases (negative numbers) or increases (positive numbers) or graphs of the population trends for each sampling period, after which students should compare the three graphs.

2. Take the class on a field trip to a large wooded park and conduct point counts to listen for birds.

3. Contact the Illinois Department of Natural Resources (https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/default.aspx), the Illinois Ornithological Society (http://www.illinoisbirds.org) or the Illinois Audubon Society (217-544-2473; http://www.illinoisaudubon.org) to find out about current bird research topics.

4. Pair students with experienced birders to participate in a bird census.

ASSESSMENT

1. Assess group proposals based on how well they address the research question.

2. Evaluate students' abilities to persuade class members of the merits of their proposal.

Population Trends In Illinois of Some Neotropical Migratory Species for Three Sampling Periods: 1966-1994; 1966-1979; and 1980-1994. Numbers represent population decrease (negative number) or increase. The numbers in the chart represent compilation of data collected over the sample periods. Numbers across each row have been calculated statistically and will not compute as presented (data from Illinois Department of Natural Resources, 1995).

SPECIES	1966 to 1994	1966 to 1979	1980 to 1994
black-billed cuckoo	-2.1	3.4	-4.0
yellow-billed cuckoo	-3.4	4.5	-3.8
eastern whip-poor-will	-16.1	-9.9	-8.7
chimney swift	-1.7	2.1	-4.2
ruby-throated hummingbird	-2.0	2.5	3.8
eastern wood-pewee	-0.7	-5.3	0.7
Acadian flycatcher	-2.9	-8.3	-2.1
great crested flycatcher	-1.4	0.4	-1.6
eastern kingbird	-2.9	-6.4	-1.7
purple martin	-5.1	-0.7	-5.5
northern rough-winged swallow	-1.5	11.9	5.7
bank swallow	-2.5	5.4	-2.4
cliff swallow	19.0	-6.1	8.9
barn swallow	0.9	4.2	-1.3
house wren	1.6	-0.1	3.0
blue-gray gnatcatcher	5.9	-0.9	8.1
wood thrush	-1.5	0.3	-4.9
gray catbird	1.5	3.2	—
white-eyed vireo	-0.9	1.8	-2.2
yellow-throated vireo	4.2	-4.4	2.2
warbling vireo	1.2	1.6	0.4
red-eyed vireo	-2.7	-0.4	0.4
northern parula	6.7	13.3	11.1
yellow warbler	6.1	6.4	3.8
prothonotary warbler	1.2	-14.0	-1.8
common yellowthroat	-0.4	0.4	-0.9
yellow-breasted chat	-4.1	-8.2	-4.3
scarlet tanager	-1.5	4.4	7.9
rose-breasted grosbeak	3.3	12.0	-0.8
indigo bunting	-0.8	0.5	-1.8
dickcissel	-4.0	-10.4	-1.7
chipping sparrow	10.4	2.9	10.2
grasshopper sparrow	-6.1	-9.5	-2.0
bobolink	-10.7	-5.4	-12.6
orchard oriole	-8.9	-6.5	-1.3
Baltimore oriole	1.1	7.0	-2.1

PREPARATION: Cut strips of construction paper for bands. Make banding permits.

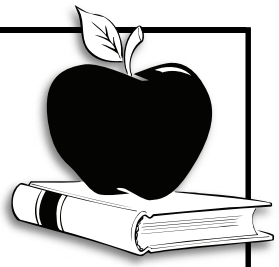
CLASS TIME: 20 minutes class time on each of two days

VOCABULARY: bird banding, scientific inquiry, data

MATERIALS: construction paper bands (enough for four-fifths of the class); masking tape; banding permits

COMMON CORE STANDARDS: mathematics 6.SP, 5.MD

TEACHER'S GUIDE



ACTIVITY

Buddy Banding

OVERVIEW

By conducting a simulation activity that involves banding fellow classmates, students use scientific inquiry and learn about how some bird research is done.

CONCEPTS

Scientific inquiry, including posing problems, solving problems and persuasion, can be used for the study, management and conservation of bird populations and forest ecosystems.

OBJECTIVES

Students will be able to: 1) describe the process of bird banding; 2) recognize bird banding as a research tool; and 3) use the process of scientific inquiry.

KEY POINTS

- Researchers use the process of scientific inquiry to learn about birds.
- Bird banding is one way researchers learn about birds.
- There are many obstacles to finding out exact information about bird populations through banding.

TEACHER BACKGROUND

Scientists can attach radio transmitters to large animals, including large birds, to track the animals and see where they go. Because of their size, it is difficult to put a radio on the body of a small bird, like a warbler, especially if the bird is trying to fly long distances. The main technique used by scientists to follow the movements of birds is banding.

Bird banding is the art and science of capturing, marking and releasing wild birds for research. Biologists have been marking birds for study for more than 100 years. The first record of anyone marking a bird for study was that of John James Audubon, who captured an eastern phoebe in the 1850s and wrapped a small piece of silver wire around its leg and noted that the same individual bird returned to the same place the following year. Today, bird banding involves attaching a tiny aluminum bracelet to a bird's leg, just above the toes. This loose-fitting band that does not harm the bird or restrict its movements. Many of the details of birds' lives are known only through the observation and banding efforts of scientists around the world.

In Illinois, about 300 different species of birds are found each year. Not all of these are seen at one time or in one place. Some are here only during summer because they winter far south of here. Others only come "south" to Illinois during the cold Canadian winter. Some only pass through Illinois during migration because they neither nest nor winter here. There are only a few species of birds that remain in our state throughout the year, both nesting and wintering here. These species generally include some woodpeckers, several hawks and owls, crows, jays and chickadees. We refer to these birds as permanent residents.

Why do we band birds, and what do we learn from banding? To discover which kinds of birds live in a particular area or habitat, we could walk the area throughout the year and watch for different species. With the aid of a good field guide and plenty of practice, we should be able to identify all of the birds that come to an area. However, some birds are hard to see, especially in summer when the leaves are thick. Some people can identify the birds by their calls and songs, since each bird sings differently. Identifying songs and calls is, of course, even more difficult. Since each species looks different from others, we should be able to separate American robins from blue jays or northern cardinals. However, all individuals of any species look the same. Every American crow, great horned owl, Canada goose and bald eagle looks just like the others of its species. How do we know which is which and how many there are in the local population? Color marking, with the use of bands, helps provide the answers.

It is important to estimate the number of birds to monitor population increases and declines. If populations decline at a threatening rate, we can activate management strategies to help them. Population counts are a measure of the success of the management programs we use. Banding birds with a numbered, aluminum band may help in the monitoring efforts of some bird populations. However, hundreds, if not thousands of birds must be banded to get sufficient information on survival and population size.

Some birds that nest in Illinois travel as far south as the tropical rain forest, while others fly only to Mexico or the southern United States for the winter. Do these birds winter in a very specific area? Are they threatened with loss of habitat on their wintering grounds? By marking individuals and seeing where other biologists catch them again, we can learn about their travels. But this knowledge is dependent upon catching the same bird twice. Many birds that are banded are never recaptured. Researchers here and in Latin America both band birds and share information.

One typical method used by researchers to catch birds for banding is mist-netting. A fine net is stretched across an area where birds are likely to fly. Birds are caught when they fly into the net. A researcher then collects data on the species of bird, its age and sex and takes measurements. The bird is banded, and then released. Each band is coded with a unique identification number.

How long do birds live? If we mark young birds in the year they hatch and record their annual return, we can observe a turnover in the population as they die and are replaced by their young. Our songbirds live an average of three to five years. Chickadees have been known to live 10 to 12 years, but this feat is as likely as one of us living to be 100! In fact, 75 percent of all songbirds born this summer won't live to see next spring. That is why it is so important to protect habitat here in Illinois, where these birds raise their young, as well as in the tropics.

Many birds that have been banded die without the researchers knowing where or when they died. If you find a dead bird with a band on its leg, you should notify the U.S. Geological Survey Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if known) and the exact location. Report the information at http://www.pwrc.usgs.gov/bbl/bblretrv/ or by calling 1-800-327-2263.

With such a high percentage of natural losses, further decline in bird populations may threaten their continued existence. We can help birds best if we understand where they live, what they need, and where they travel. Banding is one technique that provides us with the essential information we need to manage habitat for bird conservation.

PROCEDURE

1. Begin a class discussion on bird banding. How do biologists know where birds fly for the winter? How do scientists know which birds go where, when most individuals of the same species have a similar appearance? How would banding birds facilitate gathering information? Explain that the students will have the opportunity to see what it's like to be a bander and to be a bandee. However, because it requires special equipment, special permits from the federal government and lots of training, they will not actually be banding birds; they will be banding people!
2. Review the method of scientific inquiry. As a class, select a research question, such as: Where do students go at lunch?; Where are the students from the participating class during the last period of the day?; How many students from the participating class use the front door to leave the school building at the end of the day? More than one question may be pursued during the data collection, as is often done in real research. Tell the students that they will need to collect data to answer their question.
3. Divide the class into "researchers" and "migratory birds" with a ratio of approximately one researcher to five birds. Band student "birds" with numbered construction paper anklets and instruct them to go through the school day in their normal fashion. (If you are doing this activity with several classes at once, use different colored bands for each class. If a large percentage of the students in the school are participating in the activity at once, it would be more realistic if the number of banded "birds" were reduced to two out of every five.)
4. Give each researcher a "banding permit" that gives permission to do this activity. Researchers then set up imaginary mist nets. For example, researchers can stand in a selected hallway to catch migrating students, recording the number and color of the band, the time, location and whether or not they had been caught before and any information necessary to the research question. Emphasize to the student "birds" that they shouldn't change their daily activities on account of the research project, or they will risk invalidating data. Because birds are not usually confined to hallways when they travel, and they may fly over or around the mist net without necessarily knowing it's there, student researchers should agree to accept a handicap, such as only stopping every fifth person who passes them.
5. The next day, have students organize the data and present their findings to the class. It would be a

good opportunity to incorporate math skills, such as fractions, probability and graphing. Students could calculate what percent of all "birds" migrated outside during lunch and what percent were caught by the library, then graph the results. Some questions may require more "field work" to collect data. If any new banding is required, students need to request a new banding permit.

6. Discuss the process of scientific inquiry. Relate this process to how students answer their research question.
7. Ask "researchers" to share some of the problems they encountered in banding "birds." Compare these results to the problems bird banders might face. Discuss the benefits and limitations of obtaining data on birds from banding.

DISCUSSION

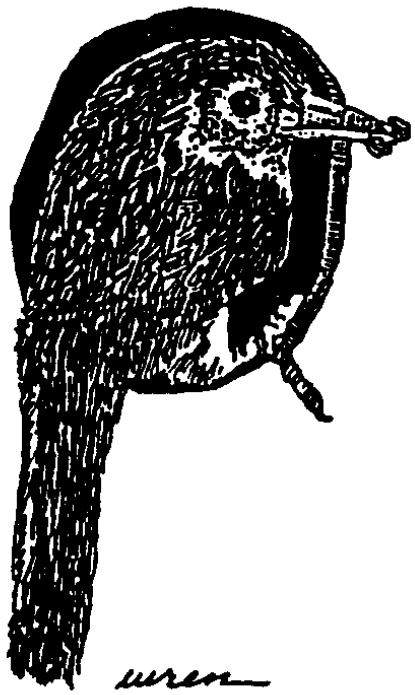
1. Did the research answer the original question? What similarities exist between this activity and what bird banders do? What differences exist? Why is cooperation and sharing of data important in any study such as this? How could the study have been improved to increase the accuracy of the findings? Who else might be interested in your findings?
2. How have scientists been able to learn so much about migratory bird travel and needs? Do they know all that needs to be known about bird migration? Why is it that we don't know many exact details about where individual birds spend various parts of their lives? For how many years do scientists have to band and catch birds before they obtain sufficient information on bird ages and survival? Before participating in this activity, what would you have done if you found a dead bird with a band on its leg? What would you do now?

EXTENSIONS

1. To really simulate what happens in bird banding, several different parties should be monitoring the same banded students at different times. Some ideas for incorporating this suggestion include: a) have two groups of students (or two classes) collect data on the same banded students at different times of the day or week; or b) on the back of the bands, have students write a request to the parents of the banded student to please return the band to school with information about where the family lives or what types of things the student does at home.
2. Visit a bird bander in the field, or invite one to come to your school to demonstrate equipment. Banders are most active during the spring and fall migrations. Contact the IDNR at 217-785-8547 for information about bird banders in your area.
3. Sometime during the school day, introduce a catastrophic event that would affect part of the "bird" population. For example, have a hazardous storm sweep by the lockers, "killing" any "birds" there at the time. Then recover the bands and discuss what you would do with them in real life.

ASSESSMENT

1. Students should be able to explain some benefits and shortcomings to relying on bird banding for learning about birds.



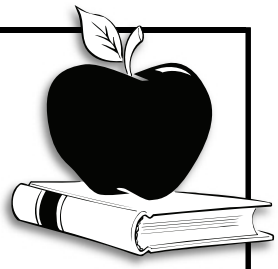
CLASS TIME: one class period

VOCABULARY: biological diversity (or biodiversity), conservation, preservation

MATERIALS: old, junked radios, telephones, clocks, toasters and other such equipment; tools to disassemble them, such as screwdrivers, pliers, etc.

NEXT GENERATION SCIENCE STANDARDS: MS-ESS3-4

TEACHER'S GUIDE



ACTIVITY

Intelligent Tinkering

Flower in the crannied wall,
I pluck you out of the crannies,
I hold you here, root and all, in my hand,
Little flower—but if I could understand
What you are, root and all, and all in all,
I should know what God and man is.

— Alfred, Lord Tennyson

OVERVIEW

By removing parts of a machine used to model an ecosystem, students learn about biodiversity and the dangers of removing parts before knowing the role they play in a system.

CONCEPTS

- Forests are complex ecosystems.
- Birds are part of forest ecosystems.

OBJECTIVE

Students will be able to understand the need to conserve biodiversity.

KEY POINTS

- People need to conserve biodiversity, even if we don't know the importance of all the components of an ecosystem.
- A living creature or an ecosystem is more complex and harder to put back together again than a humanmade machine.

TEACHER BACKGROUND

Biodiversity (or biological diversity) is defined simply as the variety of life. It is usually thought of in three ways. First, and most commonly, we refer to species diversity, the variety of species present in a given area. For instance, we can speak of species biodiversity in a particular forest, meaning all fungi, protozoa, bacteria, animal and plant species. Sometimes, rather than counting each species equally in measuring species diversity, one species may be given more weight. This procedure is done in the case of a rare or endangered species, for the loss of a few could deplete biodiversity by reducing the number of species present.

Biodiversity is also used to describe genetic diversity, which is defined as the variability present in a particular gene pool of any given species. Usually, the more diverse the gene pool, the healthier the species, as diversity allows for adaptation and change over time.

Finally, biodiversity can refer to ecosystem diversity. Ecosystems are systems where there is an exchange of materials between the living and nonliving components. This diversity can be an indication of the variety of populations and communities in a given region. A national forest may contain coniferous and deciduous forests and lake and stream ecosystems. The deciduous forest itself contains a variety of ecosystem types, such as in the canopy and the forest floor. Greater ecosystem diversity often contributes to greater species and genetic diversity.

However we define biodiversity, it is dynamic, changing. For example, through geologic time, the climate has changed enough to greatly alter diversity with the advance and retreat of glaciers. On local levels, we may see changes in diversity through human interactions with the environment, such as clearing woodlands for agriculture or discharging untreated waste water into streams. Biodiversity also changes continuously through dispersal mechanisms and adaptation strategies of individual species. If a particular habitat becomes less desirable for a species, the species may be able to thrive by migrating or dispersing to another area. Or, a species having higher genetic diversity may be capable of adapting to the changes within its environment.

Generally, the more specialized or isolated a species is, the more vulnerable it is to environmental change. A species that exists only in a small area, such as an island, can be destroyed completely in a single storm. A

species can be driven to extinction by human activity, as was the passenger pigeon (*Ectopistes migratorius*) due to excessive, unregulated hunting and dramatic changes in available habitat. Many species suffer from human actions, such as destruction of suitable habitat like wetlands or land conversion from forests to suburbs and shopping malls. In some places, the loss of large amounts of contiguous forest habitat has been associated with declining populations of many species.

Maintaining biodiversity is an important goal for humankind, given that the variety of life is more threatened today than in any time since the extinction of the dinosaurs 65 million years ago. The dodo bird (*Raphus cucullatus*), passenger pigeon and Labrador duck (*Camptorhynchus labradorius*) have all become extinct, while the whooping crane (*Grus americana*), red-cockaded woodpecker (*Dryobates borealis*) and piping plover (*Charadrius melodus*) have been declared endangered.

In the United States, the Kirtland's warbler (*Setophaga kirtlandii*) was once on the federal endangered species list. From 1961 to 1971, the population of Kirtland's warblers decreased to dangerously low levels, primarily due to parasitism by the brown-headed cowbird (*Molothrus ater*). (See “Cowbird Capers” for more information on cowbird parasitism.) With a massive recovery plan, which included cowbird control, the warbler's population stabilized. Another factor causing its population to decline was lack of suitable breeding habitat. This species breeds in a very specific habitat of dense, young jack pine (*Pinus banksiana*) stands found in Michigan. Historically, jack pine required naturally occurring fires to reproduce. The heat of the fires was necessary to open the cones and release the seeds. Due to fire prevention, this habitat became limited. In addition to cowbird control, recovery efforts now include developing and maintaining suitable nesting habitat on a sustained basis, including planned rotation cuttings of jack pine stands within designated management areas. Kirtland’s warbler responded so well to these management techniques that it is no longer an endangered species.

Why care about maintaining biodiversity? Given the present rate of habitat degradation and loss, particularly in the tropics, 15 percent of all species may become extinct in the next few years. The implications of such loss are immense. As humans, we are subject to the moral and aesthetic aspects of such destruction. Unfortunately, these aspects are hard to quantify and categorize and therefore often get overlooked and omitted from the conservation equation. Other implications are more concrete, such as alteration of ecosystems to the extent that the change affects climate and important ecosystem functions such as cycling nutrients, purifying water and removing wastes. Jeopardizing ecosystem functions could hamper sustainable production of some crops on which humans depend. We are just beginning to realize what unknown adverse impacts may occur as a result of the loss of biodiversity.

Loss of species diversity can mean the destruction of potential but not yet identified resources, such as medicine and food. For example, recent research has found that the bark of the Pacific yew (*Taxus brevifolia*), a tree that grows in the Pacific Northwest, contains the makings of a drug, taxol. Taxol is used in treating certain types of cancer in humans. Before anyone discovered this potential use of the Pacific yew, the tree was not considered economically important and was often burned as waste during logging operations.

Humans can take positive steps to conserve biodiversity. The bald eagle (*Haliaeetus leucocephalus*), our national symbol, was endangered due to pesticides in the food chain. By limiting the use of certain pesticides, such as DDT, we reduced the pesticides’ residues in the food chain and improved the quality of the eagle's food sources. In large part due to these efforts, the number of bald eagles increased greatly, and this species has been removed from the endangered and threatened species list, both federally and in Illinois.

To protect species and genetic diversity, we have to maintain habitats and ecosystems. One way to do so is through the creation and management of parks and reserves. **Preservation** is one strategy; the maintaining of a natural environment undisturbed by the influence or activities of humans. However, this approach alone is simplistic and will not be effective in the long run. Natural succession will change the ecosystem, even if humans do not interfere. Nor will we be able to set aside enough land to preserve biodiversity, in part because competition often comes from increasing human popula-tions, and our need for resources often prevents such preservation.

Many countries in the tropics are experiencing a human population explosion. Nicaragua, for example, had a population of 1.1 million in 1950, 3.87 million in 1990 and is projected to be at 9.22 million by the year 2025. This increasing human population in Nicaragua and other developing countries will necessitate the use of more land and food resources, potentially at the expense of biodiversity. In the United States, despite much slower human population growth, specialized habitats such as wetlands are often compromised for development, and we've lost most of our prairies and savannas already. It is estimated that people in the United States use up to 30 times more resources per person than most of the third world does.

While there is a need to preserve some areas, here and in the tropics, we also will have to work within managed

lands to conserve as much biodiversity as possible, while still producing commodities for humans. **Conservation** is the protection, improvement and wise use of natural resources to assure the attainment of the highest economic and social values for perpetuity. Ultimately, conservation will allow for wise use of resources and maintenance of biodiversity.

In order to conserve biodiversity, we have to understand that all species and ecosystems have value. Because it is not feasible to measure all biodiversity, nor to understand all present and future values of each living species, we have to act intelligently when we alter natural environments. As Aldo Leopold succinctly suggests in his essay “Round River,” we should not undervalue or discard a resource just because we're not sure of its use.

"Have we learned the first principle of conservation: to preserve all the parts of the land mechanism?...To save every cog and wheel is the first precaution of intelligent tinkering."

PROCEDURE

1. Divide the class into cooperative groups of four. Assign each student a role as follows: a) a Labeler to label parts; b) a Recorder to write down each part's function; c) a Disassembler to take the pieces apart; and d) an Assembler, to put the item back together.

2. Give each group an old, junked radio, clock or other piece of machinery. Instruct them to separate it into as many individual pieces as possible **in ten to fifteen minutes**. Have the Labeler and Recorder label each piece with its name and its function in that particular piece of equipment. If students are not sure exactly what a piece is called or what it is used for, have them write a "?" for that piece. There should be lots of question marks.

3. Have students throw away all the pieces labeled with a "?."

4. Instruct the Reassembler to put together the original piece of equipment, using only the pieces that are left. Students will immediately realize that this is impossible. Ask if their machinery is fixed.

5. Read them Leopold's line: "To save every cog and wheel is the first precaution of intelligent tinkering." Discuss the meaning of "intelligent tinkering." Compare the machine or appliance to an ecosystem. Point out that a forest ecosystem, once altered or destroyed is harder to reconstruct than a human-made machine.

6. Define biodiversity. Discuss the importance of biodiversity and its conservation. Discuss the importance of considering biodiversity in land-use decisions, along with the many other valid concerns: the need for agricultural expansion; housing development; conservation of other wildlife habitat; fuel wood; etc. Define and discuss the difference between conservation and preservation. Discuss ways we, in temperate climates, can help conserve biodiversity in tropical climates. Students may suggest international conservation treaties, trade agreements or education efforts.

7. Ask members how the group performed. What did your group do well? What does your group need to work on?

DISCUSSION

1. Was anyone able to repair their piece of machinery? If machines, which are created by people, are complicated to understand, how complex are living things? If a flower were plucked or a bird killed, could you fix the flower so it would function again making nectar, or the bird so it could sing or fly? What about a whole ecosystem? If a forest is destroyed, can you recreate it overnight?

2. Why is it important to save all the pieces, even those we can neither name nor identify by purpose? What pieces have we already lost? Which ones are we in danger of losing? How is your toaster/radio/clock like an ecosystem? How is it different? How are the parts like individual species? How are they different? Does the ecosystem stop working when one or some parts are removed? Can it function in a different manner?

3. Is it important to conserve biodiversity? Why? Is the loss of any single bird a big deal? Why, or why not? Is conserving biodiversity important only for humans? Do you think people in Latin America think the same way about the need to conserve biodiversity as you do?

4. What human interests and needs may conflict with conserving biodiversity? Is it appropriate to set aside large tracts of forest solely for the benefit of wildlife? Can we use forests in such a way that biodiversity can be conserved? What might happen if we tried to preserve all forests without any disturbance from human activity?

MODIFICATIONS

Have each class work on one large machine during one day, so each class takes the machine apart a little further during their class period. The next day, have classes try to put the machine back together. This process will be very difficult because students don't know what parts

other classes removed. Compare this activity to the way an ecosystem may be changed by many generations of people, each knowing little about the alterations made by previous generations.

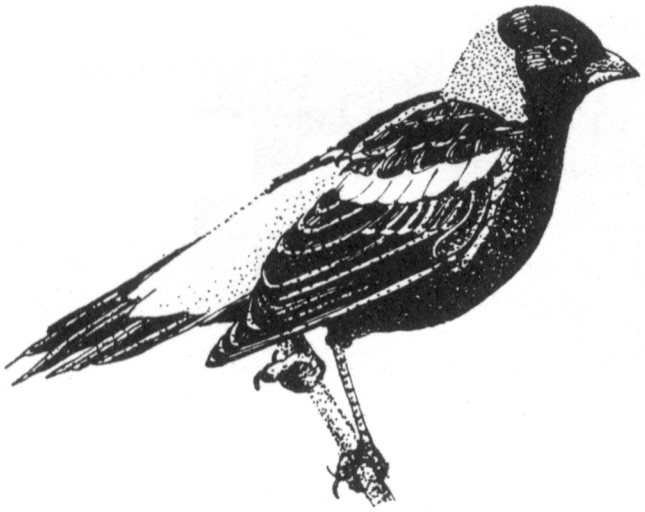
If you don't have access to machines or tools, try this activity. Ask each group to pick four letters that are not next to each other in the alphabet, including at least one vowel. Give cooperative groups a word search puzzle, withholding for a moment the key words and the fact that the block of letters is a word search. Write the four selected letters on top of their page. Next, instruct them to cross out these four letters each time they appear on the page. Supply the students with the key words and tell them the writing on the page is a word search. Ask them to find as many of the key words as they can in the search, but they can no longer use the letters they've crossed off. After they've worked on it, ask how many of the words they were able to find. Ask if they would have chosen different letters to cross out if they had understood the letters' roles in the word search. Continue with procedures five and six from above and conduct the discussion.

EXTENSION

1. Read and discuss Tennyson's poem as it relates to the complexity of living things and our ability to comprehend biodiversity.
2. In cooperative learning groups, have students conduct research on threatened or endangered species to find out about limiting factors and conservation efforts.
3. Take students outside and mark off a small area with a hula hoop or circle of string for each cooperative group. Each group must determine, as well as they can, how many different species of plants and wildlife are living in their circle. Relate this activity to a discussion of biodiversity.

ASSESSMENT

1. Evaluate student performance in cooperative groups.
2. Have students write down why you had them take apart machines.
3. Ask students to define "biodiversity," "conservation" and "preservation."



PREPARATION: Make craft dough (or paper territories for Modification).

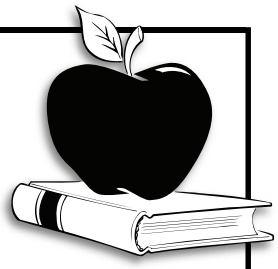
CLASS TIME: one class period

VOCABULARY: territory, forest interior species, fragmentation

MATERIALS: craft dough–enough for one lump of dough per student (or paper and compasses for Modification); round cookie cutters or similar items, such as jar lids–one for each student; rolling pins or other similar items; waxed paper; a table knife

NEXT GENERATION SCIENCE STANDARDS: MS-ESS3-4, MS-LS2-4, MS-LS2-5

TEACHER'S GUIDE



ACTIVITY

Territory Tango

OVERVIEW

Students make craft dough models of bird territories to learn about habitat requirements of interior forest species compared to edge species.

CONCEPTS

- People and some birds depend on forests for their needs.
- Bird populations are affected by human impact on their habitat.
- Each forest management option may limit other forest uses.
- Human use and management of forests affects bird populations.

OBJECTIVES

Students will be able to: 1) demonstrate how forest fragmentation reduces habitat for some migratory birds; and 2) explain that some birds require interior forest habitat, while others thrive on the edge.

KEY POINTS

- Bird species have different habitat requirements.
- Some bird species require interior forest habitat to succeed.
- Some bird species require forest edge habitat, grassland, wetland or other habitat types.
- Dividing a forest into smaller sections alters the habitat, even if the total area forested remains the same.

TEACHER BACKGROUND

When the European explorers and settlers came to Illinois, portions of the state were covered with extensive, mature forests that were broken by the open sweeps of marshes, savanna and prairie. In some places where the forest met the open prairie, there were savannas, with scattered trees and a grassland understory. The part of the state not covered by prairie was covered by forests of oak and hickory, maple and basswood, as well as mixed broadleaved trees and conifers, and other forest types. In these great forest tracts lived many kinds of mammals and birds.

Some wildlife species need large forest stands to find food and shelter to successfully rear their young. Among them are many species of birds, called interior forest species, because they live in the interior of large forested areas. The ovenbird and scarlet tanager are examples of interior forest birds.

As Illinois was being settled, trees were cut for lumber and to clear the land for farming, much as people are doing for new settlements in the tropics today. Wood was used to build homes, factories and other artifacts of modern living. Wetlands were drained, and prairies were plowed. Since reaching a low point in the 1920s, the forest cover has slowly grown back. However, we have divided the land into smaller areas and compartments for the variety of uses we demand for our lives, thus we have fewer extensive forests and more smaller woodlots. We call this division of forest land into smaller sections "fragmentation."

Some forest interior bird populations are limited by this land conversion. Other species, such as the indigo bunting, prefer a more open setting and can thrive on the edge of forests. The indigo bunting is a Neotropical migratory bird that breeds in Illinois.

Several small woodlots hold fewer interior wildlife species than one large forest, since conditions in small woodlots are different than in a large forest. In a large forest, the distance to the nearest edge or opening may be miles away, while in a 40-acre woodlot it can be no more than about 200 yards. Winds from the surrounding land keep a moist micro-climate from developing and discourage certain plants from living there. Also, brown-headed cowbirds (*Molothrus ater*) venture into these small areas to lay their

eggs in the nests of other birds. Forest interior bird species, not having lived with cowbirds before, produce fewer young, and may actually now only raise cowbirds. In other words, the area has been upset to a point where it no longer functions as an interior forest ecosystem for certain plant and animal species.

The smaller woodlots can be beneficial to those species that thrive on the forest edge, such as the indigo bunting. The abundance of indigo buntings has increased since the turn of the century with the creation of favorable habitat following logging operations and abandonment of pastures. While indigo buntings are frequent cowbird hosts, they have a strategy to defend against this parasitism (the laying of eggs by another species in the host's nest). Indigo buntings occasionally bury cowbird eggs by building a new floor in the nest.

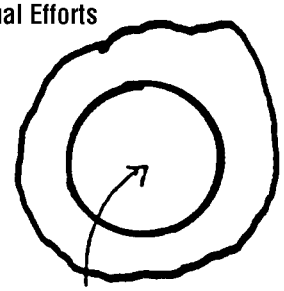
As we fragment the forest community into smaller segments, it becomes harder for those species that depend most on forest interior habitat to survive and reproduce successfully. A forest rich in biological diversity may be home to dozens of bird species. When we fragment the forest, we reduce the size of their habitat. We also open the area to invasion from competitors like brown-headed cowbirds, the introduced European starling (*Sturnus vulgaris*), or predators such as raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*) and cats (*Felis catus*). With the destruction of habitat, some forest birds no longer use the area because of the lack of space, while others cannot successfully raise their young. Over time, these populations decline.

As we turn our attention to the loss of tropical habitat, we need to keep in mind that many birds come to Illinois to raise their young. The way we manage our forests is just as important to migratory bird survival as land management in the tropics.

PROCEDURE

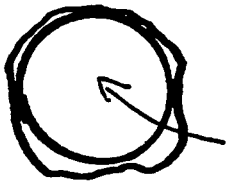
1. Tell the class they will carve bird territories out of dough. Have the students assist with the mixing of the craft dough or bring it pre-mixed from your home (simple recipes follow). You may also purchase the craft dough if you do not want to make it.
2. Divide the class into cooperative groups: in each group, half the students are "ovenbirds" (an interior forest species) and half are "indigo buntings" (edge specialists).
3. Give each class member a lump of dough that would be **just** big enough for one cut-out. Pass out lids to use as cookie cutters, waxed paper to work on and rolling pins (or similar cylindrical items).
4. Explain that the dough represents the forest habitat, and the cut-outs represent breeding territories. Explain that only whole cut-outs (territories) are allowed and that they cannot put scraps together to role out more cut-outs because birds can't create more habitat this way. Tell students that a thin, stretched cut-out will represent poor quality habitat.

Individual Efforts



Ovenbirds define their territories in the forest interior, with a buffer zone between the territory and the edge.

5. Explain to the "ovenbirds" that they prefer interior forest territories and that their cut-outs must be made with a border of one inch of dough all around. This arrangement is not because ovenbirds have bigger territories, but to simulate interior forest territory with a buffer zone. The indigo buntings can make their cut-outs right up to the edge. (See illustrations.)

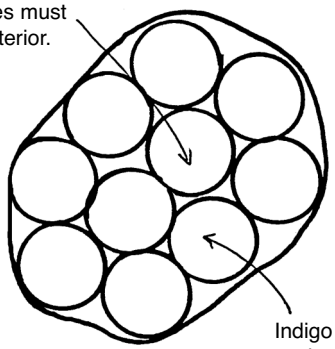


Indigo bunting territories can go up to the edge of the forest.

6. After they've tried this procedure, discuss how it worked. The ovenbirds were probably not able to create a territory with their lump of dough. If they were, it was probably too thin to be good quality habitat.
7. Redefine the group's goal: to make as many complete territories as possible, with just one round of cutting (i.e., without putting all the scraps together, rolling them out and cutting out more). All the bird territories must be whole (no partial cut-outs), and ovenbirds must have at least a one-inch border from the edge of the dough. Ovenbird territories may be next to indigo bunting territories, but not next to the edge. Explain that ovenbird territories normally don't overlap. Ideally, the group members will combine dough into one big sheet to get more territories, placing ovenbirds in the interior and indigo buntings around the edge. If the students do not adopt this

Cooperative Efforts

Ovenbird territories must be in the forest interior.



Indigo bunting territories may be in the buffer zone around the forest edge.

strategy after a while, suggest it to them. They should be able to get more territories than by working individually.

8. See how many interior and edge territories each group is able to cut from the dough and record class totals. Is there any way that more territories could be cut without making them thinner? Re-lump the dough. Merge several groups, then the whole class, and see how many territories can be carved out of the larger roll of dough. This number of interior territories should be higher than their previous totals.
9. Once all the territories have been counted, cut a thin, straight line through the center of the dough. Tell the students the people living on one side of the forest need to get to town on the other side, so they made a road, as represented by the knife line. Now see how many whole territories are left. Ovenbird territories must be one inch from this line, since the road has created a new edge.
10. Discuss how the dough represents the forest and the cut-outs represent the minimum space requirements for one pair of breeding ovenbirds or indigo buntings. Relate the dough activity to key points. Different birds require different habitats and dividing the forest, even by a slender road, fragments the forest and alters it as habitat for some species. Relate what students have learned to forest management. How would they manage a forest differently for edge or interior species?

DISCUSSION

1. Ask students why the ovenbirds had to have territories at least one inch from the forest edge. Why were the students able to get so many thick cut-outs from the larger sheet of dough when it was so difficult with the small individual portions? If you were managing a forest for indigo bunting habitat, what would you do? How about for ovenbird habitat? Why is it important for ovenbirds to have access to large blocks of forest, rather than just many small woodlots? Did cutting the sheet of dough with the knife reduce the number of whole territories that were able to be cut from the dough? What would be a parallel disturbance in a real forest? Point out that when we use forest land for one purpose, it may limit other uses.

MODIFICATION

Substitute four-inch squares of green construction paper for the craft dough and have students draw circular territories 3.5 inches in diameter with a compass. When students would re-lump the dough, have them turn over their paper squares so when they combine them with several groups together, the new compass-drawn circles will not be confused with the earlier ones. Create larger tracts of forest by putting paper squares together (like pieces of a puzzle) instead of combining dough. In the final combination of green squares for the whole class, you can change marker color to help avoid confusion. Draw the road with a different colored marker as well.

EXTENSION

Use the remaining dough to make a model of your sister country or a model of the Westerly forest in the "Town Meeting" activity.

ASSESSMENT

1. Have students write about how forest fragmentation affects interior forest birds and edge species.
2. Assess participation in cooperative groups.

BAKER'S DOUGH

This recipe is simple to make but should be mixed just before class to avoid over-stickiness.

Materials:

2 cups flour	½ to 1 cup water
1 cup salt	food coloring (green)

1. Combine flour and salt together in mixing bowl.
2. Gradually add water.
3. Mix dough with your hands until it is pliable and not sticky.
4. For color, add food coloring to the water.

This recipe makes enough dough for approximately 18 students.

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CRAFT DOUGH

This recipe is more complex, but the dough is easier to work with.

Materials:

2 cups baking soda	1 1/4 cups cold water
1 cup corn starch	food coloring (green)

1. Combine all ingredients, except food coloring, in sauce pan.
2. Cook over medium heat, stirring constantly, for 10 minutes until mixture is consistency of mashed potatoes.
3. Remove from heat, turn out onto a plate, and cover with a damp cloth.
4. When cool knead into a smooth ball, adding food coloring.
5. Store in tightly sealed plastic bag and refrigerate.

This recipe makes enough dough for approximately 20 students.

PREPARATION: Make songbird and cowbird "beaks."

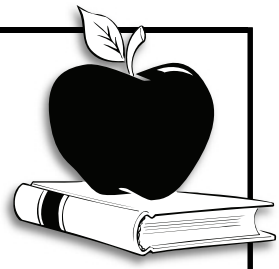
CLASS TIME: 20 to 30 minutes

VOCABULARY: cowbird, brood parasitism, fragmentation, edge effect

MATERIALS: 1 blindfold; 4 small (4- to 6-ounce) paper or plastic cups; 1 large unbreakable mixing bowl or plastic container (e.g., the bottom half of a plastic milk jug); 5, three-foot pieces of string; popped popcorn

NEXT GENERATION SCIENCE STANDARDS: MS-ESS3-4, MS-LS2-4

TEACHER'S GUIDE



ACTIVITY

Cowbird Capers

OVERVIEW

Students participate in a simulation of brown-headed cowbird (*Molothrus ater*) parasitism.

CONCEPTS

- Bird populations are affected by human impact on their habitat.
- Human use and management of forests affect bird populations.

OBJECTIVES

Students will be able to: 1) recognize that forest fragmentation increases "edge effects" including brood parasitism; 2) recognize that brood parasitism affects the reproductive success of forest songbirds; and 3) describe how nests of breeding songbirds are parasitized by brown-headed cowbirds.

KEY POINTS

- Forest fragmentation increases edge effects.
- Those edge effects impact negatively on interior forest bird populations.

TEACHER BACKGROUND

In "Territory Tango," forest fragmentation was discussed as one reason for the decline of songbird populations. Breaking a forest into fragments reduces the total number of suitable territories, and hence nesting sites, for those birds that depend on interior forest.

Fragmentation contributes to the decline of migratory bird populations in another way too, by giving parasitic birds access to their hosts, a phenomenon referred to as brood parasitism.

Brood parasites are birds that lay their eggs in the nests of other birds (host species). The parasite's eggs hatch and are raised by the host species. Some parasites never rear their own young and are, therefore, totally dependent on host species. The brown-headed cowbird is the most common nest parasite in North America. Because the host parent birds are attending to the parasite young, often few or none of the host's own young survive. Young cowbirds tend to hatch and develop more quickly than most songbirds' young. Often they are bigger too, and they may push others out of the nest. Many of the host species that co-evolved with the brood parasites have reduced the success of parasites through a variety of strategies, such as building a new nest or pushing the parasite eggs out of the nest. However, if a host species has not co-evolved with a parasitic species, the host may lack the strategies necessary to cope with parasitism. This situation is true in North America, where the brown-headed cowbird can now reach populations of forest songbirds.

The brown-headed cowbird, prior to European settlement, was found in the western part of our country. Its habitat was open grassland. It followed American bison (*Bison bison*) herds, eating insects from their dung and from the prairie disturbed by their great hooves. Because it followed the herd to find food, it could not warm and hatch its own eggs and raise its young, so cowbirds adapted by using the nests and parenting abilities of other birds. With settlement and the subsequent deforestation of large areas of eastern North America, the range of the cowbird has expanded. Along with deforestation has come significant forest fragmentation. The fragments contain more area that is adjacent to the forest edge, and cowbirds have increased access to forest bird nests.

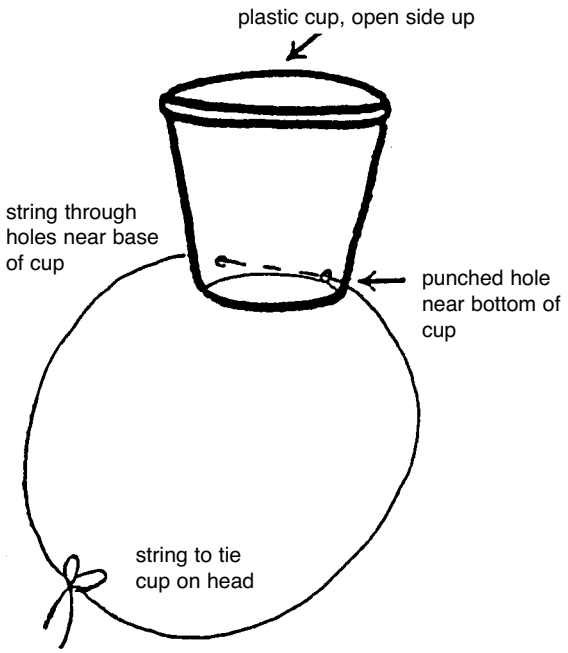
Forest fragmentation and increased edge effect were not the only influences on cowbird parasitism. The cowbird population has also increased sharply, due in part to an increase in rice cultivation in the south. Rice provides a winter food source, which was previously lacking. Now, increased cowbird populations, in combination with increased forest fragmentation and edge effects, have led to increased brood parasitism.

Many forest-breeding Neotropical migratory birds have not developed defenses to parasitism. The susceptible

host birds include warblers, vireos, flycatchers, tanagers and thrushes. If cowbird populations continue to rise, the populations of our forest-dwelling Neotropical migratory birds are likely to continue to decline.

PROCEDURE

1. Thread each of the small paper or plastic cups onto a three-foot piece of string by punching two small holes on opposite sides of the container within one-half inch of the bottom.
2. Ahead of time, secretly select a student with a loud voice to play the role of the baby cowbird. Tell the cowbird to join the others in the circle when you give the signal. Explain the activity to the selected student, but keep the cowbird's role secret from the rest of the class.
3. Introduce the activity with a question about why songbird populations are declining or what effect cutting large tracts of forest into small fragments surrounded by nonforested areas has on forest birds. Say, "Let's simulate a songbird nest to find out."
4. Select four students to be baby songbirds. Have them sit facing outward in a tight circle on the ground or on chairs. Tie the plastic cups onto the heads of the four baby songbirds like hats but with the open end pointed up. Explain that the cups represent the open mouth of the hungry baby birds. When the parent bird returns to the nest, the baby birds call loudly ("Tweet tweet tweet...") to signal the parent bird that they are hungry. The parent bird responds by distributing food to the hungry babies. Typically, the loudest bird attracts the most attention and thus gets the most food.
5. Select one student to be the parent bird. Give that student a blindfold and a bowl of popped popcorn. The parent bird distributes food (popcorn) to the hungry baby birds by standing at the edge of their circle and dropping or tossing pieces of popcorn in the direction of the tweeting birds. Blindfold the parent bird to ensure that s/he is distributing the food only in response to whomever is tweeting the loudest. Each baby bird must catch at least ten pieces of popcorn in the cup in order to survive. Caution students against trying to actively position themselves to catch the popcorn as this could result in banging heads with another student. Rather, they should simply tweet louder to get the attention of the parent bird.
6. After the directions are given and the parent bird is blindfolded, the baby cowbird is signaled to quietly enter the circle and sit in the center of the other baby birds. Don't let the parent bird know that this is happening. The baby cowbird competes for food and is aided by the larger container, such as a mixing bowl, which s/he holds on his/her head to represent the bird's open mouth. The baby cowbird should join the other baby birds in tweeting loudly for food. The cowbird's larger "mouth," louder voice and central location in the nest should give it a clear advantage over the baby songbirds and allow it to catch a significant portion of the distributed popcorn. To simulate the real-life situation of limited resources, limit the amount of popcorn given to the parent bird to throw.



7. Continue the activity until the parent songbird has used the popcorn, then have the baby birds count their pieces of popcorn.
8. Discuss how many songbirds survived. Why did so few survive? How much popcorn did the cowbird catch?
9. Define cowbird parasitism. Explain that cowbirds parasitize songbird nests and that brood parasitism from cowbirds is one factor in the population decline of songbirds. Point out that humans have altered the forest, creating more of an edge. This change in landscape has put forest birds in close proximity to the cowbird.
10. Ask whether the people of Puerto Rico should be concerned about what cowbirds are doing in the Midwest? Why or why not?

DISCUSSION

1. If all the popcorn kernels caught by the cowbird were distributed to the other baby birds in the nest, how many of them would have survived? What impact do cowbirds have on the nesting success of songbirds? What will eventually happen to songbirds if brood parasitism continues year after year?

2. Is there anything that humans can do to protect songbirds from cowbird parasitism? (Short-term responses could include trapping cowbirds, removing cowbird eggs from songbird nests or in some other way discouraging them from parasitizing songbird nests. Long-term solutions include restricting the geographic range of cowbirds by reducing the amount of forest edge and restoring the presence of large unbroken tracts of forest.) Is this something that people should do? Is the current situation "natural?" Does it preserve the balance of nature? Why do cowbirds parasitize other nests? How have changes in the rural landscape affected cowbird populations? Why is it that cowbirds are more of a threat to songbirds now than they were in the past? What changes have occurred in the landscape of the Midwest? This change in landscape has put forest birds in close proximity to the cowbird. Who is responsible for the current cowbird situation? Who is responsible for protecting the songbirds?
3. Tell students about the endangered Kirtland's warbler and the recovery effort to reduce cowbird parasitism on the warbler's nest (as explained in "Intelligent Tinkering").

MODIFICATIONS

Not all species of songbirds are successfully parasitized by cowbirds. Those that have co-evolved with cowbirds for long periods of time (hundreds or thousands of years) are able to distinguish cowbird eggs from their own eggs and may either throw out the cowbird eggs, build a new nest floor over the cowbird eggs or simply abandon the nest completely and start over elsewhere. To represent such adaptations, the activity could be repeated with the modification that if the blindfolded parent is able to distinguish the "tweet" of the cowbird from the "tweets" of the songbirds, then the cowbird can be evicted from the nest and the baby songbirds will have a better chance of surviving.

This activity can also be done with the entire class participating in small groups, rather than with only one group of five or six students actively participating while the other students observe the outcome.

EXTENSIONS

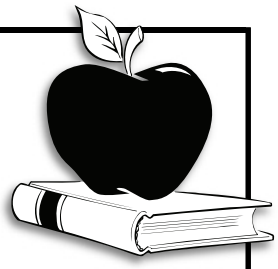
1. Students could prepare a report on cowbirds and find out how to recognize their eggs. How do state agencies and other wildlife managers recommend dealing with the cowbird situation?
2. Some students may want to conduct their own study of cowbird parasitism. They could look for nests of songbirds to see whether or not they are being parasitized by cowbirds. Cowbird eggs are most common in songbird nests during May and June. During these months, students with supervision could check to see if there are any cowbird eggs in them. (Cowbird eggs are usually white profusely speckled with brown. They should look different than the eggs of the host bird.) Caution students against disrupting the parent birds tending the nest.
3. Have students speculate why brood parasitism evolved. Think about the feeding behavior of cowbirds. They evolved to forage along with nomadic bison and had no time to build nests and raise young hence, host species.

ASSESSMENT

1. Have students describe cowbird parasitism and explain how it affects songbirds.

CLASS TIME: two to three class periods
VOCABULARY: consensus
MATERIALS: research article summaries in Appendix D; role-playing cards; The Scenario
COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Reading7, MS Reading 8, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening
NEXT GENERATION SCIENCE STANDARDS: MS-ESS3-3, MS-LS2-5

TEACHER'S GUIDE



ACTIVITY

Town Meeting

OVERVIEW
In a simulated town meeting, students use information they have learned during the unit to make decisions regarding a forest.

CONCEPTS
- People and some birds depend on forests for their needs.
- People alter and manage forests to accommodate their wants and needs.
- Each forest management option may limit other forest uses.
- People can act to help conserve Neotropical migratory forest birds and their homes.

OBJECTIVES
Students will be able to: 1) understand the complexity of making land-use decisions; and 2) demonstrate what they have learned through the unit and apply their knowledge to bird conservation.

KEY POINTS
- People can consider birds when they make land-use decisions.
- Using a forest in one way may limit other uses.
- Environmental decisions require compromise.

TEACHER BACKGROUND
This activity requires the students to use what they have learned throughout this unit by participating in a simulated town meeting. Environmental decision-making is complex and requires compromise. Read the land-use scenario accompanying this activity. Some possible ways students may resolve this land-use conflict are as follows.

The Development Company may have the trees cut in an 80-acre plot, then build a retirement center and golf course, leaving a few mature trees scattered and agreeing to enforce a rule that all cats be kept inside. They might also agree to limit use of pesticides on the golf course. They could contract with the Timber Company to cut the wood and agree to plant some new oaks along the edge of the golf course. On the other side of the golf course, Parks and Recreation might develop a nature center with trails for hiking and cross-country skiing, agreeing to keep the trails close to the forest edge and to post "Keep on the Trails" signs along the borders of the 200-acre interior section of the forest. They could invite Audubon Society members to use their facility as a meeting place and to make presentations related to migratory forest birds. In return, Audubon Society members might volunteer to identify and remove brown-headed cowbird eggs from songbird nests along the edge of the forest.

Or, the Timber Company could purchase the land, agreeing to cut small parcels along the edge at 10-year intervals and replanting to maintain the land as forest. They might plant hardwoods rather than pine, since the soil might be more suited to hardwoods and, in this location, the hardwoods would provide better wildlife habitat. The Timber Company could agree to the Parks Department's request to use the forest for education. The Parks Department could then teach students about forest management techniques through the Timber Company's activities. The Development Company might have to build elsewhere, and the retirement community might be less convenient for the elderly residents and their families.

Or, the Parks Department might claim the woods, using it primarily for hiking trails, limited campsites and a nature center. The Department could agree to the Audubon Society's request to set aside a large portion of the forest to be undisturbed. The Timber Company could reach an agreement with another community and work with that county. The Development Company could build elsewhere, too. If this kind of scenario is adopted, students should be sure to discuss possible ramifications of simply moving operations elsewhere without an environmental assessment at that site. They should be aware of the possible economic loss to their community.

Students may be able to reach complete, or at least partial, consensus by giving each interest group something they want. Perhaps the majority of participants at the meeting feel that having edge species is wonderful and sacrificing other uses of the forest for the sake of interior forest birds is out of the question, while Audubon Society members refuse to give in. If no consensus can be reached, it is important to discuss how the community should proceed from the stalemate. Students might decide more research is needed or they simply need more time to air their opinions and try to convince each other of their way of thinking. They may need to re-examine their method of decision-making. The students don't need to actually do this, but they can think about what a real town could do to traverse the difficulties inherent in making land-use decisions that affect the lives of many people with different interests at stake.

In order for this activity to work, students must be given ample time to organize their groups, discuss the perspective they are given and plan their stance for the role playing. It is best to have this activity take place over two or more days.

It is important that students take bird conservation into consideration while making their decisions. For this reason, part of each group's argument should include an environmental assessment regarding the impact of their proposal on Neotropical migratory birds. It is the teacher's role to keep the discussion focused on bird conservation.

Students should attempt to reach consensus about the use of this piece of land. Historically, any land area not privately owned was considered a commons or free-for-all area. Any benefits to be received from the area (economic or otherwise) were for any individual to enjoy; sharing was not necessary. Likewise, each individual had to bear the entire expense of any conservation effort s/he might undertake. Any effort to preserve the natural environment might be in direct opposition to the objectives of other individuals. In Latin America, the town meeting process is rare and land-use decisions are often subject to this "tragedy of the commons." For example, people may simply move into a forested area and chop down trees to meet their own survival needs. Or, the most powerful interests involved at the site may use the land as they see fit.

Consensus decision-making requires that each student, or a representative of each cooperative group, has a chance to voice an opinion, and there is opportunity for discussion. When a motion or solution is proposed, each individual has a chance to state his or her agreement or disagreement. Discussion continues with amended proposals until **all** participants can accept the same conclusion. This process is different from majority rule where a vote settles differences of opinion and action is taken according to what **most** participants think. Consensus decision-making works through cooperation and compromise so that everybody wins. It is possible your class will not come to agreement in the time period given, but consensus is a desirable goal for the activity.

PROCEDURES

1. Read the scenario regarding the land-use issue facing the town. Students will represent different interests in a simulated town meeting. Indicate clearly the amount of time students will have in groups to develop their arguments and strategies, the amount of time each group will have to present its point of view at the town meeting and how much time will be left for general discussion.
2. Assign one role to each of five cooperative groups: the Natural Products Timber Company; the Westerly Parks and Recreation Department; the Private Landowner; a local Audubon Society chapter with interests in bird conservation; and Tall Oaks Home Developers. Give each group the map of the forest and their appropriate role- play card. Explain that representatives from each interest group will come together at a town meeting where they must attempt to reach consensus on how this land is to be used. Each proposal for land use must include an environmental assessment showing impacts of their proposal on the birds.
3. To understand and represent their group's perspective, students should draw on what they have learned in this unit, the information given on the role-play cards and the accompanying research article summaries.
4. In each group, assign the following cooperative roles: a Facilitator to organize ideas; a Notetaker to document positions; a Cartographer to draw the proposal on the map; a Checker to be sure each group member understands the position and strategy of the group; and a Processor to review how the group worked together. Tell the students that during the actual town meeting, each student must be able to provide their group's arguments and position.
5. Have each group list the benefits of anything they propose, draw their proposal on the map and write down the impact their proposal would have on wildlife, especially birds. Note that some birds need interior forests, while others require edge or open space. Each group should submit a copy of their proposal to the teacher prior to the meeting.
6. Arrange desks and tables in a U-shape or square for the meeting. With the teacher as moderator, call the town meeting to order and give each group limit-

ed time to outline their proposal on how the forest should be used and the benefits of the proposed use. Remind students that they must listen closely to other groups, because they must be able to find common elements with their own positions to reach consensus. Be sure each group receives equal time to speak and to clarify compromises as they arise. It may be useful to write agreements on the board as they are made. Continue until an agreement is reached by all interests or the time is gone.

7. In a large group, discuss how similar or different this would be to real-life decision-making. Make the point that using a forest one way may limit the option of another potential use. Ask students how the decision they made today would affect Neotropical migratory birds. How might their decision have global effects?
8. Ask the Processors of each group to report on how their group worked together. Have their skills in working in cooperative groups improved since the beginning of the unit?

DISCUSSION

1. What would have helped the town reach an agreement faster or easier? Did each group adequately represent their interests during the role play? What did the students learn about cooperation and compromise? Can education make a difference?
2. What did the people in the town gain from the compromise? What did they lose? What did people in other places in the region, or in Latin America, gain or lose by the compromise? How will the decision affect Neotropical migratory birds that have used the forest for nesting? Will there be the same amount of nesting habitat? How will this change in forest habitat affect birds as a whole? What if people in other places are making decisions similar to these? What effect will these decisions collectively have on Neotropical migratory forest birds? In the event of a stalemate, what should the people in the town meeting do to make a decision?
3. Based on what students have learned during the unit, what problems do you think international planners encounter when they try to reach agreement about land use? How can we work with people in Latin America to conserve Neotropical migratory forest bird habitat?

MODIFICATIONS

Have the students present their group's interest to the rest of the town members (perhaps some other class in your school) and then hold a vote to determine the fate of the forest. Or have the teacher act as mayor of the town. It would be up to the mayor to listen to all the arguments and make a final decision.

Ask students to step out of the role they have been given. How would they have compromised on this land-use issue, personally?

EXTENSION

1. Students can make a model of the proposed forest plans.

ASSESSMENT

1. Collect and evaluate a copy of each group's proposal prior to the town meeting.
2. Evaluate ability to explain his/her group's proposal.
3. Assess student participation in the town meeting according to a rubric or checklist. Be sure to inform students of the criteria you are using to evaluate them.
4. Assess participation in cooperative groups during the planning and preparation.

The Scenario

The Town of Westerly, Illinois, includes a large area (400 acres*, or 162 hectares) of undeveloped deciduous forest (see map at close of this lesson plan). The forest land was owned by the Johnson family until this year, when it was donated to the town. There has been no significant management of this forest land for the last 100 years. Therefore, what exists is a mixed hardwood forest, consisting primarily of mature oaks and hickories, some black cherry (*Prunus serotina*) trees and much undergrowth, mainly brambles. The only restriction placed by the Johnson family on Westerly's use of the land was that it remain a favorable habitat for wildlife. The Johnsons did not indicate what type of wildlife. The Town of Westerly now needs to make some decisions as to how to use this forest. Already two businesses have expressed interest in utilizing the forest in ways they feel will help the community. The Natural Products Timber Company has submitted a proposal to the Town Council indicating interest in harvesting some trees in the forest. Simultaneously, the Tall Oaks Home Developer submitted a proposal to construct a retirement community partially within the forest.

Many citizens of Westerly have an interest in how the land is to be used. Fifteen percent of the population of Westerly works for the Natural Products Timber Company. Any increase in business generated from resources in the forest can potentially help these employees. Likewise, 25 percent of the population is more than 50 years old, and the senior citizens have put great pressure on the town to provide a suitable living environment for the elderly in town. The local Audubon Society is very active, and these citizens have noted the value of the forest for providing habitat for many nesting birds. Audubon members are very aware of just how little large forest area still exists in northern Illinois. They remind Westerly of Sara Johnson's wish that the area remain beneficial to wildlife. The Parks and Recreation Department wants to maintain the forest as a nature reserve and outdoor recreation center to bring much needed tourist dollars to the community. The private landowner is obviously concerned with how the neighboring land will be used and wants to be able to make decisions regarding his/her own property independently, without pressure.

* 1 acre = 4,047 square meters; 1 square mile = 640 acres

Role Play Cards

Natural Products Timber Company

The company plans to harvest mature oak trees from the site. Oak is currently in demand, and the company can sell the wood for a high price in the furniture market. The slash (residue remaining on the ground after cutting, such as tree tops and bark) could be sold to a local firewood dealer. Since 15 percent of the town's residents are employed in this company, the increase in business would benefit those people financially. In addition, the company would hire several additional employees, including a site manager and forester, though not necessarily from this community. These economic benefits will only extend into the future if the wood is harvested in a way that sustains the forest. The company has adequate resources to afford any harvest it plans in the Johnson forest.

Tall Oaks Home Developers

This company began in Westerly in the early 1900s when much of the area was being settled. Over the years, the company has overseen much of the housing and business development in the area. The developer has a good reputation in the Midwest for innovations in construction to conserve energy and make use of locally available materials. Several members of the community work for this developer and many more work for businesses that contract with the developer, such as plumbers and electricians. Tall Oaks has been looking for a place in Westerly to locate a retirement community. They propose that this forest would be an ideal location. Many elderly people have an interest in bird watching. There is no retirement community in Westerly and as the population ages, there is more and more need for this housing. Tall Oaks has made efforts to locate the community elsewhere. The only other suitable location, however, is 30 miles north. Tall Oaks has already received financial backing from a local bank to develop a retirement home. However, Westerly zoning law requires that any commercial development plans include an environmental assessment.

Audubon Society Members

Sara Johnson was an active member of the local Audubon chapter and a great bird enthusiast. The Audubon members remind the town that the Johnsons advocated the conservation of the forest for wildlife, including birds. Audubon Society members advocate for Neotropical migratory birds and the preservation of at least some forest. They recognize that some development may occur but prefer that it be limited and restricted to specific areas of the forest where it will have the least impact on nesting forest birds. Because of large membership, the Audubon Society has sufficient monetary donations to carry out any projects it desires.

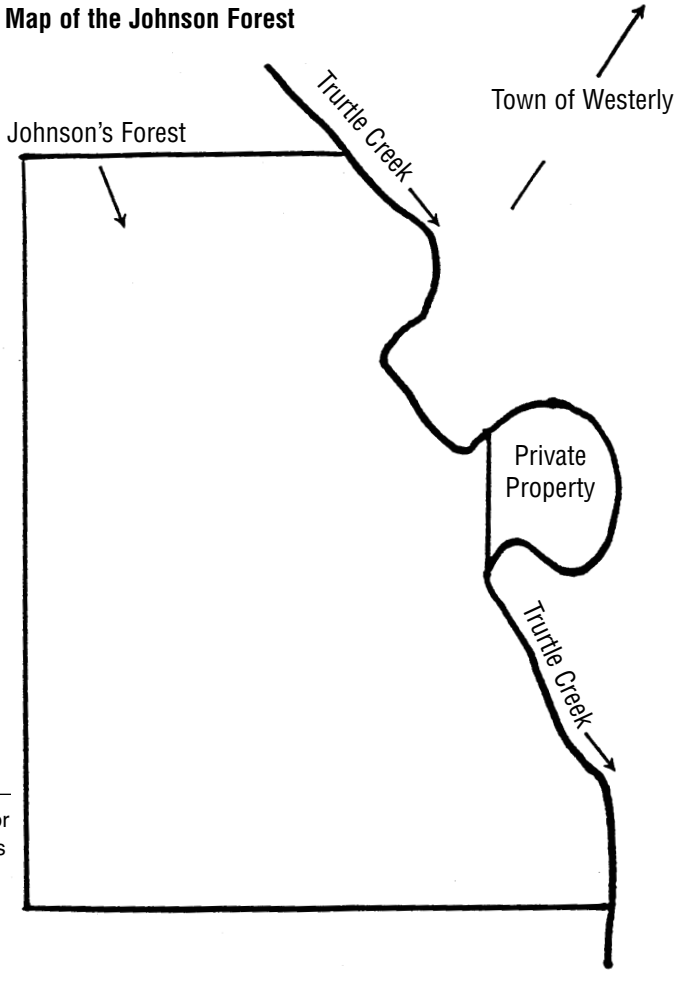
Parks and Recreation Department

This Department has been under pressure by the Chamber of Commerce to increase tourism in Westerly. The Chamber of Commerce feels that Westerly currently lacks outdoor recreational opportunities. The town is located close enough to a large urban center to bring vacationers. By developing more recreation opportunities in Westerly, the Chamber of Commerce hopes to draw some of these people into Westerly to spend money in local restaurants, shops and hotels. They propose a large park, including trails for nature observation, hiking and cross-country skiing and a nature center. The extent of development, such as amount of parking, building space and trail configuration must be discussed. By law, any Parks development must include an environmental assessment to determine impacts on wildlife. Park staff will want to make sure there is adequate habitat for the birds and other wildlife within the forest as this is one reason people will come to the area. The county has already provided grant money to Parks and Recreation to develop parks in Westerly.

Private Landowner

Just at the border of the Johnson forest is private property owned by Sara Johnson's daughter and her husband, the Millers. Their property consists of a small home on 20 wooded acres. The Millers are wildlife enthusiasts and believe the neighboring Johnson forest provides them many opportunities to see wildlife on their own land. The Millers occasionally harvest wood from their property to supplement their income. This year, they had planned to conduct a very large wood harvest. In addition to bringing in income, they feel the planned timber cutting on their property will attract additional wildlife to their area, particularly edge-dwelling species, such as indigo buntings and white-tailed deer (*Odocoileus virginianus*). However, the Millers are aware that changes to the Johnson forest in the near future may cause them to change their plans for harvesting timber on their land. They attend the town meeting to offer their own proposal for the Johnson forest that would complement their plans for their own land. The Millers are also concerned that if the Johnson forest is developed, it will add significant traffic and noise near their property.

Map of the Johnson Forest



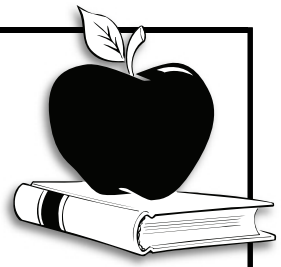
Scale: ☐ = 1 acre or 4,047 square meters (640 acres = one square mile)

CLASS TIME: one to two class periods

MATERIALS: whatever students require for their projects

COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

TEACHER'S GUIDE



ACTIVITY

Tell the World

OVERVIEW

Students express what they have learned in this unit to an audience outside of the class.

CONCEPT

People can act to help conserve Neotropical migratory bird populations and their forest homes.

OBJECTIVES

Students will be able to: 1) review what they have learned in the other lessons in One Bird—Two Habitats; and 2) teach others about the decline of some Neotropical migratory bird populations.

TEACHER BACKGROUND

People are more likely to act on their intentions when they have made a public declaration. Here students sign a public declaration committing to their continued involvement in Neotropical migratory bird conservation. A sample declaration follows:

> We, the students of _____ School's _____ grade class, have learned about declining Neotropical migratory bird populations. We understand the need for adequate forest habitat here and in _____ (name of country). We will work towards conservation of Neotropical migratory forest birds and their habitats and towards education of people who do not yet understand the issues.

Since methods of scientific inquiry include persuasion, students can use some of the information they have to educate others regarding the plight of Neotropical migratory birds. Students may use a variety of media: poster; poetry; song; skit; painting; public event; letter to a newspaper editor; launching a school yard habitat project; giving an assembly to the entire school; or more. Students could "adopt" a forest and clean it up or raise money to purchase a part of the rain forest.

Creation of a butterfly garden may indirectly aid Neotropical migrants: some species feed on these insects. Students may continue writing letters to the cultural exchange class and educate people in Latin America about this issue. Students may begin a paper recycling program at school or launch a campaign to educate people about predacious cat behavior. For additional suggestions, see the action-oriented projects in Appendix I.

One teacher wrote this rap as a model for students.

> **The Warbler's Warble**
>
> I'm just like all you other critters living way out there,
> I need a place to call home and lots of clean, clear air.
> I want some tasty bugs, and some stuff to build a nest,
> And if I have a choice, I'm gonna' get the best.
> So let trees grow tall and don't do me no wrong
> And I'll reward your days with my noble song.
> I'll eat a lot of bugs and keep your crops intact
> If you're careful with my forest and conserve my habitat.
>
> — Janet Peterson, Wisconsin

PROCEDURE

1. Divide the class into cooperative groups. Ask that students assign roles amongst themselves as responsibilities become clear within each group. They should document each role.
2. Ask each group to develop a public declaration and sign it. Read the sample provided. They should write one based on their real beliefs and intentions. When everyone has signed the public declaration in his/her group, have someone from each group read the declaration. Post the declarations for all to see.
3. As a follow-up to their declaration, have each group plan a presentation to teach others about the issue. Read the rap aloud as a suggestion. Encourage

action-oriented projects. Have the group write: 1) what message they want to convey; 2) to which audience; and 3) through which medium or project.

4. Provide limited time for each group to share their project ideas, then have them work on their projects.
5. Before having students present their completed projects to any audience outside the class, discuss the messages conveyed. Check for any misrepresentations or misconceptions. These can be addressed by raising further questions or assigning further research.

MODIFICATIONS

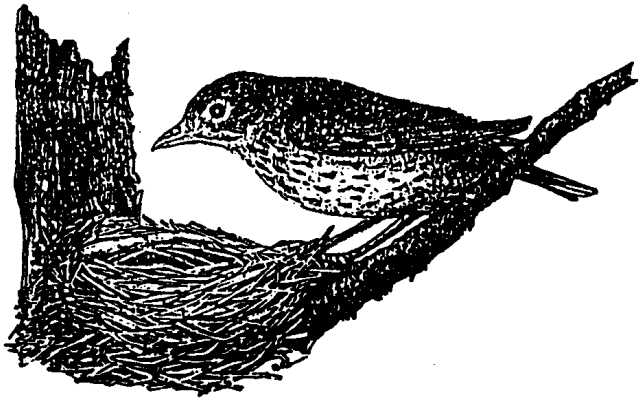
The class may decide to work on one large project together.

EXTENSION

1. When the projects are finished, make them available to the rest of the school or to the entire community. Plan and promote an event for "International Migratory Bird Day," officially the second Saturday in May, to raise public awareness of the plight of Neotropical migrants. Put displays in local business windows. Raise money to donate to forest conservation projects. Go on the radio and let students talk about the projects they have completed.

ASSESSMENT

1. Evaluate student projects as illustrations of student understanding of the issue.



Appendix A

Some Neotropical Migrants Present in Illinois

(E) = endangered in Illinois ■ (T) = threatened in Illinois

Acadian flycatcher *Empidonax virescens*
American redstart *Setophaga ruticilla*
Baltimore oriole I*cterus galbula*
bank swallow *Riparia riparia*
barn swallow *Hirundo rustica*
bay-breasted warbler *Setophaga castanea*
black-and-white warbler *Mniotilta varia*
black-billed cuckoo (T) *Coccyzus erythropthalmus*
blue-gray gnatcatcher *Polioptila caerulea*
blue-winged warbler *Vermivora cyanoptera*
bobolink *Dolichonyx oryzivorus*
broad-winged hawk *Buteo platypterus*
cerulean warbler (T) *Setophaga cerulea*
chestnut-sided warbler *Setophaga pensylvanica*
chimney swift *Chaetura pelagica*
chipping sparrow *Spizella passerina*
cliff swallow *Petrochelidon pyrrhonota*
common nighthawk *Chordeiles minor*
common yellowthroat *Geothlypis trichas*
dickcissel *Spiza americana*
eastern kingbird *Tyrannus tyrannus*
eastern whip-poor-will *Antrostomus vociferus*
eastern wood-pewee *Contopus virens*
grasshopper sparrow *Ammodramus savannarum*
gray catbird *Dumetella carolinensis*
great crested flycatcher *Myiarchus crinitus*
hooded warbler *Setophaga citrina*
house wren *Troglodytes aedon*
indigo bunting *Passerina cyanea*
least flycatcher *Empidonax minimus*
Louisiana waterthrush *Parkesia motacilla*
northern parula *Parula americana*
northern rough-winged swallow *Stelgidopteryx serripennis*
orchard oriole *Icterus spurius*
osprey (T) *Pandion haliaetus*
ovenbird *Seiurus aurocapilla*
peregrine falcon *Falco peregrinus*
prairie warbler *Setophaga discolor*
prothonotary warbler *Protonotaria citrea*
purple martin *Progne subis*
red-eyed vireo *Vireo olivaceus*
rose-breasted grosbeak *Pheucticus ludovicianus*
ruby-throated hummingbird *Archilochus colubris*
scarlet tanager *Piranga olivacea*
upland sandpiper (E) *Bartramia longicauda*
veery *Catharus fuscescens*
warbling vireo *Vireo gilvus*
white-eyed vireo *Vireo griseus*
willow flycatcher *Empidonax traillii*
wood thrush *Hylocichla mustelina*
worm-eating warbler *Helmitheros vermivorum*
yellow warbler *Setophaga petechia*
yellow-billed cuckoo *Coccyzus americanus*
yellow-breasted chat *Icteria virens*
yellow-throated vireo *Vireo flavifrons*

Appendix B

YELLOW-BILLED CUCKOO

Scientific Name . . . . . .*Coccyzus americanus*

Spanish . . . . . .Cuclillo Piquiganaldo

Present in Illinois . . . . .early May to early October

Illinois Status . . . . . .common migrant and summer resident; a decline in population noted between 1909 and 1957 with decrease in orchards and destruction of hedgerows

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodland, woodland edge and orchards

Winter Range . . . . . .southern Central America to northern South America

Length . . . . . .12" (30 cm)

Weight . . . . . .1.8 oz. (50 g)

Color . . . . . .gray-brown with red tint to wing tips, white belly, white tips on tail feathers, underside of bill yellow; sexes alike

Song . . . . . .a series of “ka” notes followed by slower and longer notes at the end

Nest . . . . . .medium height to low in vegetation (three to 13 feet); roots and twigs with a lining of mosses and grasses

Eggs . . . . . .two to five light blue or green-blue eggs; nesting occurs from late May to late August; female provides most of the care

Broods/Year . . . . . .one

Food . . . . . .insects (mostly caterpillars; also beetles, fall webworms, cicadas) with some fruit (mulberries and others)

Habits . . . . . .often goes unnoticed because it is sluggish and tends to stay in dense vegetation

Interesting Facts . . . . . .sometimes will “rob” the nests of other birds, eating the eggs; is nicknamed “rain crow” as it is thought to forecast rain with its song

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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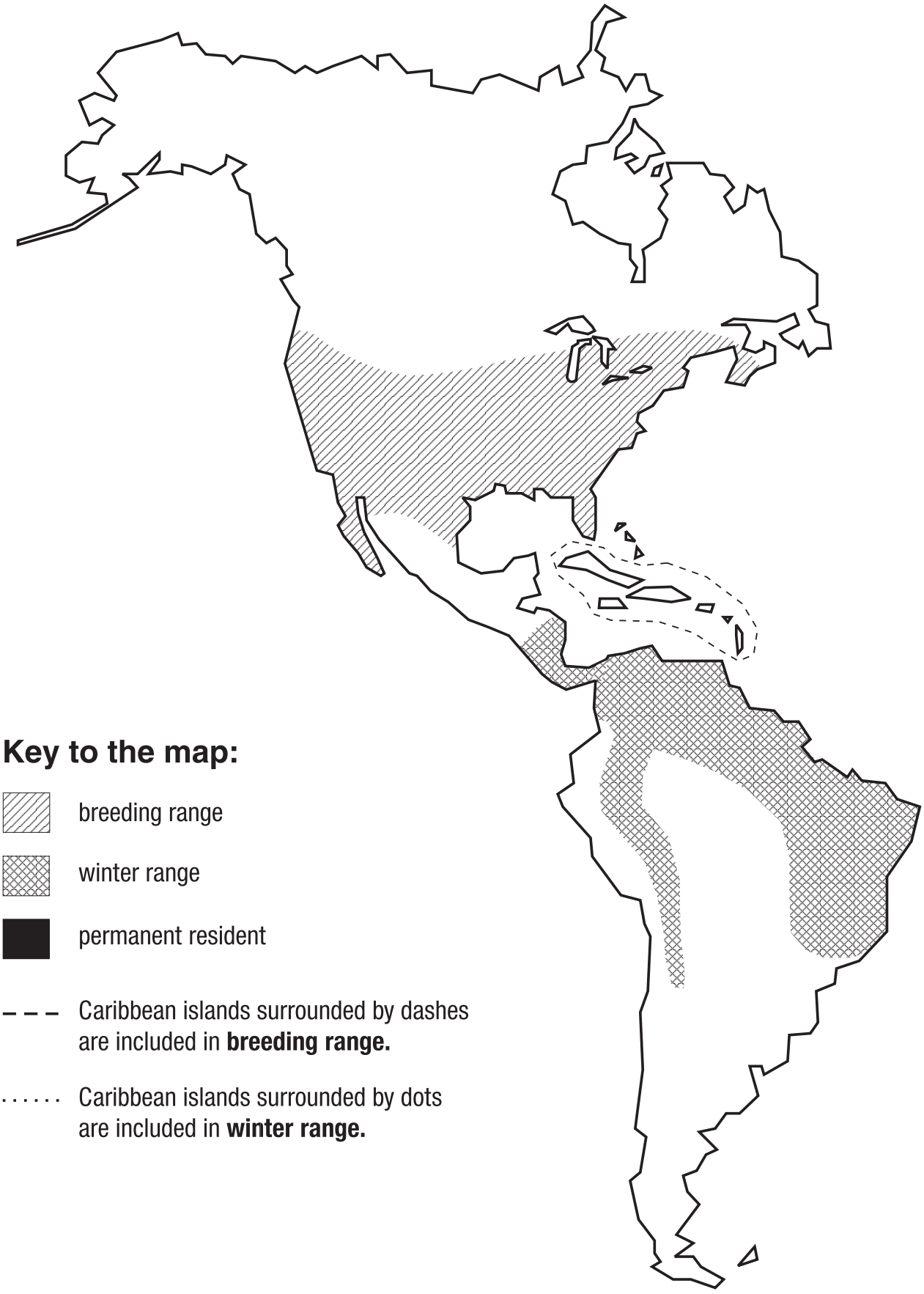
New Jersey Conservation Foundation. 1994. *The songbird connection*.

YELLOW-BILLED CUCKOO



Key to the map:

breeding range

winter range

permanent resident

– – – Caribbean islands surrounded by dashes are included in **breeding range.**

. . . . . Caribbean islands surrounded by dots are included in **winter range.**

SCARLET TANAGER

Scientific Name . . . . . .*Piranga olivacea*

Spanish . . . . . .Tangara Escarlata

Present in Illinois . . . . .late April to early October

Illinois Status . . . . . .common migrant and uncommon summer resident

Illinois Range . . . . . .statewide; nesting more commonly in the northern two-thirds of the state

Illinois Habitat . . . . . .wooded areas, preferring bottomland woodlands but occurs in uplands also

Winter Range . . . . . .Columbia south to eastern Ecuador and Peru to northwestern Bolivia

Length . . . . . .7" (18 cm)

Weight . . . . . .1.0 oz. (28 g)

Color . . . . . .male: bright red with black wings and tail feathers; female: yellow belly, dusky green head and back and brown or black wings and tail

Song . . . . . .a raspy series of notes similar to those of an American robin; also has a distinctive chip note, "chip-burr"

Nest . . . . . .thinly woven nests are built on horizontal branches at high levels, usually in oak or hickory trees; made of twigs and small roots and lined with thin stems and grasses

Eggs . . . . . .three to five green-blue eggs marked with brown

Broods/Year . . . . . .one

Food . . . . . .insects (beetles, bugs, butterflies, moths, grasshoppers, locusts) with some fruit (mulberry *Morus* spp., blackberry *Rubus allegheniensis*)

Habits . . . . . .difficult to see as it stays high in the forest canopy

Interesting Facts . . . . . .may eat as many as 2,100 gypsy moth (*Lymantria dispar*) caterpillars in an hour

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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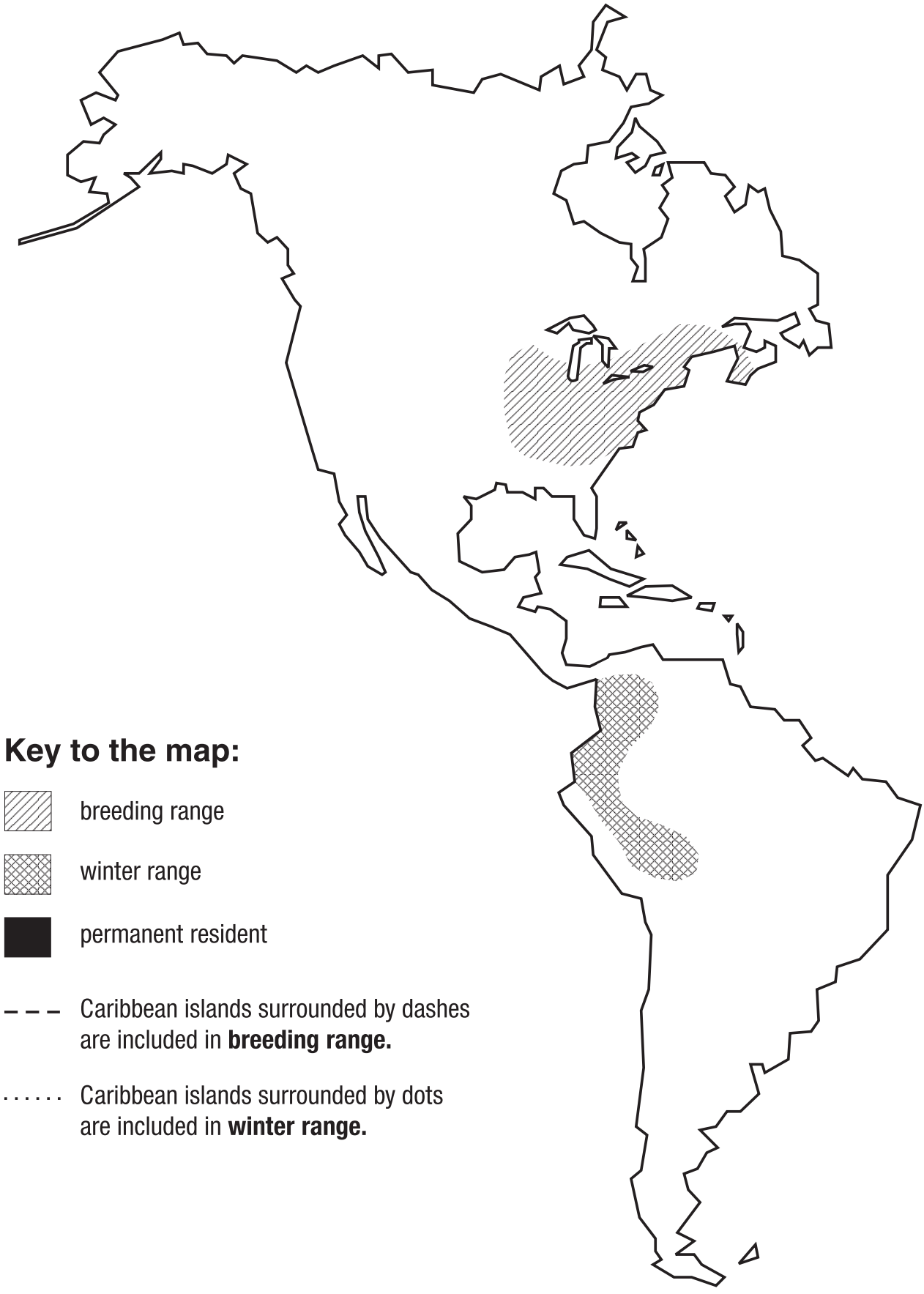
SCARLET TANAGER



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WOOD THRUSH

Scientific Name . . . . . .*Hylocichla mustelina*

Spanish . . . . . .Zorzal del Bosque

Present in Illinois . . . . .late April to late September

Illinois Status . . . . . .common migrant and summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .bottomland woodlands

Winter Range . . . . . .south Texas to northwestern Columbia

Length . . . . . .7.25" (18.5 cm)

Weight . . . . . .1.9 oz (48 g)

Color . . . . . .brown with rust-colored head, white belly with dark brown spots; sexes similar

Song . . . . . .flute-like “ee-o-lay” and a quick “pip-pip-pip-pip” call

Nest . . . . . .built in moist areas; made of weed stalks, grasses and leaves with a middle mud layer; lined with rootlets; in low- to medium-height trees

Eggs . . . . . .three to five blue eggs laid from May to early July

Broods/Year . . . . . .often two

Food . . . . . .insectivorous when feeding young; large amounts of fruit during migration

Habits . . . . . .calls from the woods at dawn and dusk; usually stays on or near the ground in heavily wooded bottomlands

Interesting Facts . . . . . .nests heavily parasitized by brown-headed cowbirds (*Molothrus ater*)

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds*. http://checklist.americanornithology.org/taxa

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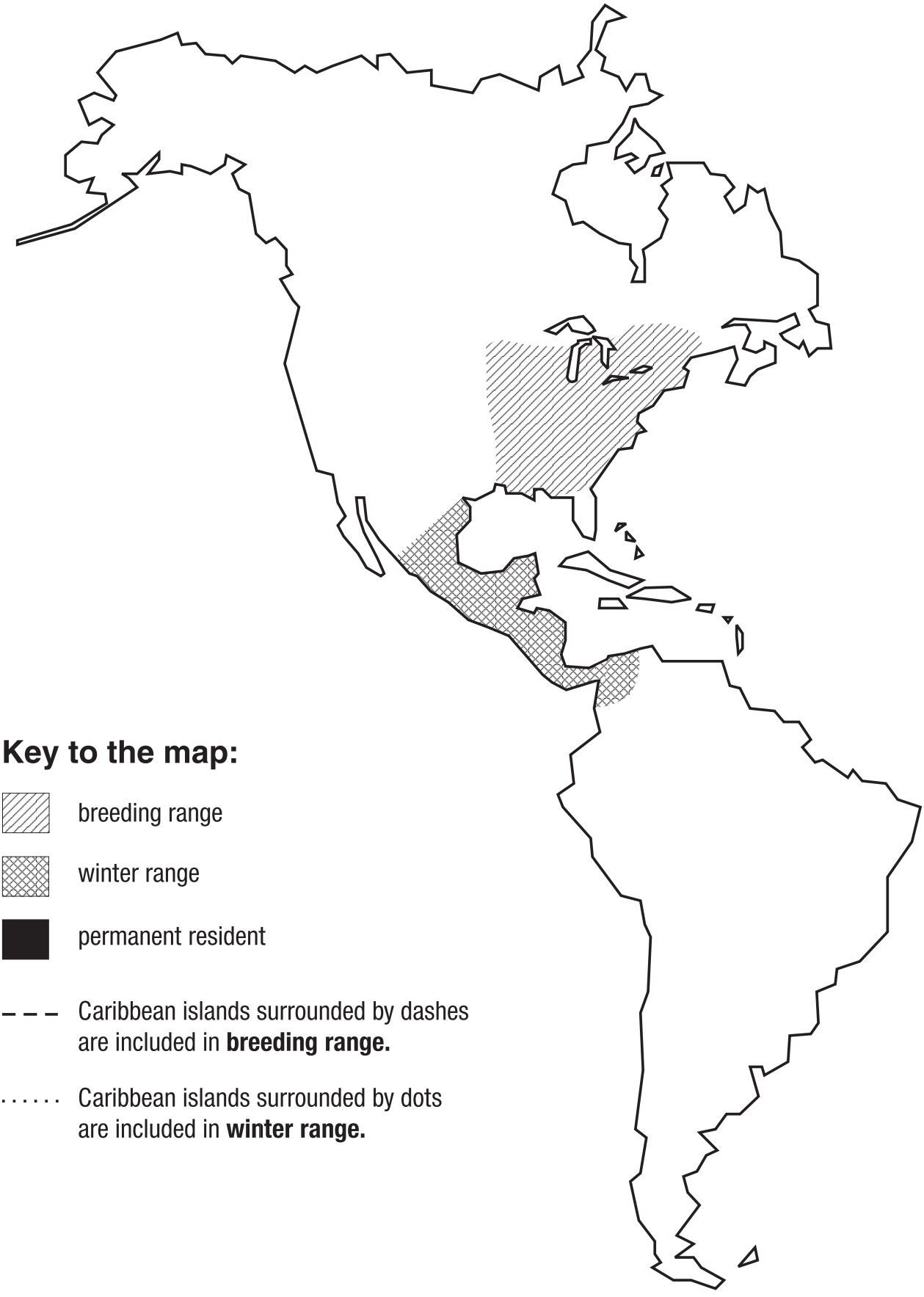
WOOD THRUSH



Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

AMERICAN REDSTART

Scientific Name . . . . . .*Setophaga ruticilla*

Spanish . . . . . .Candelita Nortena

Present in Illinois . . . . .early May to early October

Illinois Status . . . . . .common migrant and locally common summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .bottomland woodlands

Winter Range . . . . . .Southern U.S. to South America

Length . . . . . .4.75" (12 cm)

Weight . . . . . .0.3 oz. (8.5 g)

Color . . . . . .male: black with a white belly and red-orange wing and tail patches; female: olive-brown with yellow patches

Song . . . . . sweet, buzzy notes “zee, zee, zee, zee, zwee”

Nest . . . . . cup of roots and twigs decorated with lichens and feathers; 10 to 20' high in the fork of a small tree; uses willows extensively

Eggs . . . . . .three to five white eggs with red-brown markings

Broods/Year . . . . . .unknown

Food . . . . . .insects with occasional berries and seeds

Habits . . . . . .flits through the leaves catching insects

Interesting Facts . . . . . .bristles on face probably protect eyes from damage by squirming insects; often referred to as looking like a “black and orange butterfly;” nicknamed “redtail”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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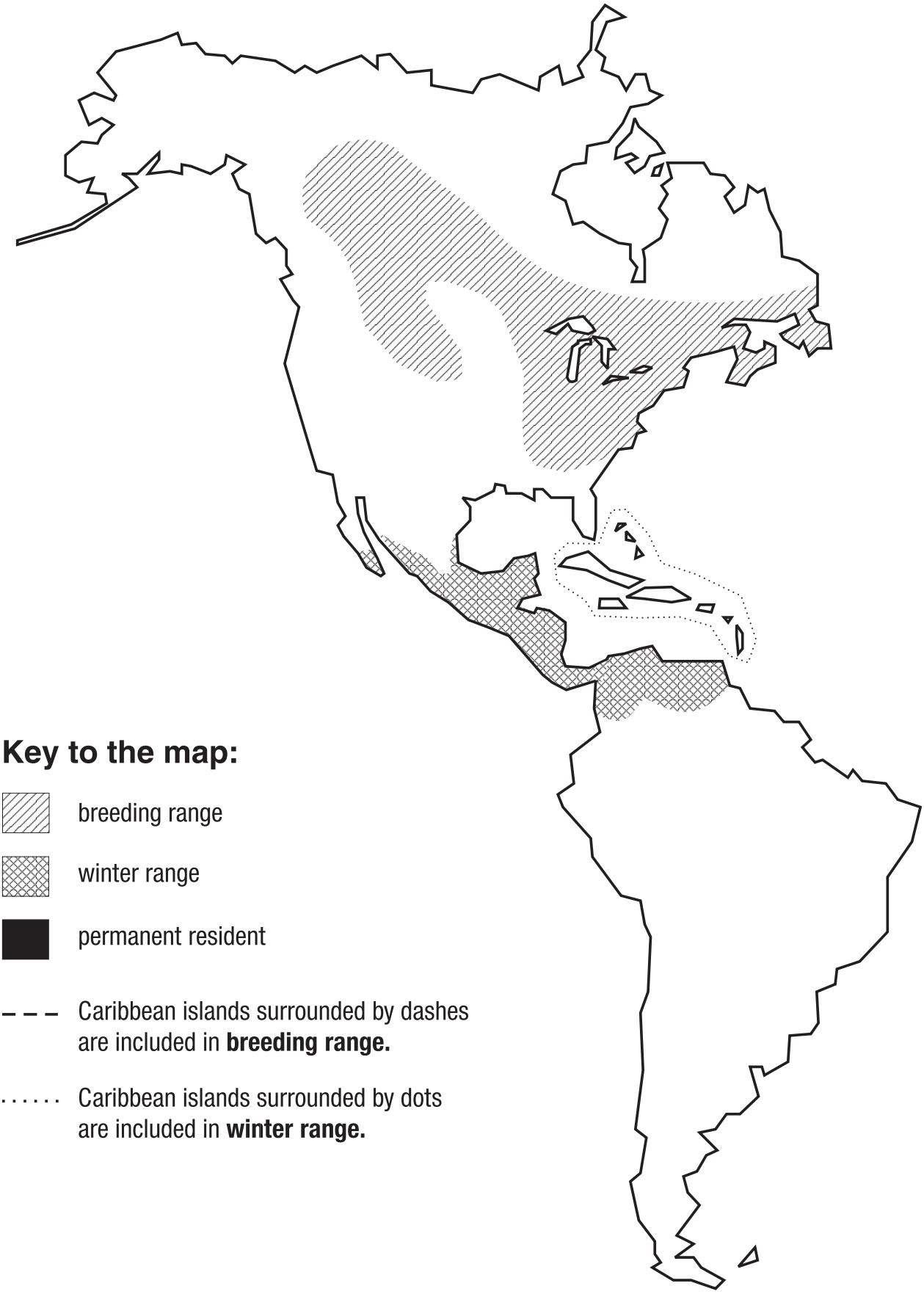
AMERICAN REDSTART



Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

OVENBIRD

Scientific Name . . . . . .*Seiurus aurocapilla*

Spanish . . . . . .Chipe Suelero Coronado

Present in Illinois . . . . .late April to mid-October

Illinois Status . . . . . .abundant migrant, locally uncommon summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands

Winter Range . . . . . .south through Central America and the Caribbean to northern Venezuela

Length . . . . . .5.5-6.5" (13.75-16.25 cm)

Weight . . . . . .0.5-1.0 oz. (14.0-28.8 g)

Color . . . . . .olive-brown above, striped belly, light orange patch on the top of the head

Song . . . . . ."teacher, teacher, teacher"

Nest . . . . . .on the forest floor; an open nest of dried grasses, leaves and mosses, often with a moss lining; roofed with leaves and branches with small slit entrance

Eggs . . . . . .three to six; white with brown markings

Broods/Year . . . . . .occasionally two

Food . . . . . .insects

Habits . . . . . .looks and acts more like a thrush than a warbler; stays on or near the ground, walking through the leaf litter

Interesting Facts . . . . . .very sensitive to fragmentation of forested habitats; a frequent brown-headed cowbird (*Molothrus ater*) host; also called the "golden-crowned thrush"

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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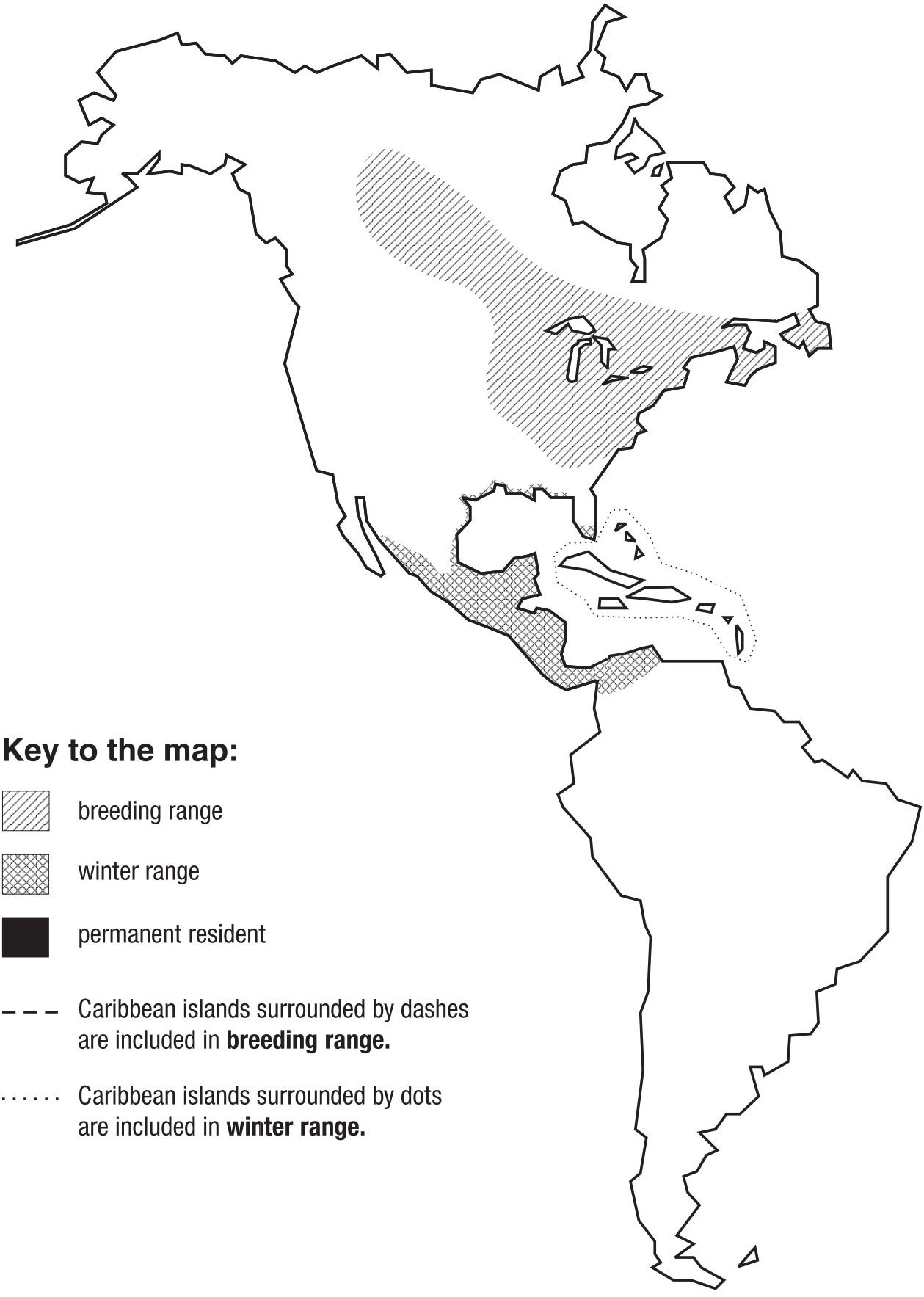
OVENBIRD



Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

EASTERN WHIP-POOR-WILL

Scientific Name . . . . . .*Antrostomus vociferus*

Spanish . . . . . .Chotacabras Griton o Ruidoso

Present in Illinois . . . . .mid-April to late-September

Illinois Status . . . . . .common migrant; common summer resident south; fairly common summer resident central and north

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands

Winter Range . . . . . .northern Mexico to western Panama

Length . . . . . .9" (23 cm)

Weight . . . . . .2.2 oz. (55 g)

Color . . . . . .brown-gray body with black markings and white throat

Song . . . . . .usually sings at night with 50 to 100 repetitions of “whip-poor-will” in each set

Nest . . . . . .no nest; eggs directly on ground

Eggs . . . . . .two white eggs with gray-brown dots

Broods/Year . . . . . .occasionally two

Food . . . . . .insects (moths)

Habits . . . . . .nocturnal bird that flies near the ground with its mouth open to catch moths and other flying insects; feeds over brushy pastures and along woodland edges

Interesting Facts . . . . . .record number of calls in a row is 1,088; reproductive cycle of the whip-poor-will is synchronized to the lunar cycle, resulting in the young being hatched when there are moonlit nights, permitting the adults to forage for insects to feed the young

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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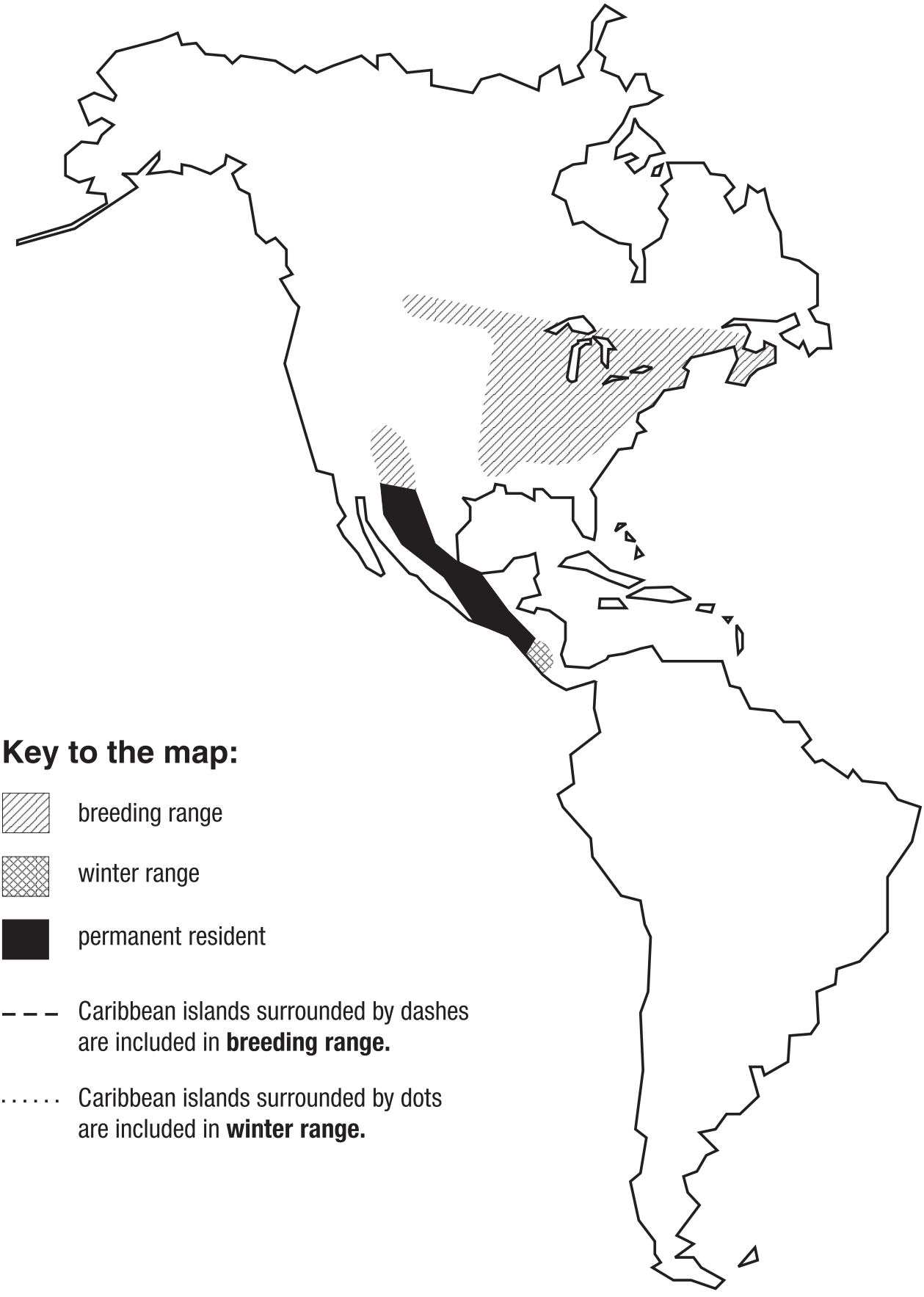
EASTERN WHIP-POOR-WILL



Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

RUBY-THROATED HUMMINGBIRD

Scientific Name . . . . . .*Archilochus colubris*

Spanish . . . . . .Colibri Garganta de Rubi

Present in Illinois . . . . .late April to early October

Illinois Status . . . . . .common migrant and fairly common summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .frequents woodlands, woodland edge, weedy areas and gardens

Winter Range . . . . . .northwest Mexico and extreme south Texas to Costa Rica, occasionally western Panama

Length . . . . . .3.25" (8 cm)

Weight . . . . . .0.1 oz. (3 g)

Color . . . . . .iridescent green back and head with white belly; bright red throat on male

Song . . . . . .high squeaky notes

Nest . . . . . .1 to 1.25" cup of leaves held together with spider webs; decorated with lichens and mosses

Eggs . . . . . .two white

Broods/Year . . . . . .two or three

Food . . . . . .nectar, tree sap, small insects and spiders

Habits . . . . . .the male courtship display is a flight of wide arcs; both males and females are highly aggressive and fight for space and food

Interesting Facts . . . . . .smallest bird in North America; favors columbine (*Aquilegia canadensis*) and trumpet creeper vines (*Campsis radicans*) in the spring and summer and jewelweed (*Impatiens* spp.) plants in the fall

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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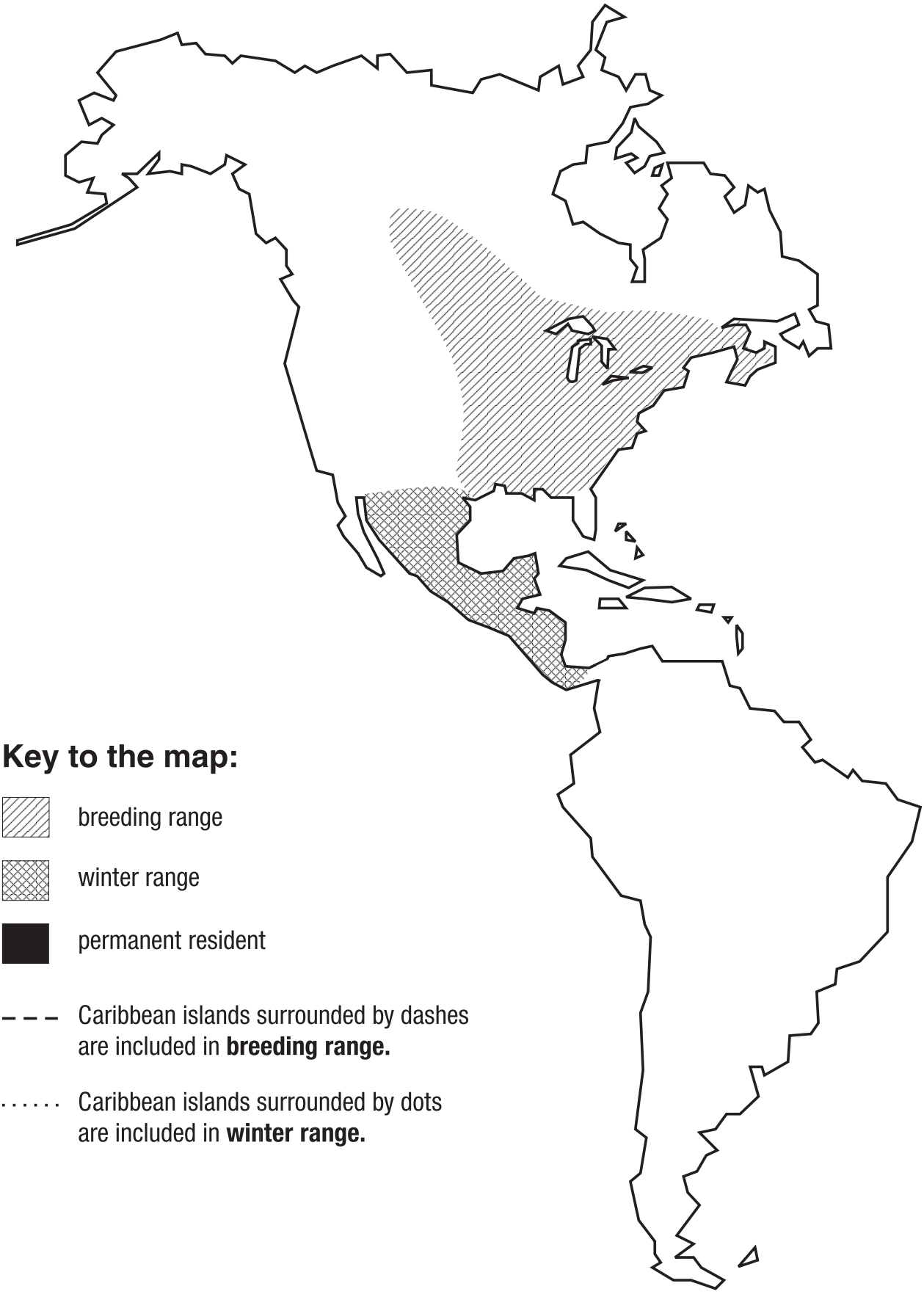
RUBY-THROATED HUMMINGBIRD



Key to the map:

breeding range

winter range

permanent resident

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BROAD-WINGED HAWK

Scientific Name . . . . . .*Buteo platypterus*

Spanish . . . . . .Gavilan Aludo

Present in Illinois . . . . .early April to mid-May

Illinois Status . . . . . .common migrant; uncommon summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands; usually follows rivers and bluff areas

Winter Range . . . . . .southern Mexico to South America

Length . . . . . .17" (43 cm)

Weight . . . . . .18 oz. (45 g)

Color . . . . . .dark brown with white belly marked with brown/red; large black-and-white bands on the tail

Song . . . . . .high-pitched “pweeeeee” trailing at the end

Nest . . . . . .dead leaves and twigs lined with lichens or oak bark chips; 15 to 50' high in crotch of tree; often near water and only in heavily wooded areas

Eggs . . . . . .two to three white eggs with brown-purple markings

Broods/Year . . . . . .one

Food . . . . . .meat-eater (small mammals, birds, reptiles, snakes, frogs, insects)

Habits . . . . . .perch on trees near a forest clearing and wait for prey to pass

Interesting Facts . . . . . .one of the most highly migratory hawks in Illinois; migrate in huge flocks, rising on warm thermal air currents (called a “kettle of hawks”)

Sources of Information

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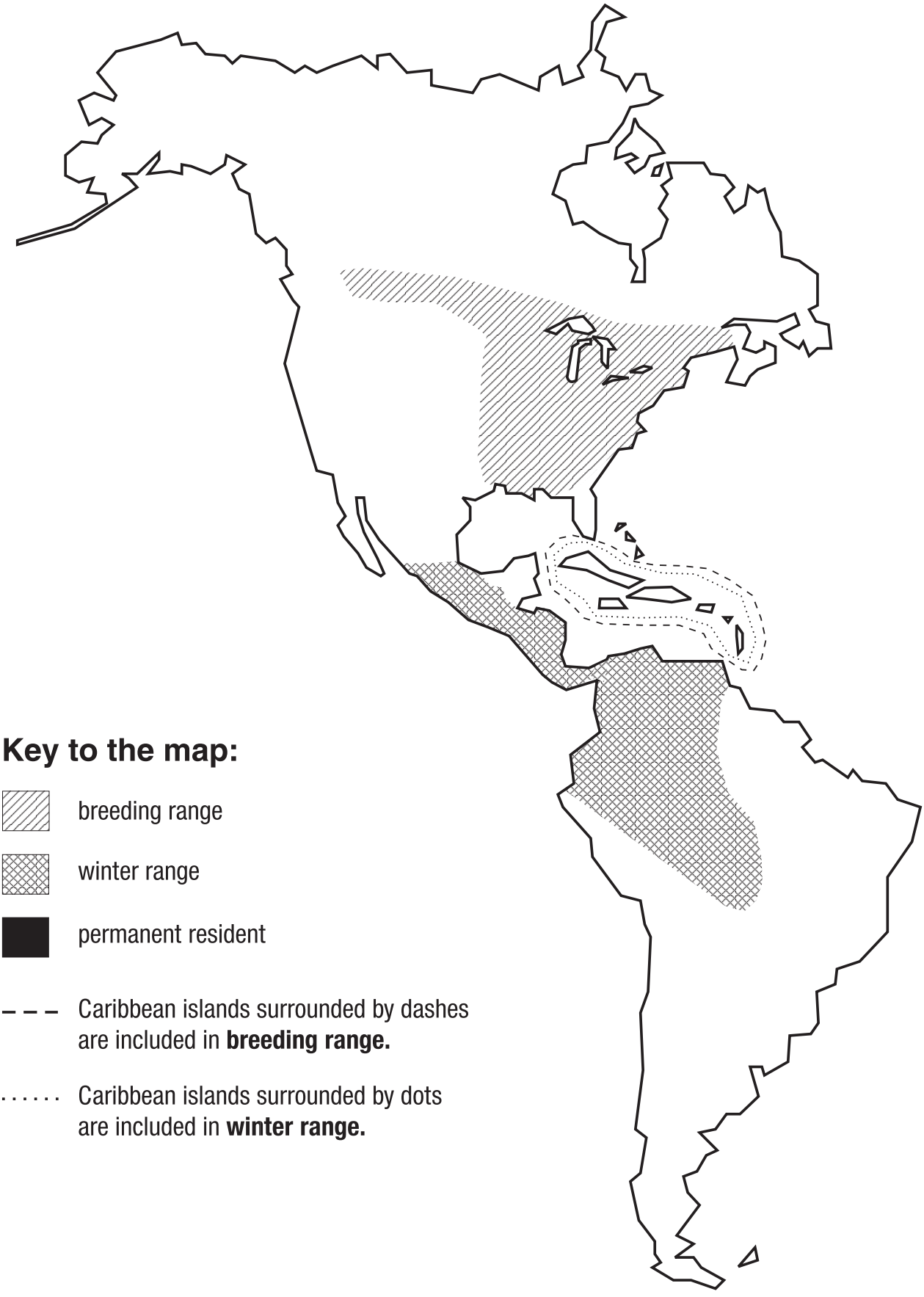

Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

ROSE-BREASTED GROSBEAK

Scientific Name . . . . . .*Pheucticus ludovicianus*

Spanish . . . . . .Picogrueso Pechirrosado

Present in Illinois . . . . .late April to early October

Illinois Status . . . . . .common migrant and summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands, residential areas, parks

Winter Range . . . . . .central Mexico to Venezuela and Ecuador

Length . . . . . .8" (20 cm)

Weight . . . . . .1.6 oz. (45 g)

Color . . . . . .male: black and white with a red triangle on the breast; female: brown with brown-and-white striped belly

Song . . . . . .similar to that of the American robin (*Turdus migratorius*); call is a sharp “chink”

Nest . . . . . .a loose cup in the fork of a branch in a tree or shrub; 6 to 15' high

Eggs . . . . . .three to four green eggs marked with brown

Broods/Year . . . . . .one to two

Food . . . . . .insects (potato beetle *Leptinotarsa decemlineata*, tent caterpillar *Malacosoma disstria*, gypsy moth *Lymantria dispar*) and fruit

Habits . . . . . .feeds in trees and on the ground

Interesting Facts . . . . .nests are often parasitized by brown-headed cowbirds; male and female build the nest together; male sometimes helps gather food for the young

Sources of Information

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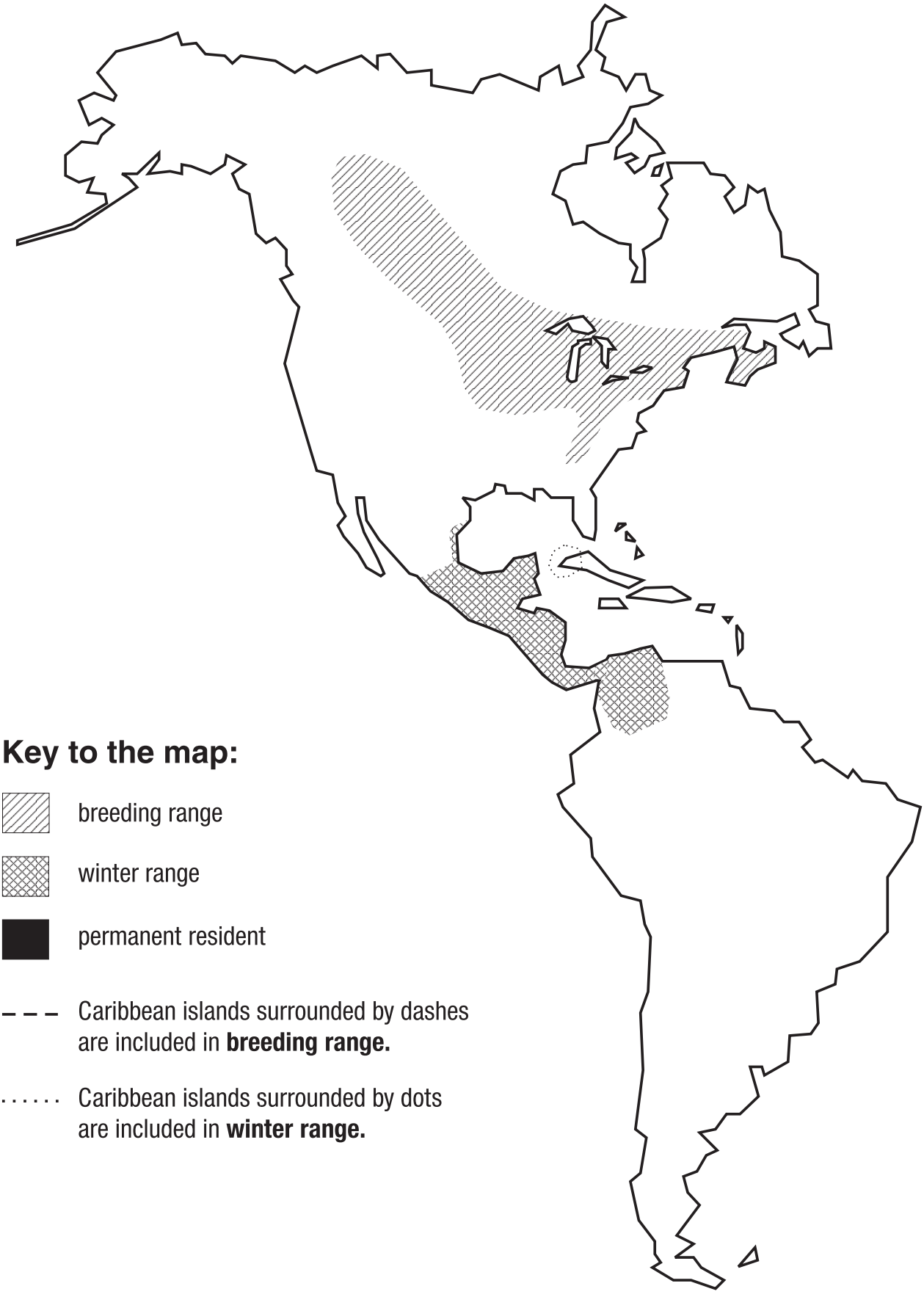
ROSE-BREASTED GROSBEAK



Key to the map:

breeding range

winter range

permanent resident

– – – Caribbean islands surrounded by dashes are included in **breeding range.**

. . . . . Caribbean islands surrounded by dots are included in **winter range.**

BOBOLINK

Scientific Name . . . . . .*Dolichonyx oryzivorus*

Spanish . . . . . .Chambergo

Present in Illinois . . . . .late April to early October

Illinois Status . . . . . .common migrant and summer resident north; fairly common migrant central and south; occasional summer resident central

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .fallow fields and marsh areas

Winter Range . . . . . .southern South America east of the Andes, from Brazil south to northern Argentina

Length . . . . . .6.5-8" (16.25-20 cm)

Weight . . . . . .1-1.25 oz. (28-35 g)

Color . . . . . .breeding male: solid black belly and is buff and white above; female: buff with dark stripes on head

Song . . . . . .a burbling song; flight note is a sharp “pink”

Nest . . . . . .a well concealed nest on the ground in dense forbs; uses a natural or scraped depression; made of coarse grasses and forbs and lined with finer grasses

Eggs . . . . . .three to seven buff-colored eggs with dark spots

Broods/Year . . . . . .one

Food . . . . . .insects and grass/forb seeds; fruit and nectar in the winter

Habits . . . . . .female runs from the nest before taking flight

Interesting Facts . . . . . .populations have decreased due to the early cutting of hayfields; uncommon brown-headed cowbird (*Molothrus ater*) host; nicknamed the “white-winged blackbird”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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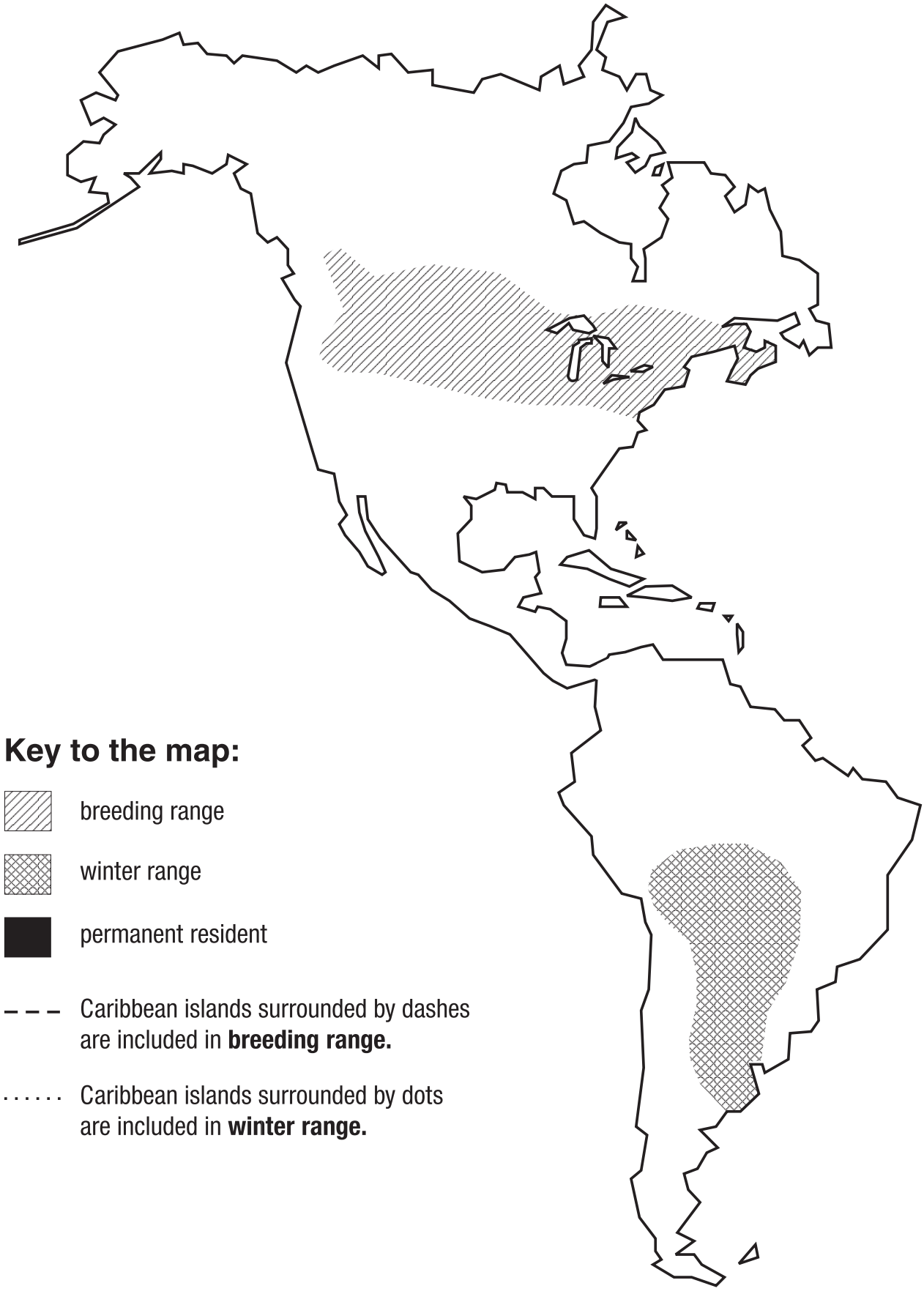
New Jersey Conservation Foundation. 1994. *The songbird connection*.

BOBOLINK



Key to the map:

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winter range

permanent resident

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HOODED WARBLER

Scientific Name . . . . . .*Setophaga citrina*

Spanish . . . . . .Reinita Encapuchada

Present in Illinois . . . . .mid-April to mid-August

Illinois Status . . . . . .uncommon migrant and summer resident

Illinois Range . . . . . .statewide; most often in southern third

Illinois Habitat . . . . . .shaded hillsides of bottomland forests

Winter Range . . . . . .Caribbean slopes and lowlands of eastern Mexico to Panama

Length . . . . . .5" (2.5 cm)

Weight . . . . . .0.4 oz. (10.5 g)

Color . . . . . .olive green with yellow belly; male has a black hood

Song . . . . . .a sharp “chink” note and “wee-tee, wee-tee, wee-TEE-o” song

Nest . . . . . .a cup built in a shrub near the ground; made of bark, plant fibers and dead leaves

Eggs . . . . . .three to five; cream-colored with red-brown markings

Broods/Year . . . . . .usually one

Food . . . . . .insects

Habits . . . . . .feeds by hovering and plucking insects from leaves

Interesting Facts . . . . . .fall migration goes almost undetected

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds*. http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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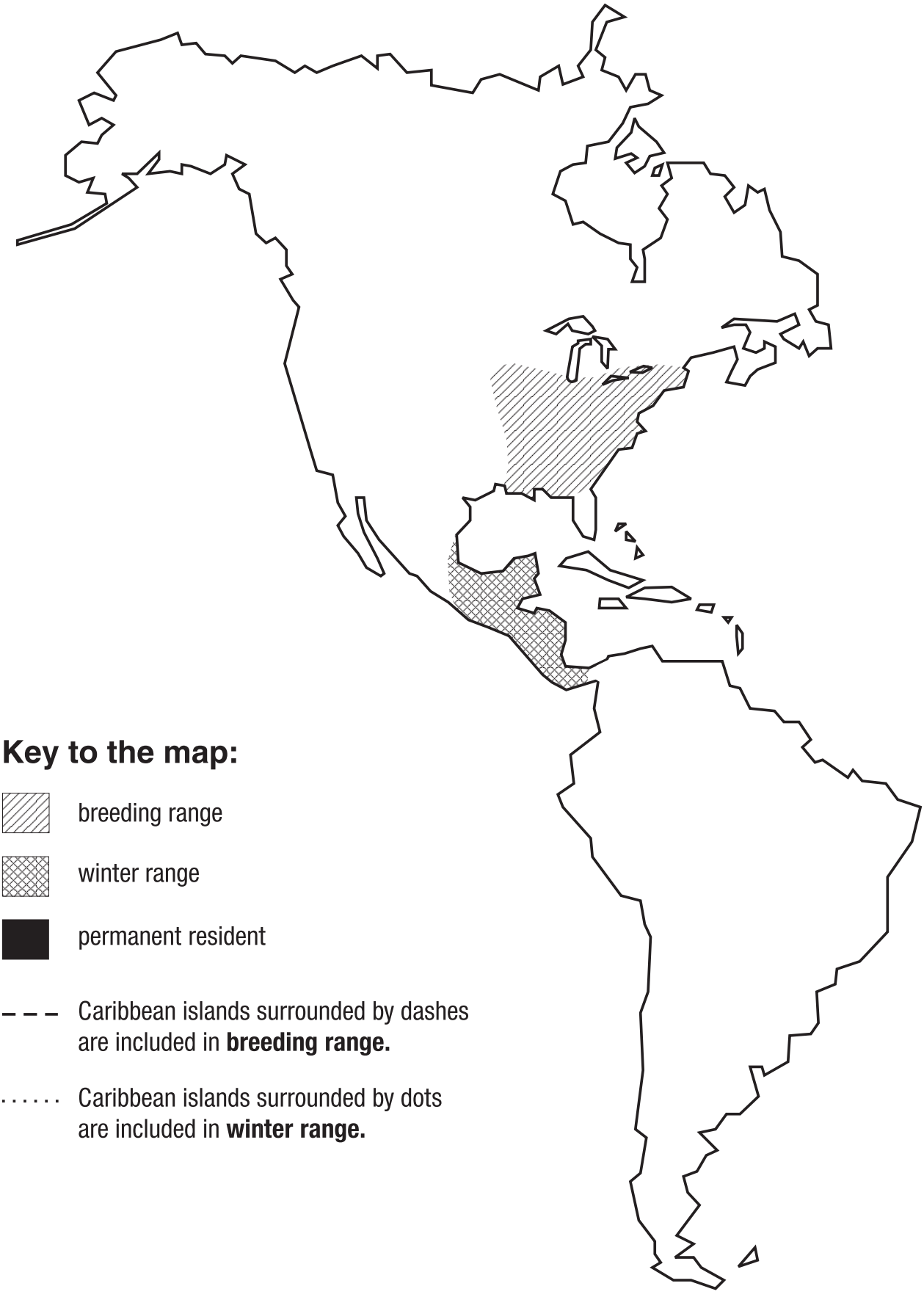
HOODED WARBLER



Key to the map:

breeding range

winter range

permanent resident

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HOUSE WREN

Scientific Name . . . . . .*Troglodytes aedon*

Spanish . . . . . .unknown

Present in Illinois . . . . .mid-April to mid-October

Illinois Status . . . . . .common migrant and summer resident; rare winter resident in south

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands and residential areas

Winter Range . . . . . .south throughout Mexico

Length . . . . . .5" (13 cm)

Weight . . . . . .0.35-0.46 oz. (10-13 g)

Color . . . . . .gray-brown with faint eye stripe

Song . . . . . .rapid, bubbly trill

Nest . . . . . .in a tree cavity, woodpecker hole or nest box; made of sticks and lined with soft materials; 4 to 30' above the ground

Eggs . . . . . .five to eight pink-white eggs with faint dots

Broods/Year . . . . . .two to three

Food . . . . . .invertebrates (millipedes, spiders, snails)

Habits . . . . . .often destroys other bird's nests by piercing their eggs and removing the eggs and young

Interesting Facts . . . . . .nicknamed the "Jenny wren;" rare brown-headed cowbird (*Molothrus ater*) host

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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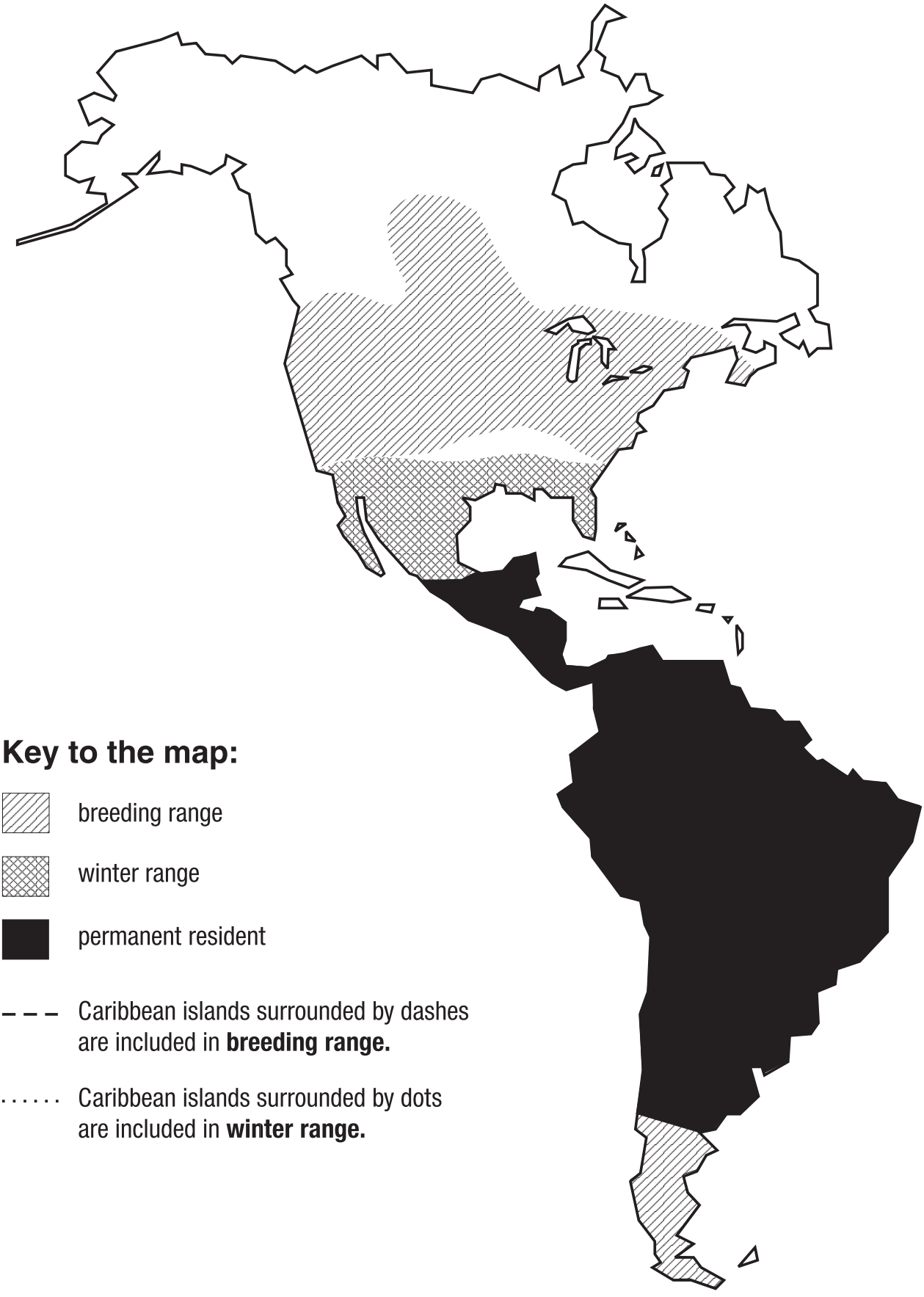
HOUSE WREN



Key to the map:

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winter range

permanent resident

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UPLAND SANDPIPER

Scientific Name . . . . . .*Bartramia longicauda*

Spanish . . . . . .Ganga (uno de los playeros)

Present in Illinois . . . . .mid-April to mid-September

Illinois Status . . . . . .uncommon migrant and summer resident; endangered in Illinois

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .grasslands, pastures and hayfields

Winter Range . . . . . .south to central Argentina and Uruguay

Length . . . . . .12.5" (32 cm)

Weight . . . . . .5-8 oz. (143-218 g)

Color . . . . . .long, yellow legs; long, thin neck; mottled above and below; white- streaked belly

Song . . . . . .long, mournful rolling whistle

Nest . . . . . .in a depression with grasses arching over the scrape; lined with dry grasses

Eggs . . . . . .four; buff with brown speckles

Broods/Year . . . . . .unknown

Food . . . . . .insects, seeds, invertebrates

Habits . . . . . .seldom nests near water; will not fly directly to the nest

Interesting Facts . . . . . .rare brown-headed cowbird (*Molothrus ater*) host; populations are declining; nicknamed the "grass plover" or "prairie pigeon;" one of Illinois' endangered bird species

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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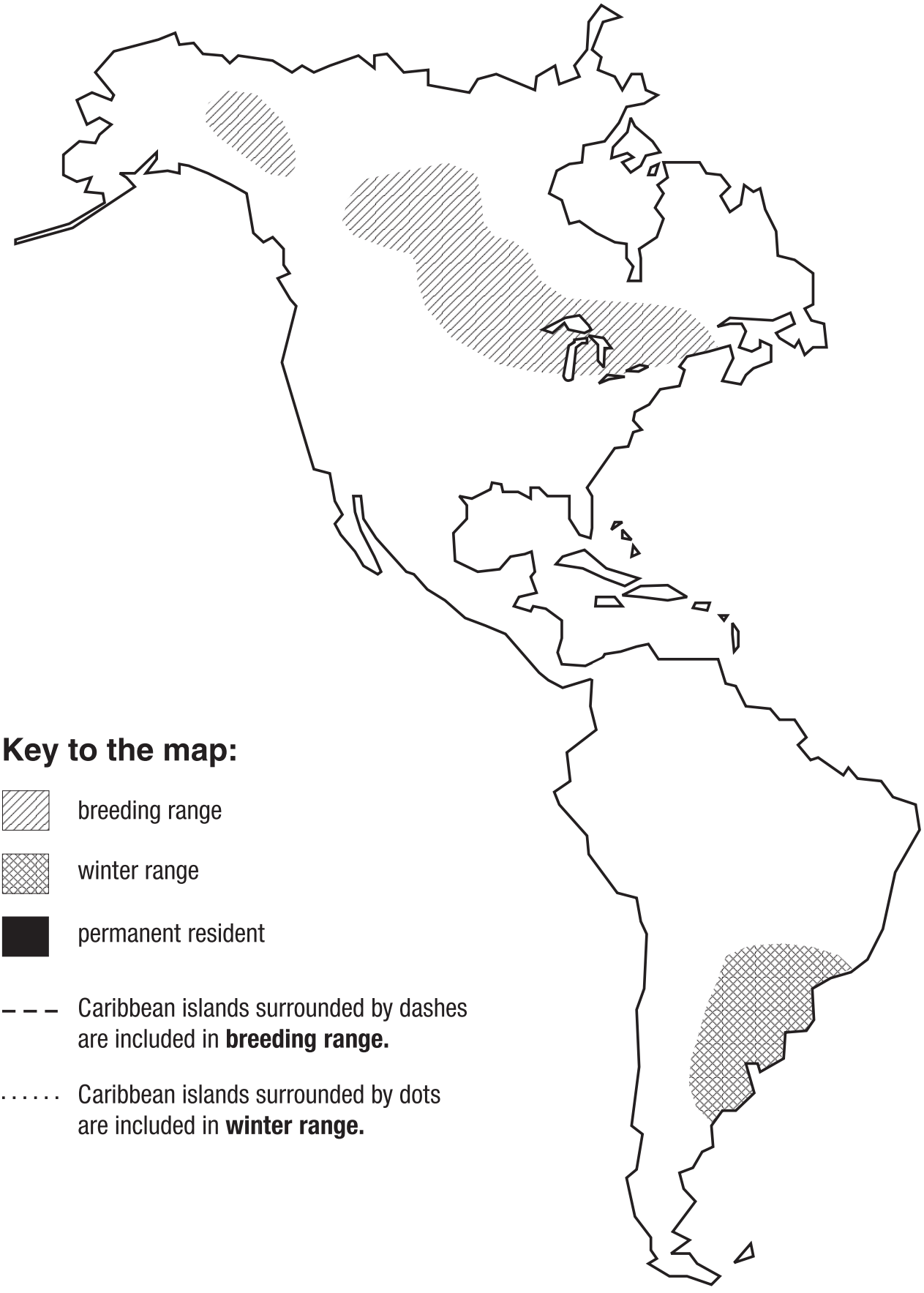
New Jersey Conservation Foundation. 1994. *The songbird connection*.

UPLAND SANDPIPER



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winter range

permanent resident

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INDIGO BUNTING

Scientific Name . . . . . .*Passerina cyanea*

Spanish . . . . . .Gorrion Azul

Present in Illinois . . . . .late April to mid-October

Illinois Status . . . . . .abundant migrant and summer resident; very rare winter resident in south and central part of state

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .roadsides and forest edges

Winter Range . . . . . .south Florida and central Mexico, south to Panama, Greater Antilles and Bahamas

Length . . . . . .5.25-5.75" (13.13-14.38 cm)

Weight . . . . . .0.4-0.7 g (11.2-21.4 g)

Color . . . . . .male: bright black-blue; female: brown with paler belly

Song . . . . . .notes usually in pairs: “sweet-sweet,” “chew-chew”

Nest . . . . . .eight inches to 7.5' high in berry, rose (*Rosa* spp.) and greenbrier (*Smilax* spp.) bushes or tall weeds and tangles of vines; made of well-woven dry grasses, dead leaves, bark strips, snake skin with lining of rootlets, fine grasses, feathers, hair

Eggs . . . . . .three to four; pale blue-white

Broods/Year . . . . . .two

Food . . . . . .grains and berries

Habits . . . . . .frequent brown-headed cowbird (*Molothrus ater*) host; will occasionally bury cowbird eggs by building a new floor in the nest

Interesting Facts . . . . . .populations have increased since 1900 with the abandonment of pastures and increased timber loss

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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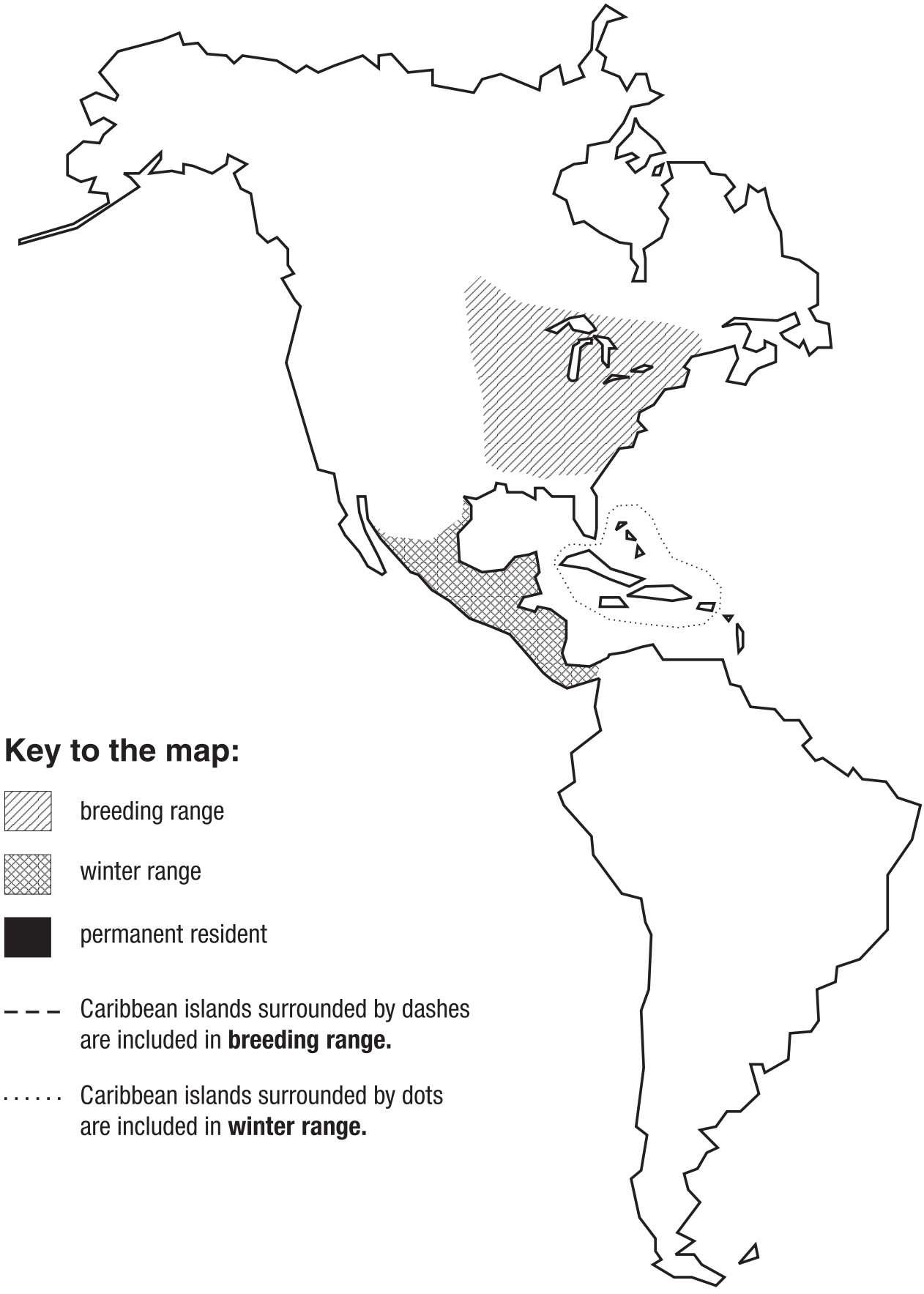
INDIGO BUNTING



Key to the map:

breeding range

winter range

permanent resident

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GRAY CATBIRD

Scientific Name . . . . . .*Dumetella carolinensis*

Spanish . . . . . .unknown

Present in Illinois . . . . .late April to late October

Illinois Status . . . . . .common migrant and summer resident; rare winter resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .forest edges, brushy areas, residential areas

Winter Range . . . . . .south to central Panama, Bermuda, Greater Antilles

Length . . . . . .9.25" (24 cm)

Weight . . . . . .0.75-1.5 oz. (21-42 g)

Color . . . . . .slate gray with black cap

Song . . . . . .a mimic that sings phrases only once; mews like a cat

Nest . . . . . .in dense thicket; a bulky cup of grasses, forbs, twigs, leaves with a lining of fine materials; two to 10' high in tree

Eggs . . . . . .three to five; blue-green

Broods/Year . . . . . .two

Food . . . . . .insects and fruit

Habits . . . . . .uncommon brown-headed cowbird (*Molothrus ater*) host; will eject cowbird eggs from its nest

Interesting Facts . . . . .nicknamed the “Carolina mockingbird;” like other mimics, includes songs and calls of other birds in its song; northern mockingbird (*Mimus polyglottos*) repeats phrases three times, brown thrasher (*Toxostoma rufum*) twice and catbird once

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds*. http://checklist.americanornithology.org/taxa

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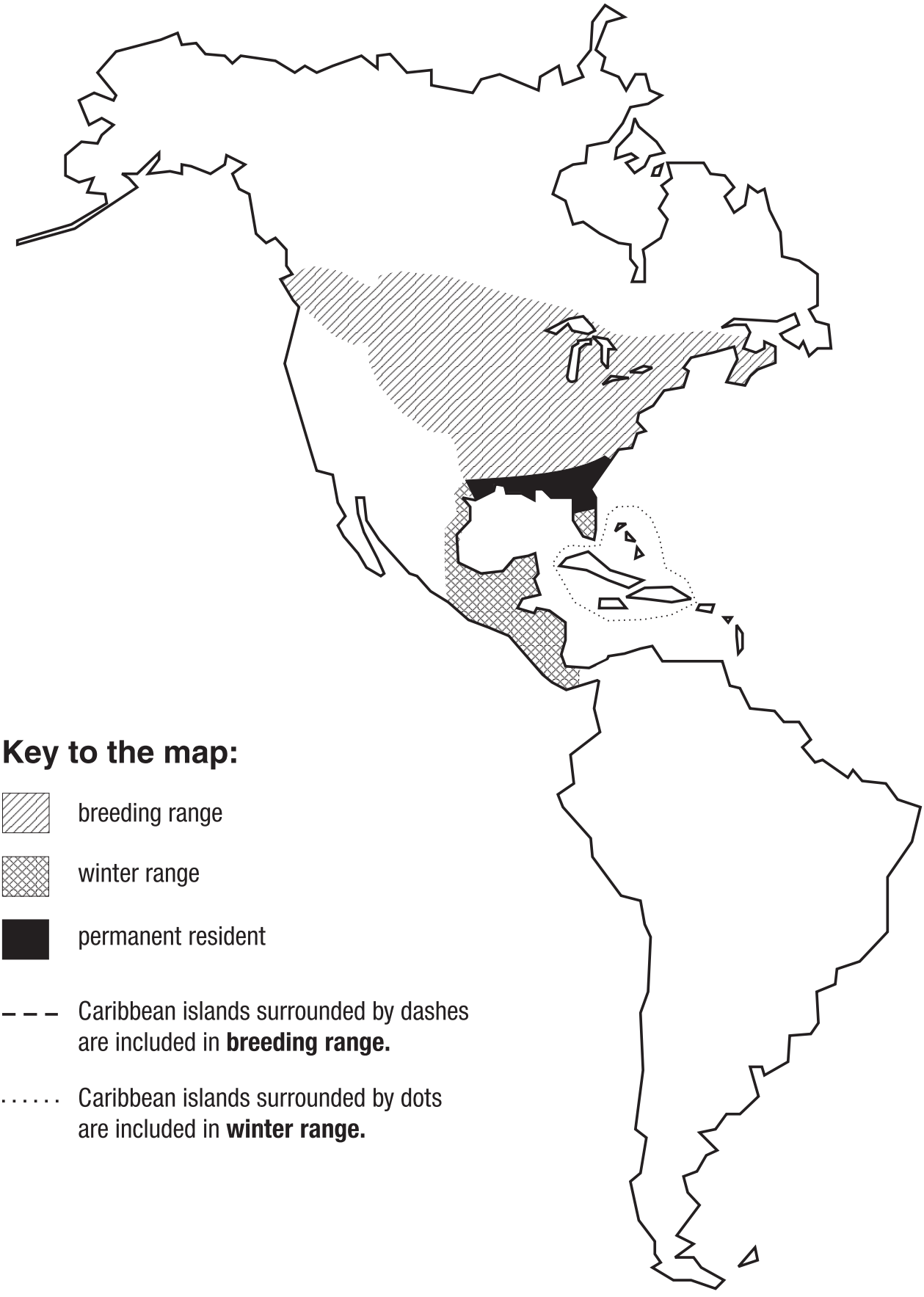
GRAY CATBIRD



Key to the map:

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winter range

permanent resident

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DICKCISSEL

Scientific Name . . . . . .*Spiza americana*

Spanish . . . . . .Sabanero Americano

Present in Illinois . . . . .late April to late August

Illinois Status . . . . . .abundant migrant and summer resident in central and south; fairly common migrant and summer resident north

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .open areas, especially clover fields and roadside bushes

Winter Range . . . . . .southwest Mexico to northern South America

Length . . . . . .6-7" (15-17.5 cm)

Weight . . . . . .0.8-1.0 oz. (23-29 g)

Color . . . . . .male: yellow breast and black bib; female: no bib and has streaking on sides

Song . . . . . .repeats “Dick-ciss-ciss-ciss” or “chup-chup-klip-klip-klip”

Nest . . . . . .on or near the ground (1" to 1')

Eggs . . . . . .three to six; pale blue

Broods/Year . . . . . .one; second possible if move to new area

Food . . . . . .grains, grass and forb seeds, insects

Habits . . . . . .often seen perching on telephone wires and fences; frequently a brown-headed cowbird (*Molothrus ater*) host

Interesting Facts . . . . . .nests often damaged by mowing machines; nicknamed the “little meadowlark”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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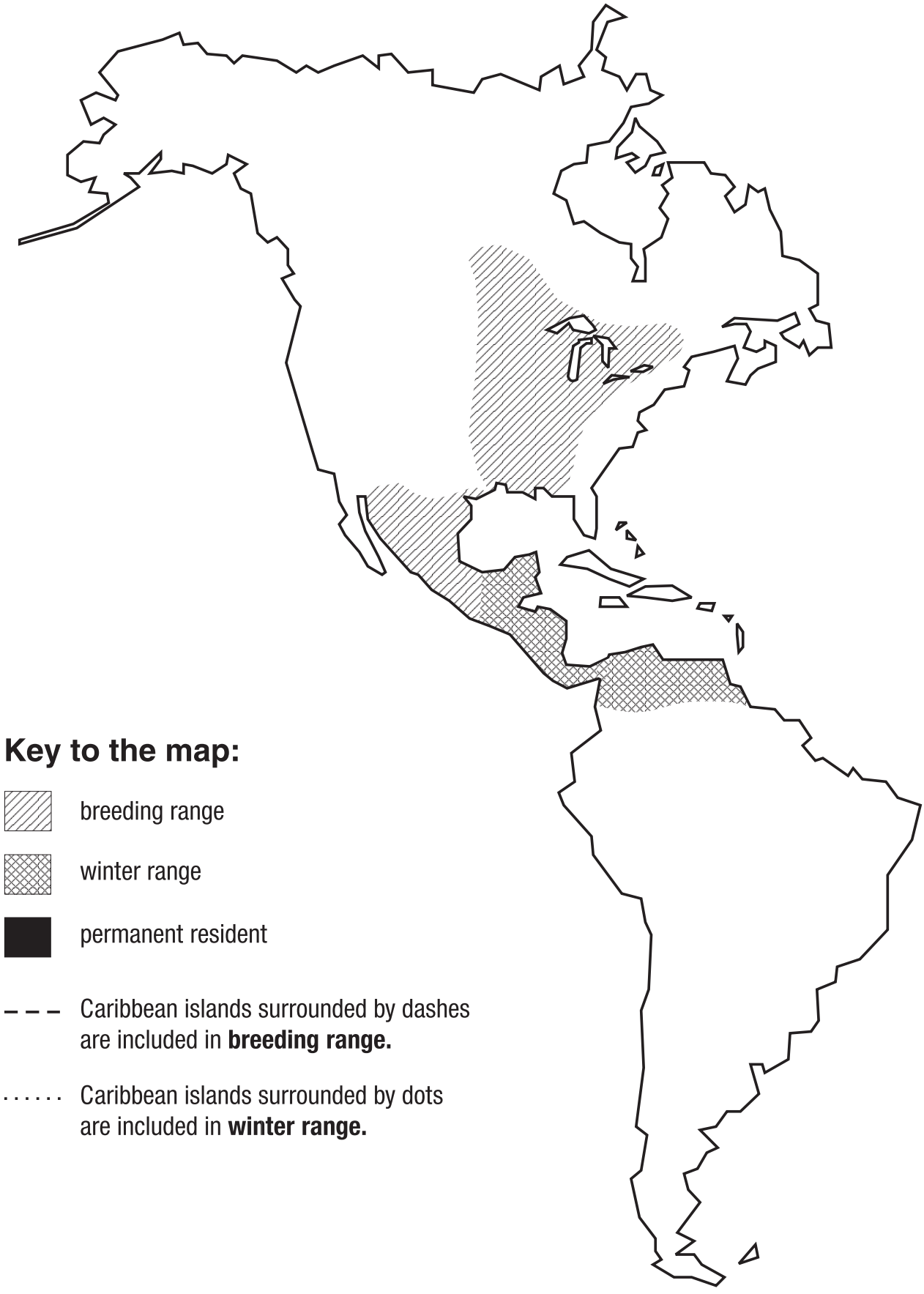
DICKCISSEL



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winter range

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PEREGRINE FALCON

Scientific Name . . . . . .*Falco peregrinus*

Spanish . . . . . .Falcon Peregrino

Present in Illinois . . . . .early April to early November

Illinois Status . . . . . .nests in large urban areas; occasional migrant

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .along large rivers and lakes

Winter Range . . . . . .south through Central America and West Indies to Tierra del Fuego

Length . . . . . .15-20" (37.5-50 cm)

Weight . . . . . .20-40 oz. (560-1,120 g)

Color . . . . . .long, pointed wings and long, narrow tail; adults are slaty-backed, barred on the belly; young birds are browner, heavily streaked below; heavy “mustache” visable when perching

Song . . . . . .repeats “we’chew” or a rapid rasping “cack, cack, cack”

Nest . . . . . .in trees 50-200' high; also roof tops and cliffs

Eggs . . . . . .three to four; white

Broods/Year . . . . . .one

Food . . . . . .waterfowl, pigeons and shorebirds

Habits . . . . . .female is larger than the male and will attack prey first and eat first when they hunt together; pairs roost together and hunt cooperatively

Interesting Facts . . . . . .nicknamed the “duck hawk”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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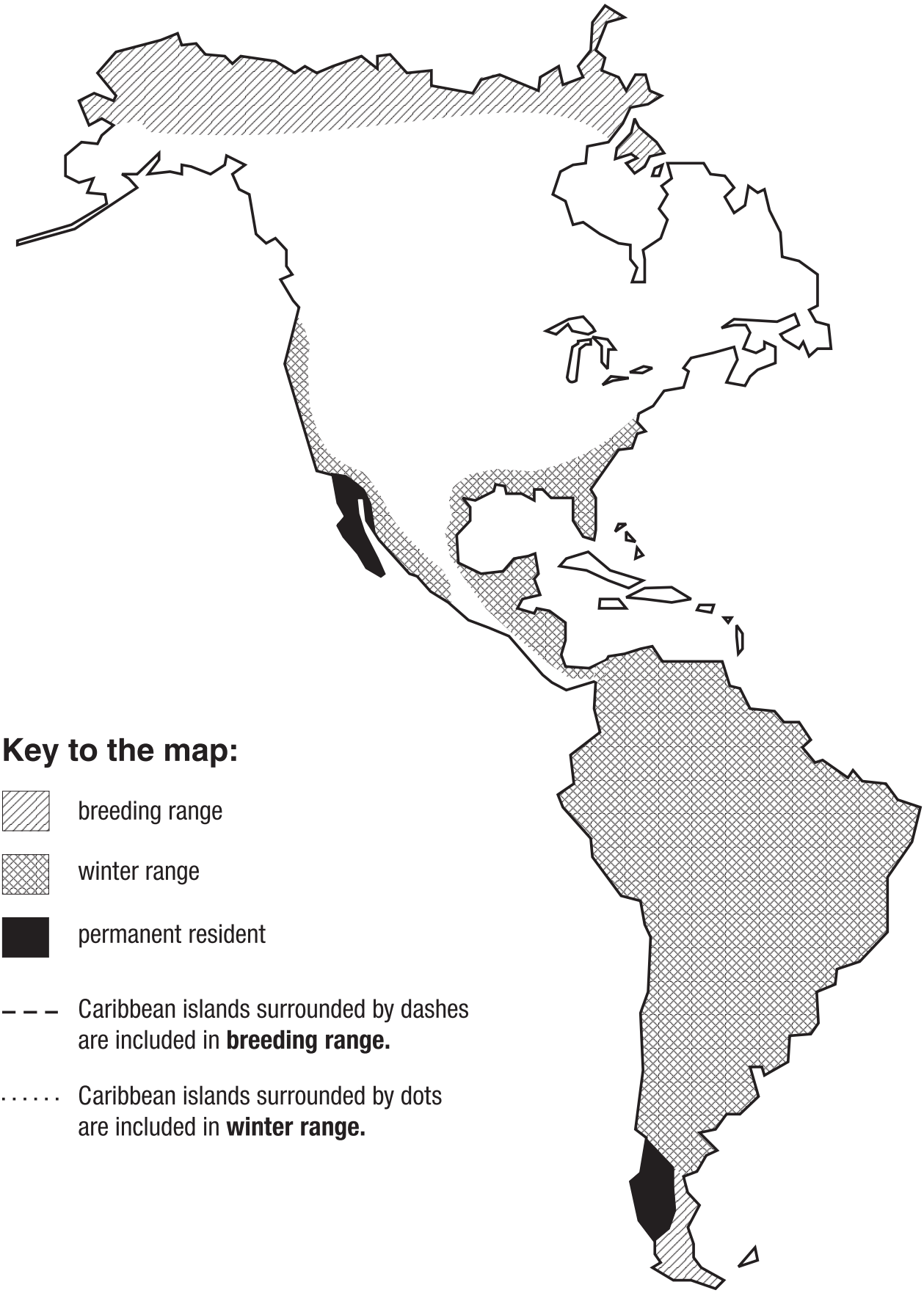
PEREGRINE FALCON



Key to the map:

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winter range

permanent resident

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BALTIMORE ORIOLE

Scientific Name . . . . . .*Icterus galbula*

Spanish . . . . . .Calandria del Norte

Present in Illinois . . . . .mid-April to mid-September

Illinois Status . . . . . .common migrant and summer resident, very rare winter resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .woodlands and trees along watercourses, ponds and lakes

Winter Range . . . . . .from Central Mexico south to northeastern South America, Greater Antilles

Length . . . . . .8.5" (22 cm)

Weight . . . . . .0.8-1.5 oz. (22.3-41.5 g)

Color . . . . . .male: orange-yellow with black head; female: olive-gray

Song . . . . . .a series of rich, piping whistled notes

Nest . . . . . .woven, pendant nest placed high and overhanging an opening

Eggs . . . . . .pale gray to blue-white with darker markings

Broods/Year . . . . . .one

Food . . . . . .insects, fruits, nectar; some spiders and buds

Habits . . . . . .uncommon brown-headed cowbird (*Molothrus ater*) host; may eject cowbird eggs from nest

Interesting Facts . . . . . .nicknamed the "hand-nest bird;" nests most commonly seen in winter; takes four to 15 days to build the nest

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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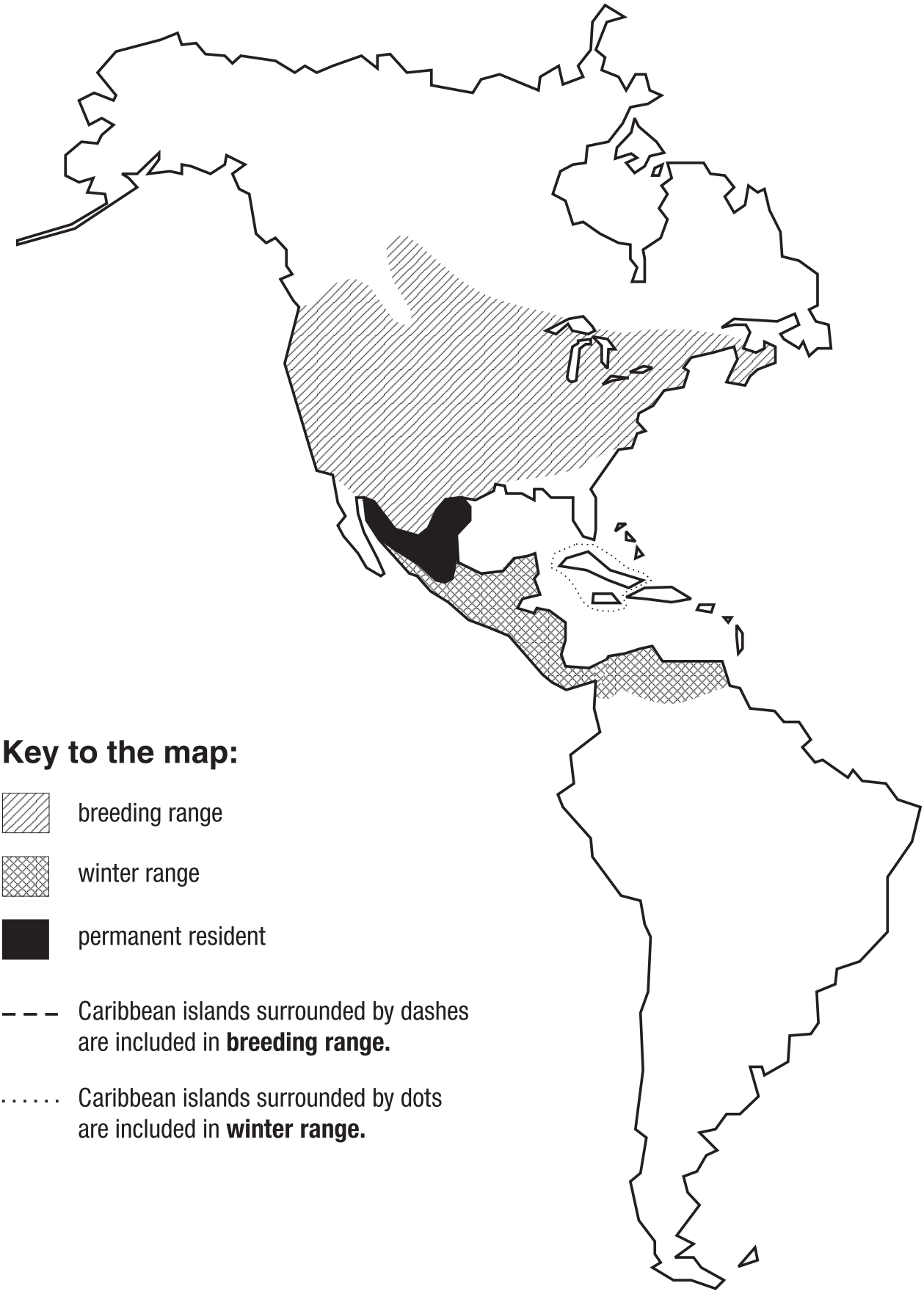
BALTIMORE ORIOLE



Key to the map:

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BAY-BREASTED WARBLER

Scientific Name . . . . . .*Setophaga castanea*

Spanish . . . . . .Reinita Castana

Present in Illinois . . . . .early May to mid-October

Illinois Status . . . . . .fairly common spring migrant, common fall migrant

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .open woodlands and groves of trees

Winter Range . . . . . .central Panama, south to northern South America

Length . . . . . .5-6" (12.5-15 cm)

Weight . . . . . .0.37-0.53 oz. (10.7-15.1 g)

Color . . . . . .male: chestnut throat, upper breast and sides and a large spot of pale buff on the side of the neck; female: paler; fall birds totally different

Song . . . . . .high song, “teesi, teesi, teesi”

Nest . . . . . .four to 40' in trees; loose or compact cup of grasses with rootlets and hair lining

Eggs . . . . . .four to five; white to off-white with brown markings

Broods/Year . . . . . .unknown

Food . . . . . .primarily insects; some fruit

Habits . . . . . .rare brown-headed cowbird (*Molothrus ater*) host

Interesting Facts . . . . . .number of eggs laid is often correlated with the abundance of spruce budworms (*Choristoneura* spp.)

Sources of Information

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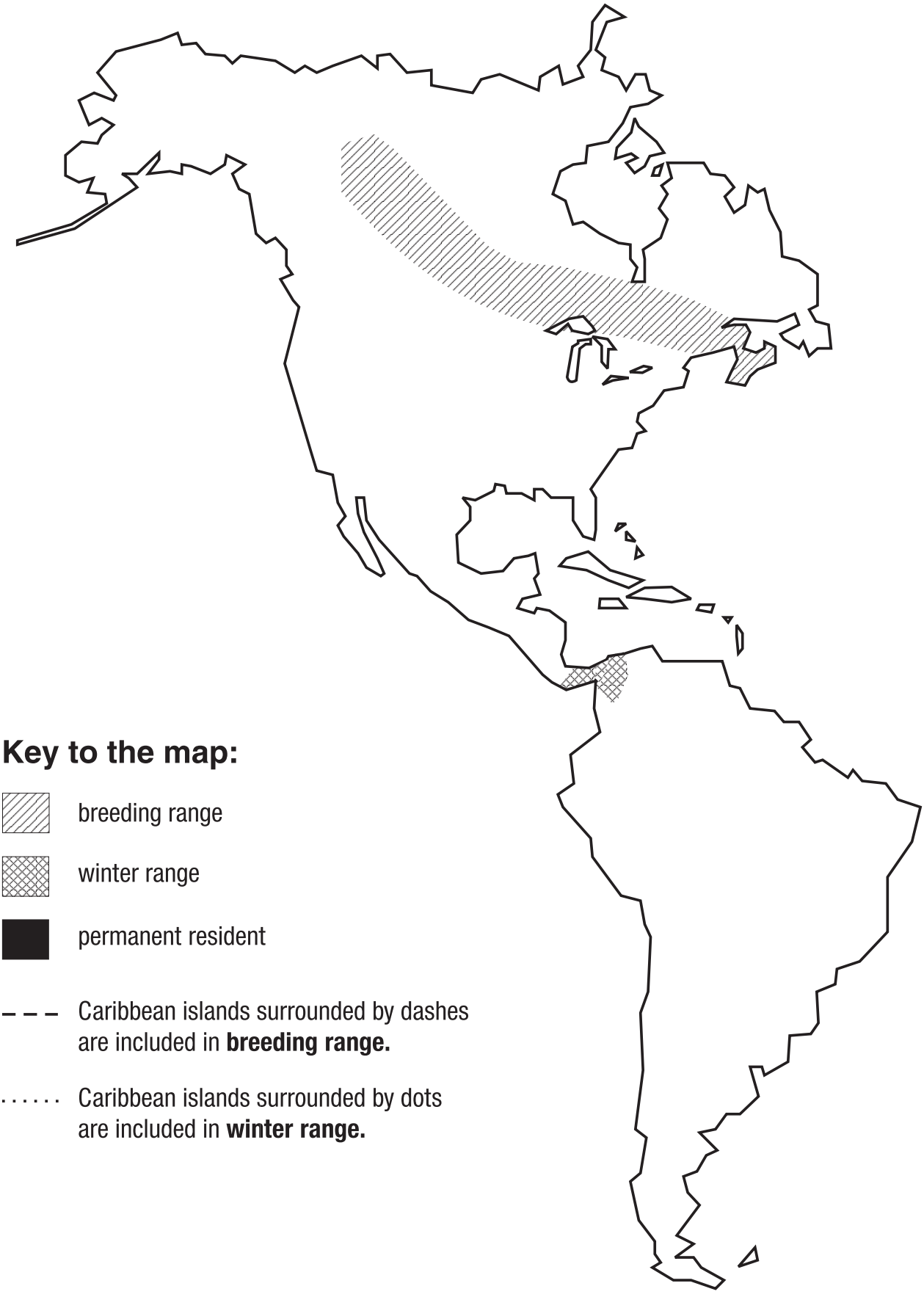
BAY-BREASTED WARBLER



Key to the map:

breeding range

winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

CERULEAN WARBLER

Scientific Name . . . . . .*Setophaga cerulea*

Spanish . . . . . .unknown

Present in Illinois . . . . .late April to early September

Illinois Status . . . . . .common migrant and summer resident in south; uncommon migrant and local summer resident central and north; threatened in Illinois

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .mature deciduous trees near rivers

Winter Range . . . . . .Venezuela and Columbia south to eastern Peru and northern Bolivia

Length . . . . . .4-5" (10-12.5 cm)

Weight . . . . . .3.2 oz. (89.6 g)

Color . . . . . .male: blue above with white belly, narrow black ring crosses upper breast; female: blue-gray and olive-green above and white below with two white wing-bars and white line over the eye

Song . . . . . .wheezy and rapid buzzy notes “zray, zray, zray, zray, zreee”

Nest . . . . . .15-80' high in deciduous trees; cup nest on horizontal branch far from trunk; made of bark, weed stalks, lichens, moss with moss lining

Eggs . . . . . .three to five; gray with brown spots

Broods/Year . . . . . .one

Food . . . . . .insects

Habits . . . . . .difficult to see the bird after the trees leaf out; sometimes seen when it ventures to the ground to drink, bathe or gather spider silk and other nesting materials; uncommon brown-headed cowbird (*Molothrus ater*) host

Interesting Facts . . . . . .very sensitive to fragmentation of breeding habitat

Sources of Information

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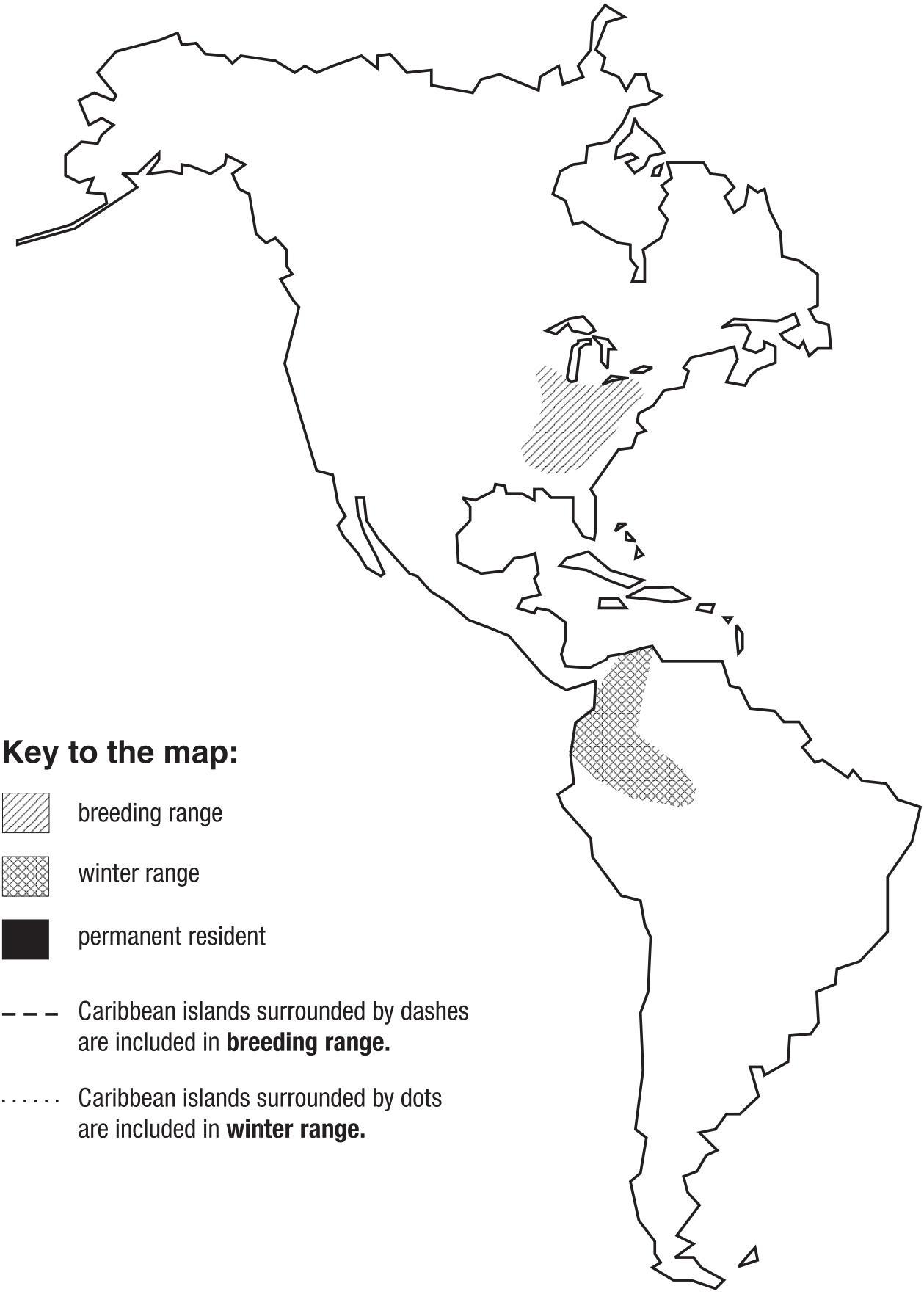
CERULEAN WARBLER



Key to the map:

breeding range

winter range

permanent resident

– – – Caribbean islands surrounded by dashes are included in **breeding range.**

. . . . . Caribbean islands surrounded by dots are included in **winter range.**

CHIMNEY SWIFT

Scientific Name . . . . . .*Chaetura pelagica*

Spanish . . . . . .Vencejo de Chimenea

Present in Illinois . . . . .mid-April to early October

Illinois Status . . . . . .common migrant and summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .originally woodlands; now mainly cities and towns; swamps with hollow trees

Winter Range . . . . . .western Peru, upper Amazon Basin of eastern Peru, northern Chile and northwestern Brazil

Length . . . . . .5.5" (14 cm)

Weight . . . . . .0.6-1.0 oz. (17-30 g)

Color . . . . . .dark brown with paler throat

Song . . . . . .piercing “chips” or “ticks”

Nest . . . . . .half saucer of twigs glued with saliva; formerly in tree holes, now in chimneys

Eggs . . . . . .four or five; white

Broods/Year . . . . . .one

Food . . . . . .flying insects

Habits . . . . . .builds nest in 18-30 days; grabs small dry twigs for nests and breaks them off while in flight; young leave the nest when three weeks old and use sharp, strong claws to cling and crawl on vertical walls

Interesting Facts . . . . . .seldom seen except while in flight; feed, drink and gather nesting materials all during flight; often called a “flying cigar” due to its body shape

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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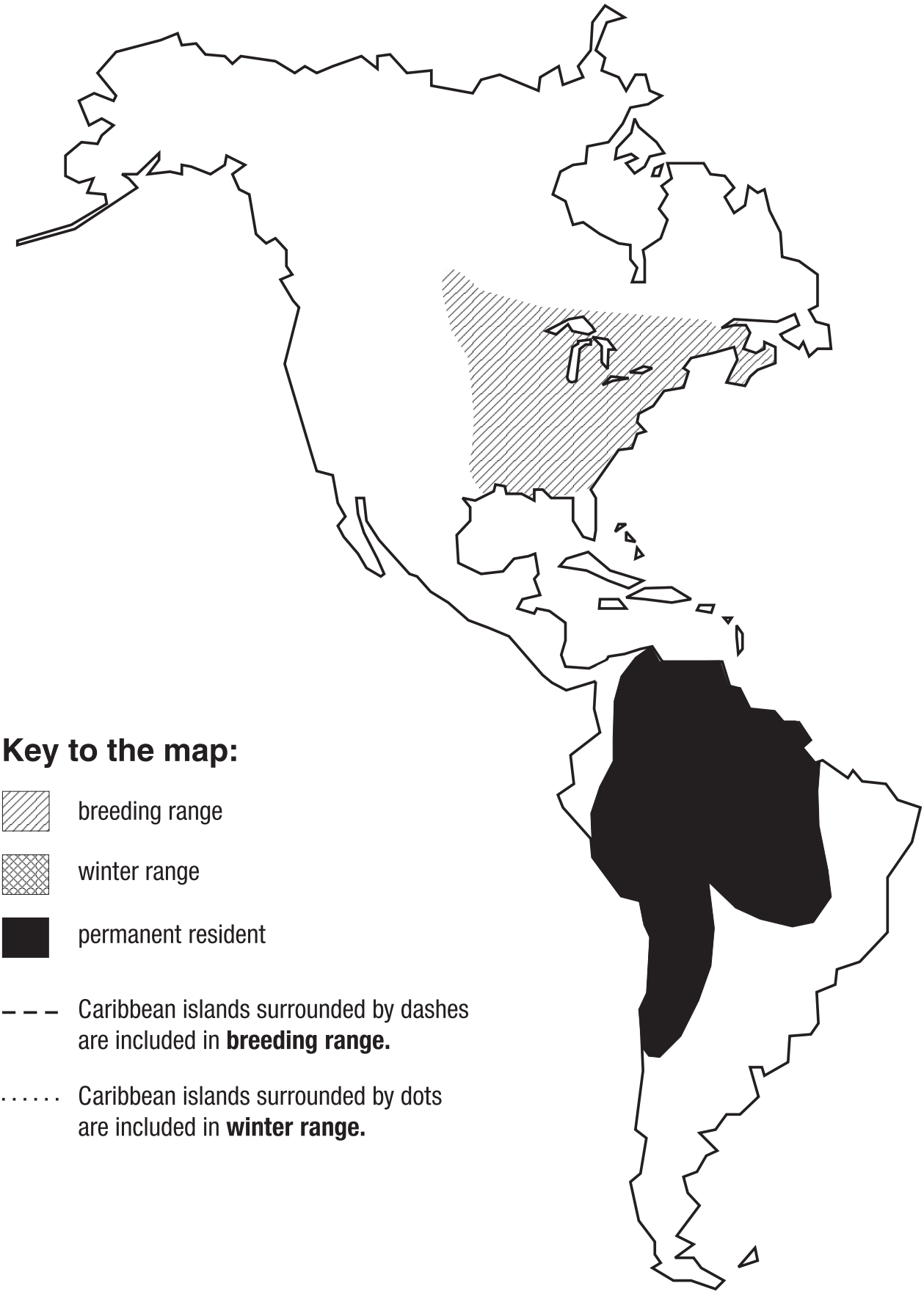
New Jersey Conservation Foundation. 1994. *The songbird connection*.

CHIMNEY SWIFT



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winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

PURPLE MARTIN

Scientific Name . . . . . .*Progne subis*

Spanish . . . . . .Golondrina Purpura

Present in Illinois . . . . .late March to mid-September

Illinois Status . . . . . .common migrant and summer resident

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .particularly numerous in residential areas; forage over open areas, including golf courses, cemeteries, lawns

Winter Range . . . . . .South America east of the Andes from Venezuela south to northern Bolivia and southeast Brazil

Length . . . . . .8.5" (22 cm)

Weight . . . . . .1.9 oz. (53 g)

Color . . . . . .male: glossy blue-black; female: dusky black

Song . . . . . .a series of rich gurgling notes; a low “chew” note

Nest . . . . . .in hollow tree, woodpecker hole, eave of building, nest box; grasses, leaves, stalks, feathers and mud; usually near water

Eggs . . . . . .three to five; dull white

Broods/Year . . . . . .one to three

Food . . . . . .flying insects

Habits . . . . . .house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*) can cause a problem by competing for nest sites; removal of dead trees decreased the availability of nest sites

Interesting Facts . . . . . .largest North American swallow

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

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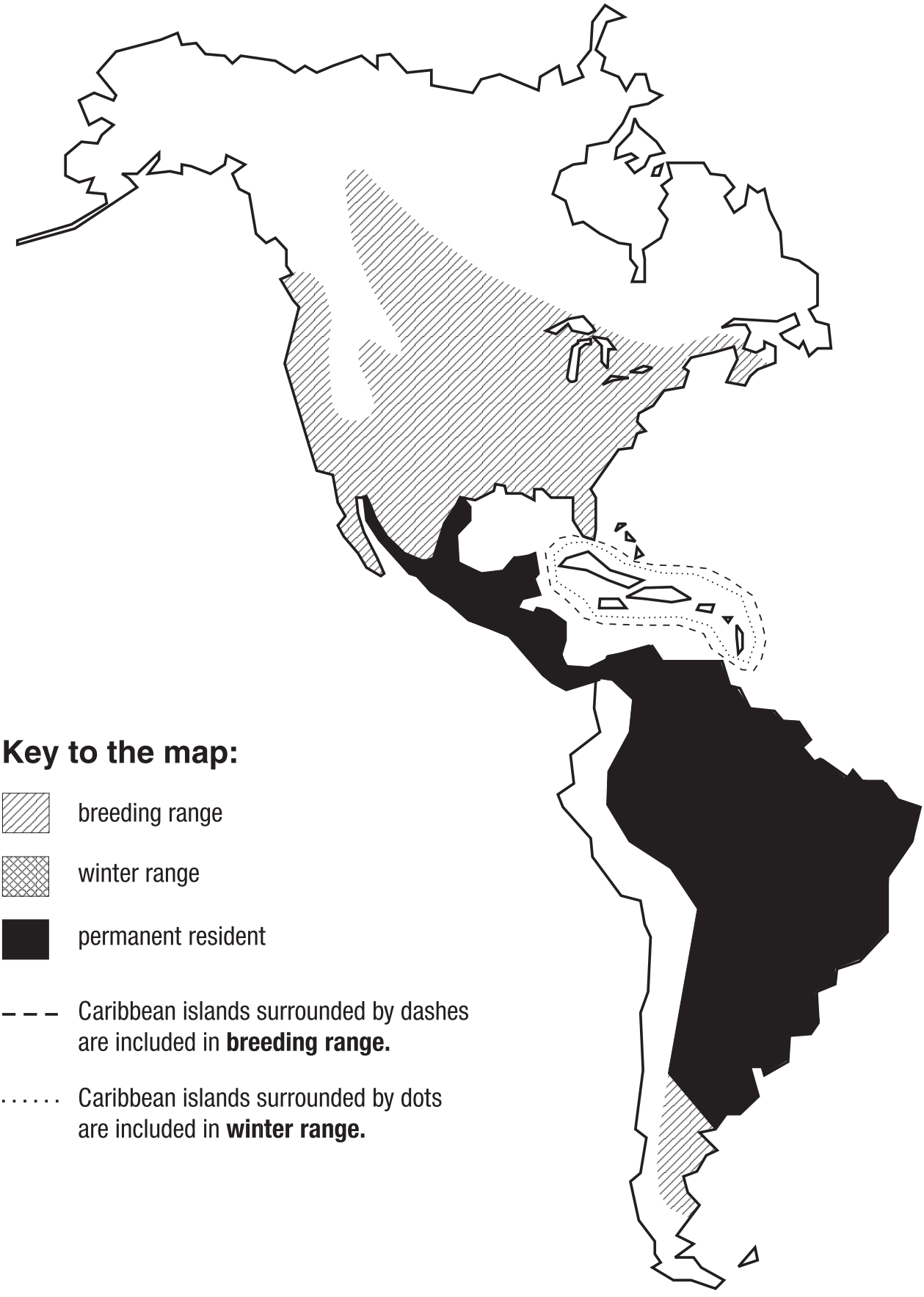
Erlich, Paul R., Dobkin, David S. and Darryl Wheye. 1988. *The birder’s handbook: a field guide to the natural history of North American birds*. Simon and Schuster, New York, New York. 720 pp.

New Jersey Conservation Foundation. 1994. *The songbird connection*.

PURPLE MARTIN



Key to the map:

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winter range

permanent resident

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GRASSHOPPER SPARROW

Scientific Name . . . . . .*Ammodramus savannarum*

Spanish . . . . . .Gorron Chicharra de Puerto Rico

Present in Illinois . . . . .mid-April to early October

Illinois Status . . . . . .common migrant and summer resident; rare winter resident in central and south

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .grasslands, pastures and fallow fields

Winter Range . . . . . .south to northern South America, greater Antilles

Length . . . . . .5" (13 cm)

Weight . . . . . .0.6 oz. (16.8 g)

Color . . . . . .dark brown head with stripe, chestnut- and black-striped back, buff belly

Song . . . . . .grasshopper-like and buzzing

Nest . . . . . .in a slight depression on the ground, the rim flush with the ground; hidden by overhanging grasses and forbs; dried grasses with a lining of finer materials

Eggs . . . . . .four to five; creamy white with spots

Broods/Year . . . . . .two

Food . . . . . .invertebrates, grasses and forb seeds

Habits . . . . . .uncommon brown-headed cowbird (*Molothrus ater*) host

Interesting Facts . . . . . .nests often destroyed by mowing machines; nicknamed the “cricket sparrow”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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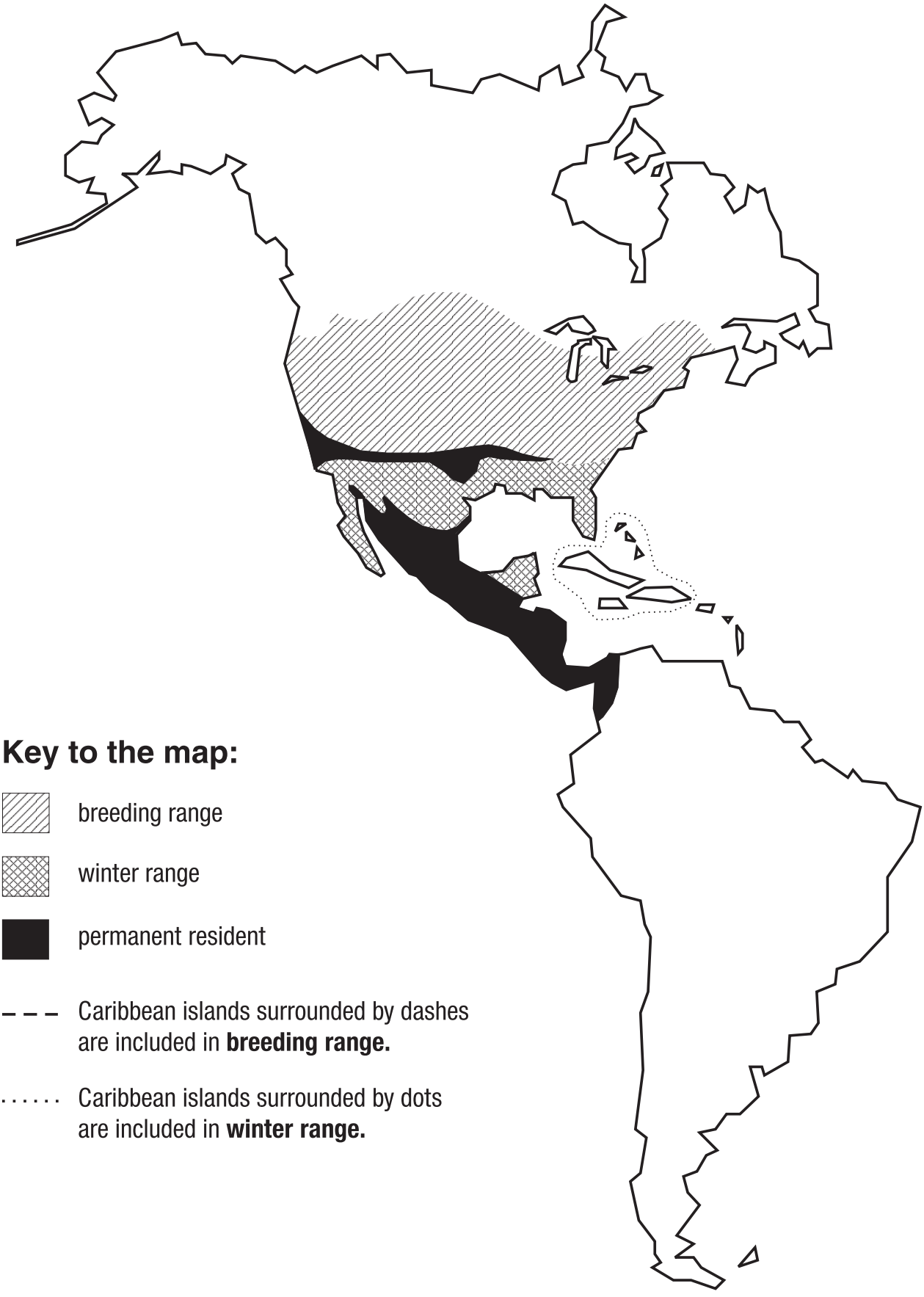
Erlich, Paul R., Dobkin, David S. and Darryl Wheye. 1988. *The birder’s handbook: a field guide to the natural history of North American birds*. Simon and Schuster, New York, New York. 720 pp.

New Jersey Conservation Foundation. 1994. *The songbird connection*.

GRASSHOPPER SPARROW



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winter range

permanent resident

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. . . . . Caribbean islands surrounded by dots are included in **winter range.**

OSPREY

Scientific Name . . . . . .*Pandion haliaetus*

Spanish . . . . . .Aguila de Mar o Anuila Pescadora

Present in Illinois . . . . .early April to late October

Illinois Status . . . . . .uncommon summer resident and migrant; threatened in Illinois

Illinois Range . . . . . .statewide

Illinois Habitat . . . . . .along rivers and lakes

Winter Range . . . . . .south to Chile and northern Argentina

Length . . . . . .21-24" (52.5-60 cm)

Weight . . . . . .42.7-66.5 oz. (1,220-1,900 g)

Color . . . . . .black above and clear white below, head largely white wih a broad black patch through cheeks

Song . . . . . .a series of short, sharp, cheeping whistles: “cheep, cheep” or “chewk, chewk”

Nest . . . . . .tops of dead or living trees in standing water; often reused year after year

Eggs . . . . . .two to four; white with brown markings

Broods/Year . . . . . .one

Food . . . . . .fishes (primarily live)

Habits . . . . . .female fed by mate from the time they form their pair bonds until she has laid all the eggs; male will sometimes incubate eggs; flies with a decided kink or crook to its wings; hovers on beating wings then plunges feet first to catch fishes

Interesting Facts . . . . . .populations crashed from the 1950s through 1970s from exposure to DDT, shooting and disturbance of the nesting grounds; conservation programs and use of nesting platforms have helped bring populations back; called the “fish hawk”

Sources of Information

American Ornithological Society. 2020. *Checklist of North and Middle American birds.* http://checklist.americanornithology.org/taxa

Bohlen, H. David. 1978. *An annotated check-list of the birds of Illinois*. Illinois State Museum, Popular Science Series, Volume IX. Springfield, Illinois. 156 pp.

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New Jersey Conservation Foundation. 1994. The songbird connection.

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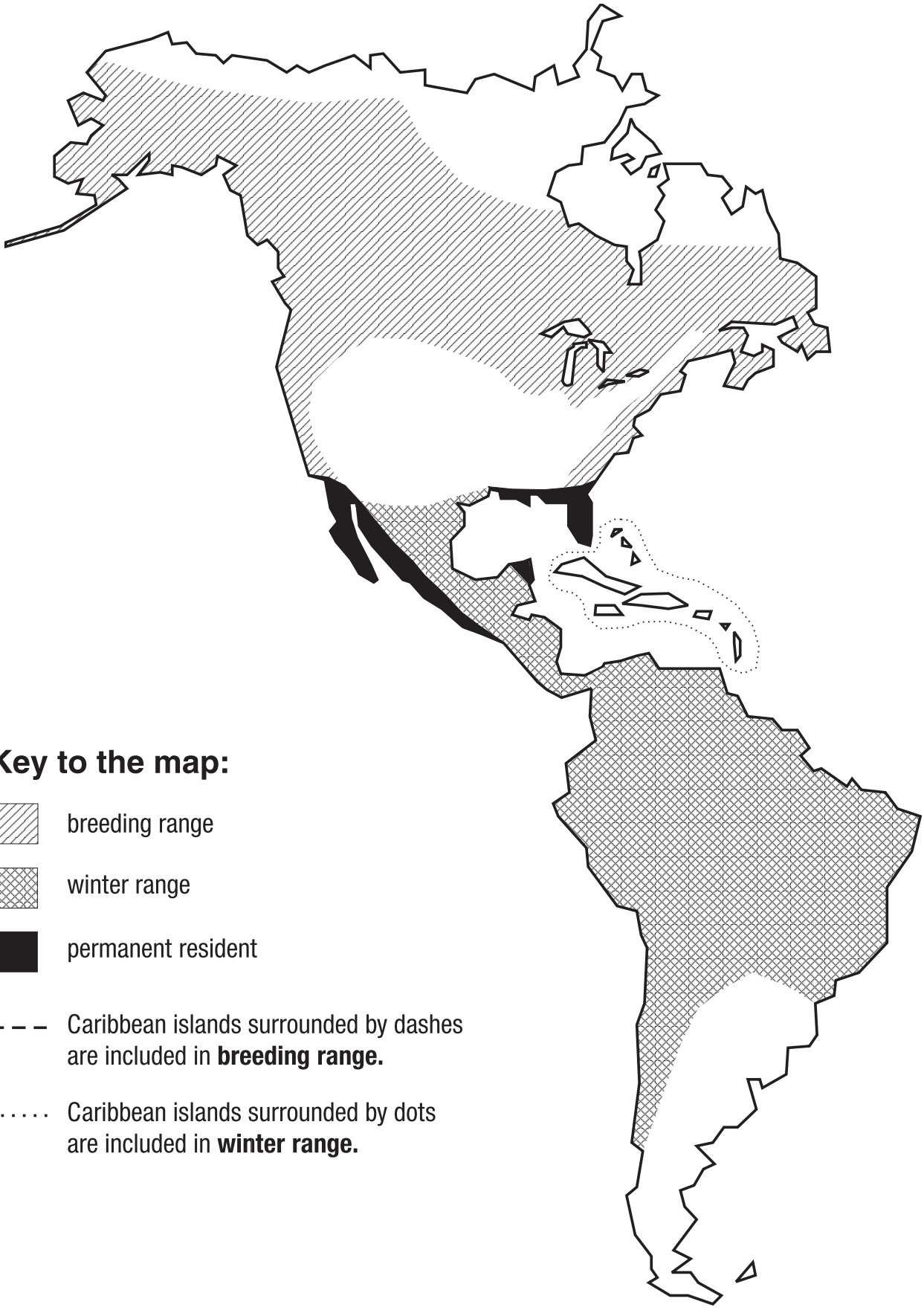

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winter range

permanent resident

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Appendix C

Ecology And Conservation: The Decline Of Songbirds

*by Dr. Bridget J. Stutchbury**

I. Introduction

About 50-75 percent of the birds that breed in the eastern forests of North America are long-distance migrants, meaning that they spend the winters in Central or South America. Although we think of them as being North American birds, many spend more time in the tropics (6-8 months) than they do up here (4 months). Recently, scientists have found alarming evidence that many of North America's migratory songbirds have experienced a serious decline in population size.

The Neotropical migratory bird system has been referred to as a "river of birds" that flows annually from North to South America, and then back again. Migratory birds pass through a series of different environments along their annual route from breeding to wintering grounds, which are often separated by distances of 3,000-5,000 km. Individual birds can travel over 8,000 km in a single year, and for small songbirds, this adds up to well over 25,000 km in a lifetime. They are vulnerable to environmental perturbations in any one of these locations along their journey. In the past several hundred years, human-caused habitat destruction has radically changed the landscape in which these birds travel and breed.

The songbird decline is an excellent example of the difficulties encountered in conservation biology, and the role that ecology can play in teasing apart a complex biological system.

1) The physical scale of the problem is huge: it potentially encompasses all of the New World. Migratory birds require suitable habitats on the breeding grounds in Canada and the U.S., on the wintering grounds in Central and South America, and all along their migratory routes.
2) There are a large number of possible causes, all acting simultaneously. Determining which is the most important requires extensive research.
3) The ecological impact is huge. It has been estimated that 3-5 billion birds migrate annually between North America and the Neotropics. These birds play a critical role in the ecosystem as consumers and as prey. How do we even begin to estimate how changes in such a large community will affect our forests and other animals?
4) A large number of different species is involved, and each is affected to different degrees by environmental perturbations.
5) This is an international problem. Many different countries "host" migratory birds during the various stages of their life cycle; these countries differ dramatically in their conservation ethic, economic status, population growth, and political stability.

The migratory songbird decline problem can be broken down into two key questions: 1) How widespread and severe is the population decline of songbirds? and 2) What are the main causes of the decline?

II. Migratory songbirds: **evidence for the decline**

a) Case histories

Start with some examples of species that have declined markedly in parts of their range over the past few decades.

These data are based on sampling the same breeding population intermittently over a period of 40 years, in a forest habitat that has not been seriously disturbed over this time (Terborgh 1989). Four species show a decline in population size ranging from 65-100 percent. Why are these species declining? First let's look at the general characteristics of these species. These birds have a number of important similarities: all are Neotropical migrant songbirds, and all breed in forest habitats. But there are differences in where they overwinter, where they nest in the forest, and their food resources.

1) Acadian flycatcher: breeds in northeastern U.S.; as name suggests they eat mostly flying insects during breeding season; overwinters Central America; probably territorial during winter; also eats fruit in winter.
2) red-eyed vireo: breeds over much of North America; gleans insects off leaf surfaces; nests in tree branches 2-5 m off the ground; overwinters Mexico to South America.

3) wood thrush: breeds in northeastern U.S.; feeds on insects and other invertebrates on the ground; nests 1-2 m high in shrubs and trees; overwinters Mexico to South America; territorial in winter.

4) ovenbird: a warbler that breeds in Canada and eastern U.S.; feeds and nests on the ground; overwinters Mexico and Central America.

These species represent a typical cross-section of songbirds (Order Passeriformes), and are in four different Families (flycatchers, vireos, thrushes, and warblers). There is nothing unusual about their breeding or wintering habits that could account for the dramatic decline in numbers.

Are these four examples merely part of natural fluctuations in population size in a single location, or do they represent the tip of the iceberg; that is, a widespread and severe decline for all migratory songbirds?

b) Population monitoring

Is the decline for real? How many species are involved? How rapidly are different populations declining? To get the answers to these questions we need to be able to count birds: not as easy as you might think.

It is very difficult to systematically census animal populations that are highly mobile, widespread, and have intercontinental home ranges. Many different methods have been used to census bird populations; each of which has a number of shortcomings. Nevertheless, consistent patterns emerge from the data.

Two main census methods have been used to look at population trends: (1) Breeding Bird Survey, (2) Migration Counts.

Breeding Bird Survey: Volunteers intensively survey all birds seen and heard during 3 minute stops, every 0.5 mile along roadsides. Each route consists of 50 stops, and is covered during the 2-3 hour period after dawn, sometime during the peak of the breeding season. Over 2,000 routes (i.e. 50,000 miles) are covered across Canada and the U.S. each year. This massive survey has been taking place since the mid-1960's, leading to a very valuable data set on long term population numbers.

Shortcomings: restricted to roadsides, so some habitats (i.e. wetlands) are poorly sampled. Areas in northern Canada have few roads, so are not adequately sampled.

Results: Many Neotropical migrants show a population decline in the period 1978-1987; before this time populations were stable or increasing (Robbins et al. 1989, Sauer and Droege 1992). Declines were noted most often for migrant birds nesting in eastern forest habitats.

Migration counts: These provide an independent count of breeding bird populations. During spring and fall, birds are surveyed through observation and capture as they migrate through the area. Long Point Bird Observatory, on the shores of Lake Erie in Ontario, has been censusing migrating bird populations since 1961. There have been some changes in the habitat at the count areas, so long term changes in numbers of particular species could be partly due to local habitat changes. However, estimates of population changes from these migration counts at Long Point are closely correlated with estimates from the Ontario Breeding Bird Survey (Hussell et al. 1992), indicating that these surveys reflect real changes in population size.

We can see that the wood thrush and ovenbird show significant declines in both survey methods. However, even though red-eyed vireos declined significantly from earlier studies (which was based on a single location), there is no evidence for a widespread decline from either BBS or migration count data.

These large scale surveys are essential for monitoring long term trends in populations, and determining whether observed changes are taking place over the entire range of a species, or just on a local scale.

c) Population trends of migratory vs. nonmigratory birds

The annual surveys of bird populations tell us that many songbird species are declining in numbers over large parts of their range. What is causing this decline? The source of the problem could lie at the breeding grounds, migratory stopping points en route, and/or the Neotropics where they spend the winter.

One way to find out where the problem lies is to compare the decline of migratory and nonmigratory birds. If a major cause of the decline lies in habitat destruction of the tropics, then only migratory species should show strong population declines.

In fact, it is the Neotropical migrants that are most likely to be declining. Of 20 Neotropical migrant songbirds with significant population trends, 85 percent were in decline (Robbins et al. 1989). In contrast, only 31 percent of temperate migrants and nonmigrants were declining significantly.

More detailed analyses of Breeding Bird Survey data have found that population trends can differ greatly between habitats and geographic regions, making it difficult to test hypotheses about which species are expected to be declining (see Hagan and Johnston 1992). Nevertheless, migrants that breed in eastern forests are

consistently found to be the group with most serious declines, although other species are also in trouble (Askins et al. 1990). Habitats are changing drastically throughout the entire range of migratory birds, so it is quite likely that a number of different factors are reducing their survival and reproductive success. We must look to both the breeding grounds and the tropics in a search for the cause of the decline.

III. Causes for the decline: **temperate zone**

a) Forest fragmentation and habitat loss

The forest habitat of eastern North America has changed dramatically since the 1600s. Two major effects: (1) less area covered by forest, and (2) fragmentation of the remaining forest into smaller pieces.

It has been well established that the composition of bird communities varies with forest area (e.g. Robbins 1980, Askins et al. 1987). Many songbirds are common only in large tracts of forest, and are rare or absent in small woodlots. These are "area-sensitive" species, who avoid tiny patches of habitat. The red-eyed vireo and wood thrush are only rarely found in small woodlots, but are common in larger forests.

Small patches of forest may contain sufficient food and nesting sites for a particular species, but due to its small area, it is not good quality breeding habitat. However, even for the birds that do select smaller forest fragments for nesting, they face the threat of reduced reproductive success. Although a forest may contain a large number of breeding migrants, these individuals may actually be producing very few, if any, offspring that survive to become adults. Two important factors associated with forest fragmentation are predation and cowbird parasitism.

b) Predation

In an experiment to quantify how predation rates vary with forest area, artificial bird nests containing quail eggs were placed in standard locations in different sized forests (Wilcove 1985). The predation rate ranged from 25-90 percent in small woodlots, but was only 2 percent in the largest forest. Why are predation rates higher in forest fragments? Some predators of bird nests can maintain higher population densities in the vicinity of human settlements (raccoons, skunks), where forest fragments are small. Important nest predators on birds may also prefer edge habitat (e.g. raccoons, blue jays), which is more extensive in fragmented forests.

c) Cowbird parasitism

Brown-headed cowbirds are a major threat to songbirds. Cowbirds are "brood parasites:" they lay their eggs only in other species' nests, and leave those host species to incubate the egg and feed the offspring. So, host songbirds that are "parasitized" expend much effort in raising cowbird offspring.

Female cowbirds often eject one of the host's eggs, so the host loses one of its own eggs right away. Furthermore, cowbird nestlings are often bigger than the host nestlings, and therefore get much of the food that the parents bring to the nest. In general, individuals that have been parasitized produce fewer offspring of their own than individuals that escaped parasitism by cowbirds.

How could this account for the recent decline in songbirds? Although cowbirds are native to North America, their natural range was restricted to the prairies. Cowbirds expanded their range eastwards as the forest was cut and fragmented, and began parasitizing the new host species that they encountered. The number of cowbirds in eastern North America has increased tremendously in the past century.

Cowbirds are much more common at the edge than the center of large forest tracts (Brittingham and Temple 1983), so forest-interior songbirds were also ecologically protected from cowbird parasitism. However, in small forest fragments most of the forest is near an edge and therefore accessible to cowbirds. Forest-interior songbirds have only had cowbirds as a nest threat in the past 150 years or so. They have no effective behavioral defenses against cowbirds, such as ejecting the cowbird eggs from the nest.

In Illinois where very little forest remains, predation rates in forest fragments averaged 80 percent, and about 75 percent of nests were parasitized by brown-headed cowbirds (Robinson 1992). Neotropical migrants averaged 3.3 cowbird eggs per nest! Wood thrush were heavily hit by cowbirds: on average, nests contained 4.4 cowbird eggs but only 1.2 wood thrush eggs. These populations in small forest fragments are maintained only by immigration of birds from other parts of the range where reproductive success is higher.

But, what happens when small forest fragments are the only remaining habitat for a species, and there is no other population that can produce surplus offspring? This has happened to the Kirtland's warbler, a migrant songbird that is an endangered species. There are only about 200 breeding pairs left, in several forest fragments in Michigan (Walkinshaw 1983). Early studies found very high rates of brood parasitism, and a corresponding low reproductive success. A massive effort to remove adult cowbirds from the breeding areas resulted in lower parasitism, and a greater production of offspring. The Kirtland's warbler can only survive with

intensive management of cowbird populations on the breeding grounds.

IV. Causes for the decline: **the Neotropics**

a) Forest fragmentation and habitat loss

Forest loss on the wintering grounds of migratory birds is widespread, and occurring at dramatic rates. About 1-4 percent of the forest is cut down annually, and converted to pastures and farms. Some countries like Costa Rica and Cuba have already cut down over 80 percent of their original forest.

Much of this destruction has taken place only in the past few decades, exactly the period when decline of migratory songbirds has been detected. There are several reasons why forest loss could be a greater problem for birds on their wintering grounds, compared with the breeding grounds:

1) The density of birds (number of birds living on a given forest plot) is much higher on the wintering grounds. The breeding grounds in North America cover over 40 million square km, but the main wintering grounds cover only 6 million square km. Migrants must funnel into a relatively small area, and compete with residents for space and food. In many different habitats in the northern part of the wintering range (Mexico), migrants make up about 50 percent of all the birds in the area.
2) Many species have relatively restricted winter ranges, so are extremely vulnerable to forest loss in those areas. The Bachman's warbler, on the verge of extinction, was thought to winter only in Cuba, where very little forest now remains.

Relatively little is known about the winter ecology and behavior of most of our migratory songbirds. However, the notion that individuals are free to wander around in search of the remaining suitable habitat is not correct. Many species are strongly territorial in the winter season, and return faithfully to the same winter territory year after year (Greenberg 1986). Furthermore, habitat selection in many songbirds is innate. While some species are generalists, and can opportunistically exploit new foods and habitats in pastures and fields, other species are specialists and avoid novel environments (Greenberg 1983). In some species, males and females even prefer different kinds of habitat (Morton 1990).

Assessing the impact of tropical deforestation on migrants is hampered by our lack of knowledge. The research effort on wintering songbirds is a tiny fraction of the amount of research conducted on breeding forest birds in Canada and the U.S. How dependent are certain species on particular winter habitats? How does winter survival vary in different kinds of disturbed habitat? How do the territorial systems of wintering migrants affect the survival and success of yearling birds? What impact do pesticides and parasites have on migrant birds while they are in the tropics? Decisions on how to manage the remaining forests, and which habitats are most critical, will depend on obtaining the answers to these kinds of questions.

V. Conclusions

Migratory songbirds are declining. Forest fragmentation in North America has lead to reduced suitable breeding habitat, higher predation rates, and high rates of brood parasitism by brown-headed cowbirds. On top of this, the same individual birds often face degraded habitats when they arrive on their wintering grounds in the tropics. For migratory birds, the candle is burning at both ends.

Deforestation in the tropics is not just a problem for the relatively "exotic" birds and other animals that live in rain forests. Literally billions of our own birds are at stake, along with their effects on our own forest ecosystems here in the temperate zone.

What can be done to stabilize migratory bird populations? Two main approaches are essential. (1) Continue scientific research to monitor population levels, learn more about the winter ecology of our migrants, and determine the most severe causes of the decline for different species. (2) Preserve tropical habitats that migrants depend on. Here, conservation groups (like

Appendix D

Research Article Summaries

Nest Predation in Forest Tracts and the Decline of Migratory Songbirds

David Wilcove conducted studies to test the hypothesis that nest predation can be an important cause of the decline of migratory songbird populations in small woodlots. He placed artificial bird nests with fresh quail eggs in 11 woodlots of different sizes in Maryland and Tennessee. He then visited each nest after seven days. Nests were considered preyed upon if one or more eggs were lost. On the ground near some of the nests, he placed cardboard squares. These provided a place to collect tracks from the animals that were preying on the nests. His results showed that the least amount of predation occurred on nests placed in large forest tracts (those over 250 ha) and the most occurred on nests in suburban forest fragments (those under 15 ha). He concludes that there are several possible reasons for higher predation rates in forest fragments. First, predators such as blue jays, gray squirrels, raccoons and cats are commonly associated with human development and therefore are near to nests in the small, suburban woodlots. Also, small woodlots do not usually have larger predators, such as bobcats and large hawks, that prey on the animals that prey on these songbirds. Finally, the small woodlots have a relatively large percentage of edge, and this edge supports predacious species, such as crows and grackles.

Wilcove, David S. 1985. Nest Predation in Forest Tracts and the Decline of Migratory Songbirds. *Ecology* 66(4):1211-1214.

Population Dynamics of Breeding Neotropical Migrants in a Fragmented Illinois Landscape

During the years 1985—1989, Scott Robinson conducted a study to determine nest success of Neotropical migratory birds in small forest fragments in Illinois. He believed that the songbirds might not be able to breed successfully in the small, wooded areas. To test this hypothesis, he conducted bird censuses throughout three forest fragments, each under 70 hectares in size. The primary censusing method he used was spot-mapping, where he walked through the forests during the morning hours (6:00 a.m. to 10:00 a.m.), stopped at predetermined points, and marked birds seen or heard on a map. He censussed each of the three forests this way at least three times each year, during the breeding season. He also located nests in these forests and returned to them frequently to see how many songbird eggs had been laid, how many cowbird eggs had been placed in the nests and how many of the young hatched and survived. While looking closely at these bird populations, he was able to determine which male songbirds did not find mates. His findings indicated that most of the Neotropical bird populations declined over the five years. Of the open-cup shaped nests he located, 80 percent failed due to predation, and 75 percent of all nests were parasitized by the brown-headed cowbird. There was an average of 3.3 cowbirds eggs in each parasitized nest. A high percentage of several forest birds appeared to remain unmated through the breeding season. Because populations of these songbirds cannot increase in these forests due to the frequency of predation and parasitism, Robinson concludes that these small forest fragments might be population "traps" for these birds. They are traps because the offspring of songbirds that breed in larger forests might come to these smaller fragments to breed, yet not be successful due to parasitism and predation.

Robinson, Scott K. 1992. Population Dynamics of Breeding Neotropical Migrants in a Fragmented Illinois Landscape. In John M. Hagan III and David W. Johnston (eds.) *Ecology and Conservation of Neotropical Migrant Landbirds.* Symposium proceedings from Manomet Bird Observatory, 6-9 December 1989. pp. 408-418.

Are Declines in North American Insectivorous Songbirds Due to Causes on the Breeding Range?

An enormous amount of bird census data has been collected since 1966 by the North American Breeding Bird Survey (BBS). The BBS is a roadside count of birds conducted during the breeding season by volunteers. Volunteers are assigned a 24.5 mile route on which they stop every half mile to record birds seen and heard in a three minute period. The data collected are submitted to the U.S. Fish and Wildlife Service, where they are entered into a computer database.

The researchers in this study analyzed the data collected from the BBS over the years to determine bird population trends. They found that some Neotropical migrato-

ry bird populations had decreased, and these declines may be attributed primarily to predation on the breeding grounds. The researchers are careful to note that just because they found a connection between bird population declines and predation, this does not prove that predation causes the declines. Yet the findings do strongly support this hypothesis and the researchers recommend that more attention is devoted to the breeding habitats in order to avoid further decreases.

Bohning-Gaese, Katrin, Mark L. Taper and James H. Brown. 1993. Are Declines in North American Insectivorous Songbirds Due to Causes on the Breeding Range? *Conservation Biology* 7(1):76-86.

Estimating the Viability of Ovenbird and Kentucky Warbler Populations in Forest Fragments

Gibbs and Faaborg make the point that researchers must be careful when drawing conclusions about bird population success based solely on singing bird counts. In this research, they studied two bird populations, ovenbirds and Kentucky warblers, in both forest fragments (under 150 ha) and large forest tracts (over 500 ha) in 1988. During the breeding season, they surveyed these forest areas by listening for singing birds for three hours each morning at daybreak. After locating each singing male, they followed it continuously for 90 minutes and carefully observed for evidence of successful pairing with a female. Seeing the male interact with a female, carrying nesting material or feeding young were considered evidence of successful pairing.
Approximately three-fourths of male ovenbirds were unpaired on forest fragments, while only one-fourth of male ovenbirds were unpaired in larger forest tracts. For Kentucky warblers, no difference in proportions of paired males was found between the large and small tracts. The forest fragments examined in this study appeared to support less successful populations of ovenbirds during 1988 than the large forest tracts. One important finding of this study is that bird censuses that use only singing males to count the number of birds present may not adequately represent the nesting success for all bird species equally. In this study, counting singing ovenbird males was not an accurate way to determine whether or not the birds were successfully breeding. To determine whether the small forest fragments were actually supporting breeding bird populations, the researchers needed to study whether or not the males were paired.

Gibbs, James P. and John Faaborg. 1990. Estimating the Viability of Ovenbird and Kentucky Warbler Populations in Forest Fragments.

Appendix E

Forest Resources of Illinois

FROM: *The Changing Illinois Environment: Critical Trends Technical Report of the Critical Trends Assessment Project. Volume 3: Ecological Resources*, Illinois Department of Natural Resources and the Nature of Illinois Foundation; and *Forest Resources of Illinois 2002*, Illinois Forestry Development Council and the Department of Natural Resources and Environmental Science, University of Illinois, Urbana-Champaign.

Forest Fast Facts

SUMMARY

- total forest area is now increasing in Illinois
- timber volume increased 40 percent between 1962 and 1985
- oak-hickory forests are declining and not being regenerated – maples are replacing them
- most Illinois forests are associated with streams
- more than 75 percent of the wildlife habitat in Illinois is found in the forests

FOREST AREA

- in 1820, 13.8 million acres of forest
- 4.3 million acres of the 1820 area was left in 1998 and all except 11,600 acres are considered secondary
- Illinois ranks 49th in the percentage of its land remaining in its original vegetation type
- lowest estimate of forest area in the state was 3.02 million acres by Telford in 1924
- other estimates include the following: 4.0 million acres in 1948; 4.04 million acres in 1962; 4.26 million acres in 1985
- forest area increased 10 percent from 1962-85 because of reduced cattle production and conversion of hayland and pastures to secondary forests
- from 1962-85 only the south-central region lost forest area; specific counties in this region which lost forest area are Bond, Clark, Clinton, Fayette, Franklin, Gallatin, Hamilton, Jasper, Lawrence, Marion, Montgomery, Perry, Richland, Shelby, St. Clair, Lawrence and Wayne
- counties in other regions losing more than 5,000 acres from 1962-85 were Alexander, Massac, Greene and Lake

OWNERSHIP PATTERNS OF ILLINOIS FORESTS

- 90 percent of the commercial forests is in private ownership while the remaining 10 percent is publicly owned
- Illinois has approximately 169,073 private forest landowners, each owning an average of 21.5 acres

FOREST PLANT DIVERSITY

- more than 250 tree species recorded (native and introduced)
- the most common tree type in commercial forests was the slippery elm; white oaks, red oaks, hickories, hard maples and soft maples were also very abundant; maples are showing the greatest gains
- total volume of growing stock in 1985 was 4.8 billion cubic feet, 40 percent greater than the 3.4 billion cubic feet reported for 1962; 5.94 billion cubic feet were reported in 1998
- sawtimber species accounting for the greatest percentages harvested were oaks, soft maple, cottonwood and aspen, ashes, hickory and hard maple
- Illinois ranks fifth in the nation in demand for wood but 32nd in the production of wood
- nearly 2 million cords of wood a year of firewood are harvested in Illinois, accounting for almost 43 percent of the trees harvested (75 percent of the firewood is taken from dead trees)
- biomass and annual harvest have increased during the past 23 years while annual growth has decreased – mortality has increased mainly due to insects and pathogens

TRENDS IN FOREST BIRDS

- Neotropical migrants formerly accounted for more than 70 percent of the breeding birds in Illinois; now

they account for less than 50 percent; based on two studies in east-central Illinois (by Kendeigh and updated in 1992 by Brawn), small woodlots may harbor only 25 percent Neotropical migrants

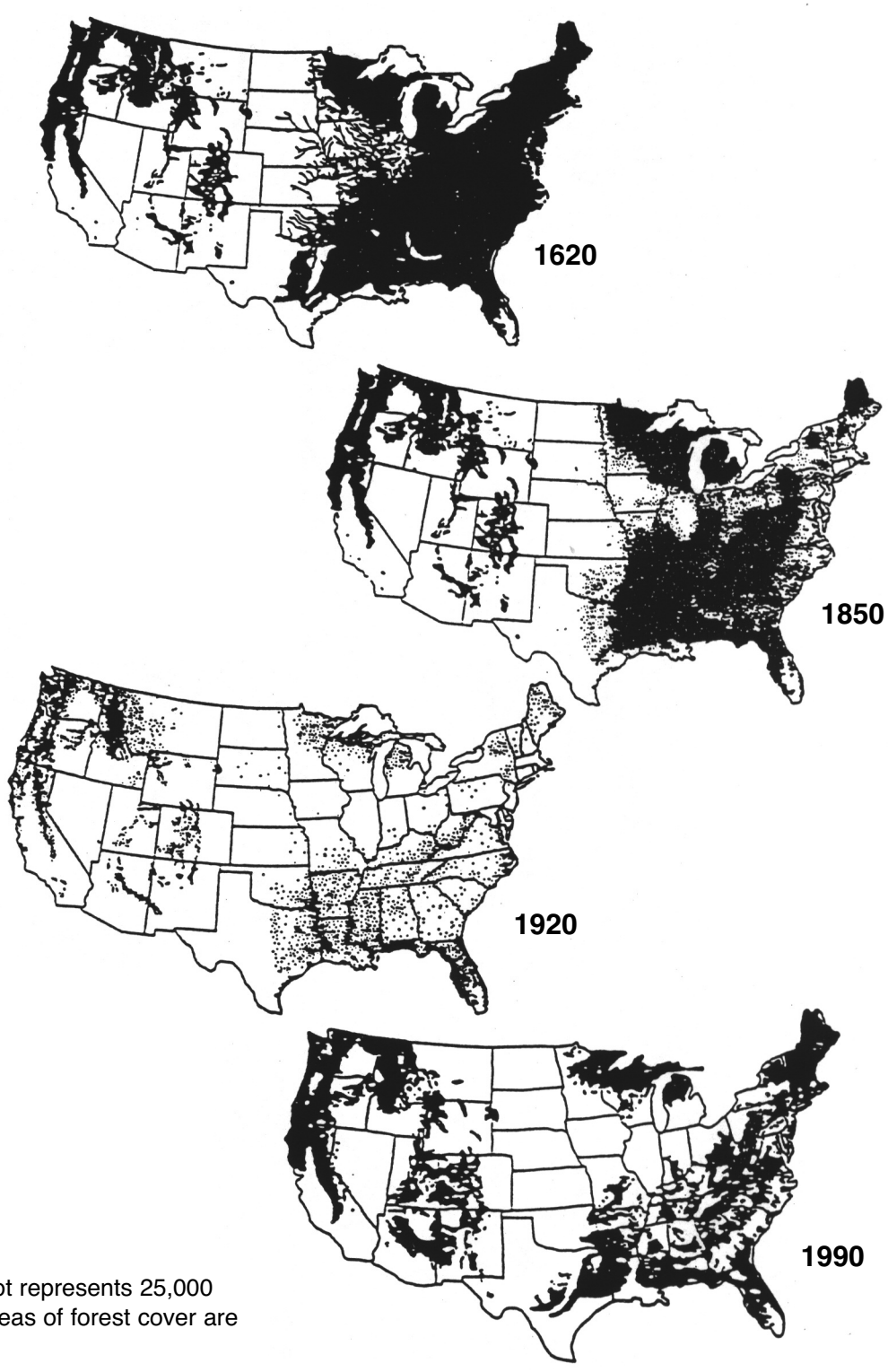
- few, if any, species were lost in the 20th century, but if trends continue one-third to one-half the typical forest species may be lost to extinction

FOREST STRESSORS

- pollution—ozone, nitrogen dioxide, sulfur dioxide in particular
- deforestation— long-term effect of past clear-cutting
- fragmentation—10,121 forested parcels of 40 or more acres in Illinois in 1980---about 44 percent of the parcels were of 100 acres or less

Appendix F

United States Forest Cover from 1620 to 1990



Because each dot represents 25,000 acres, smaller areas of forest cover are not represented.

Appendix G

Activities by Concept

Scientific Inquiry Concept

1) Scientific inquiry, including posing problems, solving problems and persuasion, can be used for the study, management and conservation of bird populations and forest ecosystems.

   ACTIVITIES: Buddy Banding, Designing Researchers

Forest Ecology Concepts

1) Forests are complex ecosystems.

   ACTIVITIES: Defining a Forest, Intelligent Tinkering

2) People and some birds depend on forests for their needs.

   ACTIVITIES: The Balancing Act, Territory Tango, Town Meeting

Bird Ecology Concepts

1) Birds are intrinsically valuable.

   ACTIVITIES: Interview a Bird, If There Were No Birds, Avian Olympics

2) Birds are part of forest ecosystems.

   ACTIVITIES: Interview a Bird, The Balancing Act, Intelligent Tinkering

3) Bird populations are affected by human impact on their habitat.

   ACTIVITIES: Interview a Bird, Territory Tango, Cowbird Capers, Migration Migraines

4) Some birds migrate to meet their habitat needs.

   ACTIVITIES: Interview a Bird, A Round Trip Ticket, The Balancing Act, Avian Olympics, Migration Migraines, Migrateering

Interconnectedness Concepts

1) People in Central America and North America have similar needs.

   ACTIVITIES: Cultural Exchange

2) Migratory birds depend on habitat in Central America, the Midwest and along flyways.

   ACTIVITIES: Interview a Bird, A Round Trip Ticket, Avian Olympics, Migration Migraines

3) Human actions that impact the forest environment have a global effect.

   ACTIVITIES: Tell the World, Migration Migraines

Management Option Concepts

1) People alter and manage forests to accommodate their wants and needs.

   ACTIVITIES: Town Meeting

2) Each forest management option may limit other forest uses.

   ACTIVITIES: Territory Tango, Town Meeting

3) Human use and management of forests affect bird populations.

   ACTIVITIES: Interview a Bird, Cowbird Capers, Territory Tango, Habitat Squeeze

Conservation Concept

1) People can act to help conserve Neotropical migratory forest birds and their homes.

   ACTIVITIES: Cultural Exchange, Tell the World, Town Meeting

Appendix H

Activities by Subject

English Language Arts
- Balancing Act, The
- Cultural Exchange
- Defining a Forest
- Designing Researchers
- Habitat Squeeze
- If There Were No Birds...
- Interview a Bird
- Tell the World
- Town Meeting

Mathematics
- Avian Olympics
- Buddy Banding
- Migration Migraines
- Round Trip Ticket, A

Science
- Avian Olympics
- Balancing Act, The
- Cowbird Capers
- Intelligent Tinkering
- Interview a Bird
- Migration Migraines
- Territory Tango
- Town Meeting

Physical Development and Health
- Migrateering

Foreign Languages
- Round Trip Ticket, A

Appendix I

Action Projects

Following are some practical ideas to get your students involved in action projects to help conserve Neotropical migratory bird populations.

1. Participate in International Migratory Bird Day (the second Saturday in May) to educate others on the issue.
2. Write to state and national elected representatives to voice your concern over the plight of migratory birds.
3. Contact local environmental organizations or chapters of national organizations, such as the Audubon Society or Society for Ornithology to find out what they are doing about this issue. Or contact Partners in Flight, a federal interagency program working towards Neotropical migratory bird conservation (http://www.partnersinflight.org).
4. Contact local representatives and parks personnel to learn about local land-use issues. Find out how you can learn about important local hearings, to provide public input on land-use decisions. To get the names of your representatives, call the city or town clerk's office.
5. Conduct a school or district-wide “Avian Olympics Day” to educate others in your school about birds.
6. Take field trips to learn bird identification and to contribute observations about bird populations to bird censuses or the Christmas Bird Count. Contact your local Illinois Department of Natural Resources office for information on bird censuses.
7. Continue writing letters to your cultural exchange class and educate people in Latin America about this issue.
8. Plant native trees in appropriate places to encourage bird habitat.
9. Take steps to reduce, reuse and recycle paper in your class or school. Start a paper recycling system in your class or school.
10. Plant a butterfly garden to provide habitat that supports insects that birds feed on.
11. Volunteer at a bird-banding station.
12. Raise money to buy an acre of rain forest or to make a donation toward acquisition of local land.
13. Educate neighbors about the dangers feral cats pose for birds.
14. Leave snags and fallen trees in woodlots to provide habitat for cavity-nesting birds.

Appendix J

Resources

The following organizations and items can provide you with more information and educational materials regarding biodiversity, forests, birds and other topics related to One Bird—Two Habitats.

Chicago Wilderness

Chicago
http://www.chicagowilderness.org

Chicago Wilderness is a regional nature reserve of globally significant rare natural communities in an area encompassing southeastern Wisconsin, the six-county Chicago region and northwestern Indiana. Chicago Wilderness is also a partnership of public and private organizations whose goals are to protect, restore and manage these lands.

Illinois Department of Natural Resources

Division of Education
One Natural Resources Way
Springfield, IL 62702-1271
217-524-4126
https://www2.illinois.gov/dnr/education/Pages/default.aspx

The Illinois Department of Natural Resources' Division of Education is responsible for the development, training and dissemination of educational programs and events, including Illinois ENTICE (Environment and Nature Training Institute for Conservation Education). The Division of Education develops and distributes a variety of environmental education materials. For monthly updates on new materials and scheduled workshops, visit https://www2.illinois.gov/dnr/education/Pages/default.aspx.

U.S. Fish and Wildlife Service

Shorebird Sister Schools Program
National Conservation Training Center
698 Conservation Way
Shepherdstown, WV 25443
304-876-7479
http://www.fws.gov/sssp/

Arctic nesting shorebirds migrate each year, from their wintering grounds in Latin America, Hawaii, Japan and Australia to their nesting grounds in Alaska, Russia and the Canadian Arctic. Students are connected along the flyways by sharing their observations of shorebirds, habitat and their own cultures with other students. Students are linked to conservation by opportunities to ask biologists questions, follow research projects and collect data.

Appendix K

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Appendix L

Glossary

ABIOTIC The nonliving components of the environment, such as oxygen and soil.

ADAPTATION The evolutionary process by which a species adjusts to its environment, for example: 1) flight adaptations include hollow or partially hollow bones, feathers, body shape and wings; 2) migration to North America to find better nesting territory and return to warmer climates when northern winters make food scarce; and 3) songbirds developing behaviors (building a new nest bottom over a brown-headed cowbird egg or throwing cowbird eggs from their nests) in response to pressures from other bird species to increase the reproductive success of the songbirds.

AVIAN A term that refers to or relates to birds.

BIOLOGICAL DIVERSITY (BIODIVERSITY) The variety of life; the spectrum of life forms and the ecological processes that support and sustain them. This unit describes three levels of biodiversity: species diversity; genetic diversity; and ecosystem diversity.

BIRD BANDING A research technique in which a small, aluminum band is attached to a bird's leg. If the bird is captured again or found dead, and the band number is reported to the responsible federal agency, the bander and other researchers can learn about avian traits such as movements and longevity.

BREEDING HABITAT The local environment where an animal carries out reproductive activities. For example, the ovenbird's breeding habitat is the forest floor.

BROMELIAD A tropical plant in the pineapple family that often grows on the trunks and branches of trees in the rain forest. Bromeliads have adapted to life off the ground by collecting raindrops in funnels at the base of their spiny leaves.

BROOD PARASITISM Behavior characterized by birds laying their eggs in the nests of other birds (the host species). The parasite's young are raised by the host species.

CANOPY The upper layer of the forest formed by the leaves and branches of trees.

CARRYING CAPACITY The population that a given area, such as a forest, will support without undergoing deterioration.

COMMUNITY An assemblage of species living together in a particular area, at a particular time, in a prescribed habitat.

COMPOSITION The makeup of an ecological unit in terms of the organisms or groups of organisms present in an area.

CONSENSUS A decision reached by mutual acceptance of persons involved.

CONSERVATION The use of resources in a way which assures their continuing availability for future generations; the wise use of natural resources.

COWBIRD A parasitic bird that lays its eggs in other songbirds' nests.

DATA Units of information that are collected for a specific purpose.

DRY SEASON A season in the tropics characterized by low rainfall and the loss of leaves on deciduous trees.

ECOSYSTEM An interacting system of the biotic community and its abiotic environment. Ecosystems are characterized by nutrient cycling and energy flow between trophic levels (producers, consumers and decomposers).

EDGE EFFECT The ecological impacts resulting from the meeting of two distinctly different habitats.

EMERGENT LAYER A layer of the forest consisting of trees that protrude above the canopy layer.

ENVIRONMENT Conditions in an area influenced by the climate, soil, topography and biotic components.

FAT LOADING Process by which a bird builds up fat reserves prior to migration.

FLYWAY Flight routes established by migratory birds between their wintering grounds and their breeding grounds.

FOREST INTERIOR SPECIES Those species whose optimum habitat is deep in the forest, where conditions are not influenced by edge effects.

FOREST TYPE Tree species which commonly grow together because of their similar environmental requirements and tolerances.

FRAGMENTATION The division of large, continuous tracts of habitat into smaller areas.

GENE POOL The various genes present in a population.

GENETIC DIVERSITY The variety of genetic material carried by different populations.

HABITAT The place where an organism lives and its surrounding environment, including the biotic and abiotic components. A habitat provides the organism with food, water, shelter and space in a suitable arrangement.

INDIGO BUNTING A Neotropical migratory bird that uses forest edge habitat for its breeding ground.

INTERCONNECTED The state of being connected one to the other.

MAGNETIC FIELD A region subject to the influence of magnetism.

MIGRATION Movement of a species from one place to another, often following a change of seasons.

MIGRATORY RESTLESSNESS A change in behavior, described as "frantic," that demonstrates the desire to migrate. The behavior has been observed in experimental settings by confined birds during the time the birds should be migrating.

NEOTROPICS The area of the Americas situated between the Tropics of Cancer and Capricorn.

NEOTROPICAL MIGRATORY BIRD A bird which moves seasonally between temperate regions of the Americas, where it spends its breeding time, and tropical areas, where it spends the months when winter occurs in the north.

NUTRIENT CYCLING The flow of nutrients through the ecosystem.

ORIENTEERING The process of finding direction by using a compass.

OVENBIRD A Neotropical migratory forest bird that breeds in northern North America and spends winters in the tropics. Its name probably comes from the oven-shaped nest it builds on the forest floor.

POPULATION The number of members of a particular species in a given area.

PRESERVATION The maintenance of a natural ecosystem or environment undisturbed by the influence or activities of humans.

RENEWABLE RESOURCE These living resources can renew themselves naturally or through sound management practices, so as to not deplete their supply in the long run.

SITE The place where something is located.

STRUCTURE The pattern or physical arrangement of an area, such as a forest.

SUSTAINABILITY The process of managing ecosystems to meet the needs of present human populations without interruption, weakening or loss of the resource base for future generations.

SUSTAINABLE USE Use of natural resources in a manner that does not eliminate or degrade them or otherwise diminish their usefulness for future generations.

TEMPERATE The region of the earth that lies between the tropical and polar regions.

TERRITORY The concept of "ownership" of, or dominance over a unit of habitat; an area used by an animal for breeding and/or feeding, and which it defends against others.

TROPICAL The area of the world that lies between the Tropics of Cancer and Capricorn.

UNDERSTORY The plant layer growing under the canopy of a forest that includes small trees, shrubs and herbs.

WET SEASON A season in the tropics characterized by abundant rainfall.

WINTER HABITAT The local environment where an animal spends the winter. For example, the ovenbird's winter habitat includes the forests of the Neotropics.

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