BIRDS GEORGIA

Learning About Birds
Educator Guide

Common Birds of Georgia

Objective(s): Students will demonstrate proficiency in (1) identifying several birds common to their region, (2) categorizing birds by family and shared characteristics, and (3) recording observations.

Overview

Students will learn to identify common birds found in their community.

Georgia Standard(s) of Excellence (GSE)

SKL1; SKL2; S1L1; S2E3; S3L1; S5L1; S7L1; SEC1; SEC2; SEC3; SEC5; SEV4; SZ5.

Essential Terms

Characteristic
Checklist
Classification
Habitat
Family
Field guide
Field mark

Materials

- *LAB: Common Birds of Georgia Student Guide*
- *LAB: Common Birds of Georgia poster*
- Field guides
- Bird checklists
- Drawing supplies

Additional Resources

- *LAB: Birding & Binoculars*
- *LAB: Cheep Sheet for Bird Songs and Calls*
- *LAB: Using a Bird Checklist*
- *LAB: K-2 Observation Sheet*
- *AllAboutBirds.org*
- Merlin Bird ID (app)

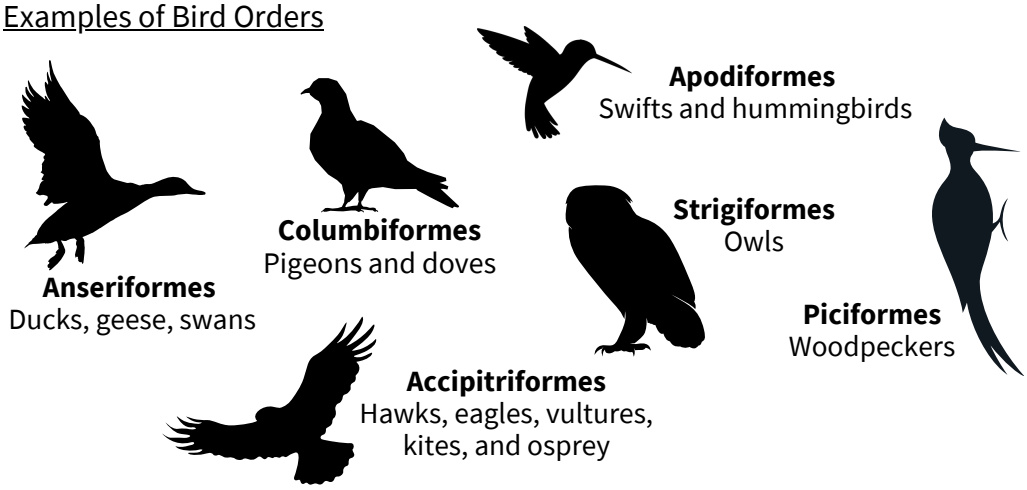
Background

Roughly 10,000 species of birds live on Earth, and more than 300 can be seen in Georgia during the year. Fascinating and familiar, birds provide endless opportunities to engage students in meaningful, real-world learning in any subject. Watching birds not only sparks wonder and curiosity, it also cultivates awareness, hones observation and recall, and requires attention to detail. These skills will equip students for lifelong learning in the classroom and beyond. To make learning about birds manageable, common southeastern birds are the focus of these activities. **Field guides** are useful tools for learning about the many birds that visit your region. They are usually organized by taxonomic order and family. Navigating a field guide is a skill that is transferable to many reference sources your students will encounter. In addition to content knowledge, basic information literacy can be taught using a field guide's index, table of contents, diagrams, and maps.

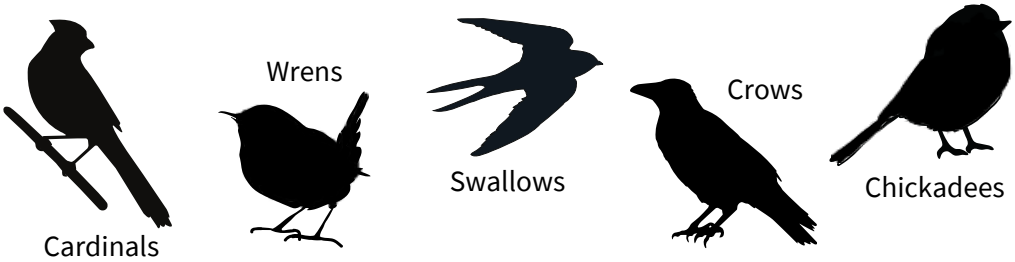
Birds of a Feather

Birds can be **classified**, or grouped, by **order**. Within orders, birds are further classified by **family.** Familiarizing yourself with bird families and their general silhouettes will help you guide students in identification. The largest order of birds is the Passerines, which includes nearly half of all bird species in diverse families that share physical traits, behaviors, and habitat preferences. Birds in this order, more commonly known as "songbirds," are distinguished from other orders of birds by their complex vocalizations and the arrangement of their toes, which facilitates perching.

Examples of Bird Orders

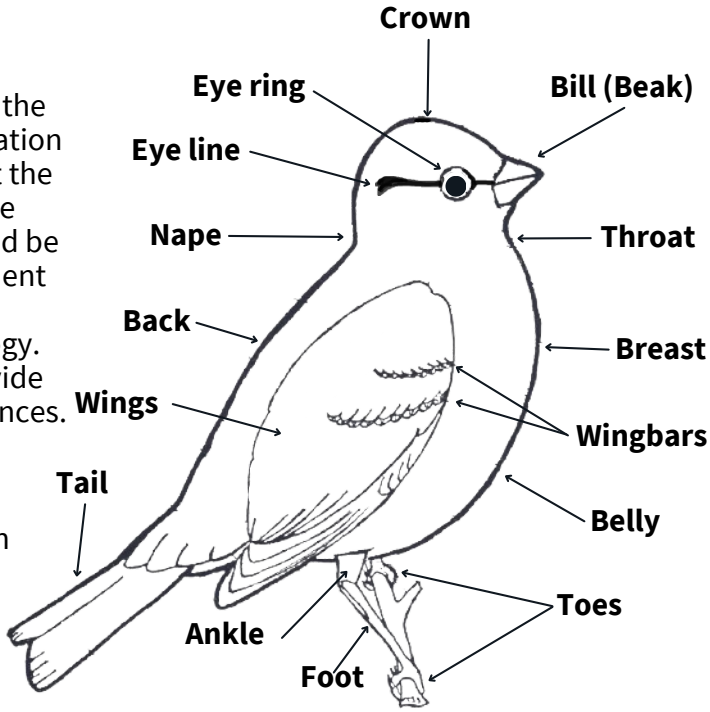


Examples of Bird Families in the Order Passeriformes (Passerines)



Bird Bodies

Prepare students for observing and describing birds by completing the *LAB: Bird Bodies* activity. The diagram to the right represents the general shape of a bird, though variation exists across species. Encourage students to think about the body parts of humans and other animals to help label the diagram. Ask students why learning bird body parts could be helpful. In the field, instruct students to note the placement of colors, markings, patterns, and other field marks that stand out on the bird's body, using the proper terminology. Noting the length and shape of the legs and bill can provide clues to the bird's family and its diet and habitat preferences.



Preparing for Flight

Studying hundreds of species can be a daunting task. To make this process easier, students will focus on common birds found in their region. Through hands-on activities, students will practice bird identification and sharpen observation and communication skills. In addition, students will learn to organize species taxonomically.

Activity 1: What's Out There?

Students will practice the skills necessary to observe birds.

The best way to identify birds is to go looking for them! Review *LAB: Birding and Binoculars* for tips on facilitating groups outdoors. Learning a few facts about common species in your area is helpful. Below are a few ideas to prepare for a bird walk.

Practice sound mapping: Listening to and pointing out sounds helps students take an inventory of the space around them. Students can practice this before observing birds.

1. Bring the group outside and explain that looking for birds also means listening for birds. Being able to locate where a sound is coming from can help increase students' chances of seeing a bird.
2. Instruct the group to remain quiet for about one minute. Ask students to listen carefully for bird sounds and point to where they're coming from. Do this a few times until students are confident in identifying the locations of the sounds. Students can also practice this skill on paper by using words, symbols, and pictures to create a sound map of what they hear, marking themselves as an "x" on the center of the page.

Learn common sound devices: Teach common mnemonics like the Northern Cardinal's "what-cheer, what-cheer," and the Carolina Wren's "teakettle, teakettle, teakettle," all of which can be heard on almost any bird walk in the Southeast. Refer to *LAB: Cheep Sheet for Bird Songs and Calls* for examples of songs and calls of common birds.

Get Outside and Observe: The *LAB: Observation Journal* can be used on bird walks to encourage groups to record and make field notes about their observations. This exercise can be used repeatedly to document the diversity of birds in the students' area. The *LAB: K-2 Observation Sheet* is more appropriate for younger audiences.

Activity 2: Putting it Together

Students will create a field guide of common birds in Georgia.

Individually or as a class, students will create a field guide by gathering information on common birds in their community. If possible, distribute field guides for students to flip through in order to draw inspiration for their field guide pages. If books are not available, visit an online resource such as *allaboutbirds.org* (Cornell Lab of Ornithology).

1. Using the birds from the *LAB: Common Birds of Georgia Poster*, students will pick a focal bird (or birds). Depending on time and students' abilities, they can create field pages for one or multiple species.
2. Using basic drawing supplies (paper, markers, etc.), students should include information such as size, behaviors, physical features, and songs/calls as well as illustrate the bird's habitat. Where applicable, encourage students to represent at least three different orders of birds in their pages.
3. Once completed, students can create a cover, index, or other additions. Bind the pages together to create individual booklets or a class field guide.

BIRDS GEORGIA

Learning About Birds
Student Guide

Common Birds of Georgia

How many bird species can you identify in your area?

So Many Birds...

More than 300 species of birds can be seen across Georgia during the year. Whether you live in the mountains, on the coast, or somewhere in between, birds are everywhere. From hummingbirds, to hawks, to herons, these diverse animals have fascinated humans throughout history. How many birds can you find right outside your door?

Ruby-throated Hummingbird

Where Do I Start?

Field guides are publications that help you identify something in the natural world. A bird guide in the form of books, smartphone applications, or website is a useful tool to learn more about the many birds in your area before, during, and after birdwatching.

Guides are often **classified**, or organized, by **family**. However, the word "family" is not used the same way we describe our relationship to our parents, siblings, or cousins. Birds in a family share characteristics you can observe, such as similar body and beak shapes, behaviors, or habitats. Get to know a field guide by flipping through one! Notice that families like ducks are arranged together, as are other families like hawks and hummingbirds.

What's in a Field Guide to Birds?

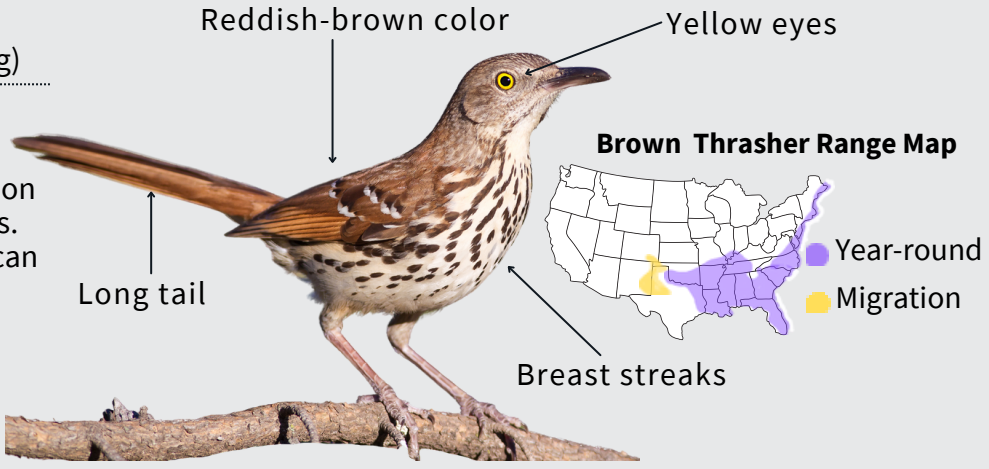
In addition to providing illustrations or photographs, field guides usually highlight:

- **Field Marks** (physical traits): colors and markings; length and shape of beak, legs, and tail
- Habitat: where a bird meets its survival needs—food, water, shelter, and nesting space
- Behavior: actions related to feeding, flying, flocking, and other activities
- Voice: vocalizations, including songs and calls
- Range Maps: maps indicating where species are found at different times of year
- Measurements: body length, wingspan, and weight. (Length is measured from the tip of the beak to the tip of the tail. Wingspan is the length between wingtips when the wings are fully extended.)
- Conservation Status: population abundance, usually noted as common, uncommon, or rare. The status of a species can change over time

Brown Thrasher

L 11.5" WS 13" WT 2.4 oz (69 g)

Solitary species usually found hiding in dense vegetation or hopping in the grass. Forages on the ground, looking for insects. Mimic with large repertoire—can have more than 1,000 songs. Repeats phrases twice, with a pause between each set.



Did you know? Georgia's state bird, the Brown Thrasher, gets its name from the "thrashing" it does while foraging. They use their pointed bill to toss around leaves and dirt in search of food.

What to look and listen for when birding:

- Field Marks: what features stands out?
- Behavior: what is the bird doing?
- Voice: what does the bird sound like?

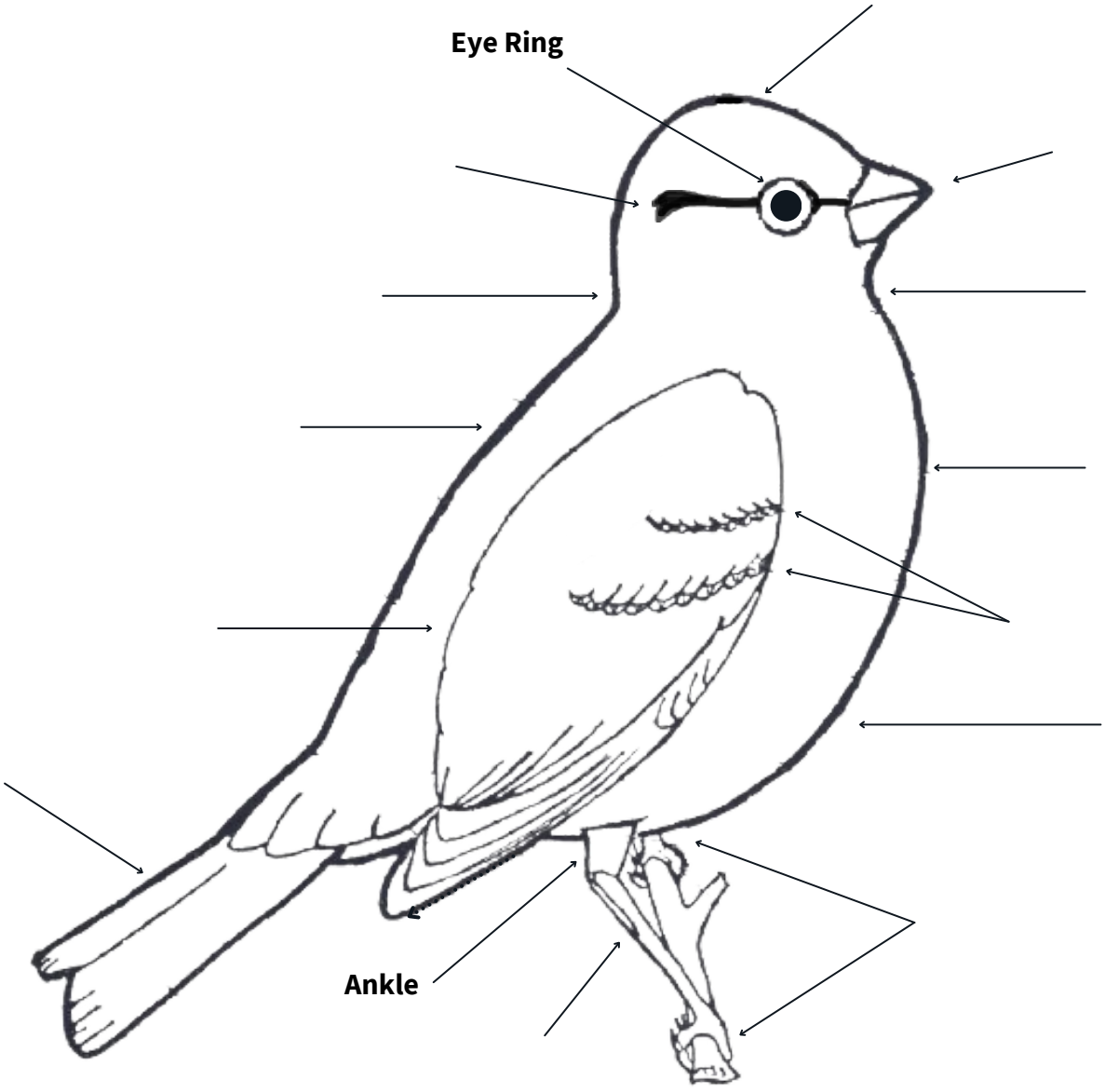
A bird **checklist** is another useful tool to learn about birds local to your area. Checklists outline the species that occur in a specific location during different seasons.

Bird Bodies

Birds are one of the most diverse groups of animals on Earth. Unlike other animals, birds live on every continent, including Antarctica! Yet birds share a general body shape despite variations in size, habitat, diet, and behaviors. When learning to identify birds, it is useful to know their various body parts to help you better describe their **field marks** more accurately.

Instructions: Label the diagram using the vocabulary list. Think about the body parts of other animals, including humans, to help you. Then answer the questions below the diagram.

Nape	Throat	Bill (Beak)	Foot	Eye Line	Back	~~Eye Ring~~
Crown	Wingbars	Belly	Breast	Toes	Tail	Wings



1) Choose one body part and describe its function.

2) Other than the wings, name two body parts that help birds to fly. Explain how.

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Learning About Birds
Educator Guide

Bird Adaptations

Objective(s): Students will (1) define the term adaptation, (2) identify adaptations that are unique to birds, and (3) describe how particular adaptations help birds survive in different environments.

Overview

Students will describe how birds are uniquely adapted to their environment.

Georgia Standard(s) of Excellence (GSE)

SKL2; S1L1; S2L1; S2E3; S3L2; S4L1; S5L1; S5L2; S7L1; S7L2; S7L4; S7L5; SB1; SB5;

Essential Terms

Adaptation
Bill
Generalist
Gizzard
Specialist

Materials

- *LAB: Bird Adaptations Student Guide*
- *LAB: What's on the Menu?*
- *LAB: Know the Toes*
- *LAB: Build-a-Bird Cards*

Additional Resources

Check out these Cornell Lab of Ornithology websites:

- *K-12 Education*
- *All About Bird Anatomy*
- *All About Feathers*
- *Wall of Birds*
- *Bird Cams*

Background

In a world of enormous biodiversity, birds provide the perfect example of **adaptation** to the environment. More than any other group of animals, they have adapted to every imaginable ecosystem around the world. Like amphibians, fish, mammals, and reptiles, birds are vertebrates, or animals with a spine (backbone). As a taxonomic class, Aves, birds have unique physical and behavioral traits that distinguish them from other vertebrates. This unit focuses on three physical features that distinguish birds from other wildlife: feathers, **bills**, and highly specialized feet. Other distinguishing features include hollow bones, wings, a **gizzard**, acute eyesight and hearing, oviparity (egg-laying), and a syrinx (the vocal organ in birds' throats).

Adaptations at Work

Birds must be able to find food, escape predators, and withstand extreme weather. To survive, birds have several unique traits, or **adaptations**, both **physical adaptations** (such as wings), and **behavioral adaptations** (such as cavity nesting).

Feathers

The one feature that distinguishes birds from all other animals is feathers. They fall into different categories based on their structure and location on the bird's body. In addition to facilitating flight, feathers provide insulation and may play a role in camouflage or breeding displays. Collectively, a bird's feathers are referred to as **plumage**. Plumage sometimes changes colors during different seasons (breeding vs. nonbreeding), and males often have different plumage than females (sexual dimorphism).


Contour feather

Down feather


Flight feather

In addition to these main types of feathers, birds have downy semiplumes, as well as filoplumes and bristles (like whiskers and eyelashes).

Bills

Birds' bills are as diverse as birds themselves. The size and shape can tell you about a species' taxonomy, diet, and behavior. The beak, which covers the bill, is composed of keratin, the same protein found in fingernails, hair, antlers, and hooves.

What do a heron's bill and feet tell you about its habitat and diet?


Great Blue Heron

Feet

The feet and toes enable birds to expertly maneuver within their environments. Long, flexible toes are useful for perching and creeping up and down tree trunks; stilt-like legs and webbed toes can wade through mucky marshes; and talons with sharp claws grip small prey with ease.

Many adaptations work together to allow birds to fly. In addition to feathers and wings, some key traits that facilitate flight are:

- Fused, hollow bones make the body of a bird very lightweight. Many of these bones have struts, or thin pieces of bone, inside to help support them.
- The keel is a flattened ridge of bone on the sternum that provides a place for flight muscles to attach.
- Lack of teeth, speedy digestion, and egg-laying keep birds from carrying added weight.

Although the terms "beak" and "bill" are commonly used interchangeably, "beak" technically refers to the keratin coating that covers the bony skeletal structure that is the bill.

Preparing for Flight

Before reviewing the student guide with the class, ask students the following questions to prompt discussion and gauge prior knowledge:

- What are the three key characteristics that set birds apart from other animals?
- What adaptations, physical or behavioral, allow birds to fly?
- What can we learn by studying birds' feet and bills?

Activity 1: Adaptation Match

Students will examine the relationship between birds' physical features and their diets and habitats.

Distribute *LAB: What's on the Menu?* and *LAB: Know the Toes* and review instructions together.

1. Have students complete the handouts. These activities will give them an idea of how bills and feet are adapted to help birds obtain food and survive in their habitats. Reiterate that although birds have preferred diets, species will eat other food items based on environmental conditions (drought, seasonal changes, etc.).
2. Ask students questions to challenge their critical thinking. For example, how do bill shape and diet influence bird behavior? Ask them to describe how different species feed or hunt.
3. Based on the pictures, have students guess each species or what types of bird may possess the pictured features.

Activity 2: Build-a-Bird

Students will create a new species of bird they piece together with randomly drawn cards.

To prepare for this activity, copy and cut out the *LAB: Build-a-Bird Cards*, which includes sets of six different bills, feet, and wings. Place each set of cards in a separate container.

1. Explain to students that they will "build a bird" based on the cards they draw. Their birds will be randomly generated—students will pick one card from each bin and design their species based on the physical features they select.
2. Each student should have three cards in total. Explain that students should also decide what type of food and habitat their bird prefers. (Some habitats include forest, open water or ocean, shoreline, swamp, grasslands/open fields, and city/urban environments. This can also be narrowed to specific eco-regions.) They should also decide how their bird moves and raises its young.
3. Distribute paper and drawing materials. Give students enough time to name and draw their birds and sketch a habitat. Remind students that their bird must be adapted to survive in its environment; therefore, its features should reflect its diet and behaviors. (Their habitat must match at least one of their adaptations, and some birds may be able to survive in more than one habitat depending on what they have chosen.)
4. Once complete, have each student describe their species to the class. A collage of unique bird species can be displayed.

Extension Ideas: Have student create a 3-D model of their bird using craft supplies (straws, sponges, cardboard, feathers, etc.) or write a narrative about their bird, describing its habitat and key behaviors (foraging, roosting, breeding, nesting, etc.).

Type: Conical (cone-shaped)
Adaptation: Wide, pointed bill for cracking open nuts and seeds

Bill
(Example: Northern Cardinal)

Type: Large scoop bill
Adaptation: Large pocket-like bill for scooping fish

Bill
(Example: Brown Pelican)

Type: Straw-like, with a long tongue
Adaptation: Thin, pointed bill for reaching into flowers

Bill
(Example: Ruby-throated hummingbird)

Type: Hooked, sharp bill
Adaptation: Sharp, curved bill for ripping and tearing

Bill
(Example: Osprey)

Type: Long bill, sometimes curved
Adaptation: Long and/or pointed for probing into sand, mud, and soil to catch worms, snails, and other prey

Bill
(Example: Curlew)

Type: Chisel bill
Adaptation: strong, triangular, and pointed bill for drilling holes

Bill
(Example: Red-headed woodpecker)

Type: Wide bill; works like a strainer
Adaptation: Rounded bill lined with ridges for straining insects and plants in water

Bill
(Example: Mallard Duck)

Type: Passive, soaring wings
Adaptation: Long, broad wings for soaring high for long periods of time, soaring on heat thermals (vertical columns of hot air)

Wings
(Example: vultures)

Type: Active, soaring wings
Adaptation: Long, narrow wings for soaring for long periods of time

Wings
(Example: albatrosses)

Type: Elliptical wings
Adaptation: For short bursts of speed, quick takeoff, tight, acrobatic movements in flight

Wings
(Example: sparrows)

Type: Hovering wings
Adaptation: Small wings with specialized nerves and muscles for quick, sustained movements

Wings
(Example: Ruby-throated hummingbird)

Type: High-speed wings
Adaptation: Long and thin, shorter than active, soaring wings. Can maintain speed.

Wings
(Example: Chimney Swifts)

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Build a Bird Card

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Build a Bird Card

Type: Paddle-like with webbed toes
Adaptation: For swimming, paddling, walking and diving through water

Feet/Toes
(Example: cormorants)

Type: Tall legs, toes long and spread
Adaptation: For walking in soft, wet habitats like lakes and marshes

Feet/Toes
(Example: Great Blue Heron)

Type: Zygodactyl (two toes in front, two in back)
Adaptation: Strong grip for climbing up, down, and around tree trunks

Feet/Toes
(Example: Eastern Screech Owl)

Type: Sharp talons, strong grip
Adaptation: For capturing, carrying, and holding prey

Feet/Toes
(Example: Red-Shouldered Hawk)

Type: Long, independent, flexible toes
Adaptation: Interlocking muscles that help toes grasp and perch on branches

Feet/Toes
(Example: Carolina Wren)

Type: Sharp claws, thick toe pads
Adaptation: Thick feet and toe pads for scratching, running, and kicking

Feet/Toes
(Example: Chickens)

Type: Wide bill, works like a strainer
Adaptation: Rounded bill lined with ridges for straining insects and plants in water

Bill
(Example: Mallard Duck)

Type: Passive, soaring wings
Adaptation: Long, broad wings for soaring high for long periods of time, soaring on heat thermals (vertical columns of hot air)

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(Example: vultures)

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Wings
(Example: Ruby-throated hummingbird)

Type: High-speed wings
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Wings
(Example: Chimney Swifts)

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Bird Adaptations

What do more than 10,000 species of birds have in common?

In order to stay alive, birds must be skilled at finding food, move quickly to escape danger, and endure extreme temperatures. As a result, they have several unique **adaptations**, or traits, that help them survive in their environment. Found on every continent and at sea, birds have adapted to diverse habitats around the world more than any other group of animals.
Birds have two types of adaptations:

- **Physical adaptations** are part of a bird's body.
- **Behavioral adaptations** are actions a bird does to survive in its environment.

Bird Bodies and Behaviors

You can learn a lot about birds just by looking at key physical features.

Feathers

Birds are the only animals on Earth that have feathers. Feathers come in a variety of shapes, sizes, and colors, and have different functions. Birds have three main types of feathers:

- Flight feathers, including wings and tail, are smooth and stiff, flexible and lightweight.
- Contour feathers cover the body and have a downy base with stiff, smooth outerparts.
- Down feathers are soft, fluffy feathers close to the skin for insulation.

Can you guess which feather type is which?

Bills

The size and shape of the **bill**, which is made of bone and muscles, determine what a bird eats.

- Raptors like hawks and falcons have sharp, hooked bills for tearing and shredding prey.
- Cardinals and finches have short, coned-shaped bills for cracking seeds.
- Herons and egrets have long, sharp bills for spearing fish, frogs, and other small prey.

Hawks shred, tear, and quickly swallow prey.

Cardinals crack seeds and nuts and use their tongues to swallow.

Herons spear and grab fish, frogs, and other small animals and swallow them whole.

Many species eat a variety of foods depending on what is available, while others have specialized diets. Birds can be categorized by their diets in two ways.

Generalists will grab whatever food is available as environmental conditions change; they do not rely on one type of food.

American Robins are generalists. Their straight, pointed bill enables them to eat seeds, berries, worms, and insects.

Ruby-throated Hummingbirds are specialists. Their long, slender bills are adapted to collect nectar from tube-shaped flowers.

Specialists have adaptations that make them experts at collecting or hunting a certain type of food. Some species are restricted to specific foods, limiting their choices when seasons change.

Feet

Just like bills, bird legs and feet can serve multiple functions—swimming, wading, climbing, perching, and running. Looking at a bird's feet may provide clues to its behavior, diet, and habitat.

- Ducks and anhingas have webbed feet to swim and propel them through water.
- Chickadees and nuthatches have long, flexible toes to perch on branches.
- Owls, ospreys, and hawks have powerful talons to grip their prey.

Osprey

What Makes a Bird, a Bird?

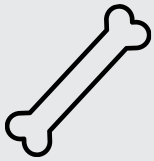
Feathers

- Are unique to birds—no other living animals have them.
- Play important roles in flight, insulation, camouflage, and attracting mates.
- Vary in structure, depending on where they are located on a bird's body.

Wings

- Have layers of feathers.
- Allow birds to fly and swim.
- Enable different types of movement depending on shape (soaring, hovering, etc.).

Hollow Bones



- Provide lightweight but strong structure.
- May be entirely hollow or only partially hollow.
- May have struts (thin pieces of bone) inside for support.

Bill

- Is covered by a keratin coating (like our fingernails), called the beak.
- Is used for collecting or catching food, drinking water, feeding young, preening (grooming), and defense.
- Differs in shape depending on the bird's diet.

Two-Part Stomach

- Takes the place of teeth.
- Breaks down food with acids in the first chamber.
- Grinds and crushes hard food like seeds in the second chamber, the **gizzard**.

Egg-Laying

- Eggs are typically laid in nests, which come in many shapes and sizes.
- Hard-shelled and fragile, bird eggs vary in shape, color, and size, depending on the species.

Acute Vision and Hearing

- These senses are usually much stronger in birds than in humans.
- Birds' ears are small holes on the sides of the head covered by feathers.
- Birds primarily have one of two types of vision.
  - Binocular: when both eyes focus on the same object
  - Monocular: when each eye focuses on a different object at the same time

Warm-Bloodedness

- Enables birds to maintain a relatively constant body temperature in hot or cold weather (like mammals).
- Allows birds to survive in a wide range of climates and habitats.

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Learning About Birds
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Birds and Their Environment

Objective(s): Students will (1) describe different roles that birds fill in an environment, (2) describe a bird's food web, and (3) describe how birds are impacted by environmental changes.

Overview

Students will explore the interdependence of organisms in the environment.

Georgia Standard(s) of Excellence (GSE)

SKL1; SKL2; S1L1; S2E3; S4L1; S5L1; S6E6; S7L1; S7L4; SB5; SEC1; SEC3; SEC5; SZ4; SZ5.

Essential Terms

Community
Decomposer
Ecosystem
Food Web
Habitat
Interdependence
Primary Consumer
Producer
Secondary Consumer
Tertiary Consumer
Trophic Level

Materials

- *LAB: Birds and Their Environment Student Guide*
- *LAB: Weave the Web activity cards*
- *LAB: Weave the Web handout*

Additional Resources

- *LAB: Bird Conservation*
- *LAB: Bird Adaptations*
- *LAB: Nurturing Nature with Natives coloring book*

Background

Birds offer students opportunities to observe first-hand how organisms interact and exchange energy within **ecosystems**, creating a **community**. This unit provides a framework for studying birds' roles in their environments, their relationships with other organisms, and how they are affected by environmental changes. As you explore bird habitats in your area, think about what defines an ecosystem or community. You will reveal a whole new dimension of your environment!

The Flow of Energy

A **food web** graphically represents the **interdependence** and exchange of energy between organisms (who eats whom). The **trophic level** of an organism is the position it occupies in a food web, indicating how it obtains its energy.

The **sun** is the driving source of energy. It sustains life on Earth. The sun's rays provide the food for plants and algae to grow.

Producers make their own food by photosynthesizing sunlight for energy. They are at the bottom of the food chain because they are eaten by other organisms.
Example: Oak trees not only provide acorns, but their leaves support the life cycles of insects that many birds and other consumers depend on.

Primary Consumers eat producers like plants or algae and may be preyed upon by upper-level consumers (predators). They are considered herbivores.
Example: Mourning Doves eat mostly seeds but also consume grasses, herbs, and berries.

Secondary Consumers eat primary consumers and may also consume producers, making them omnivores.
Example: A Downy Woodpecker's diet consists mostly of insect larvae, ants, and caterpillars, but also includes seeds and berries.

Tertiary Consumers, sometimes called apex predators, prey upon lower-level consumers and play a valuable role keeping ecosystems in balance. They have few, if any, natural predators themselves.
Example: The Great Horned Owl consumes a diverse diet of prey, including mammals, reptiles, and other birds.

Decomposers feed off dead organisms (carrion).
Example: Turkey vultures serve as nature's recyclers and sanitizers. By breaking down organic material, vultures cycle nutrients back into the environment, where energy exchange continues.

We're All Connected

When habitat loss, invasive plant or animal species, disease, pollution, and other threats endanger bird populations, we lose those valuable environmental services and the balance of the whole food web. Ask students to consider how the food web shifts when:

- **Non-native species are introduced** (domestic cats, kudzu vine, pythons, etc.).

[Non-native predators like cats and pythons reduce the available prey for native species like owls and foxes. Invasive plants like kudzu can overtake an area, reducing the food and habitat available to wildlife.]

- **Pesticides and rodenticides are present.**

[Toxins reduce available prey and bioaccumulate in the food web, poisoning higher-level consumers.]

- **A trophic level is removed** (for example, an apex predator is eliminated).

[When an apex predator is removed, prey species may reproduce unchecked, potentially leading to overpopulation, overgrazing, starvation, disease, etc.]

Preparing for Flight

The nice thing about birds is that they are readily found almost anywhere and need to eat a lot. Because they occupy almost every trophic level in their community, from primary to tertiary consumers to decomposers, they provide the perfect opportunity for students to observe trophic interactions. Complete *LAB: We're All Connected* on the student guide to prepare students for the activities below.

Activity 1: Weave the Web

Students will illustrate the interconnectedness of organisms in food webs.

Prior to leading this activity, print and/or laminate *LAB: Weave the Web cards*, holepunch the top of each picture, and tie a piece of yarn through each hole, long enough for students to wear over their necks. You will also need a ball of yarn. Alternatively, you may use the *LAB: Weave the Web Handout* as a worksheet.

1. Ask students to arrange themselves in a circle, with the teacher in the middle. Randomly distribute one *Weave the Web card* to each student. Explain that each student represents a native species in Georgia and that the group will recreate a food web using a ball of yarn. The teacher, playing the role of the sun—the driving force of energy that supports life on Earth—should toss the yarn to a producer.
2. Using the diet descriptions on each card, students will toss the ball of yarn to another organism with whom they have a trophic relationship (what they eat or what eats them). Challenge the group to connect all the organisms. Be sure to keep the string taut.
3. When completed, review how each organism connects to one another, reiterating the importance each trophic level plays in the overall food web. You may also use this time as an opportunity to introduce environmental disturbances and their potential impacts on the food web. Using the scenarios listed above (We're All Connected), ask the students who are affected by the disturbance to tug on the yarn and notice how many others feel the pull. Note the broad effects disturbances can have on an entire food web.

Activity 2: Explore your Environment

Students will make observations of ecological interactions in the environment.

Review the definitions of ecosystem, environment, community, and habitat. Discuss how these concepts are related. A visual aid may be drawn to help illustrate.

1. Working in pairs or small groups, students will use two or more blocks of time to record observations about their outdoor environment around the school/facility. Students should record (a) types of organisms they see (plant descriptions may be broad) and where, (b) weather, (c) landforms, and (d) sources of water. Students may choose any format to record observations. If possible, provide field guides, binoculars, or hand lenses. Be sure students record at least one bird.
2. After data collection, conduct a group discussion to answer these questions:
    a. What was the most numerous organism? What type of trophic interactions did you observe?
    b. What role did the bird have? Do you think birds compete with other organisms?
    c. Identify a mutually beneficial relationship between two organisms.
    d. Pick a realistic environmental change that could occur in this environment (such as invasive species, drought, flooding, urbanization, pollution). Would it matter if one species disappeared? How would this affect the ecosystem?
3. Students will create an illustration of their observations to share with the group. Repeating this activity over time is encouraged to uncover possible patterns in observed species and trophic interactions.

BIRDS GEORGIA

Learning About Birds
Student Guide

Birds and Their Environment

How do birds shape our world?

The Value of Birds

Birds provide many vital services in the environment. They control insects and rodents, pollinate, spread seeds, provide clean-up services, and more. Although we often overlook them, the planet would be in trouble without birds.

In order to survive, birds need healthy **habitat** where they can find food, water, shelter, and nesting space. These habitats are part of a larger **ecosystem**, where living organisms (like plants and animals) and non-living things (such as water and soil) interact and exchange energy. Many organisms within ecosystems are **interdependent**, relying on each other in different ways to survive. For example, in a forest, many birds depend on trees to find food and nesting space, while trees often rely on birds to spread their seeds in order to reproduce. Different organisms living together in the same habitat create a **community**, where each species fills an important role.

The Flow of Energy

Birds must find food to survive. **Food webs** illustrate who eats whom and how organisms exchange energy. Each organism fills a **trophic level** in the web based on how it obtains energy (or food). There are five trophic levels, each with a different relationship to the sun, the main energy source for all food webs.

Summer Tanagers are secondary consumers. They eat insects and spiders, as well as seeds and berries.

Instructions: Read the definition of each trophic level below, and then label each organism with the correct term. Complete the food web by drawing an arrow from each organism to its energy source(s).

Oak Tree

_____

Food webs begin with the sun, which provides the energy for plants to grow.

Turkey Vulture

_____

Great Horned Owl

_____

Downy Woodpecker

_____

Mourning Dove

_____

- **Producers** make their own food using sunlight.
- **Primary Consumers** eat plants or algae.
- **Secondary Consumers** eat primary consumers and may also consume producers.
- **Tertiary Consumers** are at the top of the food chain and have no natural predators.
- **Decomposers** feed on and break down dead or decaying matter, recycling nutrients back into environment.

Next time you're outside, pay attention to the trophic interactions around you. Energy exchange is happening everywhere!

We're All Connected

As both consumers and decomposers, birds provide important environmental services that help people and the planet. Their trophic interactions are happening everywhere, creating interdependent threads in the food web. If the population of one organism rises or falls because of environmental change, other species are also affected. Look closely at the image below and answer the following questions.

What wildlife-friendly features are pictured in this habitat?

_____

_____

_____

What producers and consumers can you identify? Be as specific as possible.

_____

_____

_____

What trophic interactions may be taking place? Do any of these interactions benefit people?

_____

_____

_____

Consider this: How would removing one organism from a habitat affect the rest of a food web? What might happen if an invasive plant or new predator was introduced? Or if poisons are used?

BIRDS GEORGIA

BIRDS GEORGIA

Learning About Birds
Educator Guide

Bird Songs and Calls

Objective(s): Students will (1) examine the biology of bird sound, (2) describe the differences between songs and calls, and (3) identify the songs and calls of at least three local species.

Overview

Students will explore the role that sound plays in bird behavior and develop their listening skills.

Georgia Standard(s) of Excellence (GSE)

S1P1; S4P2; S5L2; S6E6; S7L1; S7L4; SB5; SEC1; SEC2; SEC3; SEC5; SEV4; SZ3; SZ4; SZ5.

Essential Terms

Call
Frequency
Mnemonic
Pitch
Song
Spectrogram
Syrinx

Suggested Materials

- *LAB: Songs and Calls Student Guide*
- Merlin Bird ID app
- *eBird.org*

Additional Resources

- *LAB: Cheep Sheet for Bird Songs and Calls*
- *Bird Song Hero (Cornell Lab of Ornithology)*

Background

Birds are everywhere, and attuning to their sounds and learning to identify the unique vocalizations of different species sparks curiosity and expands students' connection to the natural world around them.

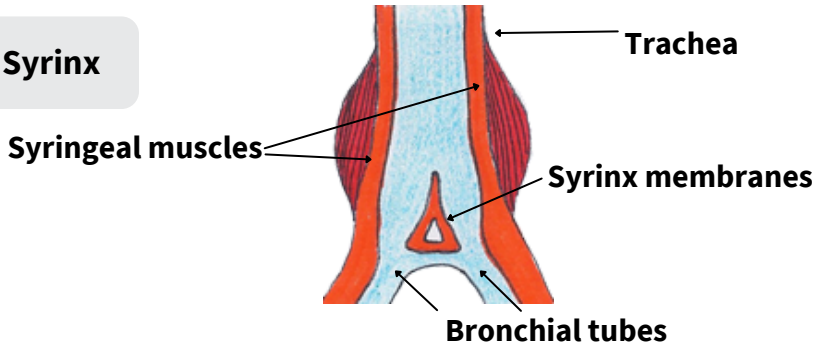
Sound Science

Sound is a form of energy caused by vibrations moving through air or matter that can be heard. These vibrations moving through space and time are called sound waves. One complete vibration is equal to one wavelength of energy. How fast a vibration occurs is called **frequency**, which determines the highness or lowness of a sound, the **pitch**. The loudness of the sound is determined by the amount of energy the wave carries, the amplitude.

Biology of Bird Song

Birds do not produce sound like humans. Instead, their "voice box," the **syrinx**, is made up of membranes that vibrate when air is forced over them. This organ has two halves, located where the two tubes to the lungs split off from the windpipe. Birds control the the sound frequency and loudness of their sounds with muscles attached to the syrinx. These muscles control the amount of air passing through the syrinx and alter the tension of the syrinx membranes. These membranes resonate on both the inhale and the exhale, enabling some birds to sing continuously for several minutes without stopping. Because the syrinx has two halves, some birds can also produce different sounds simultaneously by controlling each side of their syrinx separately.

The Syrinx



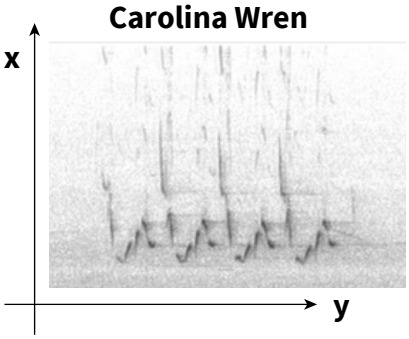
Calls versus Songs

Birds produce two types of sounds, **calls** and **songs**, and each species has its own unique vocalizations. Calls communicate a bird's location, orient a flock, signal food or water, and alert others to danger and are inherited biological traits passed from parents to their young. Songs are complex learned sounds used for courtship and holding territory. They advertise a bird's species, age, gender, fitness, and breeding status. Singing serves as a way for individuals to recognize one another, even at a distance, and strengthens pair bonds between mates. For many species, song repertoire may be as important as plumage in choosing a mate. Singing also signals to competing males that a territory is claimed. Interestingly, a population of the same bird species in a geographic area may have songs that differ from populations in other areas. These differences are called dialects.

Song Spectrograms

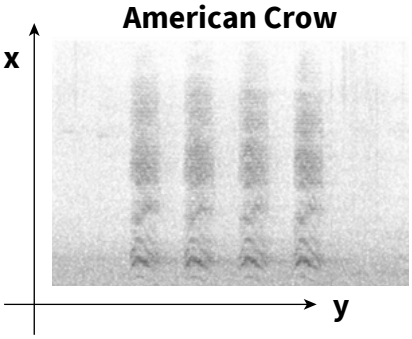
A **spectrogram**, or sonogram, is a scientific way of looking at sound that is similar to reading musical notation. Time is on the x-axis. **Frequency** is on the y-axis. The song runs from left to right on the graph, with high-pitched notes near the top and lower notes below. Loud sounds appear darker on a spectrogram, while softer sounds are lighter. Spectrograms can be helpful tools when teaching students to identify bird songs and calls, especially for visual learners.

Carolina Wren



This spectrogram shows rising and falling notes, repeated four times, of a Carolina Wren's song.

American Crow



The American Crow's loud, nasal call is represented by the dark, blurry lines on this spectrogram.

Preparing for Flight

Use the Merlin Bird ID app on a mobile device or visit *eBird.org* (under the "Explore Species" tab) to access spectrograms and other information for various bird species. Play the song and calls of a few local species and ask students if they can tell the difference between a song and a call. Then focus on the songs of those species, asking students to listen closely to pitch, rhythm, tempo, and quality and to describe those elements or to create **mnemonics** for the sound. Finally, look at the spectrograms for those songs and ask students to consider how the pictures represent the sounds they heard.

Use the *LAB: Songs and Calls Student Guide* to have students complete Activity I: Sound Pictures. Have students practice creating their own spectrograms for a few different local species.

Extra practice: As a class, try playing *Bird Song Hero* (Cornell Lab of Ornithology), a fun online game that asks players to match birdsongs to their spectrograms.

Activity 1: Sound Pictures

Students will practice drawing their own spectrograms and qualitatively describing songs and calls.

1. Review the *LAB: Bird Songs and Calls Student Guide* with the group. Using eBird or Merlin, select songs of four, preferably local, species to play aloud. Play the sound for the group several times, asking students to draw a picture of what they hear.
2. Instruct students to write down some adjectives that describe each song (pitch, rhythm, tempo, quality). Examples include fast, slow, loud, soft, harsh, sweet, buzzy, squeaky, trilling, whistle/bell-like, insect-like, scratchy, etc. Quality is subjective and can be described in many different ways.
3. Ask several students to share their work, and compare and contrast students' spectrograms and descriptions of the songs. How closely do their spectrograms match with those on Merlin or eBird?

Activity 2: Sound Mapping

Students will listen for birds and map their observations by drawing sound maps.

Students can take inventory of the sounds around them by creating a sound map.

1. Bring students outside and have them spread out with a paper and pencil.
2. Instruct students to draw a dot in the center of the paper to represent themselves. Ask them to remain quiet and focus on the sounds they hear around them, both natural and manmade.
3. Once everyone is focused, instruct students to student to draw a map of the sounds they hear around them for one to two minutes, using pictures or symbols—or spectrograms! to represent different sounds they hear in relation to where they are sitting. These should be quick, simple sketches to keep a visual record of what they hear. Each time they hear a repeated sound, they should record it again, using the same sketch or spectrogram.
4. After the activity is completed, ask students about the sounds they heard. Did they hear more natural or manmade sounds? Were certain sounds concentrated in one location, or were the sounds spread out? How many different bird sounds did they notice? Was there more than one bird making the same sound? What sounds were the most noticeable?
5. Encourage students to share their maps, explaining why they represented a sound a certain way.

Bird Songs and Calls

How do birds communicate?

We may not always be aware of them, but if the sounds of birds disappeared, people would notice. Bird tweets, chirps, and songs fill the world around us. But how do they produce such different sounds, and what are they saying?

The Biology of Bird Song

Birds have a different way of producing vocal sounds than other animals. Mammals, including humans, have a "voice box" (larynx) at the top of the throat with vocal cords that vibrate when air is forced over them. This voice box enables a baby to cry, a cow to moo, or a dog to bark. Unlike humans, birds produce sounds from an organ called the **syrinx**, which has two halves, located where the tubes to the lungs split off from the windpipe. The syrinx muscles vibrate to control the **pitch** of the sounds (highness or lowness) and the amount of air that passes through, which affects the volume (loudness) of the sound.

Calls versus Songs

Every bird species makes its own unique vocal sounds. Those sounds enable birds to recognize one another and communicate—and they also help birders to identify what species they hear. Some species, especially songbirds, make hundreds of complex sounds, while others only make simple sounds, like chirps or grunts. These songs and calls have different purposes.

- **Calls** are simple sounds that birds make to share their location, signal food or water, orient a flock, or alert others to danger. Birds may have different calls with various meanings.
- **Songs** are complex sounds used to attract a mate and to defend territory. Singing strengthens bonds between males and females and alerts competing birds that a territory is claimed. Because singing requires a lot of energy, a singing bird indicates that the bird is healthy.

Did you know? Some birds use non-vocal sounds to communicate. Woodpeckers drum on trees to attract mates and claim territory; owls clack their bills as a warning; hummingbirds make sounds with their wings during courtship displays.

Birding by Ear

Most birds are heard first and then seen—if they are seen at all. You can identify what species of birds are around just by learning their songs and calls. Listen closely to the birds around you and try learning their sounds by using these tips:

- Go outside and watch a bird singing. Try to mimic the sound.
- Compare the sound to something familiar, like a whistle or the buzz of an insect.
- Put easily remembered phrases (**mnemonics**) to the rhythm of the song. For example, many birders use the phrase "Drink your tea!" for the song of the Eastern Towhee or "Teakettle, teakettle, teakettle" for the song of the Carolina Wren.
- Describe what you hear, listening for the following elements of sound:

Eastern Towhee
"Drink your tea!"

Pitch
High or low notes?
Rising or falling?

Tempo
Fast or slow?
Does the speed change?

Rhythm
Long or short notes?
Pauses or repetition?

Quality
What does it sound like?
Does it remind you of anything?

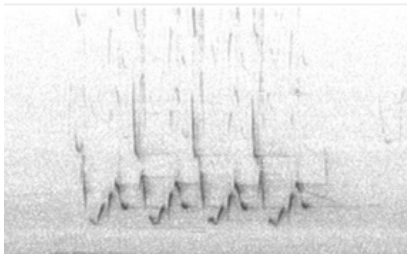
Eastern Screech-Owl

Do Birds Have Ears? Birds don't have external ears, but they do have ear holes on the sides of their heads, just like we do! Specialized feathers protect the ears from damage. Some owls appear to have ears on their heads, but those are actually just tufts of feathers that help with camouflage and body language.

Song Spectrograms

Sound is a form of energy caused by vibrations that move through air or matter and can be heard. **Spectrograms** allow us to "see" sounds as pictures, sort of like reading music, and can help us learn to recognize different bird songs. The song runs from left to right, with high pitched notes near the top and lower ones below. Loud sounds appear darker than soft sounds. Fuzzy lines may indicate a nasal or scratchy quality to the notes, while clean lines indicate clearer notes.

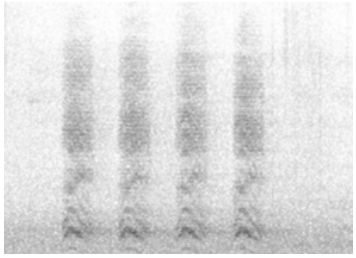
Carolina Wren



“Tea kettle, tea kettle, tea kettle, tea kettle!”

The Carolina Wren's loud, sweet, musical song is usually repeated three or four times.

American Crow



"Caw! Caw! Caw! Caw!'"

The American Crow's most common call is a harsh, repeated "caw!".

Activity 1: Sound Pictures

Listen carefully to the calls and songs played by your teacher and draw an image (spectrogram) representing each sound in the boxes below. Then describe the song or call with a few words.

Species 1 Call Song Description	**Species 2** Call Song Description
Species 3 Call Song Description	**Species 4** Call Song Description

Why learn to bird by ear?

- You can figure out what species of birds are around just by listening.
- Many birds look similar but can be told apart by their songs or calls.
- It can be an important skill for careers in research and education.
- It is fun and challenging!

Carolina Chickadee
“Chicka-dee-dee-dee”

BIRDS GEORGIA

Bird Conservation

Objective(s): Students will (1) define conservation, (2) describe major threats to birds, and (3) develop solutions to help birds in their community.

Overview

Students will identify local threats to birds and develop a conservation action plan to help them.

Georgia Standard(s) of Excellence (GSE)

S1L1; S2E3; S3L2; S4L1; S6E6; S7L4; SB5; SEC1; SEC5; SEV4; SEV5; SZ4; SZ5.

Essential Terms

Bioindicator
Community Science
Conservation
Invasive Species
Native Species

Materials

- *LAB: Bird Conservation Student Guide*
- *LAB: Using a Bird Checklist*
- eBird app
- eBird Essentials for Educators (Cornell Lab K-12 Education)

Additional Resources

- *LAB: Common Birds of Georgia*
- *LAB: Common Birds of Georgia poster*
- *LAB: Nurturing Nature with Natives coloring book*
- *LAB: Birds and their Environment*
- *LAB: Migration Hurdles (Bird Migration)*
- Merlin Bird ID app

Background

Our planet's health depends on birds. They provide essential ecosystem services that save us billions of dollars, including pollination, seed dispersal, pest control, and sanitation. Yet bird populations are in trouble, and as **bioindicators** of the quality of the environment, birds are sending a warning. Equipping the next generation to steward our natural resources is more important than ever.

Birds Georgia **conserves** birds through programs that focus on conservation, education, and community engagement. Our efforts target the major threats to birds, raise public awareness, and attempt to create places where birds and people thrive.

Three Billion Birds

The numbers are staggering. Recent comprehensive research shows that North America's bird population is down by nearly three billion birds since 1970. This devastating loss—one in four birds in one generation—has occurred across every biome. Major contributors to this decline are:

- **Habitat loss:** When habitat is destroyed, degraded, or fragmented for agriculture or urbanization, ecosystems break down and biodiversity declines. Worldwide, habitat loss is the leading cause of declining bird populations.
- **Cats:** In North America, cats are second only to habitat loss as the largest human-related cause of bird deaths. An estimated 2.4 billion birds are killed by cats each year in the United States alone.
- **Window collisions:** Current research estimates that as many as 1.5 billion birds perish in North America each year from colliding with windows. Birds may not see the glass or may be confused by reflections.

Window treatments break up the reflective surface area and reduce the number of bird collisions.

- **Light Pollution**: Migrating birds often become disoriented when city lights obscure the night sky that helps them navigate. "Trapped" by light, birds may circle in confusion until exhaustion forces them to land in urban areas, where windows and limited resources pose threats.
- **Invasive Species**: Non-native species can increase competition for resources (like sunlight or food) and create disturbance to an area. In addition, non-native plants (like kudzu and English ivy) don't support the life cycle of native insects, which usually require specific host plants to lay their eggs. (Monarch butterflies, for example, must lay their eggs on milkweed.) In contrast, the leaves of native trees and flowers support the life cycles of butterfly and moth species, whose caterpillars are a crucial part of a bird's diet.
- **Pesticides**: Weed killers and insecticides not only reduce the available food supply for birds, but they also bioaccumulate in the environment in our soil and water, poisoning wildlife and people.

Grow Native!

As urbanization increases and natural habitats disappear, planting native plants is one of the best ways to restore the habitats birds and other wildlife need. In addition to supporting insect life cycles, they are also better adapted to the local soil and climate and provide healthier food resources (like berries, seeds, nectar) timed with the seasons birds need them. Since most terrestrial birds rely on insects to feed their young, native plants are crucial to their breeding success.

It Takes a Flock

Other ways that individuals and communities can help birds are by removing invasive plants, eliminating pesticides, dimming outdoor lighting during migration periods, making windows safe for birds, supervising pets outdoors, and providing clean bird feeders and water sources.

An American Goldfinch perched on a native coneflower.

Preparing for Flight

The simplest way to turn students into scientists and conservationists is by participating in **community science**—the collection of data by everyday people, usually in support of larger projects with professional scientists. No one scientist can track all birds, but with the public's help, researchers can study population fluctuations, migration patterns, changes in range, and many other facets of birds' lives.
eBird, an online community science database developed by National Audubon Society and Cornell Lab of Ornithology, allows users to record their birding observations. This smartphone application and online portal is a free, accessible resource available to use with students to keep track of birds, explore dynamic maps and graphs, share sightings with other birders, and contribute to global science.

Activity 1: Community Science at Work

Students will complete a class bird checklist and submit their observations to the eBird database.

Community science projects like eBird enable students to participate in the scientific process, connect classroom learning with real world skills, and better understand the natural world. Moreover, by using eBird, students provide important contributions to bird conservation. Even 10 or 15 minutes in the field is sufficient. Taking students outside regularly allows them to create their own datasets, track changes over time, and ask and answer questions about their local birds.
To use *eBird,* basic bird identification skills are necessary. Review the following resources before taking students outside to complete a checklist.

- *LAB: Common Birds* provides guidance for taking students outside to observe and identify birds.
- Cornell K-12's *eBird Essentials for Educators* provides tips and tools for using eBird with students.
- Cornell's Merlin Bird ID makes identification simple by providing photos, sounds, and ID tools.

Activity 2: What's the Solution?

Students will collaborate to develop a bird conservation action plan.

In this problem-based learning activity, students will identify a local threat to birds and conceptualize, design, and launch an innovative solution.

1. **Create a Habitat Map**: Encourage students to act locally for bird conservation by first creating a map of their school or home from a “bird’s eye view,” illustrating bird-friendly features and threats. Are there native plants? Is there a water source? What types of vegetation are present for food, shelter, and nesting? Is there glass that kills birds? By creating a map and legend of these features, a visual representation is developed for students to pinpoint a conservation problem.
2. **Identify a Threat and Design a Solution**: Students will then gather information on their selected threat and develop their conservation action plan. Depending on students' and the schools' resources and capabilities, a few ideas for conservation action plans include:

- Leading a school awareness campaign on bird conservation issues through posters, social media, public service announcements, etc. (Examples: "Lights Out," "Grow Native for Birds," "Cats Indoors").
- Organizing a workday to clean up litter, remove invasive species, or plant native plants.
- Designing, building, installing, and maintaining a feeding station or water source.

It takes a flock to solve conservation challenges. Encourage students to share their birding knowledge and skills with friends and family!

BIRDS GEORGIA

BIRDS GEORGIA

Learning About Birds
Student Guide

Bird Conservation

What is conservation, and how can I help conserve birds?

Why Birds?

Consider for a moment what the world would be like without birds. Beyond their beautiful colors and songs, birds provide important ecosystem services that benefit humans. They pollinate flowers, spread seeds, control pests, and prevent the spread of disease. Because they are sensitive to pollution, birds also serve as important **bioindicators**, helping scientists to assess the health of the environment. In fact, the health of our planet—and our own well-being—depends on healthy bird populations.

A Brief History of Bird Conservation

Conservation is the act of protecting a natural resource from waste, loss, or destruction. Soil, water, trees, and wildlife are a few examples of resources to conserve.

One of the first bird conservation organizations in the United States was the Massachusetts Audubon Society, founded in1896 when a group of concerned women, led by Minna Hall and Harriet Hemenway, came together to protect waterbirds like egrets and herons from the women's hat industry. In 1905, the National Audubon Society was founded, and since then, the number of nationwide chapters continues to grow.

In 1900, another early conservationist, Frank Chapman, proposed a new tradition to replace the traditional Christmas "Side Hunt" (a competition to shoot birds and mammals) and started the Christmas Bird Count, now the longest-running **community science** project in the world. As part of this project, groups of everyday bird lovers gather in defined locations to count birds and report their sightings to a scientific database every December.

Did you know? Feathers were a popular decoration for women's hats in the 19th century.

Threats to Birds

Birds face numerous threats across the globe that have caused serious declines in their numbers. Some of the major human-caused threats impacting birds worldwide include:

Habitat Loss

The biggest threat to birds is habitat loss. When natural habitats are destroyed for farming or development, it may no longer be able to provide the food, water, shelter, and space to raise young that wildlife need for survival. Every day, wildlife has less space to call home.

Agriculture is necessary for human survival but destroys vital habitat for birds and other wildlife.

Invasive Species

Invasive species, which don't naturally occur in an area, compete with native wildlife. When invasive plants overtake an area, they crowd out native plants and reduce the food and habitat available to wildlife. Invasive animals compete with native species for those same resources.

Invasive plants like kudzu suffocate native species that birds and other wildlife need, often causing ecological and economic harm.

Cats

Free-roaming cats cause billions of bird deaths around the world each year, as well as the deaths of other wild animals.

Pesticides

Weed-killers and insecticides not only reduce the available food supply for birds, they also poison our soil and water and build up in the food web.

Window Collisions

Clear glass and reflective surfaces confuse birds, making it difficult for them to determine where safe flyways exist.

Light Pollution

Bright city lights confuse birds migrating at night, causing them to crash into windows or land in poor habitat.

No Caterpillars, No Birds

Without native plants, birds cannot survive. Native plants like oak trees and goldenrod support the life cycles of leaf-eating caterpillars and other insects, which even seed-eating birds rely on to raise their chicks. Non-native plants, in contrast, support few local insect species, if any, reducing the food available to birds and other wildlife.

As a bird conservation organization, Birds Georgia builds places where birds and people thrive through three important areas of work:

- **Conservation:** restoring habitat to create healthy ecosystems, monitoring bird populations, and reducing threats to birds
- **Community Engagement:** providing opportunities for people to enjoy the beauty of the birds and access healthy green spaces
- **Education:** equipping people with knowledge and tools to appreciate birds and take action to conserve them

Did you know? To raise one nest of chicks, parents must feed them up to 9,000 caterpillars.

It Takes a Flock

No one person can do everything to help birds. Together, our efforts as individuals can add up to major positive impacts. Consider some simple actions you can take to conserve and reduce threats to birds:

- Improving bird habitat by planting native plants (and removing invasive plants)
- Maintaining a bird feeder or bath
- Reducing light pollution during migration periods by keeping outdoor lights off at night
- Keeping pets on a leash or supervising them outdoors
- Installing simple treatments, like decals or screens, to windows that cause problems for birds

Everyone can help birds! As **community scientists**, regular people provide valuable bird data for science just by observing birds and reporting their sightings to the public eBird database at the Cornell Lab of Ornithology. Scientists can't be everywhere, so the checklists submitted by birders all over the world provide an enormous amount of information about birds that can be used to conserve them.

Careers in Conservation

We often think of scientists as people with white coats in a laboratory—but many exciting science careers take place outside the science lab, including bird conservation. And conservation work depends on people in a number of fields beyond science. Consider these exciting career possibilities:

Think about your skills and how they could be used to conserve birds or other natural resources. What other conservation careers can you imagine?

Science
- Biologist
- Refuge Manager
- Biomedical Researcher

Art
- Wildlife Artist or Photographer
- Writer or Journalist
- Content Creator

Law
- Environmental Attorney
- Policymaker

Engineering
- Environmental Engineer
- Public Utilities Operator

Technology
- Computer Programmer
- Data Analyst
- Program Developer

Education
- Environmental Educator
- Outreach Director
- Park Ranger

Math
- Finance Manager
- Data Analyst
- Applied Ecologist

Business
- Executive Director
- Development Manager
- Finance Manager

How could you put your skills and interests to use in a career helping birds?

_____

_____

_____

BIRDS GEORGIA

Learning About Birds
Educator Guide

Bird Migration

Objective(s): Students will (1) define migration, (2) examine how birds migrate, and (3) identify hazards to migrating birds in their local community as well as solutions to help them.

Overview
Students will discover why birds migrate and develop solutions to help migratory species in their community.

Georgia Standard(s) of Excellence (GSE)
S1L1; S2E3; S2L1; S3L1; S3L2; S6E6; S7L1; S7L4; S7L5; SB1; SB5; SZ4; SZ5.

Essential Terms
Breeding Ground
Bird Count
Migration
Stopover Site
Wintering Ground

Materials
- *LAB: Mysteries of Migration Student Guide*
- *Migration Hurdles cards*
- *LAB: Cheep Sheet for Bird Songs and Calls*

Additional Resources
- *LAB: Migration Mapping*
- *LAB: Bird Conservation*

Background

Bird migration has awed people for centuries. Signaled by a change in seasons and the availability of resources, migration is an especially exciting period for students to catch a glimpse of species that do not normally live in their area.
Roughly 40% of the world's 10,000+ bird species are migratory, including about 350 North American species. Migrations differ by species and sometimes even by populations within a species. While the science of migration isn't fully understood, we do know that birds undergo hormonal changes in their bodies (their "internal clock") triggered by seasonal changes in day length, weather, and food availability. These physical changes, combined with amazing navigational abilities, enable birds to complete astonishing journeys. Teaching students about the migratory birds that visit their area and making them aware of the hazards they face will empower them to take action to help.

Bird Superpowers

Migratory birds have extraordinary navigational capabilities. In addition to using their acute vision to follow landmarks or celestial bodies to navigate, many birds can sense the earth's magnetic field (an invisible field produced by the Earth's rotation and liquid-metal core), which keeps them on course. Some species even use a sense of smell or hearing to navigate, picking up odors and sounds from hundreds of miles away. In addition, migrating birds undergo some dramatic physical changes. To fly vast distances between breeding and wintering grounds, birds may shrink their internal organs, rapidly gain and burn through fat, sleep on the wing, and more.

Stopover Sites: Crucial Pit Stops

Although some species fly nonstop between breeding and wintering grounds, many visit **stopover sites** as a survival strategy. They rely on predictable habitat that offers food, water, shelter, and a safe space to rest, often visiting the same locations annually. Today, habitat loss and degradation threaten the availability of these invaluable stopover sites and the migrating birds that rely on them.

Red Knots travel from wintering locations in South America, Africa, and Australia to nesting grounds in the High Arctic. Their spring migration is perfectly timed to coincide with the spawning of horseshoe crabs. In April and May, Red Knots pause at stopover sites to gorge on horseshoe crab eggs and replenish fat. **A single Red Knot needs to eat roughly 400,000 eggs during stopover to complete migration**. Sadly, coastal development and the use of horseshoe crabs in the bio-medical industry have put Red Knot populations in peril.

Students often mistakenly assume that birds migrate because of cold weather. While cold weather may trigger migration, birds are compelled to migrate because of diminishing resources (like insects or nectar, or safe spaces to nest). Many species are able to find ample resources year-round without migrating.

Migration Hurdles

We don't understand everything about migration, but we do know that birds expend tremendous energy and face many perils. Scientists estimate that almost half the birds that leave their breeding grounds in the fall will not return again the following spring. The most significant man-made perils that migrating birds face include:

- **Habitat loss**—degrades quality and the availability of resources.
- **Windows and tall buildings**—create collision hazards.
- **Light Pollution**—disorients birds by obscuring the night sky that helps them navigate.
- **Domestic Pets**—injure and predate upon birds.

Challenge your students to identify other hazards birds may face during migration, including storms, pollution, and pesticides.

Preparing for Flight

Review the student guide to help students understand the miraculous migrations that birds make and have them consider what dangers birds face on their journeys. *Migration Hurdles* (Activity 1) will highlight many of the perils birds face while migrating, preparing students for problem-based learning in *School Stopover Sites* (Activity 2).

Activity 1: Migration Hurdles

Students will learn about obstacles birds face during migration and discuss ways they can help migrating birds at school and at home.

Materials: Set of *LAB: Migration Hurdles* cards and an opaque container to hold the leader cards

Playing the game:

1. Place the leader cards in an opaque container. Have students select a student card.
2. Tell students they will be going on a migratory journey—they must stand and flap their arms until their journey ends. Caution students that migration is dangerous and that not all of them will "survive."
3. Pull leader cards one at a time and read aloud to the students. Each card tells the fate of a particular color/species. Students holding the color that is drawn are “out” and may sit down and stop flapping.
4. Once all of the leader cards have been pulled, the students still standing represent the individuals that survived migration.
5. Wrap up by discussing the dangers of migration. Which hurdles were man-made? What other hurdles do birds face?

Math Extension: Figure out what percentage of the population survived. In reality, only about 50% of the birds leaving their breeding grounds will survive and return to breed again. Consider “stacking” the deck with green cards so that roughly half the class “survives.”

Activity 2: School Stopover Sites

Students will evaluate their school grounds as a stopover site from the perspective of a migratory bird.

1. Take students outside and ask them to imagine themselves as a migratory bird who has landed on campus. Walk the school grounds and ask students to consider the four components of habitat—food, water, shelter, and space—and locate these resources on campus. Are there sufficient resources for a migratory bird? What improvements could be made to make the location a better stopover site, breeding site, or overwintering site?
2. Identify possible hazards to birds that they see. Pollution/litter, windows, construction sites, invasive plants, outdoor cats, and other predators are a few examples. What might be some possible solutions to minimize or eliminate those hazards?
3. Back in the classroom, discuss the students' observations, listing the resources and threats they noted.
4. Develop a project to raise awareness and help migratory birds on campus, working in small groups or as a class. Some ideas include planting native plants and/or removing invasive species, creating a "Lights Out" or "Pets Indoors" campaign, applying window treatments to reduce collisions, and maintaining a bird bath or feeder.

Additional Resources: the *LAB: Bird Conservation* unit highlights some of the major threats to birds as well as some possible solutions.

Extension: Assign students to research different migratory birds to gain a deeper understanding of their survival strategies and specific habitat needs.

Bird Migration

How and why do birds migrate? How can we help migrating birds?

Every spring and fall, millions of birds **migrate** through Georgia on journeys between their breeding and wintering grounds. These birds include songbirds, shorebirds, hawks, herons, hummingbirds, woodpeckers, and more. Though they come in many shapes and sizes, they share some remarkable abilities. For some, the trip may be just a few hundred miles, while others may fly thousands of miles, sometimes flying for days without stopping. Regardless of the journey, migrating birds face many challenges and dangers, and we can all take actions to help them have a safer passage.

Arctic Terns fly an astonishing 25,000 miles between the Arctic and Antarctic each year.

Bar-headed Geese regularly fly over the tallest mountains in the world, as high as 5-1/2 miles above sea level.

What Is Migration?

Migration is the regular movement of animals from one location to another in search of food and places to raise young, usually on a seasonal basis.

Who Migrates?

Many types of animals migrate, including birds—but not all birds. About forty percent of bird species migrate.

Did you know? Most Ruby-throated Hummingbirds fly non-stop across the Gulf of Mexico between wintering grounds in Central America and breeding grounds in North America. That's quite a trip for a bird that weighs only as much as a penny!

Why Do Birds Migrate?

Survival! Birds migrate in order to find enough food and space to raise their young. While weather and day length may trigger migration, the movement is tied to food and nesting resources.

When Does Migration Occur?

Birds generally migrate to their **breeding grounds** in the spring to begin the nesting cycle and return to their **wintering grounds** in the fall. The exact date and time depends on the species.

Where Do Birds Go?

Some birds travel only a few hundred miles, while others may journey from pole to pole. In some cases, birds migrate directly east and west, while other species migrate up and down mountain slopes. In North America, birds generally migrate north in the spring and south in the fall, but routes and timing are different for every species.

How Do Birds Know When to Leave and Where to Go?

Birds sense changes in day length, weather, and food availability, but they also have an "internal clock" that helps them know when to leave. During the journey they may use landforms and bodies of water to find their way, or use the sun, moon, and stars as a guide. Some birds are even able to sense the earth's magnetic field, like a compass. They have an internal global positioning system (GPS)!

How Do Birds Survive Such Long Journeys?

To prepare for long trips, birds must fatten up. Some will even double their body weight. They'll burn this fat as a source of energy during flight. During migration, some survival strategies include:

- Timing flights with tail winds.
- Flying at night, when air is cooler, winds are calmer, and fewer predators are out.
- Flying non-stop over bodies of water or hazardous habitats. (Or flying around them.)
- Stopping along the way to eat, drink, and rest.

Bar-tailed Godwits fly more than 6,000 miles across the ocean without stopping—from Alaska to New Zealand!

The Migration Equation

Day Length + Weather + Less Food + Just Knowing

Stopover Sites: Rest Stops for Birds

Finding good habitat during migration can make all the difference to a bird's survival. Even a backyard or schoolyard may be an important **stopover site**, providing a safe place for birds to eat, drink, and rest before continuing their journeys.

Georgia's coastline provides valuable stopover sites for migrating birds. In spring, thousands of shorebirds traveling from Central and South America flock together to fatten up on horseshoe crab eggs before continuing to their breeding grounds in the Arctic. Without this food and place to rest, these shorebirds would not be able to complete their journeys. Protecting them is important to protecting bird populations.

Major stopover sites like the Georgia coast provide unique opportunities for scientists to study bird populations. **But how do you count thousands of birds on a beach?!** Scientists estimate the number of birds in a huge flock by blocking off a group of 10, 100, or 1,000 birds and counting how many groups are present. How many shorebirds do you estimate are in the picture above?

Migration Hurdles

Migration is difficult and dangerous. Sadly, many birds do not survive. Can you think of any obstacles birds may face during their journeys? Write a few of them in the spaces provided below.

_____ _____

_____ _____

_____ _____

Solving the Mystery...

Scientists still don't completely understand the mysteries of bird migration, but several methods help us learn about bird movements:

- Bird counts record the species and number of birds observed in an area, noting the date, time, and location.
- Bird banding tracks individual birds with a numbered metal tag.
- High-tech tracking systems monitor birds, using transmitters, solar-powered tags, and radar.

Did you know? Banding is one of the oldest techniques used to study bird movements. Small metal tags with unique codes of letters and numbers are placed on a bird's leg. If that bird is seen or captured again, the tag is like an identification card. The Song Sparrow was tagged at the Panola Mountain Banding Station.

BIRDS GEORGIA

RED Predator Alert! You were just eaten by a Red-tailed Hawk. You are out!	ORANGE Meow! A pet cat caught you while you were resting. You are out!	YELLOW Bonk! You fly into a window and are disoriented. You are out!
LIGHT BLUE Oh no! Your habitat was turned into office buildings. You are out!	PINK Slurp! You eat and drink from a polluted lake and are poisoned. You are out!	DARK BLUE Storm alert! You were blown off course and lost at sea. You are out!
BROWN You land in a wildlife refuge – take a break. (Sit down and relax for 10 seconds) *all students play*	BROWN You land in a backyard with lots of full feeders. (Rub your tummy) *all students play*	BLACK Smack! You hit a cell phone tower in the middle of the night. You are out!
WHITE Watch out! Windmills ahead. (Angle your “wings” to fly around them.) *all students play*	WHITE Whoosh! The wind is pushing you in the right direction. (Stop flapping and soar.) *all students play*	blank

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Migration Hurdles Leader Card

BIRDS GEORGIA

Migration Hurdles Leader Card

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Migration Hurdles Leader Card

BIRDS GEORGIA

Migration Hurdles Leader Card

Summer Tanager

RED

Summer Tanager

RED

Summer Tanager

RED

Baltimore Oriole

ORANGE

Baltimore Oriole

ORANGE

Baltimore Oriole

ORANGE

American Goldfinch

YELLOW

American Goldfinch

YELLOW

American Goldfinch

YELLOW

Roseate Spoonbill

PINK

Roseate Spoonbill

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Roseate Spoonbill

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BIRDS GEORGIA Migration Hurdles Student Card	BIRDS GEORGIA Migration Hurdles Student Card	BIRDS GEORGIA Migration Hurdles Student Card
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Blue-gray Gnatcatcher

LIGHT BLUE

Blue-gray Gnatcatcher

LIGHT BLUE

Blue-gray Gnatcatcher

LIGHT BLUE

Indigo Bunting

DARK BLUE

Indigo Bunting

DARK BLUE

Indigo Bunting

DARK BLUE

Gray Catbird

BLACK

Gray Catbird

BLACK

Gray Catbird

BLACK

Ruby-throated Hummingbird

GREEN

Ruby-throated Hummingbird

GREEN

Ruby-throated Hummingbird

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BIRDS GEORGIA

Migration Hurdles Student Card

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Ruby-throated Hummingbird

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