

# ***Invasion of the Song Snatcher!***

***The Influence of Spotted Knapweed on Chipping Sparrow Song Diversity***



Photo courtesy of <http://www.istockphoto.com>.



## Meet the Scientists

► **Ms. Yvette Ortega, Ecologist:** I love searching for birds' nests. It is like a treasure hunt, only you follow the birds around in search of clues. For example, a bird on the way to its nest might have "whiskers." "Whiskers" could be any type of nest construction material such as grass gathered in the beak. A bird with whiskers will lead you right to its nest if you stand back and let it do its thing.



*Photo courtesy of Yvette Ortega.*

► **Ms. Aubree Benson, Fisheries Biologist:** In the attached photo, I am holding a large (7 pound) bull trout. We captured this trout below the Emily-A-Dam, which is in the background. The dam was on the Clearwater River near Seeley Lake, Montana. I had just finished implanting a radio transmitter in this fish, which I then carried over the dam and released. Then I tracked the trout's movement to its spawning **tributary**. The fish was unharmed from the process. This experience was a part of my research as a Master's student at the University of Montana.



*Photo courtesy of Aubree Benson.*

During this research, I helped determine that the dam had a major impact on the bull trout population. After that, Montana Fish, Wildlife, and Parks removed the dam in 2010 to benefit bull trout.

One of my favorite science-related experiences was related to the bull trout research. To identify individual trout, we clipped the adipose fin (the little fin just before the tail fin) of each bull trout we moved over the dam. Once the fish swam to their spawning stream, we **snorkeled** to determine how many fish in the spawning tributary were fish that had a fin clip versus fish that had migrated from elsewhere. We were able to show that over 40 percent of the spawning population was made up of fish we had passed over the dam. Those data helped us justify why the dam needed to be removed!

## Meet the Scientists

► **Dr. Erick Greene, Wildlife Biologist:** My favorite science experiences have always been in the field observing fascinating things in nature. These experiences are what give me ideas about interesting things that might be going on, and these observations can lead to a scientific research project.

A couple of experiences stand out for me. I spent a lot of time in the high Canadian Arctic about 800 miles north of the Arctic Circle. I once got to watch a mother polar bear teaching her two cubs how to hunt seals out on the sea ice. She communicated to them, and they crouched down and remained immobile on the ice. The cubs watched her as she spent an hour slowly stalking forward on the ice. She would only move forward when the seal put its head down and was not looking around.

Another powerful experience was spending a lot of time in the Okavango Delta in Botswana. I was on a research project studying how olive baboons communicate with each other about predators. As I spent time with the troop of 80 baboons, it was fascinating to see that they all know each other (by sight and also by their voices). They communicate with each other about predators with a complex set of alarm calls. The baboons can warn each other about lions, snakes, leopards, and other dangers.



Photo courtesy of Erick Greene.

## What Kinds of Scientists Did This Research?

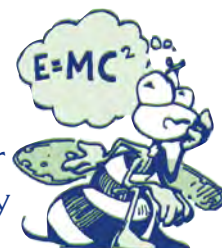
**ecologist:** This scientist studies the relationship of living things with their living and nonliving environment.

**fisheries biologist:** This scientist studies fish living in the wild, including what they eat, their habitat, and how they interact with their environment.

**wildlife biologist:** This scientist studies animals living in the wild, including what they eat, their habitat, and how they interact with their environment.

Glossary words are **bold** and are defined on page 69.

## Thinking About Science



Scientists often find a particular topic that interests them and study this topic in depth. As scientists study one topic more closely, they come up with more detailed and specific questions for which they would like to know the answers. Sometimes their discoveries about one topic help inform scientists about another related topic.

In this study, the scientists were interested in learning more about how an invasive plant species was affecting a particular bird species and the songs of those birds. The scientists thought this specific information gathered from this research could help them understand the particular bird and invasive plant. The scientists also thought that this research could help them understand the response of other songbird populations to changes in their habitat quality.



## Thinking About the Environment



Invasive species are any plants, animals, or organisms that are not **native** to the ecosystem they are in and are likely to cause harm to the environment, the economy, or human health. In this study, scientists were concerned with an invasive plant called spotted knapweed (**figure 1**).

Spotted knapweed was accidentally brought to the United States from Eastern Europe in the late 1800s. The spotted knapweed seeds were mixed in with alfalfa and clover seeds. Spotted knapweed can invade a wide variety of habitats from open areas like grasslands to those with more dense vegetation like forests



**Figure 1.** Spotted knapweed has purple flowers when in bloom. Photo courtesy of John Cardina, Utah State University, and <http://www.bugwood.org>.

(**figure 2**). The roots of spotted knapweed give off a chemical that stops the growth of other plants. Spotted knapweed also is a strong competitor for resources such as water and space and **displaces** the native plants in this way.

When spotted knapweed spreads, native plants can no longer grow in that area and the plant diversity is greatly reduced. Many animals depend on a diversity of plants for food and habitat. Spotted knapweed is a poor substitute for the habitat and food needs of these animals. The invasion of spotted knapweed, therefore, negatively impacts the food and habitat options for these animals.



**Figure 2.** Spotted knapweed often invades roadside areas. Photo courtesy of Steve Dewey, Utah State University, and <http://www.bugwood.org>.



## Introduction

Invasive species such as spotted knapweed can have an effect on a habitat and animals in that habitat (Read “Thinking About the Environment” for more information). In this study, the scientists wanted to determine how spotted knapweed affects **migratory** songbirds and their songs. In particular, the scientists studied chipping sparrows (**figure 3**). Chipping sparrows migrate to different areas for reproduction. These areas are called breeding grounds.

In migratory songbirds, it is common for the **yearling** male bird to adopt the song of the birds that are already in the breeding area. Chipping sparrows tend to match the songs of the older chipping sparrows at the site to which they have migrated. The yearlings typically imitate the song of the older birds because the older birds arrived on the breeding grounds first and already have a clear song (**figures 4 and 5**).



**Figure 3.** Chipping sparrows can be found around trees, although they spend a lot of time **foraging** on the ground. Chipping sparrows mainly eat the seeds of a variety of grasses and herbs. During the breeding season, songbirds such as the chipping sparrow add insects to their diet to give them an extra boost of energy for reproduction. Photo courtesy of Aubree Benson.



Lend a Hand  
Care for the Land

## Citizen Science Connections

Do invasive species live in your schoolyard or backyard? Help scientists track the spread of invasive species across the United States! Citizen scientists can use the Early Detection & Distribution Mapping System (EDDMapS). Visit <http://www.eddmaps.org/> and BugwoodApps to learn more and contribute to this research.

EDDMapS lets citizen scientists:

- Learn about invasive species;
- Report invasive species observations;
- Review maps of invasive species.

**EDDMapS**  
Early Detection & Distribution Mapping System

EDDMapS is a project launched by the University of Georgia. It now has a **database** of more than 2.5 million invasive species sightings made by both scientists and citizen scientists.



The scientists wanted to know if the chipping sparrows still had a similar song adoption process in areas heavily invaded by spotted knapweed. The scientists hypothesized that the number of older birds would decrease in heavily invaded spotted knapweed areas, compared with the number of yearling birds.

Further, the scientists hypothesized that this decrease in the number of old compared to yearling birds would lead to increased song similarity among birds in the area. They

believed there would be fewer song options for yearling birds to imitate.

Increased song similarity may cause the habitat to be less suitable for chipping sparrows. One reason the habitat may decline in suitability is that female birds may avoid the habitat because of lack of song variety from males. Song variety from male birds can indicate the health of the male and may indicate the success of offspring from that bird.



**Figure 4.** Chipping sparrows lay beautiful light blue eggs with dark speckles. Photo courtesy of Aubree Benson.



**Figure 5.** Recently hatched chipping sparrow waiting for food. Photo courtesy of Aubree Benson.



The scientists collected data on chipping sparrow songs, gender, and numbers to determine whether their hypotheses were correct. The scientists wanted to compare this information in areas that were invaded with knapweed and areas that had native vegetation.

## Reflection Section



- What did the scientists want to study?
- Why is a bird's song important?

## What's In a Song?

As humans, we can talk, write, and sing to communicate with others. Birds cannot talk or write. Birds rely mostly on singing and bird calls to communicate with other birds.

Some birds can only learn one song. Other birds can learn over 200 songs, such as the northern mockingbird.

Most singing birds that you hear are male birds. Like the songs that we listen to on our electronic devices, each song has a message. The male birds sing to send a message to females or other males in the area. Singing can attract females. It can also help warn other male birds to avoid the singing bird's territory. Bird songs are often loudest in the morning, but scientists are not sure why. Why do you think that bird songs are loudest in the morning?

For additional information on bird songs, visit <http://biology.allaboutbirds.org/birdsong/>.

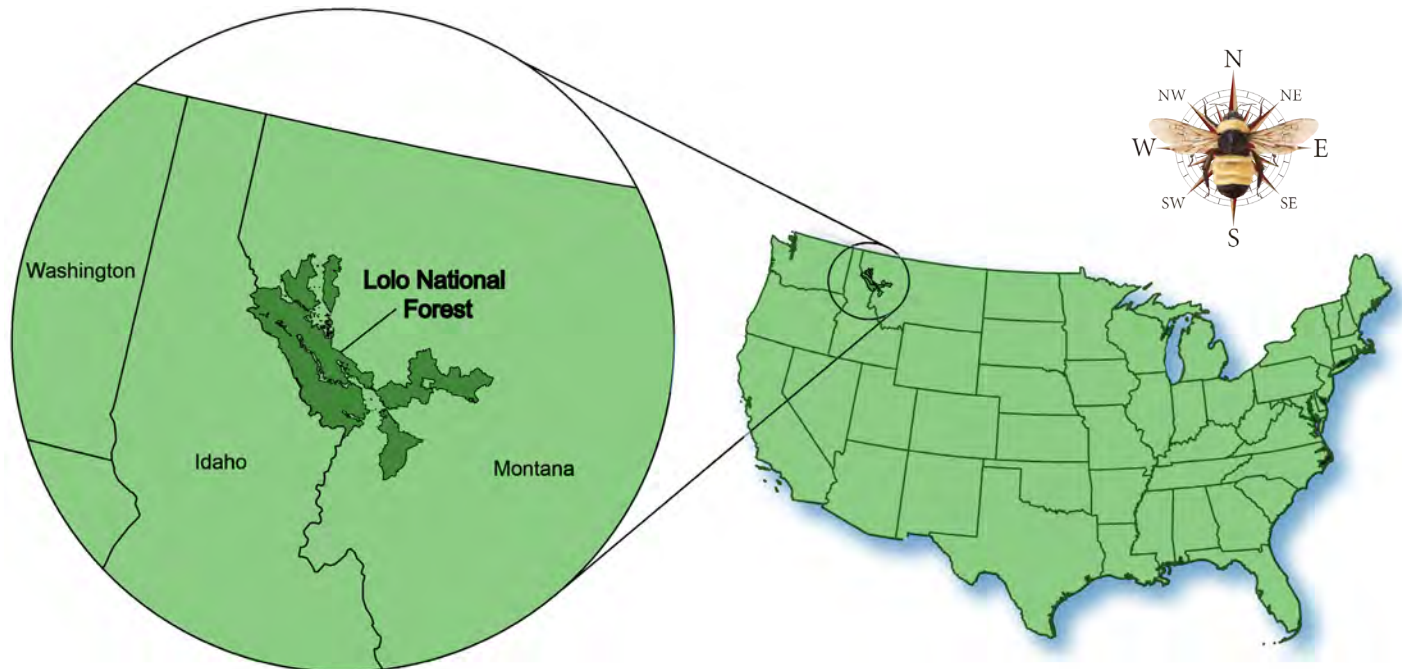


Northern mockingbirds imitate the songs of other birds, other animals, and even car alarms. Photo by Budd Titlow of Naturegraphs.

## Methods

The scientists studied six plots in the Lolo National Forest in western Montana (**figure 6**). Three of the plots had native vegetation and three of the plots were heavily invaded by spotted knapweed (**figures 7a and 7b**). The scientists collected data in 2005 and 2006.

The scientists lured chipping sparrows into mist nets by playing bird songs and calls that had been recorded in the area (**figure 8**). Each bird was marked with a unique combination of one aluminum band and three color bands (**figure 9**).



**Figure 6.** Lolo National Forest is located in western Montana and consists of 2 million acres. Map by Carey Burda and Stephanie Pfeiffer.



**Figure 7a.** A plot with native vegetation. Photo courtesy of Yvette Ortega.



**Figure 7b.** A plot invaded by spotted knapweed. Photo courtesy of Yvette Ortega.



The scientists used information about **molting** and **plumage** characteristics to determine whether the bird was a yearling or an older bird. Yearling birds spend part of their early life with a different plumage than older birds. As young birds move through their life cycle, molting occurs and yearling plumage is replaced with adult plumage. Observers conducted searches twice a week for banded birds on the study plots. The scientists recorded the information from these searches (**figure 10**).

The scientists also recorded the bird songs during the breeding season each year (**figure 11**). Only one of the scientists measured and made notes about all of the bird songs. The scientists then took the data they gathered and used computer software to help them analyze the information.



**Figure 8.** Mist nets help scientists capture and release birds without harming them. These scientists are removing a bird from a mist net so they can study the bird. Photo courtesy of Mariko Yamasaki.



**Figure 9.** Notice the tiny bands on the bird's leg. The bands do not hurt the bird and help the scientists keep track of the different birds. Photo courtesy of Aubree Benson.



**Figure 10.** The scientists inspected the birds and made notes and observations about them. Photo courtesy of Aubree Benson.





**Figure 11.** Aubree Benson recorded the songs of the chipping sparrows. Photo courtesy of Jennifer Steffan.

## Reflection Section



- ❖ Scientists use different methods to collect data about a topic. Describe one method used by the scientists in this study.
- ❖ Why do you think it is a good idea to have the same scientist measure and make notes about all the bird songs? (Hint: Think about a time when you and a friend did the same activity, but later when you talked about the activity, you both remembered different things about the event. Why might this cause a problem in the world of science?)



## Citizen Science Connections

Birds are an important part of every ecosystem. The presence or quantity of birds in a location can tell scientists a lot about the health of birds and the environment. Using eBird (<http://www.ebird.org>), scientists are asking citizen scientists to collect data about where and when they see birds. The study of birds is called ornithology (or nə **thä** lə jē).

eBird lets citizen scientists:

- Record the birds they see;
- Keep track of their bird lists;
- Explore maps;
- Share their sightings;
- Contribute to science.

**eBird**

eBird is a project created by the Cornell Lab of Ornithology. The eBird database collects millions of citizen scientist bird sightings each month for use by scientists, land managers, and other citizen scientists. Join the effort today!

## Findings

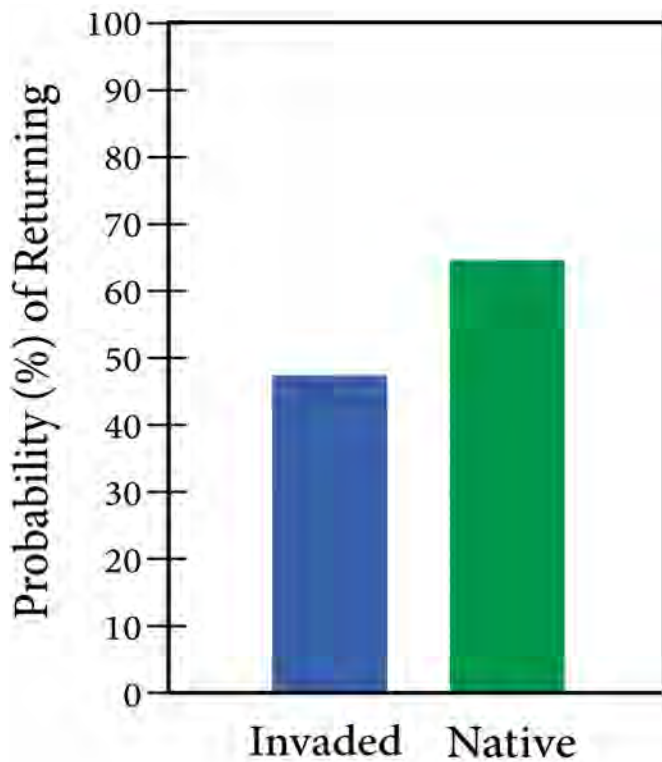
The scientists found that fewer birds returned to the sites invaded by spotted knapweed (**figure 12**). For birds, returning to a given site year after year is closely linked to breeding success.

Overall, the scientists recorded more than 96 percent of the males' songs. Of those birds, none of them changed their song between

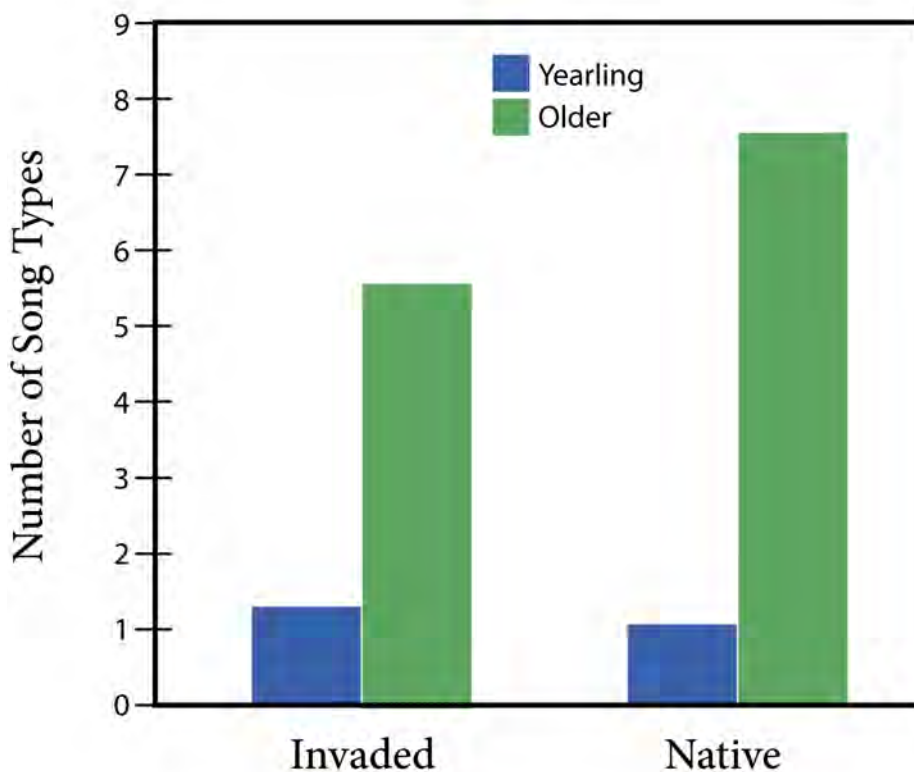
years. The scientists also found that song similarity among individuals was higher for yearling birds than older birds.

Song similarity among male birds was higher in the areas invaded by spotted knapweed. The diversity of song types was lower in spotted knapweed areas (**figure 13**).







**Figure 12.** The scientists found that fewer birds returned to invaded areas as compared to returning to areas with native plants. Graph by Stephanie Pfeiffer.



**Figure 13.** The number of song types was also lower in invaded compared to invaded areas. Graph by Stephanie Pfeiffer.

## Reflection Section

-  In your own words, summarize what the scientists found.
-  Review figure 13. What is one difference you notice for the older birds when you compare them in the native versus the invaded habitat?





## Discussion

The scientists' findings supported their **hypothesis** that invasion of spotted knapweed has a negative effect on chipping sparrow populations. An invasion of spotted knapweed reduces the quality of the bird breeding area in multiple ways. The presence of spotted knapweed decreases the food resources available to the birds. Once spotted knapweed has taken over a breeding area, birds are less likely to return from year to year. Yearling birds tend to take the place of the birds that have left the invaded area.

With fewer older birds around, the chipping sparrows have fewer songs to imitate. Therefore, song similarity at the spotted knapweed sites increases leading to a reduction in the number of song types sung. The increase in song similarity may **deter** female birds from this site. They may be deterred because fewer mating choices are available to them compared to the native-plant breeding sites. Overall, the scientists believe that bird songs may serve as an important indicator of habitat quality and population status for a variety of migratory songbirds.

## Reflection Section

- ✿ Explain one reason why spotted knapweed may impact the chipping sparrow.
- ✿ Do you think that other migratory songbirds may respond similarly to invasive plant species invasions? Why or why not?



## Glossary

**database** (dā tə bās): A comprehensive collection of related data organized for convenient access, generally in a computer.

**deter** (di tər): To cause someone, to decide not to do something.

**displace** (di splās): To force (people or animals) to leave the area where they live.

**forage** (fōr ij): The act of taking food by animals, usually taken by browsing or grazing.

**habitat** (ha bə tat): The environment where a plant or animal naturally lives and grows.

**implant** (im plant): To place something in the body of a living thing, in this case, a fish by means of surgery.

**migratory** (mī grə tōr ē): Having a characteristic of moving from one place to another on a periodic basis.

**molt** (mōlt): To shed hair, feathers, outer skin, shell, or horns with the cast-off parts being replaced by a new growth.

**native** (nā tiv): Living or growing naturally in a particular region.

**plumage** (plü mij): The feathers of a bird.

**snorkel** (snōr kəl): To use a tube when swimming so that the swimmer can breathe with his or her head under water.

**spawn** (spōn): To produce or lay eggs in water.

**tributary** (trib yə ter ē): A stream flowing into a larger stream or a lake.

**yearling** (yi(ə)r līŋ): An animal, that is a year old or in the second year after birth.

Accented syllables are in **bold**. Marks and definitions are from <http://www.merriam-webster.com>. Definitions are limited to the word's meaning in the article.



## Time Needed

One class period

## Materials

(for each student or group of students)

- Bird observation tally sheet
- Pencils
- Clip boards
- Binoculars (optional)
- Field guide (optional)

The question you will answer in this FACTivity is: How many birds do I notice in my schoolyard habitat?

## Methods

First, break into small groups and brainstorm a list of reasons why you feel birds are important. Title the list "Why Are Birds Important?" After your groups brainstorm at least three reasons that birds are important, come together as a whole class and create a classroom list. Hold a brief discussion of why birds are important.

Next, have everyone in your class think about the habitat in your schoolyard. Imagine spending 10 minutes outside walking around in the schoolyard habitat. Write down an estimate for how many different individual birds you think you will see and hear.

Your teacher will collect your estimates and write them on the board. Did the groups report a wide variety of estimates? Add all the class estimates together and calculate an average for the estimate.

As a class, go outside and walk through the schoolyard habitat for 10 minutes. Your teacher will set a timer. Remember to be quiet and observe with your eyes and ears. Make tally marks on your bird observation sheet (page 71) when you see or hear

## A Note From the "Invasion of the Song Snatcher" Scientist

**I**n an activity like this one, birds are often more easily heard than seen. Particularly during the birds' breeding season, if you listen carefully, you are likely to notice many more birds with your ears than if you are only using your eyes.

Have Fun!

Ms. Yvette Ortega



an individual bird. Then tally only those birds that you see and hear. Everyone in the class may see or hear different birds. Count each individual bird only once.

After your observation time outside, add the tally marks in each column. Create a class total for the first two columns and find the average for these columns.

- How does the class average from your time outside compare to your class's individual and average estimates about the number of birds that were in the schoolyard habitat?
- What do you notice about the number of birds you heard versus the number of birds you saw?
- How are you surprised by your results?

Have a class discussion about the number of birds you observed. What are some reasons why there may be so few or so many birds? Name three ways your class can help create a better schoolyard habitat for birds.



# ***Invasion of the Song Snatcher Bird Observation Tally Sheet***

Name \_\_\_\_\_ Date \_\_\_\_\_

See a Bird	Hear a Bird	Notes About What You Hear or See

## FACTivity Extension



The *Natural Inquirer* website has a “Birding in the Classroom” Outdoor FACTivity which provides many more birding activities. This Outdoor FACTivity was adapted from Cornell University’s BirdSleuth program. To see the full lesson plan, visit [http://www.naturalinquirer.org/UserFiles/File/Birding%20FACTivity\(1\).pdf](http://www.naturalinquirer.org/UserFiles/File/Birding%20FACTivity(1).pdf).

## Technology Extension



### Time Needed

One class period

### Materials

(for each student or group of students)

- An original song that is age and content appropriate for students
- One or more covers of the original song (Note: A cover is a new performance or recording of a previously recorded song. The cover is recorded or performed by someone other than the original performer.)
- A way to play chosen songs for the class to hear
- Access to the Internet and a way to listen to .wav files
- Bird song files (.wav files) located at <http://www.naturalinquirer.org>
- Spectrograms (on page 74)
- Graphic organizer

The questions you will answer in this FACTivity are: What similarities and differences do you notice between bird songs? How does the way a song sounds have an effect on you?

### Methods

To start thinking about songs and sounds, your teacher will play a song for you. First, your teacher will play the original song. Then your teacher will play the same song, but with someone else singing it. (Note: Some songs may have several different versions that your teacher can play.) Which song did you like better? Why? Have a class discussion about this introduction activity and how it is similar to what happens to the birds in the “Invasion of the Song Snatcher” article you read.

Next, you will listen to six recorded chipping sparrow bird songs that the scientists

in this study recorded. First, simply listen to each file. Next, play each file several times in a row.

As you listen to each song, take some notes about the song on the graphic organizer on page 73. For example, you may want to think about the following questions:

- What do the notes sound like to you?
- Is the song fast or slow?
- Does the sound remind you of anything?

Make a note of the song or songs that seemed to have the most differences.



# ***Invasion of the Song Snatcher Bird Song Graphic Organizer***

Name \_\_\_\_\_ Date \_\_\_\_\_

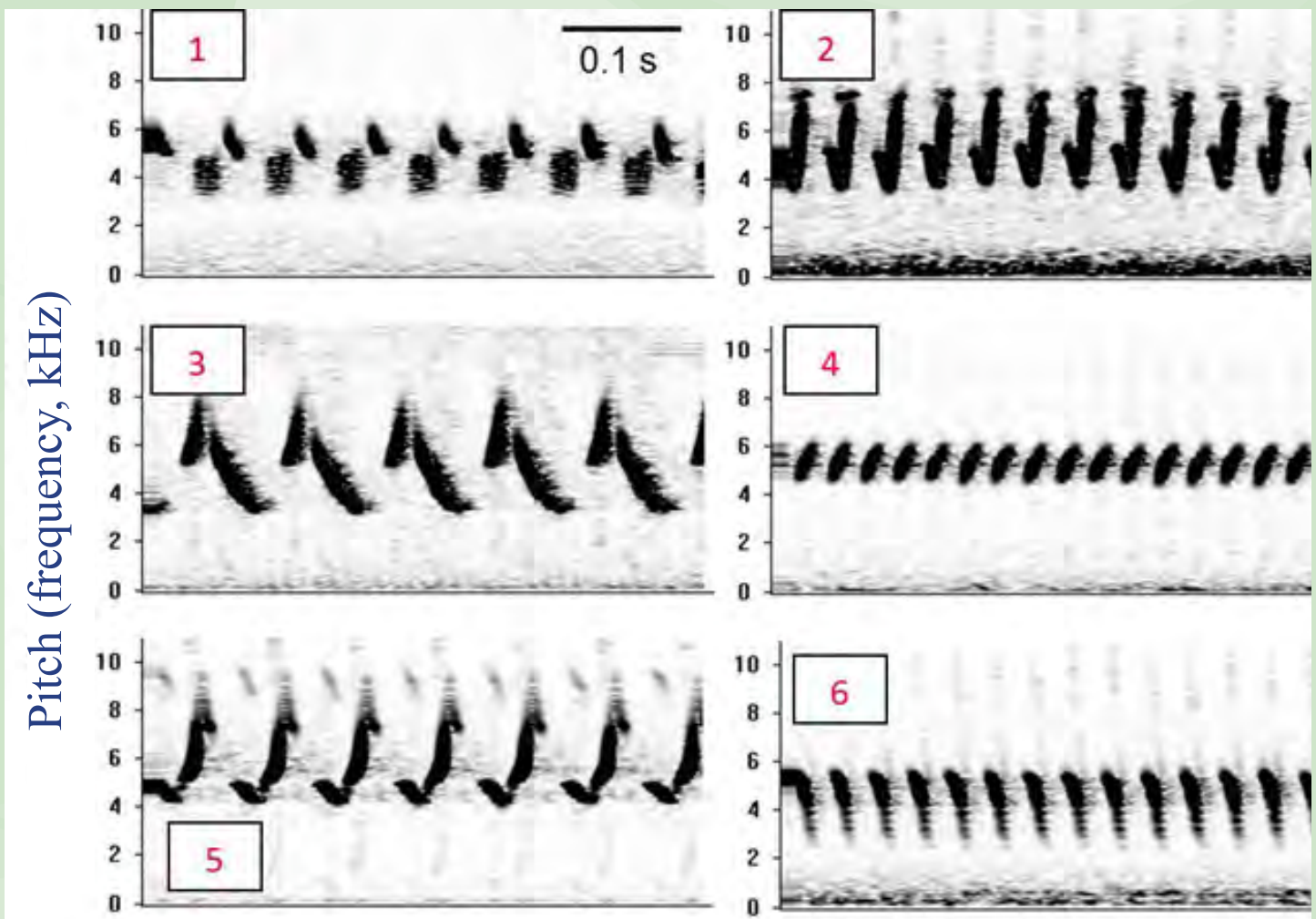
Bird Song	Notes About What You Hear in the Song
Song 1	
Song 2	
Song 3	
Song 4	
Song 5	
Song 6	

Now, examine the spectrogram illustrations provided by the scientists in figure 15. A spectrogram is a visual representation of sound qualities such as pitch and how this changes over time. In the spectrograms, the black shapes are the notes, repeated by the bird. The vertical axis (y-axis) shows the pitch of the note. For example, this axis shows whether the notes are high or low or represent a range. The horizontal axis (x-axis) shows the change over time. The horizontal axis is time, with all of the spectrograms depicting 0.5 seconds.

After you have listened to the bird songs and reviewed the spectrograms, answer the following questions:

- Do the spectrograms help to show what you heard?
- What is one thing that you learned today about birds?
- What are you still curious about?

To learn more about bird songs and calls, visit <https://www.allaboutbirds.org/how-to-learn-bird-songs-and-calls/>.



**Figure 15.** Spectrograms of chipping sparrow songs (0.5 second clips) illustrating differing song types identified. Each spectrogram shows one unique song type. The number in the box shows what song number the spectrogram represents. Photo courtesy of Yvette Ortega.



If you are a trained Project Learning Tree educator, you may use “Have Seeds Will Travel” as an additional resource.



## Natural Inquirer Connections

**Y**ou may want to refer to this *Natural Inquirer* article for additional information and FACTivities related to this article:

- “Goll-ly! Don’t Take a Knapweed!” in the Invasive Species edition of *Natural Inquirer*.

This article, along with others, can be found at <http://www.naturalinquirer.org/all-issues.html>.



## Web Resources

### Cornell Lab of Ornithology – Chipping Sparrow

[https://www.allaboutbirds.org/guide/Chipping\\_Sparrow/id](https://www.allaboutbirds.org/guide/Chipping_Sparrow/id)

(Note: To find the eBird data on the chipping sparrow, go to the website provided above. On the right hand side of the page under the “Range Map,” click on “View dynamic map of eBird sightings.”)

### Lolo National Forest

<https://www.fs.usda.gov/lolo/>

### Spotted Knapweed – USDA Forest Service Weed of the Week

[https://www.na.fs.fed.us/fhp/invasive\\_plants/weeds/spotted-knapweed.pdf](https://www.na.fs.fed.us/fhp/invasive_plants/weeds/spotted-knapweed.pdf)

