

Lab 15. Competition for Resources: How Has the Spread of the Eurasian Collared-Dove Affected Different Populations of Native Bird Species?

Introduction

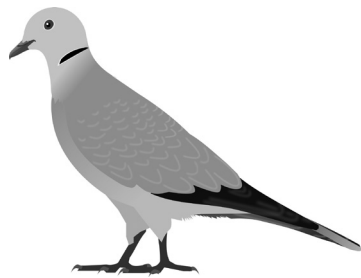
A community is any assemblage of populations in an area or a habitat. There are a number of different interspecies interactions that take place within a community. One example of an interaction that takes place between species is competition. Organisms compete for resources, such as food, water, and space, when resources are in short supply. For example, weeds and grass compete for soil nutrients and water, grasshoppers and bison compete for grass, and lynx and foxes compete for hares. There is potential for competition between any two species populations that need the same limited resource. Resources, however, are not always scarce in every community (e.g., water in the ocean or oxygen on the Great Plains). Species therefore do not always compete for every resource they need to survive.

Species also do not compete for resources when they occupy different ecological niches. An ecological niche is the sum total of a species' use of biotic and abiotic resources in its environment. An organism's ecological niche is its ecological role or how it fits into an ecosystem. The ecological niche of a bird, for example, includes the temperature range it tolerates, the type(s) of tree it nests in, the material it uses to build its nest, the time of day it is active, and the type of insects or seeds it eats (along with numerous other components). Species with different ecological niches require different resources and play different roles in a community. Therefore, species with different ecological niches rarely compete for the same resources.

In the first half of the 20th century, a Russian ecologist named Georgii Gause formulated a law known as the competitive exclusion principle. This law states that two species occupying the same ecological niche cannot coexist in the same community because one will use the resources more efficiently and thus be able to reproduce more offspring. The reproductive advantage of one species results in the local elimination of the other one. Competitive exclusion, as a result, can have a significant effect on the number and types of organisms found within an ecosystem. It is important to note, however, that species with similar (but not identical) ecological niches can coexist in the same community if there is at least one significant difference in their niches (such as when they are active or what they eat).

Invasive species are organisms that are not native to an ecosystem. These organisms are introduced into a new environment through some type of human activity. Invasive species often colonize a community and spread rapidly. They are able to colonize and spread because they can tolerate a wide variety of habitat conditions; they grow fast, reproduce often, compete aggressively for resources, and usually lack natural enemies in the new community. Invasive species, as a result, can cause environmental, economic, and human harm by displacing native species, altering habitats, upsetting the balance of an ecosystem, or degrading the quality of recreation areas.

The Eurasian collared-dove



An example of an invasive species is the Eurasian collared-dove (see the figure to the left). This bird was introduced to the Bahamas in 1970 and spread from there to Florida in 1982. It has since spread across North America and is now found as far south as Veracruz, as far west as California, and as far north as Alaska (see the figure on the next page). Although the Eurasian collared-dove does not migrate, it spreads and then colonizes new areas at an alarming rate. In Arkansas, for example, it took only five years (1997–2002) for it to spread from the southeast corner of the state to the northwest corner (a distance of about 500 km).

The impact of the Eurasian collared-dove on native bird species in North America is not yet known, but it seems to occupy an ecological niche that is similar to the other members of the dove family (Columbidae). Scientists are attempting to determine if the Eurasian collared-dove will outcompete native dove species for available resources. They are also interested in the impact that this invasive species may have on other native species of nonmigratory bird. Fortunately, there are a number of databases that allow scientists to track where different species of bird can be found, when they can be found, and how common they are in a given location. One such database is eBird, which enables users to go online to access observational data submitted by birdwatchers at thousands of locations across the United States. Scientists can use these data and the visualization tools built into the website to examine the frequency and abundance of different species of birds at different locations and over time.

Your Task

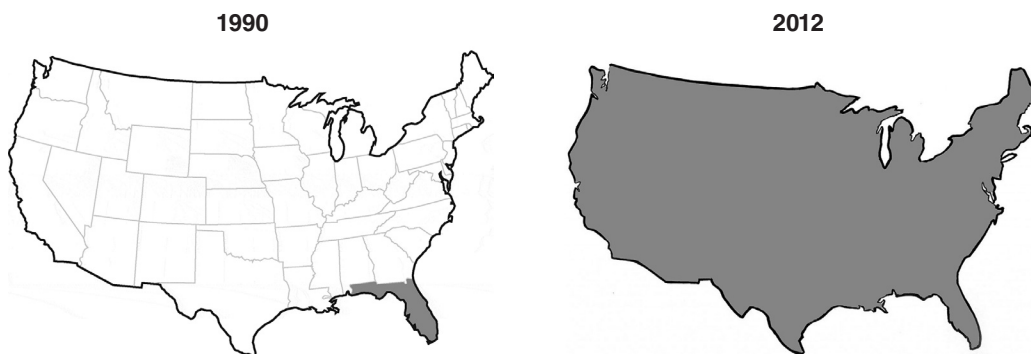
Identify at least two native bird species that occupy a similar ecological niche as the Eurasian collared-dove. Then determine what has happened to these two species of birds over time as the Eurasian collared-dove spread across the United States.

The guiding question of this investigation is, **How has the spread of the Eurasian collared-dove affected different populations of native bird species?**

Materials

You may use any of the following resources during your investigation:

Range maps of the Eurasian collared-dove in the United States (shaded areas indicate a sighting during that time period)



- eBird database: <http://ebird.org>
- All About Birds database: www.allaboutbirds.org

Safety Precautions

1. Use caution when working with electrical equipment. Keep away from water sources in that they can cause shorts, fires, and shock hazards. Use only GFI-protected circuits.
2. Wash hands with soap and water after completing this lab.
3. Follow all normal lab safety rules.

Getting Started

To answer the guiding question, you will need to design and conduct an investigation. To accomplish this task, you must determine what type of data you will need to collect, how you will collect it, and how you will analyze it. To determine *what type of data you will need to collect*, think about the following questions:

- Which native bird species will you include in your investigation?
- How will you determine if a native species of bird has been affected by the spread of the Eurasian collared-dove?
- What will serve as your dependent variable (e.g., range, frequency of sightings, abundance)?
- What type of observations will you need to record during your investigation?

To determine *how you will collect your data*, think about the following questions:

- What will you need to compare?
- How often will you collect data and when will you do it?
- How will you keep track of the data you collect and how will you organize the data?

To determine *how you will analyze your data*, think about the following questions:

- What type of calculations will you need to make?
- What type of graph could you create to help make sense of your data?

Investigation Proposal Required? Yes No

Connections to Crosscutting Concepts and to the Nature of Science and the Nature of Scientific Inquiry

As you work through your investigation, be sure to think about

- the importance of identifying and explaining patterns,
- what is relevant or important at different times and scales,
- the difference between observations and inferences in science, and
- how society and cultural values shape the work of scientists.

Argumentation Session

Once your group has finished collecting and analyzing your data, prepare a whiteboard that you can use to share your initial argument. Your whiteboard should include all the information shown in the figure to the right.

To share your argument with others, we will be using a round-robin format. This means that one member of your group will stay at your lab station to share your group's argument while the other members of your group go to the other lab stations one at a time to listen to and critique the arguments developed by your classmates.

The goal of the argumentation session is not to convince others that your argument is the best one; rather, the goal is to identify errors or instances of faulty reasoning in the arguments so these mistakes can be fixed. You will therefore need to evaluate the content of the claim, the quality of the evidence used to support the claim, and the strength of the justification of the evidence included in each argument that you see. In order to critique an argument, you will need more information than what is included on the whiteboard. You might, therefore, need to ask the presenter one or more follow-up questions, such as:

- Why did you decide to focus on those data?
- What did you do to analyze your data? Why did you decide to do it that way? Did you check your calculations?
- Is that the only way to interpret the results of your analysis? How do you know that your interpretation of your analysis is appropriate?
- Why did your group decide to present your evidence in that manner?
- What other claims did your group discuss before you decided on that one? Why did your group abandon those alternative ideas?
- How confident are you that your claim is valid? What could you do to increase your confidence?

Once the argumentation session is complete, you will have a chance to meet with your group and revise your original argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the most valid or acceptable answer to the research question!

Report

Once you have completed your research, you will need to prepare an investigation report that consists of three sections that provide answers to the following questions:

1. What question were you trying to answer and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in two pages or less. This report must be typed, and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!

Argument presentation on a whiteboard

The Guiding Question:	
Our Claim:	
Our Evidence:	Our Justification of the Evidence: