

Student Guide: Ornamentation in Birds

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Introduction

Have you ever noticed that in some animals males are larger, brighter, or more ornamented than females? This difference between the sexes is known as sexual dimorphism. Why are some species more sexually dimorphic than others, with males and females even looking identical in some species? Why does sexual dimorphism exist in the first place? These are questions you will consider and address in this exercise.

Using your collective knowledge of evolution, behavior and the scientific method your class will develop hypotheses to explore factors that may have shaped the evolution of ornaments and sexual dimorphism specifically in birds. You will observe a variety of bird species, quantify how different males and females are in each species, and then relate the degree of sexual dimorphism to behavioral, social, or ecological factors. As a class we will collect enough data to evaluate our hypotheses and then discuss our conclusions.

Essential Questions

- Why are some bird species more elaborate than others?
- What causes the varying degrees of sexual dimorphism we see across bird families?
- What happens when natural selection is in conflict with sexual selection?

Learning Objectives

Students will be able to:

- Describe and compare plumage traits in a number of bird species
- Pose and test hypotheses using authoritative online sources of multimedia and scientific literature
- Discuss theories and evidence for the evolution of sexually dimorphic plumage traits

Materials

- 1 laptop per group of 2 - 4 students or individual
- Internet access
- Flash or QuickTime player installed for viewing videos from the Macaulay Library (<http://macaulaylibrary.org>) or a bird field guide
- Subscription to the Birds of North America Online (most college libraries have access, or temporary and educational licenses are available at <http://bna.birds.cornell.edu>)

Procedure

Exploration and Data Collection

1. The instructor will begin by showing video clips of two bird species with very different degrees of sexual dimorphism using videos from the Cornell Lab of Ornithology's online archive of animal behavior media: <http://macaulaylibrary.org>.

Northern Gannets:

<http://macaulaylibrary.org/video/405047>

<http://macaulaylibrary.org/video/56362>

Consider the following questions:

- a. What are they doing?
- b. Why do you think that? (What evidence do you have?)

Mallard:

<http://macaulaylibrary.org/video/18044>.

Consider the following questions:

- a. What kind of a mating system do you think each set of birds has? Why?
 - b. How could we test this hypothesis?
2. As a class you will discuss the behaviors and appearance of the birds from the videos. How do these birds demonstrate the concept of sexual dimorphism? What other examples of sexual dimorphism have you noticed in birds? How common do you think sexual dimorphism is in birds?"
 3. You will now spend some time looking at slides of birds with varying degrees of sexual dimorphism, or use Macaulay Library videos or bird field guides to assess the extent and variation of sexual dimorphism in birds. Make sure you decide as a class on what kind of scale you will use to score variation in sexual dimorphism. For example, you might want to use a scale of 1 to 5, with 1 showing the least dimorphism or most similarity between sexes, and 5 showing the most dimorphism. You could first agree on how the two video examples (gannets and mallards) would each be scored under the class system. If you are using the Macaulay Library, refer

to the Macaulay Library tutorial for how to browse its archives. If you have decided to only look at one species within a given bird family, make sure to note the group with the Latin ending *-idae*, indicating the family. Also consider how you will know the sex of the animals in the videos, and how you will differentiate sexual dimorphism from dimorphism related to age or season. Use the table below to record your data, choosing species based on the guidelines given by your instructor.

- Your instructor will ask you to pool your data with those of other students so you can assess the extent and variation of sexual dimorphism among the bird species examined.

Group _____

Family	Species	Sexual Dimorphism Score

- At this point you have investigated *what* variation in sexual dimorphism exists across different bird families, but not *why* this variation exists, or what explains the patterns of dimorphism seen. You will now brainstorm factors that might account for the patterns of sexual dimorphism observed. Consider what you already know or might need to know about life history or social behavior of these bird families to answer this larger question. Also consider what selective pressures might be at work?
- Based on the thoughts put forth by the class, formulate testable hypotheses and predictions. In other words, what factors do you think explain variation in sexual dimorphism, what data would you need to test your hypotheses, and what patterns would support your hypotheses?
- You will use an online database called Birds of North America (BNA; <http://bna.birds.cornell.edu>) to collect data on your hypothesized explanatory factors, and sexual dimorphism if you have not done so already, for one or more assigned species. Your instructor will demonstrate how to use this resource and may have demo slides available for you to refer to later. You may be instructed to collect these data in class or for homework and will be given specific guidelines on how to quantify or qualify the variables that you are researching.

Data Analysis and Discussion

Once all of the data have been collated, the instructor will either analyze the data outside of class or involve the class in doing so. Either way you will then evaluate whether the data supported your hypotheses.

- View the graphs and statistical results presented and summarize the class's findings.
- Describe your results in evolutionary terms. In other words, describe how your explanatory factors would through natural or sexual selection shape sexual dimorphism among bird species.
- Also discuss any exceptions to overall patterns and what factors might account for these exceptions.

You may at this point be given questions for homework, or directed to additional resources or articles for further reading.