Imaginary Mist Nets

Adapted with permission from "One Bird, Two Habitats." Wisconsin Department of Natural Resources.

Grade Level: upper middle school/ high school
Duration: one 25-minute class period for the introduction and preparation; up to one full day of regular activities during which one or two 5-15 minute time periods allow student "researchers" to gather data on their classmates; and then one 45-minute class period for presentations and discussion
Skills: collection and interpretation of data, discussion, vocabulary, formation of hypotheses, communication, and presentation
Subjects: science, math, and language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can best conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are many tools researchers use to collect information about shorebirds.
- Bird banding is one tool researchers use to collect information about shorebirds.

Vocabulary

- scientific method
- banding
- banding permits
- hypothesis
- population
- sample size
- random sample
- bias
- individual
- color band
- number band
- mist net
- fieldwork
- trends
- stopover site
- migration

Overview

Students create a study plan to answer a research question, then "band" their fellow students and collect data to answer their question.

Objectives

After this activity, students will be able to:

- Give a general description of bird banding.
- Explain why bird banding is an effective research tool.
- Explain what the *Scientific Method of Inquiry* is and how it is used.
- Outline the steps to designing an effective study plan.
- Present and explain the data collected to their class.
- List at least three variables that affected the collection of data in this activity.

Materials

- Colored construction paper
- Masking tape
- Scissors
- One copy per student of the *Banding Birds* reading
- One copy per student of *The Scientific Method of Inquiry* reading

Introduction

Banding is an important method of capturing and marking animals for study. It allows for close examination of live birds, often the only way biologists have of determining sex, age, race, and breeding condition. Because many members of a single shorebird species can look alike to people, banding allows biologists to tell them apart.

When banding and observations are carried out in many places around the world, important information can be gathered about migration routes, destinations, and behaviors. Banding individuals is one of the most important tools in studying many aspects of bird behavior and biology in their natural habitat.

It is often impossible to capture and mark an entire *population*, be it a group of shorebirds that breed locally, a group using the same migratory flyway, or another designated population. If a large enough *sample size* can be studied, it is not always necessary to study the entire population. Sample size is the number of objects in a study. Since scientists can seldom study every member of a population, a random sample provides information that accurately represents the entire population.

For example, when a bird is captured and examined closely, a researcher can sometimes tell such things as its sex and whether it is a juvenile or adult. The researcher also records where and when the bird was captured. If that *individual* bird is marked with a unique *numbered band* and is captured again or recovered by a hunter, its number and all the original information can be looked up. Combining the first set of data with the new set can tell us such things as how far the bird traveled or how long it lived.

Large numbered markings, visible from a distance, can be used on big birds like geese. But to read the number on a shorebird band, the bird would have to be recaptured, which is often difficult. Another method of marking is to use *color bands* arranged in original combinations. This way individual shorebirds can be identified by observing them from a distance, without having to capture them.

A third scientific method of collecting data involves marking an entire group or population with one particular color of band or paint. For instance, if a population

of Black-bellied Plovers in Nome is marked with spots of red paint, and a red-spotted Black-bellied Plover is glimpsed later in Hawaii, one might determine that at least some of that species wintering in Hawaii migrate to the Nome area. If red-spotted Black-bellied Plovers are seen at several broad areas, we might assume that the Nome population winters over a large area. Refer to *Shorebird Technology and Research* in the *Shorebird Primer* for more information about banding.

Activity Preparation

1. Make one copy for each student of the *Banding Birds* and The Scientific Method of Inquiry readings.

Procedure

1. Pass out the copies of the *Banding Birds* reading and *The Scientific Method of Inquiry* to the students.

2. After each student has read the handouts, review the material with the class.

3. Together, have students brainstorm and select an interesting, fairly specific, research question designed to learn more about their fellow classmates. More than one question may be pursued during the data collection, as is often done in scientific research. Tell the students they will be collecting data to answer their question(s). Remember that students need to be available (that is, not in another teacher's physical education class) to collect the data at the appropriate times.

   Example Research Questions

   - How long do students spend eating lunch?
   - Do girls or boys take longer to eat?
   - Where are the students from this class during the last period of the day?
   - What percentage of students leaves the building at the end of the day by way of the front door?
   - How many students leave by the back door?

4. Divide the class into "researchers" and "migratory shorebirds" with a ratio of approximately one "researcher" to five "birds." All the "birds" in this class will be banded. The other students in the school will be thought of as non-banded "birds." Alternatively, all students in the school wearing red on their shirts, for example, could be considered "banded." Decide ahead of time what works best for your classroom situation, but remember that the banded birds should be a representative random sample of students. After the activity, discuss whether or not your assumption was truly a *random sample*. For example, if you choose hat-wearing students to be the "birds," will you be biasing your sample in favor of boys?

5. Ask "researchers" to decide on where they will set up their imaginary *mist nets* to best observe and catch "birds." At the same time, have the "shorebirds" write "banding permits" that give each "researcher" permission to band and observe "birds."

   Mist Net Set-up Ideas

   - "Researchers" can stand in a selected hallway to catch "birds" as they "*migrate*." Perhaps they can stand by the lunchroom and ask departing "birds" if they ate a vegetable or whether they had a brown-bag or hot lunch. Help them to design and prepare data questions and actual data sheets.
   - Because birds are not usually confined to hallways when they travel, they may fly over or round the mist net. Student "researchers" should agree to a "handicap," such as only stopping every fifth banded bird that passes them.

6. Have "researchers" band the "shorebirds" in their class, using masking tape to attach numbered construction paper anklets or bracelets. Instruct the "shorebirds" to go through the school day in their normal fashion.

   Notes:
   Decide ahead of time whether to band on the ankle or wrist, because all "birds" must be banded on the same place since the same team of "researchers" is banding them. In real life, several different researchers, even in different countries, may be banding, and they can more easily tell "their" birds apart at a distance if they are banded in a consistent place or with similar-looking bands.

   If several classes are participating at once, use different colored bands for each class. If a large percentage of the students in the school is participating in the activity, the number of banded birds should be reduced to two out of every five, because in real life researchers can seldom band an entire population.

7. Have students set up their imaginary mist nets to "catch" migrating students and record the data at the time(s) appropriate to answer the research question(s). Emphasize

to the "shorebirds" that they should not change their daily activities because of the research project, or they will risk providing invalid ("bad") data.

8. The next day, divide the class into cooperative groups with at least one researcher per group. Have the students organize the data, with "shorebirds" helping "researchers," and then present their findings to the class. Have students: (1) refer to the original research question (2) present results, preferably using a table or graph (have students pool the data on the board) and (3) draw a conclusion that refers back to the original question or hypothesis.

   Note:
   This presentation can be a good opportunity to incorporate math skills such as fractions, probability, and graphing. Students can determine if a pie chart, bar graph, or line graph is the more appropriate way to clearly convey their comparisons, results and conclusions. Students can calculate the percent of "shorebirds" that migrated outside during lunch and the percent caught in the library — and then graph the results.

9. Some questions may require more *fieldwork* to collect data. If any new banding is required, "researchers" need to request a new banding permit.

10. Have students do a "fast-write" (allow ten minutes for writing up a page-length response to these prompts or questions) on what they learned about the "shorebirds" or about their own observation plan and skills. Here are some possible questions:

    - Do they think results would differ on different days?
    - Did they encounter any significant problems?
    - What would they do differently?
    - Did they collect enough data (Was *sample size* sufficient?) to answer the question?
    - Did new questions arise?
    - What other questions about student behavior could they answer this way?

11. Discuss the activity with the class.

    - How did they use the Scientific Method of Inquiry to answer their research question?
    - What were some of the problems they encountered in "banding birds"? Compare these to the problems bird-banders might face in the field.
    - What were the benefits and limitations of obtaining data on banded birds? What are the similarities between this activity and what biologists actually do? What are the differences?
    - What are some basic categories of data biologists collect on banded birds (date, time, age, sex)?
    - Did the research answer the original question?
    - Why is cooperation and sharing of data important in any study such as this? Who else might be interested in their findings?
    - How could the study be improved to increase the accuracy of the findings?
    - Do scientists know all that needs to be known about bird migration? Why is it that they do not know many exact details about where individual birds (or whales or walrus or certain insects or many other aquatic animals) or populations spend various parts of their lives?
    - How many years do scientists have to band and catch birds before they obtain sufficient information on bird population *trends* (declines or growth)? (At least two years so the data from each year can be compared.)
    - Before participating in this activity, what would they have done if they found a dead bird with a band on its leg? What would they do now?

Additional Activities

Cultural Connection

Students discuss how different people with different cultural viewpoints might react to the idea that shorebirds are banded by scientists. Explain that when we work in other places, it is important to be aware of the variety of cultural viewpoints that may be different from our own so that we can learn how to work with them better.

Take a Field Trip to a Banding Station

Visit a bird-bander in the field or invite one to come to your school to demonstrate the proper use of bird-banding equipment. Banders are busiest during spring and fall migration seasons. Your local, state, or federal wildlife agency's migratory bird department, a local Audubon chapter, or a nearby wildlife refuge should be able to direct you to someone who bands birds in your area.

Human Labels

Brainstorm or discuss with students ways in which humans are labeled or marked, whether for study or as an aid in daily life (for example, name, Social Security Number, library card, medical identification tags, "dog tags" for soldiers).

Banding Shorebirds

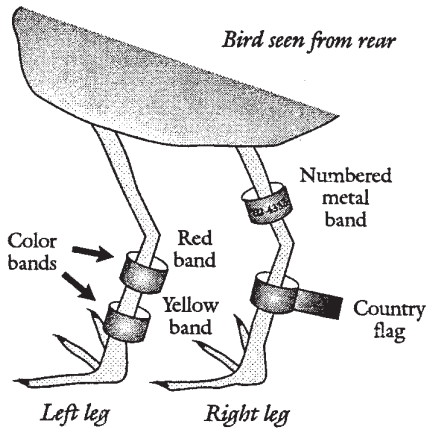
Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird Banding* is a technique to help answer many of these questions.

Whether scientists want answers about a group of local breeding shorebirds or a group using the same migratory stopover site, it is often impossible to capture and band every *individual* within the *population*. However, if a large enough *random sample* is banded, then scientists can assume that the data they collect accurately represents the entire population.

Bird banding involves attaching around the bird's leg a loose-fitting aluminum band that is coded ahead of time with a unique identification number. Biologists record the bird's age, sex, species, location of capture, and weight. If this same individual is captured somewhere else, the original data can be looked up using the bird's personal identification number. By comparing old data with current sightings, scientists can slowly piece together answers to a sort of question puzzle to create a picture of this bird's life. How far has it traveled? Where does it spend its winters? Where does it breed? How long does it live? What caused its death?

Sometimes a series of *colored bracelets* and *flags* are also attached to shorebirds. These may represent the country where the bird was banded, the banding year, and perhaps the age of the bird. The advantage of color-coded bands and flags is that it reduces the times a bird must be captured to gather information. With colored bands, researchers can observe shorebirds from a distance to gather the

Shorebird Leg Bands



information they need. No matter how careful biologists are in capturing birds, it creates stress on them and takes time away from feeding, a critical activity at their migration stopover sites.

Sometimes biologists will clip the feathers between a shorebird's shoulder blades and attach a small radio or satellite transmitter with glue. This technique allows scientists to study shorebirds in remote habitats that are difficult for researchers to get to, and it allows the birds to continue their natural behaviors that might be interrupted if people were nearby.

Bird researchers capture shorebirds with a delicate, almost invisible net called a *mist net* that is stretched across an area where birds are likely to fly at night. Another method for banding shorebirds is banding chicks that are not ready to fly. By banding birds in the year they hatch and recording their annual returns, biologists can see how long they live and if they are being replaced by a sufficient number of young. Another method, *cannon netting*, is used mostly in coastal areas. Here, a net is shot out over feeding shorebirds.

Not just anybody is allowed to capture and band birds. A special permit from the U.S. Fish and Wildlife Service is required for all bird banding in the United States. This is to ensure that the birds are handled carefully and that the data is collected properly.

Many birds that have been banded disappear and die without the researchers knowing where, when, or why. If you find a dead bird with a band, please report it to the appropriate agency.

To Report a Metal-banded Bird

Notify your local state wildlife agency or the U.S. Fish and Wildlife Service Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if you know it), and the exact location.

Send this information along with the band if possible, to:

Chief, Bird Banding Laboratory
Office of Migratory Bird Management
U.S. Fish and Wildlife Service
Laurel, MD 20810

Or call: 800/327 2263
or 800/327 2263

To Report a Color-banded or Flagged Bird

Describe each band: type (metal, color band, flag), colors (as exactly as possible - light green, dark blue), and location on bird (bird's left or right leg, upper or lower leg, above or below other bands). Note if you are unsure of any bands or if you did not see all parts of both legs clearly. Note species, location of sighting, date, and any other information such as behavior, other birds, etc.

Submit shorebird color band sightings by mail or Web:
PASP, Canadian Wildlife Service
115 Perimeter Road
Saskatoon, SK S7N 0X4
CANADA
Or
http://www.mb.ec.gc.ca/nature/migratorybirds/pasp/dc29s01.en.html

The Scientific Method of Inquiry

In science, if you want to answer, or propose a theory to answer, the questions "Why?" or "How?" it is important to have a good study plan. The *Scientific Method* is the framework that scientists use to form a study plan when they are trying to answer questions about our world.

The Scientific Method involves making observations and then forming a *hypothesis*, a statement that answers your question. For example, you watch shorebirds feeding and wonder if the males feed in different places than the females. You guess that the do not feed separately. Your hypothesis statement might read: "*Male and female shorebirds do not feed separately.*"

Unfortunately, you are not a shorebird and you cannot tell the males apart from the females by watching. Now, in order to prove or disprove your hypothesis, you need a plan. Whether you are right or wrong is not the point. You just want to know the answer.

A plan involves a list of *procedures* you are going to conduct to answer your question and a list of *materials* you will need in order to carry out the procedures. You also need to decide how to present the *results* of your plan — for example, by table, graph, or picture.

Now that you have a plan, it is time to put it into action. You carefully collect your *data* and come up with a *conclusion* that answers your hypothesis. Your method, or plan, must be something that can be repeated by another person in order to verify your work and determine if you indeed came to the correct conclusion.

You have hypothesized that there is no *sexual segregation* of shorebirds while feeding. Now what is your plan? First you have to tell the males and females apart. One way to do this is by *color-banding* individual shorebirds. This involves catching the birds in nets, determining whether each bird is male or female by taking certain measurements, and then attaching a color-coded leg bracelet that you can distinguished at a distance. To ensure that you do not injure the birds you are studying, you must have the proper training and permission to band birds. If you do not already have a bird banding license, this would be the first step in your procedure.

Let us say you decide to put green bands on female shorebirds and red bands on the males. Now you need a plan for observing the birds and recording which bird is eating where. Where, when, and how will you make these observations? How will you record your results?

After you have completed the study and gathered your data, you might find that you are not able to come to a conclusion based on your data because there were problems with your plan. Perhaps your data did not provide you with a clear answer. It might be necessary to redesign your plan and then try again.

Often, a scientific plan has to account for a variety of *variables*. This is especially true in the field of biology. Living organisms are part of an ecosystem and are affected by many living and nonliving components of their environment. Consider the *biotic* and *abiotic* factors in your environment that affect your life — air, pollution, kinds of food available, your parents or people you live with, etc. Some variables that might affect a shorebird experiment or a scientist's conclusions include the time of year, the species of bird being observed, the weather, or the availability of food during the study.