Shorebird Research and Technology

Concepts

- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to 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.
- The Scientific Method of Inquiry is the method researchers use to develop a clear hypothesis and a strong study plan.
- Technology provides vital tools for research.
- There are still many unanswered questions about shorebirds and how we can conserve them best.

Activities

Banded Birds
(upper elementary school/ middle school)
Students conduct a banding simulation in which they attach colored construction paper armbands to a group of classmates and then observe and record its behavior over the course of a school day.

Bird Beans
(upper elementary school/ middle school)
Using beans and their desktops, students learn and practice techniques for estimating a population of shorebirds.

You Be the Scientist
(upper middle school/high school)
Students work in pairs to develop a study plan that will help them investigate a question about shorebirds.

Imaginary Mist Nets
(upper middle school/high school)
Students create a study plan to answer a research question, they "band" their fellow students and collect data to answer their question.

Shorebirds on the Web
(all levels)
Students use the computer as a resource tool to learn about shorebirds, ecology, wetlands, other cultures, and ecosystems, while at the same time they discover computer technology that will help them throughout their school years and beyond.

Banded Birds

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

Grade Level: upper elementary school/middle school
Duration: one 30-minute class period to one full day, depending on the option selected
Skills: vocabulary, discussion, collection and interpretation of data, formation of hypotheses, observation, communication/ presentation, evaluation, and team building
Subjects: science and math

Concepts
- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are still many unanswered questions about shorebirds and how we can conserve them best.
- There are many tools researchers use to collect information about individual birds, as well as an entire population of shorebirds.
- Bird banding is one tool researchers use to collect information about individual birds, as well as entire populations of shorebirds.

Vocabulary
- banding
- population
- sample size
- individual
- mist net
- cannon net
- random sample
- color bands
- breeding ground
- migration flyway
- nonbreeding area

Overview
Students conduct a banding simulation in which they attach colored construction paper armbands to a group of classmates and then observe and record the students behavior over the course of a school day.

Objectives
After this activity, students will be able to:
- Give a general description of bird banding.
- Describe the two types of bird bands and the way they are used to provide research data.
- Explain why bird banding is an effective research tool.

Materials
- Ruler
- Colored construction paper
- Masking tape
- One copy of the *Banding Birds* reading for each student

Optional
- Clipboards or shorebird notebooks assembled as described in the *Activity Preparation* section

Introduction
Banding is an important method of capturing and marking animals for study. It allows close examination of live birds, which is often the only way 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 shorebirds 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 behavior and biology of birds in their natural habitat.

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

Biologists use three methods of marking shorebirds: individual numbered metal bands, individual colored plastic bracelets, or a *color band* for an entire group.

For more information about what these bands mean, how biologists safely capture shorebirds, and how to report a dead banded bird, read the *Shorebird Primer* section *Shorebird Technology and Research*.

Activity Preparation
1. Make a photocopy of the *Bird Banding Reading* for each student.

2. Assemble shorebird notebooks by stapling several sheets of 8½ x 11 (or smaller) paper in the middle and then folding them in half.

Procedure
1. Give each student a copy of the *Bird Banding* student reading to review before conducting this activity.

2. Begin with a class discussion on bird banding.
   - Why is it important to be able to track where shorebirds or other animals migrate? (To learn what habitats they depend on; to learn how and where different sexes, age classes, or populations interact; etc.)

- How do biologists know the destinations of migrating birds?
- Is it possible that a different population (in this case, groups made up of a single species of shorebird) of the same species can act separately, behave differently, or rely on different places during their lives? (Yes.)
- How do biologists know which individuals go where, since most members of the same species look alike to us, at least at a distance?
- How would marking birds facilitate the gathering of information?
- What are some ways in which birds can be marked without interfering with or altering their behavior? (Banding, dyeing a patch of feathers, radio tagging)
- Can you think of other important information to be gained from marking individual birds or being able to tell populations apart? (To learn how long birds live, how large their territories are, or how they interact; to find out whether they return to the same area to feed day after day or to the same area to breed year after year; to discover if juveniles return to the area where they were hatched; and to learn how quickly the population migrates from one habitat to another, etc.)

3. Explain that students will have the opportunity to see what it is like to be a bird-bander, as well as a banded bird. However, since it requires special equipment, special permits from the federal government, and a lot of training, they will not actually be banding birds—they will be banding each other!

Option 1 — Observing Banded Birds for a Class Period

4. Have the students make bands out of construction paper that are long enough to fit around their wrists or their ankles. Using as many colors as possible, pass out two pieces (mixing colors randomly) to each student. If you have a big class or not many colors, pass out three colors to each student. (This will allow for more combinations if students wear them in different orders.) Have the students measure and cut out one 1" x 7" strip of each of their colors. These are their "bird bands."

5. Have the students attach the strips around their "bird's" wrists, one strip above the other. Both bands must be visible, placed over any long-sleeved clothing. Secure them with tape. Each student should have a different color combination.

6. Now tell them that they are banded birds and will be known today by their color combinations—"blue over red," "red over blue," or (if three colors are used) "red-green-yellow." Explain that this is how a biologist tells birds apart when they might otherwise look alike.

7. After all the birds are banded, tell the "bird biologists" to observe their "birds" in their natural habitat—in this case, the classroom. Clear the desks away or lead the class to a large open area. Designate one end of the study area as the northern shorebird "*breeding ground*" and the opposite end as the southern "*nonbreeding area*," where shorebirds rest and eat. The middle of the study area is the "*migration flyway*," the flight path shorebirds take to travel between nesting and wintering sites.

8. Divide the "banded birds" into three groups and move each group to a different location in the study area. Instruct the "banded birds" in the nesting area to sit down on the floor as though they are on their nests. "Banded birds" located along the migration route must flap their arms or make eating motions. Those in the south must also make eating motions or pretend that they are resting by standing on one foot.

9. Give the "banded birds" a few minutes to act out their parts and for "bird biologists" to observe them. Ask the "bird biologists" questions like the following:
   - Is "yellow over white" migrating or nesting? Is "red over green" a male or female?
   - Which nesting birds (answer with band combination) have blonde feathers (hair)?
   - Which migrating shorebird is flying (flapping) fastest?
   - How many wintering birds are there with green bands?

After a few minutes, instruct the "banded birds" to "migrate" to the opposite habitat and continue with more questions. Repeat this a few times.

10. Now repeat the activity, reversing the students' roles: "bird biologists" become "banded birds" and previously "banded birds" are now "bird biologists."

11. When everyone has had a chance to play both roles, discuss their observations.
    - Did any birds lose their bands?
    - Do you think you could keep your bands on all day?
    - Were any colors hard to see?
    - Did any birds have exactly the same color combination or confusing combinations?

- Was it hard for everyone to see all of the birds all of the time?
- What would this be like if you were real birds and biologists? What problems might you have?

Option 2— Observing Banded Birds for a Day (or Two)

4. Assign each student a partner. Designate one student the role of "banded bird" and the other of "bird biologist." Explain that the job of the "bird biologist" is to locate and observe the "banded bird." The role of the "banded bird" is to go about doing what it always does.

5. Explain that each "bird biologist" has five times (which occur during the remainder of the day or the next school day) to locate and observe his or her "banded bird." In a real shorebird study, these times might be high or low tide or early versus afternoon hours.

6. Have the "bird biologists" take out a piece of paper, or a shorebird field notebook if they have one, and instruct them to draw up a data sheet similar to the example provided. Substitute the observation times to fit your class schedule. Divide the time you have available for this activity into two rounds so that each student has a chance to play both roles. "Banded birds" should not know the times they will be observed! Ask students to give the table an appropriate, descriptive name. This will encourage them to keep focused on the data question and practice the skill of clear labeling.

7. At the times indicated on their data tables, "bird biologists" should record in words what their "banded birds" are doing. Explain to them that you will not announce when it is time to make an observation. This would alert the "banded birds" to the fact they are being studied and may cause them to change their behaviors. If their banded birds are not present at the observation times, students should also record that on their data tables.

8. After the five observation times, have the students reverse roles. The new "bird biologists" should secretively draw up their data tables and prepare to make their observations. Make sure you give the new "bird biologists" different *observation* times.

9. When all the students have had a chance to role-play as a "bird biologist," have them report on their findings by:
   - Pooling the data on a "flock" data sheet drawn on the board. Ask the "bird biologists" to work together to determine the most common activity, any pattern of activity according to the time of day, the most unusual activity, etc.
   - Using a graph that shows their results in order to identify the most common activity. Make a bar graph comparing how often an activity was observed in each time period.
   - Comparing percentages of the birds not observed at each time. Determine the percentage of "bird biologists" who did not observe birds at a designated time.
   - Presenting the results in a paragraph describing what they learned about their "banded birds" or about their own observation techniques.

10. Discuss the results and the following questions with the class:
    - Was it easy to find your bird at the appropriate time?
    - How did your bird's activities compare to that of other birds?
    - Do you know what was going on (for example, lunch, math

Data Table Example

What My Banded Bird Is Doing at Certain Times of the School Day

Time	*Description of Activity*
10:15	
12:35	
1:00	
2:10	
2:30	

period, physical education, class break) in the school or class during each observation time. Do you think that might have a relationship to the data results (for example, was there more running during lunch or more talking during art)?

- Did you notice any differences in the activity patterns of males and females?
- Do you think you got an accurate picture of what your bird does during the day?
- Was the sample size sufficient to give an accurate picture of bird activity?
- Did you have a banded bird that was not present? What challenges would that create for researchers?
- How could the plan we followed be modified to learn something about the specific activities of all the birds in the school? (First, come up with a study question or hypothesis. Then decide when and where would be the best time and place to collect data.)

Additional Activities

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. Keep in mind that 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 bird 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, residency status, medical identification tags, "dog tags" for soldiers).

How Do You Report a Banded Bird

If you or your students see a banded bird, it is important to report it. Color bands are reported to a different organization than silver/metal bands. To learn more, go to the Shorebird Sister Schools Web site *http://sssp.fws.gov* and click on "Tracking."

Banding Shorebirds

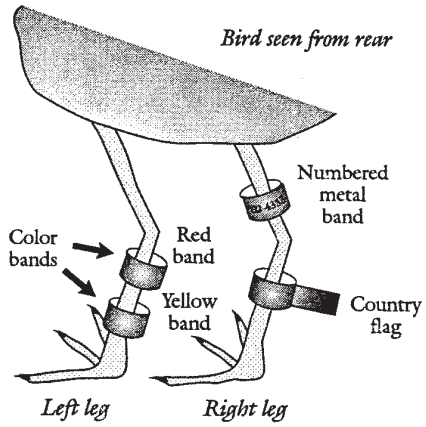
Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird 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 information they need. No matter how careful biologists are in capturing

Shorebird Leg Bands



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 the Web site:

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

Bird Beans

Grade Level: upper elementary/ middle school
Duration: 30-40 minutes
Skills: critical thinking, comparison, collection and interpretation of data, vocabulary, discussion, and visualization
Subjects: science and math

Concepts
- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- Because of this concentration, shorebird populations are extremely difficult to count.
- Estimating population trends helps alert biologists to potential problems within a habitat.

Vocabulary
- census
- population
- migration
- stopover
- sample
- bias
- camouflage
- transect

Overview
Using beans and their desktops, students learn and practice techniques for estimating a population of shorebirds.

Objectives
After this activity, students will be able to:
- Explain why biologists conduct shorebird population censuses at migration stopovers.
- Define the terms population, census, sample, and bias.
- Describe how camouflage might affect census numbers.
- Instruct another classmate on how to estimate, as accurately as possible, the population size of a large group of moving shorebirds (or other organism).

Materials
- One copy for every two students of the *Sampling Populations* reading
- One *Bird Beans Student Worksheet* for every two students
- Large, dry beans (about two-thirds cup per pair)
- Measuring cups or paper cups
- String (about three feet per pair)
- One pair of scissors for every two students

Introduction
In their rush to get to the summer breeding grounds as soon as the weather allows, many Arctic-nesting shorebirds *migrate* almost simultaneously. They also tend to share the same important *stopover* wetlands along the migratory flyways. Flocks of shorebirds appear at these "rest stops" in the hundreds, thousands, hundreds of thousands, and even millions! Many shorebird flocks were even larger before nineteenth century market-shooters took their toll.

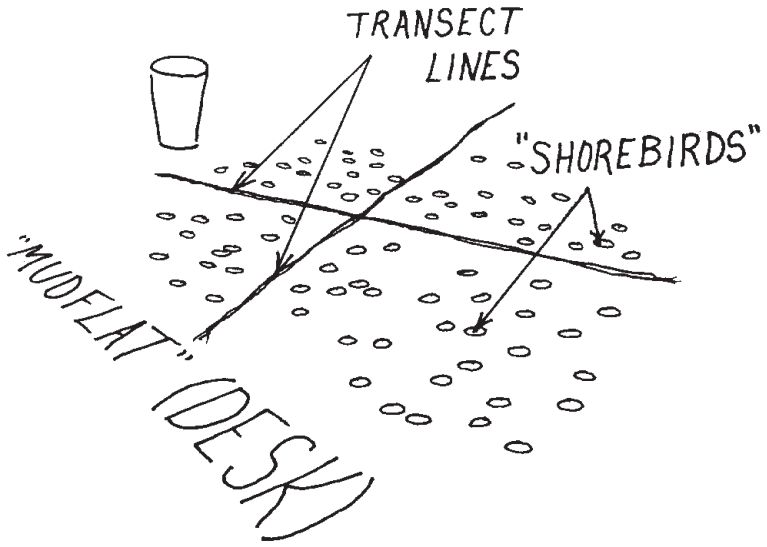
An accurate *census* (count) of these shorebirds is necessary each year, or every several years, to note and understand any changes in the *population* sizes of these migrating birds. Significant changes in the population size may alert biologists to potential problems within the birds' habitat.

However, counting such huge flocks before they fly away or split up is not an easy task. Working fast, yet gathering accurate numbers, is critical. Biologists have devised several methods that make counting large groups of wildlife easier.

Procedure
1. Discuss with students how large shorebird flocks can become during migration. Have older students read the *Sampling Populations* sheet. Are they ready to try counting big numbers, or do they want to learn some "tricks" to make it easier?

2. Divide students into groups of two and give each pair a Bird Beans Student Worksheet.

3. Have each pair measure and cut two pieces of string about 18 inches long.



4. Have each pair measure out two-thirds cup of beans. Tell them that each cup holds a "population of shorebirds" to estimate. If enough measuring cups are not available, or students are younger, give them each a five ounce paper cup nearly full of beans.

5. Ask them to write down quickly their best guess of how many "birds" they have in their cups. Each member of the pair may have a different guess.

6. Now have each pair spread their "birds" out on their desk which now represents a mudflat. Direct them to spread the beans in a single layer on the desk (mudflat) as evenly as possible without counting them out.

   Optional: Set aside five beans. Concentrate on what five beans look like. Now try "dividing" the beans with your eyes into groups of five. Count those groups of five as best you can, either with or without using your fingers. In other words, count by fives. Do not worry about getting the exact number. Encourage students to race through this step. Repeat, using groups of ten instead of five.

7. Instruct them to divide their "birds" into two sections by laying the string across the center. Lay the other string at right angles to the first, dividing the beans into four sections of approximately equal areas.

8. Ask students to count all the "birds" in one square. Write down their answers on Line 3A and multiply this answer by four (the four quadrants).

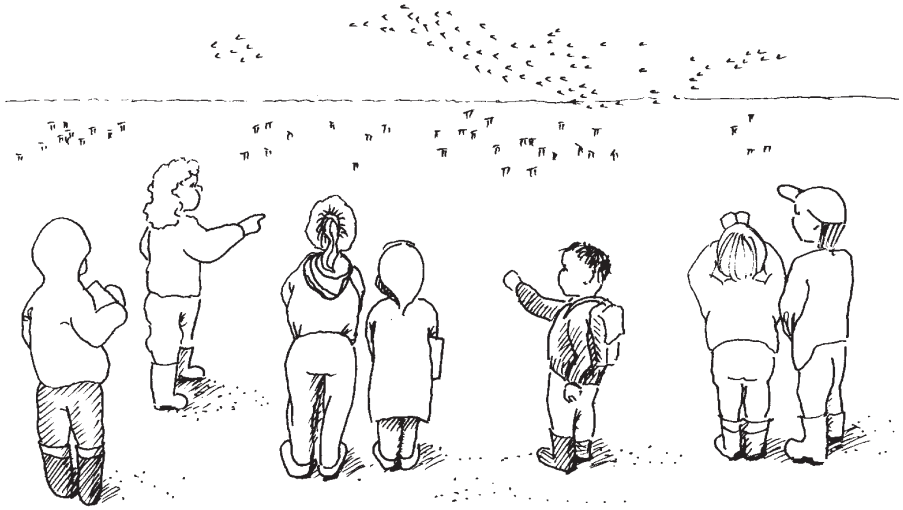
10. Now have them count and record the number of "birds" in each of the other three squares. Follow the directions on Line 4, add these four numbers together, and write down the result.

11. Look at the answers the students got. Compare and discuss the results as a class. Remind the students that when they look at a real flock of shorebirds, they will not be able to divide it with string or even fences. They will have to use their eyes to mentally divide either the flock (beans) or the beach (area of desk that encloses all beans) that the flock is on into equal groups of birds; then multiply to obtain the total.
    - Which was closer to the actual number — their guesses, the sum of the four counted areas, or the result of multiplying the birds found in one quarter of the area by four?
    - Who guessed high and who guessed low?
    - How can we determine how many bird beans the entire class has without counting any more beans? (Count the number of pairs of students, and multiply that number by the number of beans your group has. This method works only if every pair has approximately the same number of beans, of course.)

12. After dividing the beans into four sections with two strings and multiplying, repeat the step using three strings to divide into six sections, and four strings to divide into eight sections.

13. For a more challenging and realistic experience, and to test for *bias*, use a mixture of three different kinds of beans (for example., kidney, pinto, and navy) as your "shorebird population." Also try counting them against different colored paper backgrounds that match either the light or dark colored beans. How does this make population sampling an even greater challenge?

14. Practice this counting procedure on a shorebird observation field trip. If such flocks are not seen, have them practice by counting trees in a park or people in a field.



Additional Activities

Assemble and Use Transect Frames
In fieldwork (conducted in the natural habitat of the organism), *transects* are a way of dividing habitat into small, representative *samples* of the entire area. A study of the sample is far less time-consuming, and perhaps less expensive, than a study of the entire area or population. If we assume that the sample is very similar to the rest of the area, then anything we learn from the sample helps us understand the total.

Ask students to construct transect frames ("windows") of approximately two inches using paper or cardboard squares.

Repeat the bird-bean counting activity, following these steps:

1. Measure the height and width of the spread beans.

2. Calculate how many two inch transects fit inside the spread of beans, or simply rotate the transect around the pile, counting how many times it fits.

3. Count how many beans are in one square.

4. Multiply the number from Step 2 by the bean count from Step 3.

Transects can also be used on field trips to examine the invertebrates on a beach or insects in the grass. Students can randomly toss their frames out three times and examine what is found within the sample. Compare the samples or average them together if they are all located in the same area.

Advanced Study of the Population Census Technique
Taking a population census is another commonly used method in wildlife biology and management. Discuss with students — or invite a wildlife biologist to the classroom to discuss — the reasons why censuses are important.

What does a census tell us? (The number present in one place at one time.) What it does not tell us is the significance of the census number. For instance, a census does not tell us whether a population is healthy or not. We need some baseline data to compare it with. How is census information useful to humans? Often it is most useful when compared to other information, like the number present in other areas or the number present in the same place in a different season, a different year or under different weather conditions.

Your discussion may include terms like:
- change over time
- population trends (declines or growth over time)
- inter-year variability (differences between years)
- intra-year variability (differences within one year)
- baseline data (initial or historical information often presumed to be taken at a time of typical environmental conditions and useful for future comparison should there be a major or catastrophic event like El Niño or an oil spill)

Bird Beans Student Worksheet

Directions: Pretend that the beans you spread on your desk are a flock of shorebirds. Follow your teacher's directions to try and "count the birds." Use this page to record your answers.

1. How many birds do you guess are in your cup?

   Name:_____Guess:_____

   Name:_____Guess:_____

2. How many groups of five birds do you have? _____

3. A. How many birds are in one (of the four) sections?_____

   B. Multiply the above number by four:

   _____ x 4 = _____
   (Number in one section) (Number of total birds)

4. Count the number of birds in the other three sections and add them together to get the total number of birds:

   _____ + _____ + _____ + _____ = _____
   (Total number of birds)

5. Was your guess too high or too low? _____

Sampling Populations

Estimates are more than a random guess made by researchers. Biologists watch and become familiar with the behavior of the species they are surveying, study photographs of a known number of birds at various concentrations, and practice making estimates via computer-generated models and exercises.

Why do biologists count birds and what do they do with this information?
Knowing the exact size of a population is less important to biologists than knowing how the population numbers of individual species change over time. Careful counts can alert biologists to serious population declines and justify management protection. Counts can also tell biologists whether or not their management efforts are helping a species to increase its population numbers.

What are some of the difficulties in counting birds?
The total size of a population is difficult to know for species with thousands or millions of moving individuals. Biologists therefore estimate the number of animals in a given population. Shorebird populations are most easily estimated when they congregate in large flocks at migratory stopover sites. When shorebirds are in their breeding or wintering habitats, they are much more spread-out, making them even more difficult to count.

Mistakes can occur when there is *bias* or *sampling error*. Bias occurs when some characteristic of a population causes it to be over or under-represented. For example, in an estimate of a flock of mixed species, the estimate would likely be less accurate for small, drab-colored, hard-to-see species (one that was well *camouflaged*) than for a brightly colored bird. One type of sampling error, observer variability, occurs when individual observers regularly make incorrect estimates. Look at the following numbers observers recorded while counting the same flock of birds:

Observer 1	*246,000 birds*
Observer 2	*638,100 birds*
Observer 3	*638,900 birds*
Observer 4	*638,400 birds*
Observer 5	*1,452,800 birds*

From this example, we can see that observers two, three, and four do not show much variability, but observers one and five show great variability when compared to other observers. Some observers regularly estimate too high, others too low. If you are making important counts, it is important to know what type of observer you are.

You Be the Scientist

Grade Level: upper middle school/ high school
Duration: one 40 to 50-minute class period.
Skills: critical thinking, communication/presentation, formation of hypotheses, vocabulary, discussion, and team building.
Subjects: science and language arts

Concepts
- There are still many unanswered questions about shorebirds and how we can best conserve them.
- The Scientific Method of Inquiry is the method researchers use to develop a clear hypothesis and a strong study plan.
- Some shorebirds concentrate in great numbers at stopover sites which provide large populations of birds for study.

Vocabulary
- hypothesis
- Scientific Method of Inquiry
- data
- procedure
- study plan

Overview
Students work in pairs to develop a study plan that will help them investigate a question about shorebirds.

Objectives
After this activity, students will be able to:
- Explain the *Scientific Method of Inquiry*.
- Rewrite a scientific question into a hypothesis statement.
- Develop a scientific study plan that includes a hypothesis, procedures, and materials list.

Materials
- One *Scientific Question Card* for each pair of students
- One copy of the student reading *The Scientific Method of Inquiry* for each student.

Activity Preparation
1. Photocopy and cut a set of *Scientific Question Cards*. Students can write their own questions or rewrite an existing question in the form of a hypothesis in the blank cards provided.

Procedure
1. Push desks aside; arrange the students and their chairs in a circle.

2. Form teams of two and give each pair a copy of the reading *The Scientific Method of Inquiry*. Ask them to carefully read the handout. Answer any questions about what they read before proceeding.

3. Have each team choose a *Scientific Question Card* without reading it first.

4. Give them ten minutes to prepare answers to the questions. Each team must develop a *study plan* that includes at least five procedures, how, when, and where (time of year, and possibly time of day or tide, etc.) they will conduct their observations or experiments and a list of materials they will need.

   Note: Remind students that the object of this activity is to figure out how they would go about trying to answer their questions if they were biologists studying shorebirds. The answers to many of these questions are not yet known for many species. In fact, they may never be completely answered.

   Here are just a few methods that students might use to gather information:
   - Literature research/interviews (to find out what is already known)
   - Captivity experiments (on organisms brought into the laboratory rather than observed in the wild, natural habitat, or "field")
   - Dissections
   - Banding or marking birds
   - Observations
   - Volunteer observations
   - Censuses (counting)
   - Transects (extrapolating from what is found in one area)
   - Averaging a number of observations
   - Comparing seasonal data or annual data to show changes or trends
   - Presenting results as a bar, line or pie graph (for example: comparing the diet of Dunlins and Western Sandpipers by graphing the percentage of worms in their diet as Y-axis and bird species as X-axis)

5. When all teams are ready, have each team read its card and present its study plan to the class.

6. Each team should ask the rest of the class: Is this a good study plan? Why or why not? How could it be better?

Additional Activities:

Cultural Connection
Students can write a question to a shorebird scientist in another country, asking about the people's attitudes towards shorebirds and their habitats (wetland or grassland). Submit the question on-line: *http://sssp.fws.gov*, click on "References", go to "Ask a Biologist."

What Are Your Questions?
Have students brainstorm a shorebird question they want answered and develop study plans to find out the answer. Are any of their questions already the topic of scientific research? Go to the Shorebird Sister Schools Web site at http://sssp.fws.gov. and click on the "Tracking" or "Reference" links. Through the program's Web site, your students can meet real biologists and read about what they do, learn about current shorebird tracking projects, ask a question, and browse the Web site archives to read the questions other students have posted to biologists.

Develop Hypotheses
Instead of devising study plans, use this activity format to have students develop and present *hypotheses* or possible theories (answers) to the science questions.

Examples:
1. Why do shorebirds tend to be *circumpolar* in their breeding distribution (breed on more than one continent or in different hemispheres of the globe)?

2. Say Daniel counted 56,800 Western Sandpipers on the peak day (most birds) of spring migration on a beach in the Copper River Delta. In the fall he counted 783 on the peak day. How many were missing and where did they go?

You Be the Scientist, Part II
Have students conduct research projects designed to answer a question, or ask them to write a paper based on the research they do.

You Be the Scientist
Scientific Questions Cards

(Make one photocopy so every two students get a card.)

You Be the Scientist Question	You Be the Scientist Question
How could you prove if a species is territorial or not?	How could you find out if a shorebird's territory is three-dimensional (like a polygon) or two-dimensional (like a line along the beach)?
You Be the Scientist Question	**You Be the Scientist Question**
How could you devise a plan to find out if female shorebirds are territorial?	How could you measure the size of a home range or territory?
You Be the Scientist Question	**You Be the Scientist Question**
How could you find out what a shorebird eats?	If studying nests, how could you keep predators from following your scent trail to the nests you are observing?
You Be the Scientist Question	**You Be the Scientist Question**
How could you find out the percentage of breeders versus non-breeders in a shorebird population?	How could you find out if a population of shorebirds comes back to the same place every year?
You Be the Scientist Question	**You Be the Scientist Question**
How could you find out if there is a greater *diversity* of breeding shorebirds in tundra or in coastal marsh? If there is greater diversity of breeding in the tundra than elsewhere, why?	Scientists believe that shorebird eggs are slightly pointed at one end to minimize heat loss when the eggs are lying next to each other in the nest. How could you prove or disprove this theory?
You Be the Scientist Question	**You Be the Scientist Question**
How could you answer the question "Are shorebirds *sexually segregated* when feeding?"	How could you find out if plastic leg bands interfere with the bird's lifestyle (flying, walking, feeding, mate selection, etc.)?

You Be the Scientist
Scientific Questions Cards

(Make one photocopy so every two students get a card.)
(Write your own research questions in the blank cards provided.)

You Be the Scientist Question	**You Be the Scientist Question**
How could you find out how oil development in Arctic breeding grounds impacts the survivorship of shorebird chicks?	How could you find out why a population of migratory breeding shorebirds is declining?
You Be the Scientist Question	**You Be the Scientist Question**
Migrating shorebirds stop at the Delaware Bay by the thousands during spring migration. How can you find out why?	Shorebirds are breeding in nearby prairie grassland but not in one area that looks like good habitat. How can you find out why?
You Be the Scientist Question	**You Be the Scientist Question**
You Be the Scientist Question	**You Be the Scientist Question**
You Be the Scientist Question	**You Be the Scientist Question**
You Be the Scientist Question	**You Be the Scientist Question**

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.

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

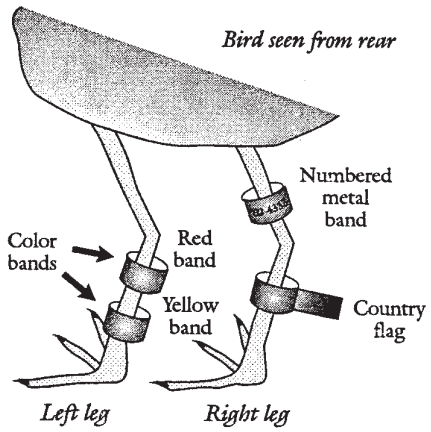
Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird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

Shorebirds on the Web

Using the Internet Students learn about Shorebirds and Connect with Others

Grade Levels: all levels
Skills: communication, use of technology, and interpretation of data
Subjects: science, technology, social studies, and language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can conserve them best.
- Scientists are still learning where shorebirds migrate and the flight paths they follow.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- Technology provides vital tools for research.

Vocabulary

- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail
- hypertext links

Overview

Students use the computer as a resource tool to learn about shorebirds, ecology, wetlands, other cultures, and ecosystems, while at the same time discovering computer technology that will help them throughout their school years and beyond.

Objectives

After this activity, students will be able to:

- Locate a species of migrating shorebirds using the Shorebird Sister Schools Web site.
- Describe the regions of the world one local shorebird species visits.
- Communicate with students in other states, provinces and countries about shorebirds.
- Use the Internet to communicate with biologists and other students.
- Post questions on the Shorebird Sister Schools Website.

Materials

Access to a computer that satisfies the following requirements:

1. Monitor, keyboard, mouse, hardware computer, IBM clone or Apple/Macintosh with modem. Modem can be internal or external — the faster the modem the better. A 28.8 speed modem or faster is recommended.

2. Minimum computer speed of a "486" (preferably higher or the kids will lose interest because the pictures load too slowly).

3. Internet browser such as Netscape, Microsoft Internet Explorer, etc.

4. Dedicated phone line for your modem. If your school has a sophisticated phone system, you will need one phone line to the outside that is not part of that system. Perhaps you have a computer lab with that setup.

5. One copy of *Shorebirds on the Web Computer LINGO Crossword Puzzle* for each student.

Background

The Shorebird Sister School Program (SSSP) allows students, teachers, biologists, birders, parents to share shorebird observatoins as they migrate between their nesting and wintering grounds. By tracking the shorebird superhighway on the Internet, students will be engaged in learning about shorebird stopover locations, shorebird ecology, migration, ecology, and ecosystems while learning how to use computers.

By using the Internet to view the Shorebird Sister Schools Web, participants will have the opportunity to exchange ideas and observations with others throughout the Western Hemisphere. Participants can share field trip information and data, report sightings of banded shorebirds, and learn about current shorebird research. Participants can also ask questions about what other classes are doing in the Shorebird Sister Schools Program, or direct shorebird ecology questions to other educators and shorebird biologists.

Participant can also join the Shorebird Sister Schools E-mail Network. The Network will provide monthly e-mail updates on upcoming activities and events for participants, as well as new features on the Website.

For complete details on how to get involved in the Shorebird Sister Schools Program and how to use the Web site, go to SSSP and Connecting to Cultures.

Activity Preparation

1. Find and Become Familiar with the Shorebird Sister Schools Web site
   - To get to the Shorebird Sister Schools Program Web site, type in the Web address *http://sssp.fws.gov* wherever it asks you for a location or address. Then hit "return/enter" and the Shorebird Sister Schools Program Web site will appear on your screen.

   - To *navigate* around the various pages, you will need to click with your mouse on the colored, underlined text (*hypertext links*). This will take you to another page. There are two methods to return to the previous page — click with your mouse on the "back" button on your browser or click on the hypertext that says "Shorebird Sister Schools Main Page."

- To quit the *browser* program, click on the quit button or click on File, Quit/Exit in the menu bar at the top of the page.

2. Join the Shorebird E-mail Network
   - To join the network, you will need an *E-mail* address. An E-mail address may look something like this: sandpiper@western.flyway.net.

   - Depending on how your school is set up, you may already have an *Internet* connection or may need to sign up with an Internet provider. The computer support staff at your school can help you set up an E-mail address.

   - Once you have an E-mail address, join the E-mail Network by clicking on the "I want to join the Network" box on the Shorebird Sister Schools Registration page on the Website. You can also send your request directly to the Shorebird Sister Schools Program coordinator, *sssp@fws.gov*.

Procedure

1. Make sure your students are familiar with the computer terminology used throughout this activity. Use the Computer LINGO Crossword Puzzle for practice using and defining these terms. The answers are located on the last page of this activity.
2. Show your students how to log on to the SSSP Web site. Explore the different information categories together.
3. Ask the students to brainstorm how they could use the site individually and as a class. Write this list on the board. Refer to the suggestions provided in the box if the students did not come up with ideas. Go to the SSSP section of the guide for more Web ideas too.
4. Assign individual students, or student teams, to work on as many of their ideas as possible. Send home information about the Shorebird Sister Schools Program (including the Web address) so parents can log on too.

Field Trip Options:

1. During the Field Trip: Take a laptop computer to the field. At the end of the Field Trip, as a wrap-up activity, gather students in a circle around you with the open laptop. As a group, have the students write a posting for the SSSP Web site describing the Field Trip site, weather, birds send, activities done, etc. When you return to the office, simple copy and paste the posting on the SSSP Web site "Report Shorebird Sightings" link located from the "Tracking" link on the main page.

2. Post Field Trip: At the beginning of the next class period after the field trip, have students use their field journals to write a class posting for the SSSP Web site. Follow the directions above posting the observations on the Web site.

Ideas for Using the Shorebird Sister Schools (SSSP) Web Site

- Get the students on the SSSP Website at least once a week to check on shorebird migration. Check more often during the spring migration. Those birds move fast!

- After a field trip, "publish" the students field data observations on the Website.

- Find pen pals through the Website. Share what you have learned about shorebirds with your pen pals.

- Have the students write a question to ask research biologists and send them through the "Ask a Biologist" form on the Website.

- Use a large wall map to track the shorebirds as migration routes are reported online. You may be able to use the poster included with this activity guide.

- During the Spring plan time to allow students to follow along on the Tracking Projects featured on the SSSP Web site.

Additional Activity

Build Your Own Web Page

Older students might be interested in building a Web page that highlights their shorebird projects, field trips, and activities. Include species lists, research projects, maps of local habitat, and information about a local threat. Once your Web page is complete and on-line, send an E-mail message to the SSSP coordinator at *sssp@fws.gov* and the U.S. Fish and Wildlife Service will make a link to your site.

Answers to Web LINGO

Down

1. Web page
2. browser
3. Internet
4. Listserve

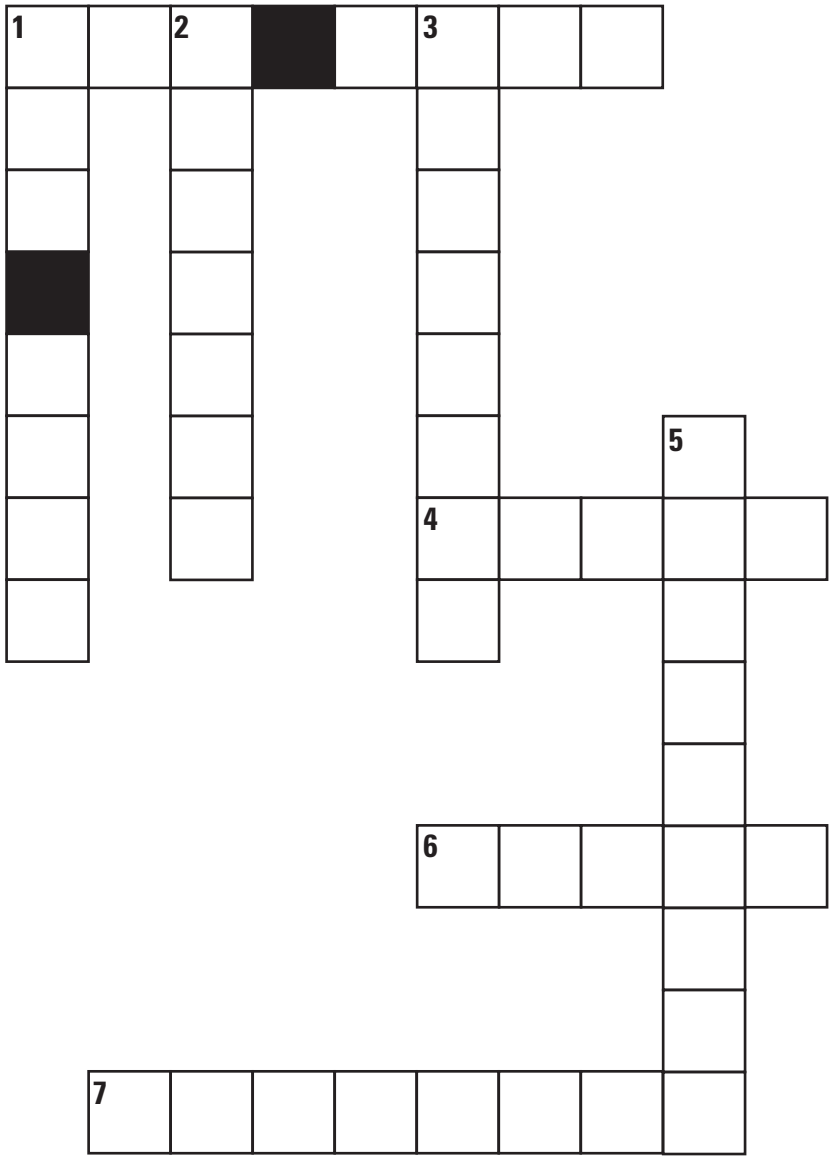
Across

1. Web site
2. E-mail
3. modem
4. navigate

Shorebirds on the Web
Computer LINGO

Directions: Match the correct computer term with the sentences below to complete the crossword puzzle.

Vocabulary
- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail



Down
1. One page of a Website
2. Locates and displays Websites
3. A system that connects computers
5. Sends e-mail to everyone on a list

Across
1. A place on the Internet containing specific information and links
4. Electronic mail
6. Device that sends information by phone line
7. To find your way around the World Wide Web