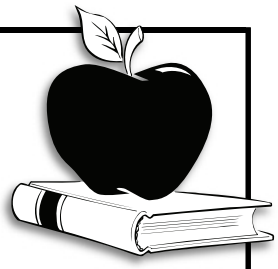
CLASS TIME: two class periods

VOCABULARY: scientific inquiry

COMMON CORE STANDARDS: English language arts MS Writing 1, MS Writing 2, MS Writing 4, MS Writing 8, MS Speaking and Listening 1, MS Speaking and Listening 2, MS Speaking and Listening 4

TEACHER'S GUIDE



ACTIVITY

Designing Researchers

OVERVIEW

Students practice scientific inquiry by proposing a research design to study populations of Neotropical migrants.

CONCEPTS

Scientific inquiry, including posing problems, solving problems and persuasion can be used for the study, management and conservation of bird populations and forest ecosystems.

OBJECTIVES

Students will be able to: 1) state the components of scientific inquiry; and 2) propose a research design to study the distribution of a species of Neotropical migrant.

KEY POINTS

- Scientific inquiry includes posing problems, solving problems and persuasion.
- There are different ways to gather scientific information about birds.

TEACHER BACKGROUND

In this activity, students review the process of scientific inquiry and the "Three Ps:" problem posing; problem solving; and peer persuasion.

Have students recall a Neotropical migrant that they have already been introduced to that lives in the forest. Their task will be to devise potential ways to determine the location and number of this bird in their county. Students don't have to carry out the actual research but can share their proposal with class members. The emphasis here is on scientific inquiry. Encourage students to be creative in making proposals to find the answers. Place little emphasis on what you know about population censusing and allow students to speculate.

To estimate the number of birds in a particular area, monitoring is done over a period of time, such as 10 days. Different methods are then used to census birds in the area. Integral to any census is detailed, accurate journal-keeping.

A point count is considered an efficient method for counting birds in forested habitats. At a specified time of day (usually between 5:00 a.m. and 9:00 a.m.), an observer stands in one spot for a specified amount of time (such as three minutes) and records all birds heard or seen within a certain distance. This process is repeated at many spots, over the course of several days. The data are recorded on a map.

Strip transects are another common method for censusing birds. Strip transects are similar to point counts, but the observer is moving along a specified path while recording birds seen or heard within a certain distance from the path. This method is more effective in open spaces.

Bird census methods are not infallible. Different researchers may have different abilities to hear or see birds. In addition, bird identification skills vary with the individual. The time of year is important for identifying birds by sound, since birds are more noticeably vocal during the spring mating season. It cannot necessarily be assumed that every male calling is successfully mated, either. Some birds continue to call in search of a mate. Hearing one bird does not necessarily mean that more are present. Not hearing any birds does not necessarily mean that none are present. It just means that none happen to be vocal or visible during that bird observation time. It is also difficult to ensure that the same bird is not identified more than once, at different times or different places or by different observers. Despite these difficulties, bird census techniques continue to be a relatively successful way to estimate bird populations.

Group proposals should include an introduction (a brief description of the question) and a methods section (detailed procedures for answering the question). For example, one group's proposal might be to select a

sample of forest areas in the county, schedule visits to the sample forests over a 10-day period and count the number of birds in the sample forests by walking through the forests and stopping every 100 paces to listen for these birds. Peer review of this proposal might include questions such as: What time of year should this be done?; Are you also collecting data on the size and type of forests you visit?

PROCEDURES

1. Review the process of scientific inquiry with students. You will be giving them a research question (problem posing), and they will need to propose a research design to answer the question (problem solving) and then present the proposal to the class for peer critique (peer persuasion).

2. Divide the class into groups of four to five students each. Tell students they will be taking the role of researchers. Have groups propose a method to address the following problem: “Research has indicated that (insert bird species) populations may be declining in some places. To understand more about where these birds live and what may be happening to them, we need data. Your problem is to determine where these birds are found in your county and to determine approximately how many there are.”

3. Student groups should think through this problem and write a proposal for their research. Make it clear that students will not have to actually conduct the research, so they can think beyond their own immediate resources. Questions such as "How can you tell when there's a (insert species name) in the woods?" may help prompt student thinking. Students may suggest ways to survey different woodlands around the county to listen for these birds. How would they know where forest plots are located in their county? What time of year would they conduct this research? What time of day? Where might they look to find any previous research? They may suggest looking for last year's nests during the winter. How would they know what the nest of this bird looks like or where it would be found in the forest? Encourage creativity.

4. Give students the rest of the period to design their research proposals. Suggest that they use study halls or time after school to conduct any background research.

5. The next day, have student groups write a formal proposal, then present their ideas to the class for review. Reviewers should be able to point out potential flaws in the research designs, and presenters should be able to persuade the class that their design will work.

6. Discuss how the data to be collected might aid researchers in bird conservation. Show how this activity follows a process of scientific inquiry necessary for any research. Incorporate information on bird censusing techniques into the discussion.

DISCUSSION

1. What other kinds of information would students need to study this bird? Did this activity generate more questions?

2. How varied were the research designs? What other ways could researchers census bird populations?

3. How easy or hard was it to create a proposal as a group? What kind of expertise would your group need to actually carry out this research? Was it difficult to persuade other class members that your research design had merit?

EXTENSIONS

1. Using the tables on the following pages, have students graph trends of some select migratory bird populations in Illinois from 1966-1994. Some graphs could include a bar graph showing all birds, birds with population decreases (negative numbers) or increases (positive numbers) or graphs of the population trends for each sampling period, after which students should compare the three graphs.

2. Take the class on a field trip to a large wooded park and conduct point counts to listen for birds.

3. Contact the Illinois Department of Natural Resources (http://www.dnr.illinois.gov/conservation/NaturalHeritage/Pages/Home.aspx), the Illinois Ornithological Society (http://www.illinoisbirds.org) or the Illinois Audubon Society (217-544-2473; http://www.illinoisaudubon.org) to find out about current bird research topics.

4. Pair students with experienced birders to participate in a bird census.

ASSESSMENT

1. Assess group proposals based on how well they address the research question.

2. Evaluate students' abilities to persuade class members of the merits of their proposal.

Population Trends In Illinois of Some Neotropical Migratory Species for Three Sampling Periods: 1966-1994; 1966-1979; and 1980-1994. Numbers represent population decrease (negative number) or increase. The numbers in the chart represent compilation of data collected over the sample periods. Numbers across each row have been calculated statistically and will not compute as presented (data from Illinois Department of Natural Resources, 1995).

SPECIES	1966 to 1994	1966 to 1979	1980 to 1994
black-billed cuckoo	-2.1	3.4	-4.0
yellow-billed cuckoo	-3.4	4.5	-3.8
eastern whip-poor-will	-16.1	-9.9	-8.7
chimney swift	-1.7	2.1	-4.2
ruby-throated hummingbird	-2.0	2.5	3.8
eastern wood-pewee	-0.7	-5.3	0.7
Acadian flycatcher	-2.9	-8.3	-2.1
great crested flycatcher	-1.4	0.4	-1.6
eastern kingbird	-2.9	-6.4	-1.7
purple martin	-5.1	-0.7	-5.5
northern rough-winged swallow	-1.5	11.9	5.7
bank swallow	-2.5	5.4	-2.4
cliff swallow	19.0	-6.1	8.9
barn swallow	0.9	4.2	-1.3
house wren	1.6	-0.1	3.0
blue-gray gnatcatcher	5.9	-0.9	8.1
wood thrush	-1.5	0.3	-4.9
gray catbird	1.5	3.2	—
white-eyed vireo	-0.9	1.8	-2.2
yellow-throated vireo	4.2	-4.4	2.2
warbling vireo	1.2	1.6	0.4
red-eyed vireo	-2.7	-0.4	0.4
northern parula	6.7	13.3	11.1
yellow warbler	6.1	6.4	3.8
prothonotary warbler	1.2	-14.0	-1.8
common yellowthroat	-0.4	0.4	-0.9
yellow-breasted chat	-4.1	-8.2	-4.3
scarlet tanager	-1.5	4.4	7.9
rose-breasted grosbeak	3.3	12.0	-0.8
indigo bunting	-0.8	0.5	-1.8
dickcissel	-4.0	-10.4	-1.7
chipping sparrow	10.4	2.9	10.2
grasshopper sparrow	-6.1	-9.5	-2.0
bobolink	-10.7	-5.4	-12.6
orchard oriole	-8.9	-6.5	-1.3
Baltimore oriole	1.1	7.0	-2.1