Young Naturalists

Teachers Guide

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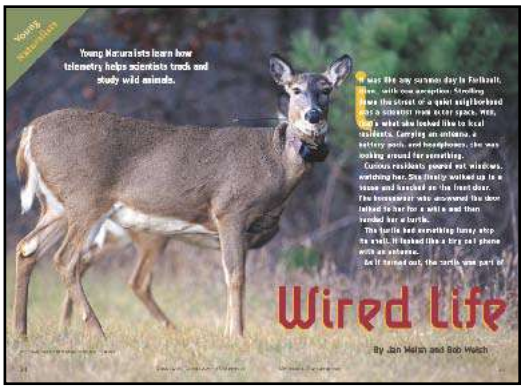
"Wired Life" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Wired Life," by Jan Welsh and Bob Welsh. Published in the November–December 2003 *Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/telemetry.



Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the articles, suggested independent reading levels, word counts, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources (including related Conservation Volunteer *articles), copy-ready study questions with answer key, and a copy-ready vocabulary sheet. There is also a practice quiz (with answer key) in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified a to suit user needs. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html. Note: this guide is intended for use with the PDF version of this article.*

Summary

"Wired Life" describes how a variety of animals, from turtles to migratory birds, are equipped with transmitters to monitor their locations. Telemetry, "remotely sending signals over a distance," is illustrated through real-life examples. Finally, the authors explain how wildlife telemetry enables scientists to gather important management information about animals.

Suggested reading levels: Upper elementary through middle school

Total words: 1,598

Materials: Paper, pencils, pens, resources from your media center, state and world maps.

Preparation time: About one hour

Estimated instructional time: Two 50-minute class periods (not including extensions)

Minnesota Academic Standards applications: "Wired Life" may be applied to the Minnesota Department of Education Academic Standards below. Complete standards are available at www.education.state.mn.us.

Language Arts

I. Reading and Literature
- A. Word Recognition, Analysis and Fluency
- B. Vocabulary Expansion
- C. Comprehension

II. Writing
- A. Types of Writing
- B. Elements of Composition
- C. Spelling
- D. Research
- E. Handwriting and Word Processing

III. Speaking, Listening and Viewing
- A. Speaking and Listening
- B. Media Literacy

Science

Grade 4

I. History and Nature of Science
- A. Scientific World View
- B. Scientific Inquiry

IV. Life Science
- B. Diversity of Organisms

Grades 5–8

I. History and Nature of Science
- A. Scientific World View
- B. Scientific Inquiry
- C. Scientific Enterprise

Grade 5 and 7

IV. Life Science
- E. Biological Populations Change Over Time
- F. Flow of Matter and Energy

Grade 7

IV. Life Science
- C. Interdependence of Life

History and Social Studies

Grades 4–8

V. Geography
- D. Interconnections: The student will identify examples of the changing relationships between patterns of settlement and land use in Minnesota.

Mathematics

Grades 4–8

V. Spatial Sense, Geometry, and Measurement

Arts

Artistic Expression: Visual Arts

Teachers who find other connections to Minnesota academic standards are encouraged to contact *Minnesota Conservation Volunteer.*

Preview

Begin by talking about the different ways people communicate over a distance. Ask students if they know how cell phones, walkie-talkies, or direct TV work. How do cable television, e-mail/Internet, and conventional telephones work? Help them understand how we communicate over distances by sending signals through the air (cell phones) or over cables (the Internet). Next, ask students to skim the article. List the bold topic headings on the board or on a transparency. Call students' attention to beginning, middle, and ending headings. How do they suggest the article is organized? A transparency-ready vocabulary preview list is provided. To keep preview time brief, you may wish to simply alert students to be on the lookout for the words on the list, and also call their attention to italicized words in the story (definitions included). Effective comprehension strategies that students might apply to unfamiliar words include looking at the word in relation to the sentence, looking up the word in the dictionary, looking for other key words in the sentence, referring to a picture or illustration, and thinking, "What makes sense?" Spending too much time previewing or giving a long list of vocabulary words will intimidate many readers and dampen their interest in the article (Allen, 1995).

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). This is an important organizational tool for students and should be emphasized before you begin working on the study questions. Preview the questions with your class before you read the article. You may wish to read the story aloud and complete the study questions in class or in small groups. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section, below). The study questions also may be used as a quiz.

Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first. If time allows, remaining items may be attempted. For example, items 2, 3, 4, 5, 6, and 11 give students some basic knowledge of telemetry. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or some of the study questions, combined with vocabulary, as a quiz. Other assessment ideas: (1) Ask students to draw a diagram of triangulation with accompanying explanation. (2) Ask students to explain how transmitters are attached to turtles, fish, and moose, and why different transmitters are needed. (3) Assign a brief essay on a threatened species that is currently being monitored through telemetry, to include a description of the animal's population status, and what information telemetry has provided thus far.

Extension activities

1. Refer students to "Moose Mystery" in the September–October 2003 *Conservation Volunteer* (www.dnr.state.mn.us/volunteer/sepoct03/moosemystery.html). Students can learn more about the moose telemetry study mentioned in "Wired Life."
2. Contact your regional DNR Wildlife office or biology department at a college or university near you. Chances are good you can arrange either a field trip or a guest speaker who can give your students a more in-depth look at wildlife telemetry.
3. Type "wildlife telemetry" into your Internet search engine, and a wealth of information on telemetry and wildlife conservation projects all over the world will be at your fingertips. Students may write and present a Web site review or place markers on a world map where telemetry is helping researchers protect threatened and endangered species.
4. Participate in a global study of wildlife migration through Journey North (www.learner.org/jnorth).
5. Ask your media specialist to collect resources on threatened and endangered species, as well as on telemetry. Assign a research project for individuals or small groups related to item 3 in Assessment (above). Students may present reports orally or in writing.
6. Include the concept of triangulation in your math lessons the week you read "Wired Life."

Web resources

DNR's Nongame Wildlife Program
www.dnr.state.mn.us/ecological_services/nongame

Related *Conservation Volunteer* articles
www.dnr.state.mn.us/volunteer/articles—such as
"Nature Watchers" and "Researchers Track Deer on the Move" (September–October 2002)
"Where's the Lynx?" (January–February 2002)
"Why Do Turtles Cross the Road?" (May–June 2001)
"The Missing Lynx" (November–December 2000).

See page 43 of "Wired Life" for several other useful Web links.

References

Allen, Jane. 1995. *It's Never Too Late: Leading Adolescents to Lifelong Literacy.* Portsmouth, N.H: Heinemann.

Study Questions

"Wired Life," by Jan Welsh and Bob Welsh
Minnesota Conservation Volunteer, November–December 2003
www.dnr.state.mn.us/young_naturalists/telemetry

Name _____ Period _____ Date _____

1. What do scientists hope to learn about the wood turtle found by a child in Faribault? _____

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2. Explain how radio transmitters and receivers work. _____

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3. Why is telemetry a useful tool in wildlife research? _____

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4. In conventional radio telemetry, researchers use a technique called triangulation to locate animals. Explain the triangulation procedure. Why do you think it is called triangulation? ___

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5. What are the advantages and disadvantages of GPS telemetry compared with conventional telemetry? _____

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6. Explain how satellite telemetry works and for which animals it is an effective tracking tool.

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7. How did researchers attach transmitters to muskies, and what did they learn about this popular game fish? _____ .

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8. Why have bullsnakes been studied with telemetry? _____

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9. List five important facts scientists learned about bullsnakes?

a. _____

b. _____

c. _____

d. _____

e. _____

10. Why have researchers developed several different methods for attaching transmitters to animals? _____

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11. What happens to the signal a transmitter emits if the animal it is attached to dies? _____

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12. What has happened to the moose population in northwestern Minnesota? _____

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13. How many moose were fitted with transmitters? What have we learned about them?

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14. Why are wildlife biologists in Grand Rapids studying white-tailed deer?_____

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15. List at least four important questions the Grand Rapids wildlife biologists have answered, and two new research questions they are asking. _____

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Study Questions Answer Key

"Wired Life," by Jan Welsh and Bob Welsh
Minnesota Conservation Volunteer, November–December 2003
www.dnr.state.mn.us/young_naturalists/telemetry

1. What do scientists hope to learn about the wood turtle found by a child in Faribault? **How wood turtles use their habitat and ways scientists can improve wood turtles' chances for survival.**
2. Explain how radio transmitters and receivers work. T**ransmitters, attached to an animal, send off signals, which are picked up by a receiver. The receiver also amplifies (makes louder) the signal so researchers can hear it.**
3. Why is telemetry a useful tool in wildlife research? **Telemetry allows scientists to study animals from a distance. It is difficult or impossible to follow many animals, such birds and fish, around. Animals change their behavior if they know they are being observed.**
4. In conventional radio telemetry researchers use a technique called triangulation to locate animals. Explain the triangulation procedure. Why do you think it is called triangulation? **The researcher first locates the animal's signal. A line is drawn on a map to indicate the signal's compass direction. The researcher then moves to a new location and repeats the process. The animal is located where the two lines on the map intersect. The two lines form part of a triangle.**
5. What are the advantages and disadvantages of GPS telemetry compared with conventional telemetry? **Advantages: GPS collects data around the clock and computers do the tracking. Disadvantages: GPS is more expensive than conventional telemetry and transmitter batteries wear out faster.**
6. Explain how satellite telemetry works and for which animals it is an effective tracking tool. **Transmitters send signals from animals to a satellite orbiting the earth. Signals are relayed from the satellite to stations on earth. Scientists can then access the data over the Internet. This is especially useful for whales, migratory birds, and other animals that travel long distances.**
7. How did researchers attach transmitters to muskies, and what did they learn about this popular game fish? **Transmitters were surgically implanted. Researchers learned where muskies moved from season to season, how they used their habitat, and where they spawned.**
8. Why have bullsnakes been studied with telemetry? **They are disappearing from prairie habitat, where they were once plentiful.**
9. List five important facts scientists learned about bullsnakes:
   a. **One snake traveled at least one mile in a week.**
   b. **Bullsnakes spend 60 percent of their time underground.**
   c. **When they are above ground they stay under dead grass and plants.**
   d. **Crossing roads is deadly.**

e. **Snakes need at least 640 acres to support a large enough population for reproduction.**

10. Why have researchers developed several different methods for attaching transmitters to animals? **Answers will vary, but may include: size and type of animal, habitat, or type of telemetry.**
11. What happens to the signal a transmitter emits if the animal it is attached to dies? **It begins to beep at a different rate.**
12. What has happened to the moose population in northwestern Minnesota? **The population fell from more than 4,000 in the 1980s to fewer than 300 in 2003.**
13. How many moose were fitted with transmitters? What have we learned about them? **152. Most moose had parasites and low levels of copper. Fewer than half the females were pregnant.**
14. Why are wildlife biologists in Grand Rapids studying white-tailed deer? **To learn how conifers such as white cedar and balsam fir affect deer survival.**
15. List at least four important questions the Grand Rapids wildlife biologists have answered, and two new research questions they are asking. **Where do deer migrate? How many deer survive each year? Why do they die? How many young are born? Where do deer live? How do deer use their habitat? New questions: How does snow depth affect deer habits and survival? How do temperatures affect deer habits and survival?**

Minnesota Comprehensive Assessments Practice Items

"Wired Life," by Jan Welsh and Bob Welsh
Minnesota Conservation Volunteer, November–December 2003
www.dnr.state.mn.us/young_naturalists/telemetry

Name _____Period _____Date_____

1. Telemetry is
   A. a new type of cell phone.
   B. a useful technology for studying wildlife.
   C. the name of a satellite.
   D. a medical procedure.

2. How do radio transmitters used with fish differ from those used with moose?
   A Transmitters with fish placed inside the body.
   B. There is no difference.
   C. Fish transmitters are much smaller.
   D. A. and C.

3. If the signal from a transmitter changes to a different rate it means
   A. the animal is moving faster.
   B. the animal is sleeping.
   C. the animal has died.
   D. the animal is eating

4. The newest type of telemetry uses
   A. satellites to relay data.
   B. Morse code.
   C. too much electricity.
   D. the Chinese language.

5. Through telemetry studies wildlife biologists learned that moose
   A. were actually not members of the deer family.
   B. were not getting enough copper in their diet.
   C. suffered from parasites.
   D. B. and C.

Minnesota Comprehensive Assessments Practice Items Answer Key

"Wired Life," by Jan Welsh and Bob Welsh
Minnesota Conservation Volunteer, November–December 2003
www.dnr.state.mn.us/young_naturalists/telemetry

1. Telemetry is **B. a useful technology for studying wildlife**.
2. How do radio transmitters used with fish differ from those used with moose? **D. A. Transmitters for fish are placed inside the body, and C. Fish transmitters are much smaller.**
3. If the signal from a transmitter changes to a different rate it means **C. the animal has died**.
4. The newest type of telemetry uses **A. satellites to relay data**.
5. Through telemetry studies wildlife biologists learned that moose **D. B. were not getting enough copper in their diet, and C. suffered from parasites.**

Vocabulary

"Wired Life," by Jan Welsh and Bob Welsh
Minnesota Conservation Volunteer, November–December 2003
www.dnr.state.mn.us/young_naturalists/telemetry

amplifies	makes louder
carapace	the top shell of a turtle
conifers	evergreen trees with cones
conventional	usual
data	information used in scientific studies
elastic	stretchable or expandable
habitat	an animal's natural environment
migratory birds	birds that travel with the seasons
Nongame Wildlife Program	a DNR program to preserve species of animals that are protected from hunting and fishing
parasites	living things that live in or on another living thing and benefit from it without giving anything in return
receiver	device used to gather telemetry signals
remotely	from a distance

spawn	reproduce
telemetry	process of remotely sending signals over a distance in order to record information
transmitter	device used to send telemetry signals
triangulation	technique used to find something from multiple signals
threatened species	plant or animal species whose numbers are falling toward the endangered level