LESSON 5:
Conservation Challenge

Photo by Tim Romano, Smithsonian's National Zoo

LESSON 5:
CONSERVATION CHALLENGE

OVERVIEW

Lesson Five will allow students to apply what they have learned about tracking in order to design a project that will appropriately answer a conservation/research question about a particular migratory bird species.

ENGAGE	What are some things a scientist has to consider when choosing a tracking device(s)?	Review what was learned in previous activities about tracking devices and their uses, why we track birds, what research questions we can answer with which devices.	10 minutes
ELABORATE	Which tracking device will best help us answer a given conservation/ research question?	Students will be given an ecological story regarding a species of bird that may be in decline and will have to ask a scientific question and determine the appropriate tracking technology in order to make conservation decisions.	Several class periods or time spent outside of class
EVALUATE	Group write-up	Group write-up and justification for using their chosen tracking device.	N/A

DISCIPLINARY CORE IDEAS

MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

OVERARCHING UNDERSTANDING

The type of tracking technology to use depends on many factors including the research question, cost, and species of bird.

Photo by Tim Romano, Smithsonian's National Zoo

ESSENTIAL QUESTIONS	RELATED MISCONCEPTIONS
How do scientists decide which tracking technology to use when they are conducting research on migratory birds?	Students may think technology is so advanced that we could put any kind of device on any bird (not taking into account size of bird, type of data we need, etc.).

KNOWLEDGE *Students will know...*	SKILLS *Students will be able to...*
N/A - No new information in this lesson.	Formulate their own research questions about a particular migratory bird species and choose an appropriate tracking device to investigate or answer the question or problem based on several constraints/parameters.

PRIOR STUDENT KNOWLEDGE:

- Students will be familiar with several tracking devices and their uses from Lesson 2.

SCIENCE AND ENGINEERING PRACTICES:

- Asking questions
- Using mathematics and computational thinking
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

CROSSCUTTING CONCEPTS:

- Structure and function
- Patterns

MATERIALS:

Activity 1: ENGAGE

- None

Activity 2: ELABORATE

- Internet access
- Ecological Stories
- Supply Sheet
- Scoring Rubric

Activity 3: EVALUATE

- Scoring Rubric

ACTIVITY 1

ENGAGE - What are some things a scientist has to consider when choosing a tracking device(s)?

As a large group, discuss how scientists choose tracking devices. Ask:

- *Based on what you have learned about tracking migratory birds, what type of questions can be addressed by the different devices?*
- *What are some things a scientist has to consider when choosing tracking devices to use in his/her research?*

Long-billed curlew wearing an argos tag. Photo by Tim Romano, Smithsonian's National Zoo

ACTIVITY 2

ELABORATE - Which tracking device will best help us answer a given conservation/ research question?

Work in groups to design a tracking project.

- Tell students that they will be working in groups to design a tracking project to conserve a migratory bird.
- Give each group one of the Ecological Stories that describes a conservation mystery. Tell groups they will develop a research plan to address the mystery they are presented with.
- Provide each student with a Supply Sheet containing budget guidelines the students will use for their research project.
- Have the group formulate a scientific question that they believe will assist scientists in learning the "story" of their migratory bird and eventually aid in making conservation decisions regarding their bird species.
- Once the group has agreed on a scientific question, have them then work together to determine the appropriate tracking technology to use. Then, "give" students a budget of $10,000 for their project. Groups need to consider which technology will help them best answer their particular research question and consequently make conservation decisions. Decisions on the appropriate technology to use will include (but not be limited to):
  - The scientific question being asked (the most important of the considerations)
  - The weight of the device
  - The cost per device (they may not realize they will need more than one device!)
  - Battery life, if applicable
  - Location accuracy
  - Storage vs. transmitting devices
  - Other budgetary things to consider - staff costs, materials (nets, etc.)
- Remind students to think back to Lesson 2: Tracking the Annual Cycle of Migratory Birds and consider the advantages and challenges are to each type of technology. Allow students to access the Follow that Bird! website for reference.
- Before students begin, share the Scoring Rubric for their final write-up with them.

ACTIVITY 3

EVALUATE - Assess group write-ups.

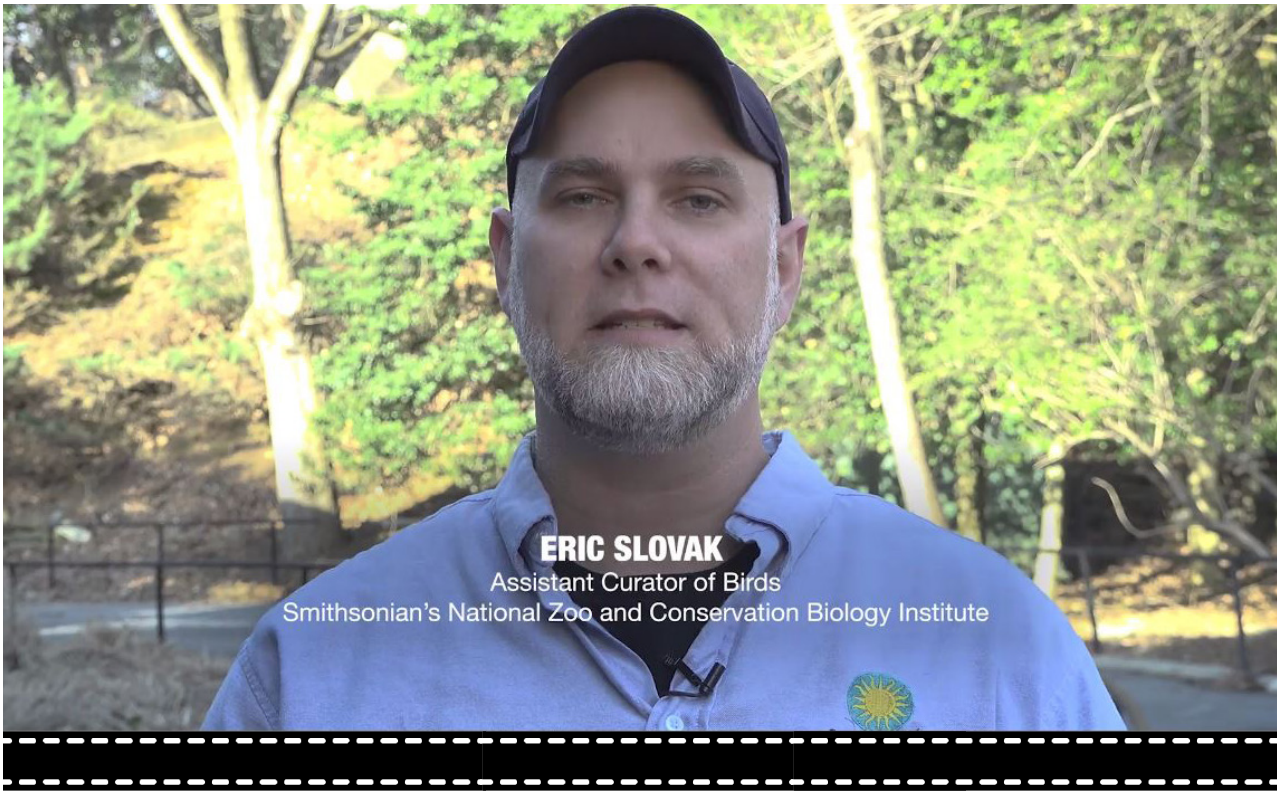
Use the provided Scoring Rubric to assess the group write-ups. Adapt the rubric as needed to fit your class.

EXTENDING THE LESSON

1. Watch the career connection video (page 73).
2. Discuss what students can do to protect birds (page 73).

CAREER CONNECTION

SPOTLIGHT ON: ERIC SLOVAK, ASSISTANT CURATOR OF BIRDS



EVER WONDER WHAT IT WOULD BE LIKE TO BE AN ANIMAL KEEPER?

Eric Slovak is the Assistant Curator of Birds at the Smithsonian's National Zoo and Conservation Biology Institute. That means that he, along with the Curator, oversees the care of birds at the Zoo's Bird House exhibit. In this career connection video, you will learn what it takes to look after a wild flock of birds and keepers!

HOW CAN YOU HELP?

Taking Action to Protect Birds!

As you've learned in Follow that Bird!, it takes a "flock" of people and research to study and save migratory birds. One of the largest threats to birds is window collisions, when a bird can't see glass and flies into windows of houses and other buildings. **You can help** by making windows in your home more visible to birds. Do this by...

- Breaking up window reflections witch stickers, window decals or tape.
- Using blinds.

The following ecological story is a narrative that describes a real mystery that bird researchers have encountered when trying to solve a conservation problem. The researchers are looking for your help! They want you to come up with a solution to this scenario using tracking technology. With your team, read the story of your selected species. Pay careful attention to the problem you are trying to address, as well as any details about the biology of the species that may allow for or limit the use of a certain tracking device.

RUSTY BLACKBIRD

Rusty blackbirds have experienced one of the strongest declines ever documented among North American birds in recent times. Long-term survey data suggest that rusty blackbird numbers have plummeted by 85 to 95% since the mid-1900s. They are a migratory bird with a wingspan of 18 inches (47 cm) and weight of 1.6 to 2.8 ounces (47-80 grams). Rusty blackbirds live in large flocks, often with other species of blackbirds, during the summer breeding and migratory periods.

A loss of wetland habitats is considered to have a big impact on rusty blackbird populations. At each stage of their annual cycle, Rusty blackbirds rely on wetlands for their survival. These habitats are ideal because they provide lots of insects, which make up the bulk of their diet throughout the year. In the southern United States, where the blackbirds overwinter, wetland habitats have been lost due to agriculture, urban development, and efforts to control flooding on rivers and streams. On the blackbirds' breeding grounds in Canada and the northern United States, wetlands have become prone to drying out due to climate change.

Loss of wetlands may not be the only cause for rusty blackbird decline. On their breeding ground, they may be exposed to high levels of pollution. One of the pollutants they are exposed to is mercury, a heavy metal that is emitted from burning of fossil fuels. Mercury has harmful effects on the immune systems and general health of rusty blackbirds. Mercury pollution is found to be highest directly downwind of coal-fired power plants and increases the closer you get to the North Pole.

Your team studies an overwintering population of rusty blackbirds along the banks of the Mississippi River in Louisiana. You tested samples of blackbird feathers, collected while banding the birds, and found that some showed high levels of mercury. You suspect that mercury poisoning on the breeding grounds may be harming your population, adding to the problem of habitat loss. **Your team wants to find out if the breeding region of your population is in an area that is prone to mercury pollution.**

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BACHMAN'S SPARROW

Photo by Don Faulkner, Creative Commons (View license)

The Bachman's sparrow is a grassland bird species that has been declining since the 1930s. Their population is currently declining at a rate of about 15% per decade. They have a wingspan of less than eight inches (20 cm) and weigh less than one ounce (20 grams). They feed on a diet of insects during the breeding season, and eat seeds during the winter. Due to this change in diet, the amount of habitat they use during the breeding season is quite small, about the size of three football fields, but they require much more habitat in the winter to support their population.

The Bachman's sparrow is a resident species that lives exclusively in pine savannahs in the southeastern United States. Pine savannahs are a type of grassland habitat that have a low density of pine trees. Pine savannahs were at one time the most common type of habitat in the southeastern United States coastal plain, a large region of the eastern United States that is characterized by low elevation and flat appearance. These habitats were created by frequent wildfires that would kill young trees and shrubs, but leave larger pines standing. Due to the needs of development, agriculture, and logging, humans began suppressing these fires and, over time, the savannahs transformed into dense forests of oak and pine.

Preserving Bachman's sparrow habitat requires the reintroduction of fire. Land managers use small, controlled fires to reduce forest growth within pine savannahs. Today, very little pine savannah is left and what remains requires a lot of maintenance. Because of this, it is often unclear whether land managers are maintaining enough habitat to support healthy populations of Bachman's sparrows.

Your team wants to use tracking technology to determine if the amount of habitat being managed is enough to support the overwintering sparrow population. You will study a population of Bachman's sparrow in North Carolina to determine whether the amount of habitat being managed matches the amount of habitat the sparrows require during the winter months.

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GOLDEN EAGLE

The golden eagle is a large bird – one of the biggest raptors in North America. This eagle's wingspan can be over seven feet across (185-220 cm) and it can weigh over 13 pounds (3000–6125 grams). Golden eagles are incredible predators. They eat mostly small mammals like rabbits, but have been known to also eat larger mammals, such as seals and domestic livestock, and birds as large as swans.

While golden eagles in the northwestern United States are resident birds, most golden eagles migrate. Their breeding range is very large, stretching from northern Canada and Alaska to northern Mexico. They can be found in the winter in all but the southeastern corner of the United States. Migration between breeding and overwintering grounds usually occurs along mountain ranges and hills.

Due in part to a law passed in 1962 to protect the golden and bald eagles, golden eagle populations are stable. Human impact on golden eagle populations is still a concern, however, as most of their observed deaths are a result of human actions. One of the primary causes of death is collision with man-made structures, like buildings and wind turbines.

A bird conservation organization has become concerned that wind farms along the Appalachian Mountain chain are negatively impacting golden eagle populations. **Your team has been hired by the organization to determine the migratory route of golden eagles living in Virginia and Maryland.** The results of your efforts will determine whether wind farms are located along the migratory route of golden eagles and ensure that new wind farms are not placed in the path of their migratory route.

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NORTHERN CARDINAL

Photo by Connor Mallon, Smithsonian's National Zoo

The northern cardinal is a species of bird that is common to all sorts of habitats in the eastern and central United States. Cardinals are a medium-sized songbird, with a wingspan of up to one foot (21-23 cm) and a weight of about 1.5 ounces (40 to 50 grams). They are a resident bird with a seasonal diet – they eat mostly insects when caring for the young, and mostly fruits and seeds during the rest of the year. Their nests can be found in the bushes and shrubs common to suburban and urban yards.

The cardinal is not a species in decline. In fact, their range (that is, the area in which they live) has expanded to the north and west over the last 50 years. There are different theories as to what has caused or made it possible for them to move into areas where they didn't used to live. One theory is that the expansion of urban and suburban environments in the 20th century created lots of shrubby habitat, the kind of habitat they use to raise their young and find food. Another theory is that bird feeders have allowed cardinals to live in areas where they otherwise would not be able to survive. This is especially true for cardinals overwintering in the north, where bird feeders can provide food throughout the colder winter months when the natural food supply is limited.

Studying the ecology of a species that benefits from people can help scientists better understand why some species can be harmed by human activity. **Your team will conduct a study to determine whether bird feeders have helped cardinals survive harsh northern winters.** Your team will observe individuals in the winter in Springfield, Massachusetts. You will compare the winter survival of individuals that live near bird feeders with those that do not.

Supply Sheet

SUPPLY	EXPLANATION	QUANTITY	PRICE
Nets	For catching the birds you will study	You will need at least 3	$100
Banding toolkit	The tools you will need to set up your net and place the bands on the birds	You will only need 1 toolkit	$500
Color bands (for 1 bird)	The colored bands you use to identify individual birds by sight	However many birds you choose to study	$1
Aluminum bands	The numbered bands you will use to identify individual birds	However many birds you choose to study	$0
PIT tag	Tag you will place on the birds you choose to study	However many birds you choose to study	$2
PIT tag receiver	Receiver that picks up the signal of a nearby PIT tag	You will only need 1 receiver	$40
Radio telemetry tag	The tag you will place on the birds you want to study	However many birds you choose to study	$180
Radio telemetry antenna	The device that allows you to locate the bird you are studying	You will only need 1 antenna	$300
Radio telemetry receiver	The device that allows you to locate the bird you are studying	You will only need 1 receiver	$700
Light-level geolocator	The tag you will place on the birds you want to study	However many birds you choose to study	$200
Satellite transmitter	Tag that you will place on the birds you want to study	However many birds you choose to study	$3,000
Intern (1 month salary)	The field assistant who will help you carry out your study	You may choose to employ 1 or more interns depending on the type of technology you choose.	$1,000

Scoring Rubric

CATEGORY	15 points	11 points	7 points	3 points
Introduction/ Thesis	Exceptional introduction that grabs the reader's interest and clearly states the topic. Thesis is exceptionally clear, well-developed, and a definitive statement.	Proficient introduction that is interesting and states topic. Thesis is clear and arguable statement of position.	Basic introduction that states topic but lacks interest. Thesis is somewhat clear and arguable.	Weak or no introduction of topic. Paper's purpose is unclear/thesis is weak or missing.
Content knowledge: Quality of Research	Paper is exceptionally researched: contains 3 peer reviewed articles and the 3 articles relate to the thesis argument in a logical manner. References are correctly cited.	Information relates to the main topic. Paper, is well-researched in detail and from 3 good sources. References are correctly cited.	Information relates to the main topic, but few details and/or examples are given. Shows a limited variety of sources. References are not cited correctly.	Information has little or nothing to do with the thesis. Information has weak or no connection to the thesis. References are not cited correctly.
Content application: Support of Thesis and Analysis	Exceptionally critical, relevant and consistent connections made between evidence and thesis. Excellent analysis.	Consistent connections made between evidence and thesis Good analysis.	Some connections made between evidence and thesis. Some analysis.	Limited or no connections made between evidence and thesis. Lack of analysis.
Conclusion	Excellent summary of thesis argument with concluding ideas that impact reader. Introduces no new information.	Good summary of topic with clear concluding ideas. Introduces no new information.	Basic summary of topic with some final concluding ideas. Introduces no new information.	Lack of summary of topic.
Writing	Writing is clear and relevant, with no grammatical and/or spelling errors – polished and professional. Reference section properly formatted.	Most ideas are stated clearly and are related to the topic, with only minor grammatical and/ or spelling errors. Reference section adequate.	Many ideas require clarification and/or are off-topic or have marginal relevance to the assignment. Many grammatical and/or spellings errors throughout the paper. The paper is very challenging to read due to poor writing flow. Improper reference section.	Paper does not meet the criteria for the assignment (too short or incomplete, too long, and/or completely off-topic). Reference section missing.

Golden Eagle