Making and Recording Observations

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Introduction

Some species are relatively easy to locate and observe—they might be larger, more abundant, have unique characteristics, or stay rooted in place. Other species are more elusive—think of species that are small or agile, able to run, fly, or swim away. Or species that are active only at night, or live only in the tallest treetops or the darkest caves. Yet, during a BioBlitz, every species, large and small, counts. So, while participants need to know where to look and what to look for, it’s also important to know how to make and record scientific observations.

KEY QUESTIONS:

› What are observations?
› What are some differences between casual and scientific observations?
› What factors impact human observations?
› How are observations recorded?
Guided Discussion/PowerPoint

Introduce students to the importance of observations both in daily life and in scientific research. Discuss differences in powers of observation among species; differences between scientific and casual observations; factors that impact human observations; and techniques scientists use to record observations.

Teaching Methods:
Discussions; Multimedia Instruction

Grouping:
Large-group Instruction

Materials/Preparation:
• Go to nationalgeographic.com/bioblitz to download Making and Recording Observations in PowerPoint format.
• See Outline for Guided Discussion, p. 10, for a preview of slides and teaching notes. Use this as a reference during the guided discussion.
• Students should have pens and paper available for a warm-up activity.

Optional:
• Incorporate video segments on wildlife research into the discussion. See Supplemental Media, p. 4, for details.

Turn to p. 10 for the complete outline.
Supplemental Media: Wild Chronicles

Available online at nationalgeographic.com/bioblitz-video.

Video segments from National Geographic’s Wild Chronicles are an engaging way to show pioneering wildlife research from around the planet to students. Segments can be viewed as an independent activity or incorporated into the Guided Discussion.

› A New Perspective on Biodiversity
  Botanist Mark Olson uses a powered paraglider to gain a fresh perspective on the diversity of trees and how evolution has shaped them to make the most of photosynthesis. Time: 4:19

› Capturing Tigers on Camera
  Photographer Michael “Nick” Nichols uses remote cameras set with infrared triggers to photograph tigers in India. Time: 7:07

› Seeing Bats in the Dark
  Deep in the rain forests of Central America, scientists use infrared thermal imaging cameras to study the nocturnal behaviors of bats. Time: 2:47

› Swimming with Blue Whales
  Data from a Crittercam® camera reveals a whale’s-eye view of hunting techniques and one of the most breathtaking displays of cooperative feeding in nature. Time: 6:14

› Fishing with Emperor Penguins
  National Geographic’s Crittercam® dives deep into the Antarctic Ocean to observe the feeding behaviors of emperor penguins. Time: 7:07

**DISCUSSION**

- What question or issue is the researcher investigating?
- What challenges does the researcher face?
- What tools are being used to assist wildlife observations?
- Why are these tools helpful?
- Have any scientific discoveries been made because of this research?

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**Credits**

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Activity: WildCam

WildCam is a National Geographic project that streams digital video from wildlife observation sites located around the world. In this activity, students view WildCam video and record observations on a worksheet.

DIRECTIONS

1. Divide the class into small groups and have each group designate a leader. Explain that each student will complete an individual worksheet and that the group leader will summarize findings on a group worksheet.

2. Introduce. The National Geographic WildCam project streams live video from digital cameras located in the wild. Tell students to imagine they are working on a project to research animal behavior. As part of their research, they will analyze video and record their observations on a worksheet.

3. Distribute the WildCam Worksheet. Review the worksheet with students, if necessary.

4. Finish small-group work. Students should complete their individual worksheets and then work together to summarize findings on the group worksheet.

5. Share student work and discuss. To complete the activity, ask groups to report back to the entire class and compare their observations. Use the prompts below to guide a discussion about the strengths and weaknesses of using stationary cameras to study wildlife.

DISCUSSION

- What are the strengths or weaknesses of using video to study animal behavior in the wild?
  
  Possible answers: Strengths—e.g., can observe and study animal behavior from remote locations that may be challenging for human observers, due to climate or location; the camera may be less intrusive than a human observer; a video recording is permanent, can be shared and reviewed. Weaknesses—e.g., the camera is in a fixed location so it does not capture action that is out-of-range.

  • How is the location of the camera a factor in terms of what is recorded?
    
    Possible answers: The camera is in a static position but animals move; the camera can record only what is within range of the lens and microphone.

  • Is there additional data that the camera does not record?
    
    Possible answers: Anything outside the range of the camera; smell; temperature.

TRY THIS!

Students can observe human animals as another example of studying behavior. Select locations where students can observe unobtrusively (e.g., school library, cafeteria, gym) and ask students to observe and record the types of behavior they think they are seeing (e.g., feeding behaviors, social behaviors, and territorial behaviors). Have students record their observations and report back their findings. Encourage students to think about why scientists watch behaviors and what can be learned by looking and observing.

—Kimberly Swift, Education Program Manager, Indiana Dunes National Lakeshore
Activity: Plot Study

Students conduct a plot study to observe and record the presence of all living organisms in a selected area.

Note: This activity is designed as an outdoor activity. To adapt it for inside, ask students to observe and record objects rather than wildlife specimens.

Teaching Methods:
Discussions; Multimedia Instruction

Grouping:
Large-group Instruction

Materials/Preparation:
- Select an area to research, ideally one that is biodiverse.
- 6-8’ sections of rope (one per student group) to mark plots. Hula hoops can be used instead of ropes.
- Copies of Plot Study Datasheet, p. 9, one per group.
- Clipboards

Optional:
- Field guides
- Measurement tools, e.g., rulers, thermometers
- GPS units to record specimen locations

DIRECTIONS

1. Introduce. Explain that students will conduct a plot study to observe and record the presence of all living organisms (plant and animal) in their selected area.

2. Review. Review best practices regarding scientific observation and recording; for example, remind students that there are different ways to record data (written descriptions, photographs, sketches) and factors that impact human observation (location, time, tools, knowledge, perception).

3. Distribute datasheet and brainstorm. Distribute the datasheet and ask the class to brainstorm the characteristics they think are important to observe and record for each organism observed, such as size, color, and markings.

4. Label datasheet. Have students label spaces in the first column of the datasheet with the characteristics they have determined to be important. Note: To complete this activity, students are not required to identify the organisms they observe, but they may wish to consult field guides, if available, for additional information.

5. Divide the class into small groups and distribute additional materials. Each group should have a length of rope or hula hoop, a clipboard, and a Plot Study Datasheet.

6. Go to the research area and complete the plot study. If necessary, show students how to mark off a bounded area.

7. Review and discuss the results. Have students report their findings back to the class. See the next page for discussion prompts.

continued >
Plot Study, continued

Discussion Prompts

• Mark the location of student plots on a map of the study area. Discuss abiotic factors encountered (temperature, sunlight, water, wind, etc.) What abiotic factors were common to most/only a few of the plots?

• Identify difficulties encountered during sampling (include sampling of very small organisms, flying or crawling organisms, physical factors such as rain, wind) and discuss possible effects on data. List possible sources of error in sampling data.

• Discuss biodiversity in the student plots and identify plots containing most/least diversity. Ask students whether they notice any correlation between location of plots, abiotic factors, and apparent biodiversity.

This activity is based on an activity developed at the Institute at Tremont, Great Smoky Mountains National Park and used with permission.

TRY THIS!

Consider having students do this activity more than once. An inventory is a snapshot in time. It tells us what we have right now on this day, under these conditions. Different days and different conditions will produce different results. For this reason, inventories are most valuable when they are part of a monitoring program that allows you to track changes over time.

Species richness and evenness are other measures that scientists use to measure the variety of living organisms in a community. Richness is how many different types of organisms are found in an area, and evenness is the abundance of each organism. Comparing richness and evenness of an area over time is one method of monitoring ecosystem health. Changes in data over time may indicate environmental changes.

To calculate the richness of the sample, count the number of different “species” found in the sample. To calculate evenness, use the following equation. Evenness = \( \frac{n_i}{N} \), where \( n_i \) = number of specimens found in group and \( N \) = total number of specimens found. When added together, the evenness number should total 1.

—Susan Sachs, Education Coordinator, Appalachian Highlands Science Learning Center, Great Smoky Mountains National Park
## Directions
2. Select a location. You will watch and analyze video from this location.
3. Make and record scientific observations. Remember to include as many details as you can, including qualitative (descriptive) and quantitative (numeric) data.

### Name

### WildCam Location

### WildCam Observation Date / / WildCam Observation Time AM PM

### General Observations

**Weather Conditions**

### Landscape

(land and water features, land cover, etc.)

### Wildlife Observations

*What do you see? What do you hear?*

### Additional Notes

(Use the space below and the back of this paper for field sketches, maps, photographs, etc.)
### Plot Study Datasheet

<table>
<thead>
<tr>
<th>Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Date   /   /   Weather Conditions</td>
</tr>
<tr>
<td>Plot Location</td>
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<tr>
<td>Time Started     :   AM   PM   Time Ended     :   AM   PM</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specimen 1</th>
<th>Specimen 2</th>
<th>Specimen 3</th>
<th>Specimen 4</th>
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bioblitz > making and recording observations

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<table>
<thead>
<tr>
<th>Slide #</th>
<th>Slide</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1.png" alt="Making and Recording Observations" /></td>
<td><strong>Start the presentation.</strong></td>
</tr>
</tbody>
</table>
| 2    | ![WARM-UP](image2.png) | **Suggested time:** 8-10 minutes. Students will need pen and paper. Keep additional instructions vague. If students ask, "What should I observe?", reply "Whatever you can."
Later, students will have an opportunity to repeat this activity and apply new knowledge. |
| 3    | ![Share & Discuss](image3.png) | **Prompt students with these open-ended questions.**
Student responses will vary. Humans use all of their senses to make observations. Tools can include eyes and ears as well as paper, pen, cameras, etc.

Ask students: *How do you feel about making observations? Are you a good observer? Are humans good observers? Why or why not?*

**KEY QUESTIONS**

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>What are observations?</td>
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<td>How are observations recorded?</td>
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</tbody>
</table>

This slide is an organizational slide. It introduces a question or topic that will be explored.

Encourage students to use the highlighted question to organize their note-taking and conceptual understanding. |

Go to nationalgeographic.com/bioblitz to download *Making and Recording Observations* in PowerPoint format.
<table>
<thead>
<tr>
<th>Slide #</th>
<th>Slide</th>
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<tbody>
<tr>
<td>5</td>
<td><img src="https://example.com/slide5.png" alt="Slide Image" /></td>
<td>Soccer players must look, listen, and be aware of their location, the action of their teammates, and the position of their opponents. Explain that humans use observations in everyday life. Observations help us monitor and interact with the world. Ask students to suggest other examples from their own experiences.</td>
</tr>
<tr>
<td>6</td>
<td><img src="https://example.com/slide6.png" alt="Slide Image" /></td>
<td>If necessary, explain that hawks such as the one pictured hunt rodents such as mice. Ask: <em>What do you think this mouse is doing? What senses is it using? What might the hawk be doing? What senses is it using?</em> Wild animals depend on their senses to find food and avoid predators.</td>
</tr>
<tr>
<td>7</td>
<td><img src="https://example.com/slide7.png" alt="Slide Image" /></td>
<td>Explain that through evolution and adaptation, some species have developed extremely acute senses. These are just a few examples of animals with special sensory abilities. Asks students if they can think of other examples.</td>
</tr>
<tr>
<td>8</td>
<td><img src="https://example.com/slide8.png" alt="Slide Image" /></td>
<td>Compared to other species, humans do not have especially good eyesight, sense of smell, or hearing. However, humans have developed tools to enhance observations. Review examples shown in these photographs. Prompt students to suggest other tools, such as microscopes, telescopes, light meters, temperature gauges, depth gauges, etc.</td>
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### Outline for Guided Discussion

<table>
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<tr>
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<tbody>
<tr>
<td>9</td>
<td><img src="https://bioblitz.nationalgeographic.com/bioblitz/images/key-questions.png" alt="" /></td>
<td>Introduce the next topic. Encourage students to use the highlighted question to organize their note-taking and conceptual understanding.</td>
</tr>
<tr>
<td>10</td>
<td><img src="https://bioblitz.nationalgeographic.com/bioblitz/images/take-a-look.png" alt="Image" /></td>
<td>Take a poll. Ask: <em>Is this observation casual or scientific?</em> Some students may focus on the two men, who could be simply watching a baseball game (casual observation) or recording game statistics (scientific observation).</td>
</tr>
<tr>
<td>11</td>
<td><img src="https://bioblitz.nationalgeographic.com/bioblitz/images/casual-observations.png" alt="Image" /></td>
<td>Review and discuss characteristics of casual observations. Ask: <em>What are examples from your own life when you have made a casual observation?</em> Answers will vary.</td>
</tr>
<tr>
<td>12</td>
<td><img src="https://bioblitz.nationalgeographic.com/bioblitz/images/scientific-observations.png" alt="Image" /></td>
<td>Review and discuss characteristics of scientific observations. Ask: <em>What are examples from your own life when you have made a scientific observation?</em> Answers will vary.</td>
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<tbody>
<tr>
<td>13</td>
<td><img src="image1.png" alt="Slide Image" /></td>
<td><strong>Ask:</strong> Based on what we’ve learned, do you think these people are making a casual or scientific observation? They appear to be casual observers, but many baseball fans record detailed observations (e.g., statistics) during a game. There is not enough detail in this photograph to know for sure. <strong>Ask:</strong> Was the photographer making a casual or scientific observation? We have analyzed this image twice. Are we making a casual or scientific observation? Answers to both questions will vary.</td>
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<tr>
<td>14</td>
<td><img src="image2.png" alt="Slide Image" /></td>
<td>Introduce the next topic. Encourage students to use the highlighted question to organize their note-taking and conceptual understanding.</td>
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<tr>
<td>15</td>
<td><img src="image3.png" alt="Slide Image" /></td>
<td>Review and discuss with students. Explain how each of these factors has an impact on what can be observed. Encourage students to volunteer examples from their own experiences.</td>
</tr>
<tr>
<td>16</td>
<td><img src="image4.png" alt="Slide Image" /></td>
<td>Introduce the next topic. Encourage students to use the highlighted question to organize their note-taking and conceptual understanding.</td>
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<tr>
<td>17</td>
<td><img src="image" alt="Scientists use multiple techniques to record their observations." /></td>
<td><strong>Ask:</strong> <em>In your opinion, which technique is best? Explain why none of these techniques is &quot;best.&quot; Each technique is important and useful, and they are often used together to provide a richly detailed account.</em>&lt;br&gt;&lt;br&gt;For example, the text, images, and graph included on this slide are related to research that used a Crittercam, an animal-borne imaging device, to study emperor penguin feeding behaviors.</td>
</tr>
<tr>
<td>18</td>
<td><img src="image" alt="Next, observations are interpreted." /></td>
<td>**Analyze the images with students. On the dive chart, the shaded area represents water; the clear area (2m-0) represents ice; the dive path shows the penguin dives before it feeds at the surface (points A-E). The images show a penguin hunting. Ask: Why does the penguin dive before surfacing to feed? Answer: to locate prey.*&lt;br&gt;&lt;br&gt;Option: Watch <em>Fishing with Emperor Penguins.</em> See p. 4 or go to <a href="http://www.nationalgeographic.com/bioblitz-video">www.nationalgeographic.com/bioblitz-video</a>.</td>
</tr>
<tr>
<td>19</td>
<td><img src="image" alt="Now Try Again" /></td>
<td><strong>Have students repeat the Warm-Up.</strong>&lt;br&gt;&lt;br&gt;If possible, allow more time so students can make drawings, find and use tools to enhance their observations, or try different vantage points, etc.</td>
</tr>
<tr>
<td>20</td>
<td><img src="image" alt="Share &amp; Discuss" /></td>
<td><strong>Finish with a discussion of student work. Encourage students to share whether or not they are thinking about observations in a new way.</strong>&lt;br&gt;&lt;br&gt;For a closing comment, tell students that scientists are trained to see both what is present and what is absent.</td>
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