Jaguar Camera Trap Identification

The WCS Bolivian team conducted biodiversity surveys throughout Madidi National Park with several main objectives in mind: 1) Increase the general knowledge of Madidi's biodiversity; 2) Increase knowledge about species distributions within the protected areas and document their relative abundance; 3) Provide field data, including those generated by technologies for the detection of wildlife (eg camera traps and video cameras), to provide virtual opportunities that engage the public with research; and 4) connect the urban public of Bolivia with the biodiversity found in Madidi. In this activity students will have the opportunity to use jaguar camera trap photos to learn how these photos help scientists determine the species' population density and how that contributes to broader jaguar conservation.

Objectives:

- To identify how many individual jaguars are represented in the camera trap photos
- To conceptualize how camera trapping allows scientists to accurately monitor jaguar populations
- To draw conclusions about the rarity of the species and the need for wide scale conservation efforts
- To recognize jaguars' critical roles in the structure and function of ecosystems in which they live

Materials:

- Jaguar Camera Trap Student Worksheet
- Teacher Jaguar Camera Trap Photos
- Student Jaguar Camera Trap Photos
- String

Process:

Part 1:

1) In the prior activity, students created a model of the Lower Foothill Forest of Alto Madidi and identified at which elevation WCS researchers spotted jaguars. For this activity, students will learn more about the methodology behind how researchers are able to collect data on the elusive feline species.
2) The teacher should present students with the Jaguar Camera Trap Worksheet to provide a little context on how a camera trap system works.
3) Students will be given the 10 Jaguar Camera Trap Photos. They will have to identify how many individuals are represented in these 10 photos. They will do so by looking at the jaguars' unique rosette (spot) patterns. The teachers should encourage students to look for patterns at various places in the body (e.g. face, legs, stomach, sides, etc.). There may be some individuals represented more than once in the photos.
    a) Reference for the teacher – There are 7 individuals represented in the 10 photos

Part 2:

1) The teacher should have students complete part 2 of the student Jaguar Camera Trap worksheet.
2) Students will be provided with a table displaying the individual jaguars identified in Study Site: Alto Madidi by means of camera trap data.
    a) The teacher should know that WCS scientists determined that the abundance of jaguars in Alto Madidi is 50 individuals, and estimated a density of 12.70 individuals / 100 km2 by means of capture-recapture models and using the CAPTURE software program. The capture-recapture technique is used to estimate the size of a population where it is impractical to count every individual.
3) Students will also be provided with a graph of 24-hour jaguar activity patterns.
    a) In order to help students break up the data analysis process, teachers should consider utilizing the BSCS Identify and Interpret (I2) strategy (located in the supplemented resource section). Students will first be tasked with recording low-inference observations about what they can identify on the graph. Then they will interpret each of those observations by deciding what they mean. Students will then synthesize this information to create a summation caption, which can be used as a formative assessment for determining students' understanding of the data analysis they are conducting. For a complete visual example, refer to the BSCS material in the supplemental resource section.
4) Students will be tasked with answering the following questions posed below. Potential explanations and teacher talking points are listed below each question. Check out the supplemental resources for more information about jaguar conservation. Depending on your students, some of this content may need to be frontloaded before they can effectively answer these questions. As a modification to part 2 of this lesson, the teacher could decide to have students read some of the supplemental resources (if appropriate for their reading/comprehension level) independently and then answer the questions.
    a) What is the Activity Patterns Graph showing us? What are some trends and patterns that you notice?

        Examples:

        i) The highest jaguar activity peak is at 3:30 p.m. with 4 individual events.

        ii) The mode for individual events is 2, which occurs at 10 separate time periods

        iii) There is a downward slope between midnight and 2:00 a.m.

If you are using the I2 strategy, all these trends and patterns would fall under the "identify" category. Students would need to go further to interpret these observations.

c) Why is determining the individual number of jaguars in a habitat important? Why does it matter?

i) *The teacher should discuss with students that camera trapping allows scientists to track individual jaguars, and assess their overall condition and health (for instance, are there any visible wounds or signs of malnutrition? etc.). It can also help inform them about an individual jaguar's range. If the same individual is appearing in camera traps set up in different locations, scientists can start to determine migration patterns and the distance an individual is traveling. Camera trap photos also inform scientists about population shifts at large. For instance, if new jaguars appear in photos over time, researchers will know that this individual is new to the area and could potentially contribute to diversifying the gene pool. It can also tell scientists if individuals were able to successfully mate. Evidence would be jaguar cubs caught on camera alongside their previously identified mother. Researchers can also start to get a sense of the carrying capacity of a habitat. If scientists capture images of more jaguars, they can infer that the jaguars' prey base is strong in that habitat. Camera trap photos also assist wildlife conservationists who engage in wildlife trafficking investigations. Since poaching and trade of jaguar pelts are still major threats to the species, the ability to identify individuals can inform wildlife officials about illegal trade of skins of animals from the wild.*

d) There have been periodic biological surveys in Alto Madidi dating back to 2001; what could recapture data (camera trap images of the same individuals over multiple years) tell us? Why is recapture data significant?

i) *Recaptures help scientists learn more about the natural history of the species. Scientists can pose questions such as, "where else have images of this individual been captured?" This can assist them in calculating an individual's maximum travel distance and get a better sense of its home range. If coupled with other tracking methodologies, such as scat analysis, scientists can learn about the predation preferences of individual jaguars and their activity patterns. Since jaguars are very rare, any recapture data can help them learn more about the species.*

e) Do you think an abundance of 50 individuals is high or low for Alto Madidi? Explain your rationale in more detail.

i) *This is a rather open-ended question; it could go either way. Teachers should base the strength of students' argument on the reasoning they provide for their claim. Overall jaguar populations are declining and are extremely fragmented. The species has lost 50% of its historic range. Because the abundance of the jaguar is naturally low, knowledge of its biology and ecology is a priority action to ensure its long-term conservation. However, jaguar populations tend to be higher in areas that have relatively intact habitat, such as Madidi National Park, that have limited access to people*

f) Jaguars have large ranges. They travel to wherever they can find enough prey species to hunt. This sometimes includes traveling outside of protected areas, including across country boundaries as well. What does this mean (big picture) for jaguar conservation?

i. *There are many threats facing jaguar populations including habitat loss and fragmentation, competition with human hunters for wild prey, retaliatory killing associated with livestock predation, fear for human safety, and trophy hunting and trafficking. Since they leave protected areas and have cross-boundary ranges, conservation actions will need to happen at the landscape level. This involves bringing multiple stakeholders together across geographies, sectors, and cultures. If jaguar population strongholds can be protected (areas like national parks), and stakeholders can work together to identify and protect corridors that connect those stronghold populations, jaguar populations at large have a chance to grow.*

This last question also allows the teacher the opportunity to discuss with students how having healthy populations of jaguars is good for the overall health an ecosystem. This is because of their role as apex predators, which regulates the populations of species below them in the food chain. Furthermore, healthy ecosystems result in healthy communities of people. This conservation can lead students into the extension activity.

Extension:

1) Since jaguars are apex predators (a predator at the top of the food chain), they play a very important role in maintaining the stability of an ecosystem. Without them, ecosystems can experience a trophic cascade. Have students research prey species of the jaguar and other plant and animal species that would exist in an Amazonian habitat. You can choose to have each student research their own species or group students as you see fit. Students will simulate a food web by serving as representatives for their individual species.
    - They will need to know their plant or animal species' predator/prey relationships with other species. The teacher should consider having students make cards with a picture of their selected species, and a list of their predators and prey to streamline the next steps of the activity.
    - Grab some string and have students transform themselves into a model of a food web. For instance, one student represents a jaguar and another a tapir. The jaguar would throw the string to the tapir. Next the tapir would find another species that is either a direct predator or prey (can include plants) to it. The tapir would throw the string to that animal, and so on. Any student can receive the string multiple times if necessary.
    - Once all the students are connected by the web, the teacher can model the effects of trophic cascades by pulling on a few pieces of the string at different points in the web.

Supplemental Resources:

a) Introduction to the 2030 Road Map: Jaguar Conservation and Sustainable Development in a Changing World
b) Jaguar 2030 Roadmap: Regional Plan to Save America's Largest Cat and its Ecosystems
c) WCS-Jaguars
d) WCS Bolivia- Jaguars
e) BSCS I Can Use the Identify and Interpret Strategy