Using Genetic Information for Conservation Decisions

Conservationists often rely on genetic analysis to help them better understand wild populations of animals, including the genetic variation within and between populations. Often, scientists acquire DNA samples from animals in the wild by collecting hair or fecal samples. These samples are then sent to a lab for genetic analysis. Polymerase Chain Reaction or PCR is a common method used for genetic analysis. In PCR, researchers take a small piece of the biological sample, extract the DNA, and amplify a small segment to make millions of copies that can be more easily analyzed for patterns. Many zoos have labs on grounds that allow them to conduct these kinds of genetic tests. Zoos use these results for many purposes, including to help them with reintroduction efforts. For example, genetic analysis allows zoos to compare genetic variation in both captive and wild populations to make recommendations about which captive animals should be reintroduced into the wild to increase the genetic variation of the wild population.

In this activity, students will examine the PCR results from several captive star tortoises and compare them to the results from a population of wild star tortoises in Myanmar. They will use this analysis to make recommendations about which captive star tortoises should be introduced to the wild population.

Objectives:

Students will be able to:

- Compare PCR results from wild and captive star tortoises to identify similarities and differences
- Use the similarities and differences to make a recommendation about which captive tortoises should be reintroduced into the wild
- Explain why genetic diversity is important for maintaining healthy animal populations

Materials:

- Burmese Star Tortoise Worksheet
  - PDF version
  - Editable version
- Burmese Star Tortoise PCR Results
- Genetics & Conservation Decisions Worksheet
  - PDF version
  - Editable version

Process:

1. Students should start by watching the introductory Importance of Zoo Labs video at the top of the webpage. Ask students to take notes on what they think are the major points of the video. Some guiding questions:
   a) What is the difference between field research and lab research?
   b) How do zoos support field research with lab research?
   c) What are some examples of species that are being protected using lab research?
2. As a whole class, discuss the answers. Make sure to emphasize that some zoos have lab researchers on staff to help support conservation field work and this is a STEM career that many people do not realize exists.

3. Inform students that we will be exploring the ways that the Wildlife Conservation Society (WCS) uses lab science to help support conservation efforts for the Burmese star tortoise, which is found in Southeast Asia. Have students watch the Using Genetic Information for Conservation Decisions video. While watching, they should answer the questions on the Burmese Star Tortoise Worksheet.
4. Have students discuss their answers in small groups. As a whole class, ensure that the following points are made:
    a) Burmese Star Tortoises are critically endangered primarily because of the illegal pet trade.
    b) Their current numbers in the wild are very low, but scientists have created captive breeding programs where young tortoises are bred in captivity and released into the wild to increase the population size.
    c) Scientists do lab work, specifically using polymerase chain reaction (or PCR) to amplify genetic samples to identify which star tortoises should be released into the wild.
    d) The Burmese people believe that there are spirits in the forest that are the guardians of the tortoises and hold a Buddhist ceremony to bless the tortoises when they are reintroduced.
5. Explain that students will be now be acting as researchers to assist WCS scientists in deciding which Burmese Star Tortoises will be reintroduced to the wild in the next ceremony. They will receive mock DNA data like the kind that scientists generate using PCR. The data for twenty captive star tortoises can be found on the Burmese Star Tortoise PCR Results sheet. They need to compare these samples against the data from a population of fifty wild star tortoises.
6. Students should follow the directions on the Genetics & Conservation Decisions Worksheet. After students have completed the worksheet, have them compare their answer in small groups. Each student should have selected four of the captive tortoises to be reintroduced, however, they might have different answers. Have students explain what data they used to make their decisions.
    NOTE: The activity was designed with ambiguity in mind. Inform students that it is very rare that conservation work ends up with black and white results. Scientists need to use their best judgment to identify which solution works best given the clues. Therefore, provided that students can back up their assertions with logical reasoning, they are using good scientific practice.
7. Remind the class that the Burmese people believe that the star tortoises should be blessed upon reintroduction. Ask the students to imagine that they are researchers attending that ceremony. If they were asked to share a blessing, what would they say? It's important that researchers are respectful of cultures' belief systems. Whether the individual researcher is religious, spiritual, agnostic, or atheistic, they should be prepared to say something if asked. For example, a religious researcher might draw on their religious beliefs to offer a blessing. Whereas, an atheistic researcher might offer their sincere hope that all of the tortoises live long and healthy lives. Give students a few minutes to write down what they might say if asked to share a blessing for the tortoises. Allow student volunteers to share their blessings if they feel comfortable.