Activity #2

Adaptive Radiation in Rain Forest Birds

●●●In Advance *Student Reading*

- Assign the Student Page "Adaptive Radiation in Hawaiian Honeycreepers" (pp. 4-8) as homework.

●●●Class Period One *Adaptive Radiation Discussion*

Materials & Setup

For each student

- Student Page "Adaptive Radiation in Hawaiian Honeycreepers" (pp. 4-8)
- Student Page "Adaptive Radiation in Hawaiian Honeycreepers: Questions on the Reading" (pp. 9-10)

Instructions

1) Have students complete the Student Page "Adaptive Radiation in Hawaiian Honeycreepers: Questions on the Reading" in class.

2) Spend the remainder of the class discussing adaptive radiation and the homework reading, beginning with student responses to the questions.

Journal Ideas

- Many native birds are not found in low-elevation areas on Maui. Do you think that native birds once occupied these lowland areas? How would you go about finding out?
- Do you think anything should be done to protect the remaining Hawaiian honeycreepers? Why or why not?
- Keeping in mind the different human-caused pressures that have led to declines and extinctions among Hawaiian honeycreepers, what do you think can be done to protect the species that remain?
- Imagine being a traditional Hawaiian bird catcher, collecting thousands of feathers over your lifetime. What do you think it would have been like to work mostly alone in the forests of the gods?

Assessment Tools

- Student Page "Adaptive Radiation in Hawaiian Honeycreepers: Questions on the Reading" (teacher version, pp. 2-3)
- Participation in class discussion
- Journal entries

Teacher Version

Adaptive Radiation in Hawaiian Honeycreepers: Questions on the Reading

1) Define adaptive radiation, and explain its relationship to endemic species. Give one example of adaptive radiation in Hawaiian species other than honeycreepers.

   Adaptive radiation is the evolution of many species from a single ancestor.

   Well-reasoned responses about the relationship between adaptive radiation and endemism are acceptable. Possible relationships include:
   - Adaptive radiation results in many endemic species (species that evolved here and are found nowhere else in the world) that are closely related to each other because of their common ancestor, and
   - Because species are evolving in response to local conditions, adaptive radiation may result in species that are "narrowly endemic," or restricted to a small range or a single island.

   Examples include Hawaiian *Drosophila* flies and Hawaiian lobeliads. There are many others that students may have learned about outside this unit, including the silversword alliance which includes the ʻ*āhinahina* or Haleakalā silversword.

2) Why are fossil records valuable sources of information to scientists studying the evolution of native bird species?

   Well-reasoned responses are acceptable. Fossil records enable scientists to identify previously unknown species and establish their relationships with existing species. Among Hawaiian honeycreepers, for example, 18 species are known only from fossil records. That's 32 percent of all known honeycreeper species. Our understanding of the scope of adaptive radiation among honeycreepers would be much narrower if not for the fossil record.

3) Is the shift in the size of *ʻiʻiwi* bills over the last 100 years an example of adaptive radiation in action? Explain your answer.

Well-reasoned responses are acceptable. Two possibilities:

- The shift in *ʻiʻiwi* bill size is probably not adaptive radiation in action because it is likely to be taking place across the entire species, so the changes that are taking place are probably not going to result in the creation of a new species. The extinction of the *ʻōʻō* probably affected the *ʻiʻiwi* across much of its range, as did the decline of the preferred food source, Hawaiian lobeliads.
- If there are islands or large stretches of habitat in which Hawaiian lobeliad populations are protected or restored and other places where they are not, then we may be seeing adaptive radiation in action, as the habitat for some populations of *ʻiʻiwi* would favor their existing bill size, and the habitat for others would favor a shorter bill, possibly leading to species differentiation over a long period of time.

4) Using what you have learned about evolution and adaptation, explain why extinctions of rain forest bird species have happened—and continue to occur—so rapidly in the face of human-caused changes to native Hawaiian rain forests.

Well-reasoned responses are acceptable. Two possibilities:

- Human-caused changes such as habitat destruction, pressures by introduced species, and introduced diseases are altering conditions for native birds so quickly that evolution cannot keep up. The honeycreepers took millions of years to evolve, but humans have caused dramatic changes in their environment within hundreds of years.
- Human activity has contributed to many different pressures on native birds including habitat destruction, predation and competition by introduced species, and disease. A species that might be able to adapt and survive in the face of a single human-caused pressure may not fare so well when there are multiple pressures working against its survival.