Activity #1

Win, Lose, or Adapt Game

••• Class Period One *Win, Lose, or Adapt Game*

Materials & Setup

- "Food Competition Action Chart," for your reference (master, p. 8)
- "Scenario Cards" (master, pp. 9-12)

For each student

- Student Page "Win, Lose, or Adapt: Questions About the Game" (pp. 13-14)

For each group of six to eight students

- Two decks of playing cards
- "Game Instructions" (master, p. 5)
- "Beak-Type Wheel" (master, p. 6)
- "Bird/Player Identification Cards"—Eight each of four beak types (master, p. 7)
- "Food Competition Action Chart," one copy (master, p. 8)

Instructions

1) Divide the class into groups of six to eight students, and give each group the materials listed above.

2) You are the "master of ceremonies" for this game, making sure players understand and follow instructions and reading the "Scenario Card" that precedes each round of competition. Begin the game by reviewing the "Game Instructions" with students. Make sure that everyone understands that they are looking for any three-of-a-kind, regardless of suit.

3) Begin each round by reading the appropriate "Scenario Card." End each round by asking groups to tally the number of food items each player collected and following the instructions on the "Food Competition Action Chart."

4) Use the question on the final "Scenario Card" to begin a class discussion about the game and its results. Other discussion questions include:
   - Which kind of bird was most successful? Why?
   - What does this game tell us about adaptation and evolution in the natural world?
   - How many honeycreeper species do you think actually evolved in the islands?

   If you are continuing with Activity #2, students will be able to answer these questions better, based on their homework reading.

5) Assign the Student Page "Win, Lose, or Adapt: Questions About the Game" as homework (or discuss in class).

Assessment Tools

- Student participation in the game.
- Student Page "Win, Lose, or Adapt: Questions About the Game" (teacher version, pp. 3-4)

Teacher Version

Win, Lose, or Adapt: Questions About the Game

1) In the game, the "jacks" had to get three of a kind of any card, while the specialized birds only had to get a pair but in a certain numeric range. How do you think this division of food items parallels what happens in nature?

   Well-reasoned responses are acceptable. The specialized birds have a limited range of food items and are well-adapted for that kind of food. The "jacks" have a wider range of food sources, but they may have lower feeding efficiency than the specialists for each one, making it slightly more difficult for them to obtain food from particular sources.

2) What effect do you think declining food sources would have on overall population size of native birds? Why? What would you need to know in order to predict the effects on different types of birds (i.e., nectar sippers, etc.)?

   Any well-reasoned response is acceptable. The basic line of reasoning is likely to be that declining food sources would support a smaller number of birds. In order to gauge the effects on the different types of birds, one would probably need to know how different types of habitat were changing, whether a species of plant that bird is dependent on is declining, whether the birds have substitute food sources in other habitats, etc.

3) If all food sources are declining equally rapidly, which of the four types of birds do you think would have the advantage? Why?

The likely response is the jacks, because they can exploit all food sources and would likely be able to shift between food sources, depending on what's available. (Again, any well reasoned response is acceptable.)

4) List and explain at least two ways in which you think this game is similar to/different from the actual process of evolution and adaptation.

Well-reasoned responses are acceptable. Examples of responses include:

- In the game, the direction of evolution in beak shape/food specialization is determined by a chance roll of the die. In nature, environmental conditions and genetic characteristics determine the direction of natural selection.
- In the game, populations of the most successful species increased without evolving. This probably is the case most often in nature as there is less selective pressure on successful species.
- In the game, it may seem as though adaptation and evolution are happening to individual birds, when in reality the process takes place over many, many generations and entire species.
- In the game, we lumped all nectar eaters together into one group and did the same with the other types of birds. In reality, bird species can be even more specialized to specific sources of food, and changes in the abundance and type of food sources will create selective pressures that are different among species that fall into the same general category.

Win, Lose, or Adapt Game Resources

Win, Lose, or Adapt
Game Instructions

1) Play in groups of six to eight with two decks of playing cards randomly mixed and facedown in a central pile. These cards represent your food source. Each player has a Bird/Player identification card that specifies your beak type and particular food source (a combination of playing cards).

2) Your instructor will begin each of the five rounds of this game by reading a "Scenario Card" with instructions about how many cards each player is to draw and information concerning the beginning of the round.

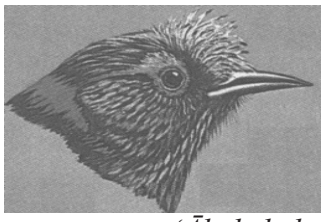
3) In each two-minute round, you must try to collect as much of your food source as possible.
   - Draw the specified number of playing cards from the central pile. When the two-minute round begins—
   - Draw one playing card at a time, and decide whether to keep it. (Do not take turns drawing playing cards. All players will draw and return playing cards simultaneously, racing each other to collect your food source.)
     If you keep the card, discard one playing card from your hand facedown on the pile.
     If you do not keep the card, return it facedown on the pile.
   - Draw another playing card and continue.
   - Place the food source you collect faceup on the table in front of you, and draw enough playing cards from the central pile to replace the playing cards you put down.
   - Always maintain the original number of playing cards in your hand.
   - Continue playing in this fashion until the two-minute round is up.

4) At the end of each round, tally up the number of food sources each player collected, and follow the instructions on the "Food Competition Action Chart" to determine the winners of the round and the appropriate actions for each player. Ties are resolved by drawing a playing card from the central pile. The high playing card wins the tie. Aces are low.

5) In preparation for the next round, return your playing cards to the central pile and mix them up.

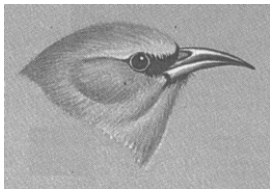
Beak-Type Wheel

Nectar Sipper



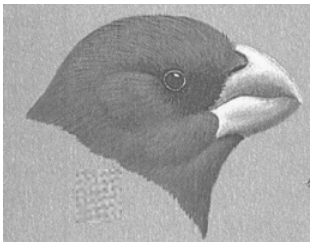
ʻĀkohekohe

Jack of All Trades



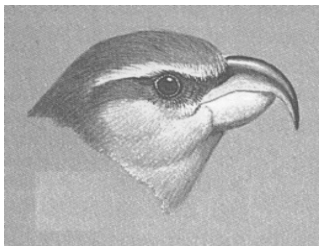
ʻAmakihi

Seed & Fruit Eater



Grosbeak finch

Kiwikiu



Insect Eater

Illustrations: H. Douglas Pratt, Jr.

Bird/Player Identification Cards

For each group of eight students, make eight copies of this sheet, for a total of eight cards that represent each beak type. Use card stock or another heavy paper. Cut apart on the dotted lines.

Jack of All Trades

Your beak shape allows you to prod, nip, and probe, taking advantage of all food sources. But since your beak is not specifically adapted to any one source of food, you're at a bit of a disadvantage when specialized birds are around.

Your food source
Three-of-a-kind of any cards, Ace through King, any suit

Collect as many as you can in each round!

Seed & Fruit Eater

Your beak crushes, slices, and pries to get through the husks, pods, and fleshy fruits surrounding the seeds you eat.

Your food source
Pair of cards, 6 through 9, any suit

Collect as many as you can in each round!

Nectar Sipper

Your tubular tongue and petal-probing beak is well-suited to sipping nectar from flowers. Your probing beak and feathers also transfer pollen from one flower to another, providing a function important to plant reproduction.

Your food source
Pair of cards, Ace through 5, any suit

Collect as many as you can in each round!

Insect Eater

Your beak probes the nooks and crannies of shrubs and trees, sometimes probing beneath the bark, to search out insects that hide there.

Your food source
Pair of cards, 10 through King, any suit

Collect as many as you can in each round!

Food Competition Action Chart

Ties are resolved by drawing a card. The player with the higher card wins. Aces are low.

Winner or Loser	Players	Action
The Winners These birds were the most successful at feeding and successfully reproduced, multiplying their numbers significantly.	The two birds that collected the MOST food	These birds thrived and so did their young, so each of these players "recruits" one of the players that died. The recruited player takes a matching bird identification card, representing the new generation.
The Unsuccessful These birds were not successful at feeding, and they died.	The two birds that collected the LEAST food	These birds "die" by turning in their identification cards. They then join the population of one of the birds that successfully reproduced by taking a bird identification card that matches one of the successful players.
The Survivors These birds were successful at feeding to keep themselves and some of their young alive, but they were at a definite disadvantage in the competition for food.	All other birds	These birds survived, but did not thrive. Each of these players draws a card to evolve to a new beak type, enabling them to exploit a different food source. • **Red suit** = Trade in your I.D. card for the next bird type in a CLOCKWISE direction on the beak-type wheel. • **Black suit** = Trade in your card for the next bird type COUNTER-CLOCKWISE.

Scenario Cards

Round 1 Scenario and Instructions

1) Each player takes one "jack of all trades" player identification card.

2) Each player draws **five** playing cards from the central pile.

3) Read Scenario #1:

This game loosely follows what scientists believe to be the story of a small flock of finches and their descendants, which eventually evolved into at least 56 species of endemic birds collectively known as the Hawaiian honeycreepers.

The scene: The island of Kaua'i, three to four million years ago—or so. You are part of a small flock of finch-like birds that are blown by a great hurricane to this island, more than 2,500 miles from your North American or Asian continental homeland. On Kaua'i, you and the other members of your flock find a variety of food sources: nectar from flowering plants, seeds, fruit, and insects. Your beak shape allows you to take advantage of all of these food sources—you are a "jack of all trades" or a "generalist," probably similar to today's *'amakihi*.

Important to the survival of any individual within a species—and, more broadly, any species—is its ability to acquire enough food to live, reproduce, and feed its young. Your ability to compete for food will determine whether you survive and reproduce.

In each round of this game, the playing cards represent your food source. Look on your bird identification card to see what you are trying to collect.

You'll try to collect as many of the food items listed on your identification card as you can during each round. Each round lasts two minutes—Wait until I say "begin" before you start collecting your food, and stop collecting as soon as I say "stop."

Round 2 Scenario and Instructions

1) Each player draws **five** playing cards from the central pile.

2) Read Scenario #2:

An eon passes—maybe a million or two million years—and the original flock of birds produces generation after generation. Some birds survive and reproduce, passing along their genetic information and characteristics to their young. Over time, birds with certain characteristics, such as slightly different beak shapes, were able to successfully exploit certain food types, and the birds with those characteristics thrived and reproduced, passing these characteristics along to future generations. Today, we know this process as "natural selection."

As time went on, these characteristics became so pronounced that different species emerged from the original flock of birds, which were all basically the same. These species are represented on your "Beak-Type Wheel."

So we come to this point, where we have species of birds with different beak shapes exploiting different types of foods. The birds and species that are generalist feeders, like the original "founder flock," compete with other birds and species that are adapted to specialized food sources.

Begin Round 2.

Round 3 Scenario and Instructions

1) Each player draws **five** playing cards from the central pile.

2) Read Scenario #3:

Another eon passes—another couple million years—and evolution continues. During this time, descendant species of the original founder flock find their way to the newly emerging island that we call Maui, flying from island to island in search of food.

On Maui, about a million years ago today, the competition for food continues . . .

Begin Round 3.

Round 4 Scenario and Instructions

1) Each group removes approximately one-third of the playing cards remaining in their central food pile before beginning this round, and sets them aside for the remainder of the game.

2) Each player draws **four** playing cards from the central pile.

3) Read Scenario #4:

Another eon passes—a shorter one this time—and evolution continues. Late in this time frame, Polynesian settlers arrive on Maui. Over time, these original Hawaiians cleared land for their farms and villages and took trees from the forest for building. As their numbers multiplied, their impact on the land increased, and many of the food sources for the species that descended from the original Hawaiian finches were in shorter and shorter supply.

Begin Round 4.

Round 5 Scenario and Instructions

1) Each group again removes approximately one-third of the playing cards remaining in their central food pile before beginning this round, and sets them aside for the remainder of the game.

2) Each player draws **three** playing cards from the central pile.

3) Read Scenario #5:

A few hundred years pass, and Europeans "discover" Hawai'i. Over time, forests are cut down for sale overseas, cattle and other domestic livestock graze forests and shrublands, destroying even more habitat for native Hawaiian birds. Feral pigs and goats damage the native forests, and introduced species compete with native birds for food. Rats and mongoose prey on native bird eggs and chicks. Many native birds are forced to live exclusively at upper elevations because mosquitoes carrying bird diseases inhabit lower elevations.

Begin Round 5.

Final Scenario

1) At the end of Round 5, read the following passage:

That brings us to today. Out of the 56 species of Hawaiian honeycreepers, the descendants of finch-like ancestors that arrived on the Hawaiian Islands before Maui even existed, only 18 survive today. Of these, 11 are classified as endangered or may already be extinct. Only seven surviving species are not classified as endangered. What do you think could be happening to these native species?