

Bird Beak Buffet

Grade Level: 3, 4

Next Gen Standards

3-LS3-1 Heredity: Inheritance and Variation of Traits

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

LS3.A: Inheritance of Traits

Many characteristics of organisms are inherited from their parents.

LS3.B: Variation of Traits

Different organisms vary in how they look and function because they have different inherited information.

3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

LS3.A: Inheritance of Traits

Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.

LS3.B: Variation of Traits

The environment also affects the traits that an organism develops.

3-LS4-4 Biological Evolution: Unity and Diversity

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

LS4.D: Biodiversity and Humans

Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

4-LS1-1 From Molecules to Organisms: Structures and Processes

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Vocabulary Words/Terminology (For Presenter's Use)

Adaptation – modification of an organism or its parts that makes it more fit for existence under the conditions of its environment

Biodiversity – a measure of the variety and variability of life on Earth, or in a biome, ecosystem,



specific habitat, or population.

Biological Evolution – Evolution is change in the heritable characteristics of biological populations over successive generations.

Ecological Niche – the role and position a species has in its environment; how it meets its needs for food and shelter, how it survives, and how it reproduces. A species' niche includes all of its interactions with the biotic and abiotic factors of its environment.

Ecosystem – a community of living organisms in conjunction with the nonliving components of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flows.

Ecosystem Services – the direct and indirect contributions of ecosystems to human well-being

Generalist – able to thrive in a wide variety of environmental conditions and can make use of a variety of different resources

Habitat – the type of natural environment in which a particular species of organism lives – where that species can find food, shelter, protection and mates for reproduction.

Natural Selection – the process whereby organisms better adapted to their environment tend to survive and produce more offspring.

Specialist – can thrive only in a narrow range of environmental conditions or has a limited diet

Trait – any genetically determined characteristic. They can change over time through natural selection.

Wetlands – distinct ecosystems that are covered often intermittently with shallow water or have soil saturated with moisture. They offer numerous ecosystem services and are extremely biodiverse. (E.g. swamps, marshes, bogs, mangrove forests, floodplains, etc.)

Materials

- **Pictures of bird beaks**

- A‘eo – Hawaiian Stilt
- Koloa maoli – Hawaiian Duck
- Nēnē – Hawaiian Goose
- ‘Alae ke‘o ke‘o – Hawaiian Coot
- ‘Alae ‘ula – Hawaiian Gallinule
- ‘Io – Hawaiian Hawk
- ‘I‘iwi – Scarlet Honeycreeper
- ‘Alalā – Hawaiian Crow

- **Pictures of Bird Feet**

- A‘eo – Hawaiian Stilt
- Koloa maoli – Hawaiian Duck
- Nēnē – Hawaiian Goose
- ‘Alae ke‘o ke‘o – Hawaiian Coot
- ‘Alae ‘ula – Hawaiian Gallinule

- **Wetland Bird Taxidermy (if available)**

- **Pictures of Hanalei Refuge Habitat**

- **Model Beaks**

- Chopsticks (A‘eo)
- Strainers (Koloa)
- Ridged Clothespins (Nēnē)
- Smooth Clothespins (‘Alae ke‘o ke‘o / ‘Alae ‘ula)

- **Model Food**

- Invertebrate animals (insects, spiders, worms – 30+)
- Cotton Balls / White Pompoms (naupaka berries)
- Pink/Red Pompoms (apple snail eggs)
- Green/Brown Pipe Cleaners (terrestrial vegetation)
- Plastic Aquatic Foliage (aquatic vegetation)
- **Model Nests**
 - Detective Hats (for now), any small circle to represent a nest – i.e. Frisbee etc
- **Predator Cards** (Made into long necklaces for students to wear)
 - Pig, Dog, Cat, Mongoose, Bullfrog, Egret, Chicken

Lesson Outline

- How do different types of bird beaks reflect the kind of food they eat?
- How do other physical adaptations assist in a bird's pursuit of food?
- Habitats provide a variety of foods that satisfy the survival needs of many different birds.
- Animals have traits that are inherited from their parents and influenced by the environment.
- How do rapid environmental changes like the introduction of invasive species, habitat loss, and pollution present serious problems for highly adapted and endangered Hawaiian wetland bird species?

Set-Up

- Set up half as many nesting locations around the perimeter of the playing area as there are students.
- Disperse a good mix of food items within the nest perimeter.
- Place one beak at each nesting area. Vary the beak types from nest to nest.
- Place an example of the food each beak can forage for at each nest.
- Have the pictures of the habitat in Hanalei and the different bird beaks and feet (including 'io and 'I'iwi) with you as interpretive tools for your talk.
- Make sure all of your materials for later rounds are ready for setup once the lesson and first round are complete.

Delivery

Explain

Animals and plants are built to survive in the environment where they live. That relationship plays a part in why protecting natural habitats is so important.

Ask

Can anyone tell me what a habitat is?

Explain

A habitat is the home, or environment, of an animal or plant. Every habitat has a unique mix of food, water, cover, and other characteristics that help an organism survive.

Ask

What are some examples of habitats?

Explain

Those are all good answers. A habitat can be large or small. Deserts, forests, coral reefs, rivers, cities, or even a tree in your back yard can all be considered habitats for the animals and plants that live in or on them. If you put a bunch of habitats in one area together, you get an ecosystem.

Ask

What are some examples of ecosystems?

Explain

Grasslands, Desserts, Tropical Rainforests, Tundra, Oceans, and more are all ecosystems. Today, we are going to be specifically talking about the Wetland Ecosystem, like taro fields or the Hanalei National Wildlife Refuge. Every ecosystem has something we call Ecosystem Services which are the benefits a certain ecosystem has toward humans.

Ask

How do wetlands help people?

Explain

Wetlands help to control floods, they help refill the groundwater where we get much of our drinking water, they help protect shorelines from storms and erosion, they help clean dirty water of sediment and toxins, provide us food (like taro), and are biodiversity hotspots.

Ask

Can anyone explain what biodiversity means?

Explain

Biodiversity is a measure of the variety of life in a particular habitat or ecosystem. If a habitat has a lot of niches, or potential lifestyles that can be lived, then it will have high levels of biodiversity. Plants and animals are highly adapted to the unique mix of food, water, cover, and climate present where they live, so they have the greatest chance of survival in their niches they have found in their native habitat.

Ask

Does anyone know what an adaptation is?

Explain

An adaptation is a characteristic that a species has evolved in order to be successful in a certain environment. Provide examples: giraffes have long necks – Why??, Cheetahs run fast – Why?? Humans have thumbs – Why??

Ask

Can anyone here explain what it means for populations to evolve?

Explain

Biological evolution is the change in the characteristics of species in a population over several generations and relies on the process of natural selection.

Ask

Before I explain it, is there anyone who knows what natural selection means?

Explain

Natural selection is the process where organisms that are best suited to their environment (also known as the most fit) survive and pass on their genetic traits in increasing number to successive generations. Traits are the characteristics of any given organism, and they are influenced by two main factors.

Ask

Does anyone know where animals, plants, and even me and you get our traits?

Explain

The two main ways traits are developed are by being passed down from our parents, and through interactions with our environment. When it comes to the structure of organisms that help them survive in their environment, those traits are passed down genetically from their parents.

Explain

Today we are going to be talking about some of the structural adaptations birds have that help them survive in their wetland habitats on Kauai.

Ask

Who can tell me what kinds of adaptation they think birds have that help them to survive?

Discuss

Discuss briefly whatever adaptations your group may bring up.

Explain

Today we are going to be looking specifically at how birds' beaks and feet help them search for and eat food in the wetland habitats of Hanalei and Hulē'ia refuge here on Kauai.

Discuss

Show different bird feet and beaks to students. Ask students what they notice about the shapes of the feet and beaks. Are all of the feet the same? Are all of the beaks the same? How do birds use their feet? How do they use their beaks? How does a bird's feet/beak help them survive?

Examples:

- **Stilts**
 - Long pink legs for walking in water up to 9 inches deep, small partially webbed feet provide stabilization, allow for swimming, although they rarely swim.
 - Very long, straight beaks that are used to probe for worms, crustaceans and other small creatures in mudflats and shallow water.
- **Koloa**
 - Orange webbed feet are used for paddling in deeper water.
 - Rounded, olive-colored spoon-shaped bills that act like strainers to filter tiny plants and animals from the water.

- **Nēnē**
 - Black feet have lost much of their webbing for an important function- walking on sharp bumpy lava rock. Stronger, shorter legs that make them good for hiking.
 - Strong rounded beaks with serrated teeth help them grab Naupaka berries off the bush or tear blades of grass from the ground.
- **Coot and moorhen**
 - Long lobed toes, no webbing, coot has blue/gray feet, moorhen has yellow feet. Both can walk on floating vegetation, and can construct their nests on floating vegetation.
 - Shorter, pointy beaks that allow them to pinch seeds, fish, snails, etc.
- **‘Io and ‘Iiwi (not wetland birds, but use as example of how specialized different beaks are)**
 - Explain how the Hawaiian Hawk has a strong, hooked beak designed for ripping and tearing pieces of meat
 - Explain how the ‘Iiwi is strongly adapted to the plants that share its evolutionary history. Its long, downward-curving bill is specialized for sipping nectar from tubular flowers. The ‘ohi’a lehua flower has become very important for their survival as the flowers they evolved to get their food from have become rare.

Explain

Depending on the type of beak, each bird is adapted to collect and eat certain types of food. Now we are going to play a game using tools that represent the beaks of the birds we just talked about.

- Chopsticks (A‘eo)
- Strainers (Koloa)
- Ridged Clothespins (Nēnē)
- Smooth Clothespins (‘Alae ke‘o ke‘o / ‘Alae ‘ula)

Activity

Bring the students to the playing area directing them to pair up and choose a nest. Explain that the game is a relay, and pairs must work together to collect food from the feeding grounds. Distribute all of the native food types for the students to collect. Each member of the pair will take turns with the beak, visiting the feeding grounds and bringing one food item back to their nest. Explain that each beak is best suited for different types of food, and that they can only search for food that their beaks are specialized for in the wild.

- Invertebrates
- White Cotton Balls/Pompoms (naupaka berries)
- Plastic Aquatic Foliage (aquatic vegetation)

Depending on time, explain that students will each use the beak a certain amount of times or until you blow the whistle, etc. Choose the time frame that works for your activity schedule. If time allows, extend the game into multiple rounds with new challenges. At the end of each round, ask the students to explain how the new changes affected their ability to find enough food. Examples include:

- **Invasive predators have been introduced to the wetlands by humans!** Take the beaks from some students and give them predator cards to where instead. Explain that when a bird gets tagged by a predator, the bird must wait 5 seconds before foraging again and the predator must wait 5 seconds before tagging another bird (they’ll need some time to digest!) and that they cannot tag the same bird twice in a row.

- **Apple snail populations are exploding and they are eating the birds' favorite veggies!** Take away a certain plant-based food source or decrease the food supply overall. Litter the ground with apple snail eggs that they can eat, but they need more of before they can return to the nest.
- **Human Development is creating a loss of wetland habitat!** In this round, remove nests and have 'birds' gather food and try to scramble to find a place to lay eggs and raise chicks. It will be more difficult with more competition and some bird pairs won't be able to find a place for nesting. Discuss what happens when people drain or build on top of wetlands to create space for human activity – what do the birds lose? This example can also be used to tie in climate change by way of Sea level Rise/Coastal Intrusion as well as increased frequency of freshwater flooding and loss of useable nesting area – also a human driven impact.

After the game is over, collect the beaks, nests, and predator cards. Ask the students to help gather the food in the playing area.

Wrap-Up

Ask the group how specialized beaks can help some birds stay alive; how can specialization be a good thing? (A bird with a specialized beak can often eat a type of food that no other bird can eat.) Then ask how a specialized beak could be a negative thing; how it might hurt a bird. (If the bird's habitat changes and its food is no longer available, the bird might die because it can't eat anything else.) Explain that evolution and natural selection take place over extremely large periods of time, so when an environment changes very quickly, the most specialized animals are the most at risk. Optional: Explain that some birds, such as Hawaiian Crows ('Alalā), have very versatile beaks which allow them to eat fruits, nuts, berries, dead animals, and even fish and small rodents. These birds are called generalists. Revisit the concepts that explain why wetland habitats are so unique and important as an ecosystem.

Explain that protecting habitat is a way that we help to protect these special birds. We work to protect the place where the birds live, protect their food sources, and in that way, we can help to protect the birds as well, which is one of our responsibilities as a wildlife refuge.

Ask if there are any questions.