

Lesson 1: The Pecking Order

The Use of Various Tools to Explain and Show the Role of Adaptation in the Feeding of Birds

Overview: - Students will participate in a variety of “food gathering” activities in which various tools will simulate different kind of bird beaks, each with their own specialization. Students will also time the various activities and graph the results, comparing the results with their predictions.

Objectives (1-3): - To teach students through hands on exploration the advantages and necessity of animals adapting to fill specific niches in their respective environment.

Key Concepts: Food Webs, Predator-Prey Relations, Ecological Niches, Survival of the Fittest, Symbiotic Relationships, Biodiversity, Evolution

Subjects: Social Studies, Biology, Ecology, Geography, Ornithology

Duration: 2 class periods (80 minutes)

Setting: In the in the classroom and later in the field, outdoor natural landscape

Season: Year round, with field trip in Spring, Summer and Fall

Interdisciplinary Connections

Frameworks:

Mathematics: 6.1.1, 6.2.1, 6.4.1, 6.4.2, 7.1.1, 7.4.1, 7.4.2

Social Studies: 6.1.4, 6.1.5, 6.1.10, 7.1.4, 7.1.5, 7.1.10

Environmental Education @ the Cove River Site, and other coastal Connecticut settings.



Produced by the Graduate Students in Environmental Education EVE 546 Spring 2009



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Introduction (background): Adaptation to one’s environment is essential the individual’s survival as well as the survival of the species. In no place is this fact more evident then in the evolution of birds and their beaks.

A bird's beak is basically a lightweight, bony elongation of its skull. The beak is covered with skin that produces keratin, the same material found in human fingernails and hair. On most birds, the keratin condenses and dries, forming the beak's hard, glossy, outer covering. The tip and cutting edges of the beak are constantly renewed as they wear away, just as human nails are.

Bird beaks are multi-functional tools. Birds use them to weave nests, defend their territory, attack competitors, groom feathers, communicate, and most significantly, to gather or capture food.

Over the years, a wide assortment of bird beaks has evolved. Though many birds have straight beaks that are adapted to general feeding, some birds' beaks are examples of unique adaptations.

Materials:

- Beaks: 2 eyedroppers, 1 pliers, 5 sets of chopsticks, 4 tweezers, 1 shoestring, 1 sponge strip, 1 straw, 1 wrench, 2 slotted spoons, 1 strainer, 3 tongs, 1 envelope, 1 turkey skewer;
- Food: colored water in a long narrow container, gummy worms, sunflower seeds, styrofoam cubes, popped popcorn, rice, marshmallows, loose tea;
- Other: potting soil, shallow pans, 8 boxes, data tables for each student, 8 cups, vase or graduated cylinder, pictures of various birds with corresponding environment/habitat and food source

Preparation / Set Up (if necessary): In front of the class, arrange:

1. A tall, thin vase filled with colored water.
2. A dish of potting soil with gummy worms buried throughout.
3. Sunflower seeds spread throughout a pan.
4. A dish of water with styrofoam cubes floating in shallow water.
5. A dish of water with loose-leaf tea or herbs.
6. Popped popcorn
7. Rice grains tucked into the bark of a log (or styrofoam)
8. Marshmallows hanging on strings.

Engagement (Opening or Essential

Question: Why do birds adapt different beaks depending on their environment?

Ask the students to share with the class what they know about birds. What makes a bird a bird? What do birds need to survive? What kinds of food do they think birds eat? (Insects, seeds, berries, and meat are among the most common.) Where do birds live? Can you name some birds that you see or hear near your home or school?

Exploration: Tell students that each of these items at the various activity stations represents a type of food eaten by various birds. Ask students if they can hypothesize what each bird would have to do in order to reach their food supply. Does the shape of a bird's beak limit their food supply? (see overhead)

Note:

1. Nectar (colored water) will need to be sucked out. Hummingbird
2. Worms (gummy worms) need to be dug and pulled out.
3. Seeds (sunflower seeds) need to be cracked open. Sparrows, Finches
4. Fish (styrofoam pieces) will probably need to be scooped out of the water. Heron
5. Fine bits of vegetation (tea or herbs) will need to be carefully scooped out of water. Ducks, Geese, Swans
6. Flying insects (popcorn) need to be caught in wide openings. Swallows
7. Small insects (rice) will need to be picked and pried out of small crevices. Woodpeckers
8. Meat (marshmallows) will need to be pulled off of bones. Owls, Hawks

Divide Students into groups there will be eight different group Activities, so divide students accordingly. Pass out "Activities" and equipment to each group. (Each group gets a different food source and a set of three different utensils, which they are to use as sample "beaks.") After reading their card, ask students to write which "beak" they predict will work best for "eating" their specific "food" in their science notebooks. Each group will time in seconds how long it takes to get a certain amount of "food" with each utensil. (See Activities).

Ask each group to describe their "food" and rationalize which shape of beak and bird from the overhead they think would best suit the food source. Ask them if they can think of any other adaptations that might help each bird better survive in its niche. Ask the class as a whole what kinds of adaptations they think birds in this area might have (Osprey, Magpie, or pet birds, etc.). As a final question, ask students to relate what might happen to a bird population if its natural environment experienced a natural disaster where all the flora or fauna were wiped out

Activity #1

You have been given a graduated cylinder as a food source. You have also been given sample beaks: 1) a shoestring, 2) a medicine dropper, and 3) a sponge strip. Your Activity is to find out how many seconds it takes each "beak" to get 10mL of water from the graduated cylinder to the cup.

Record the three times in the data table provided. Try several trials with each "beak." Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #2

You have been given gummy worms as your food source. You have also been given sample beaks: 1) a straw, 2) chopsticks, and 3) a wrench. Your Activity is to find out how many seconds it takes to remove the gummy worms from the dirt using each "beak." Use multiple trials, burying the worms after each trial.

Record your times in the data table. Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #3

You have been given sunflower seeds as your food source. You have also been given sample beaks: 1) pliers, 2) chopsticks, and 3) tweezers. Your Activity is to find out how many seconds it takes each "beak" to crack the shell and remove the seed inside.

Record your times in the data table. Try this several times. Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #4

You have been given floating styrofoam squares as your food source. You have also been given sample beaks: 1) chopsticks, 2) tweezers, and 3) a slotted spoon. Your Activity is to find out how many seconds it takes each "beak" to remove all of the styrofoam square from the water. Try several trials, returning the squares after each trial.

Record your times in the data table. Try this several times. Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #5

You have been given tea as your food source. You have also been provided sample beaks: 1) a slotted spoon, 2) a strainer, and 3) tweezers. Your Activity is to find out how many seconds it takes to get all of the tea from the water. Try this several times, returning the materials each time. Record your times in the data table. Try this several times. Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #6

You have been given popped popcorn as your food source. You have also been provided sample beaks: 1) tongs, 2) an envelope, and 3) chopsticks. A group member will gently toss some kernels into the air. Your Activity is to find out how many seconds it takes to capture 20 kernels with each "beak." The kernels must be caught while they are in the air. Try this several times.

Record your times in the data table. Try this several times. Calculate the average time for

each "beak." Construct a bar graph of the averages.

Activity #7

You have been given rice as your food source. You have also been provided sample beaks: 1) a medicine dropper, 2) tongs, and 3) tweezers. Your Activity is to find out how many seconds it takes for each "beak" to remove thirty grains of rice from the bark of a tree. Try this several times, returning the rice to the bark each time. Record your times in the data table. Try this several times. Calculate the average time for each "beak." Construct a bar graph of the averages.

Activity #8

You have been given marshmallows hanging from a string as your food source. You have also been provided sample beaks: 1) chopsticks, 2) tongs, and 3) a turkey skewer. Your Activity is to find out how many seconds it takes with each "beak" to remove five marshmallows from the strings. Try this several times.

Record your times in the data table. Try this several times. Calculate the average time for each "beak." Construct a bar graph of the averages.

Explain:

Meet as a class to discuss the results of each of the activities. Ask them if their predictions were verified. Explain why each beak was the best tool for the job.

Elaborate:

Introduce or bring students to the Cove River site and have them observe the various birds or native wildlife. Instruct them to carefully observe the traits that make each bird unique. Have them extrapolate from their observations how the observed traits would give the birds an advantage in their environment.

Evaluate:

- Collect the bar graphs and averages as participation
- Have Students prepare a report on an exotic species (not found in CT) (this will help to give them a more expanded

exposure to environmental processes))
including the basics:

- Name
 - Both Common and Latin
- Appearance
- Location
- Physical Characteristics
- Niche
- Adaptations
- Reproduction
 - How many at a time?
 - Care
 - Recruitment age
- Status
 - Are they endangered?

Supplementary Material:

Forms of Bird Beaks:

http://fsc.fernbank.edu/birding/bird_beaks.htm

<http://www.ummz.lsa.umich.edu/birds/resources/anatomy/body/beaks.html>

Lesson 2: Cheep Imitations

An Introduction to the 20 most common Birds in your area and the calls they make

Overview: Students over the course of several weeks will be introduced and will be expected to memorize the appearance and calls of the most common birds in their area and then display their prowess in the field

Objectives (1-3): Students over the course of several weeks will be able to identify by sight and sound various common birds in their surroundings and through that develop the beginnings of a realization of the complexity and diversity inherent in successful ecosystems.

Key Concepts: Biodiversity, bird calls, coloration, survey techniques
Subjects: Biology, Ecology
Duration: 1 class period (40 minutes), followed by numerous short periods over the course of 4 weeks to familiarize/test students with appearances and calls
Setting: In the classroom, then eventually in the field, outdoor natural landscape
Season: late spring to mid-fall
Interdisciplinary Connections
Frameworks:

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Introduction (background): Bird vocalization includes both bird calls and bird songs. In non-technical use, bird songs are the bird sounds that are melodious to the human ear. In ornithology, bird 'songs' are often distinguished from shorter sounds, which may be termed 'calls'. Bird calls serve various purposes, these include mate attraction/selection, predator warnings, and territory notifications. In general each song and call is unique to the species (with the exception of mimics). The calls and the coloration of birds combine often to show the overall fitness of the bird and are essential in most mating rituals.

Materials: A list of necessary etc...

- The Urban Bird Sounds “Getting Started Packet” available at http://www.urbanbirdsounds.org/Site/Teaching_Materials.html
- A copy of the Urban Bird Sounds bird Call CD or podcast or mp3’s also available at http://www.urbanbirdsounds.org/Site/Teaching_Materials.html
- A copy of the Urban Bird Sounds “More Teaching Materials” packet available at http://www.urbanbirdsounds.org/Site/Podcasts/Entries/2008/2/2_Free_CD_and_Booklet.html
- A boom box (battery operated)

Preparation / Set Up (if necessary): When starting this lesson, it is important to make sure that you at least have at least a basic grasp of the calls and coloration of the various birds. Each student should have their own id sheet and it would be ideal to have large photos (laminated) so that the entire class can view the birds at the same time.

Engagement (Opening or Essential

Question: What are the various birds in my area, how can I recognize them, and why are they important?

- In a class ask your students what they know about birds
- Have them list the names of all the local birds they can think of
- Take your students on a “Listening Walk” around the school have them fill out the Listening Walk Handout

- Play the Final Quiz and ask them to write down any birds that they think they can name

Exploration:

- Each week work with your class to master not only the visual characteristics of the subject bird, but the calls of each bird as well
 - Each week should contain no more than four individual birds and their respective calls
 - At the end of each week give the students a quiz on the birds that they studied
- As the weeks progress, be sure to introduce individuals from previous weeks to keep up their familiarity
- Starting from the very beginning ask your student to spend a few minutes outside everyday listening to and observing the birds around them. Have them keep a journal where they list the birds they see and hear including the ones that they don't know, with those cases have them write descriptors for those calls and birds. Each week their journals should become more complete as their knowledge grows.

Explain:

Ask your students why they think that birds (both male and female) have different songs and colorations. Explain to your students what a Point Count is and why it is an important aspect of identifying the health of an environment (Birds are an Indicator Species)

Elaborate:

Introduce or bring students to the Cove River site, there spread them out individually and have them keep a point count of the birds that they see and hear. Be sure to take advantage of the various types of habitat that are afforded throughout the site. Bring the boom box with recorded songs, experiment with playing a bird call and listening for replies. Once several point counts have been taken gather your class together and discuss the species that were noticed.

Evaluate:

- At the end of the weeks when all of the calls have been studied and the quizzes have been given, present your class with the final test
- Ask them to hand in their song journals and point counts for participation points

Supplementary Materials:

More Bird Calls:

<http://www.enature.com/birding/audio.asp>

Information on Point Counts:

<http://www.pwrc.usgs.gov/point/help/index.cfm?pageName=What%20Is%20A%20Point%20Count?&formTitle=What%20Is%20A%20Point%20Count?&getFormName=Y>

Lesson 3 Birds of a Feather

An Introduction to the Bird Feathers and Their Uses

Overview: Students will be introduced to the feathers of a bird and to their uses and to man-made objects performing some of the same tasks.

Objectives (1-3): Students will be able to list various uses of feathers, recognize various feathers on the body of birds, and be able to list specific uses that humans have found for feathers.

Key Concepts: Biodiversity, bird feathers, coloration, evolution, insulation, ecology
Subjects: Biology, Ecology
Duration: 1 class period
Setting: In the classroom, then eventually in the field,
Season: mid to late fall or early spring
Interdisciplinary Connections
Frameworks:

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Introduction (background): Feathers are perhaps one of the most prominent features of a bird's anatomy as well as being unique to birds. Every bird has feathers and everything that has feathers is a bird.

Feathers perform a number of functions for a bird. Firstly, they provide insulation, this is very important in a warm blooded animal. It is believed by most scientists that this insulating effect was the primary force driving the evolution of feathers as well as protecting birds from UV light.

Secondly, feathers allow for flight. Scientists believe that flight evolved in birds as a result of their possessing basic feathers and that this added selective pressure to the evolution of feathers making them larger, stronger and refining their structure.

Thirdly, feathers control what a bird looks like. A plucked chicken or pigeon looks very different to a fully feathered one. Feathers supply the bird with colors allowing for camouflage and secondary sexual characteristics and sexual display (an example being the peacock).

Materials: A list of necessary materials

- Flight feathers (can be bought at an arts and crafts store)
- Downy feathers (can be bought at an arts and crafts store)
- A large diagram of a birds wing that labels the various feathers
- Magnifying glass (one per student)
- Pictures of various birds in their natural habitat (including penguins and ostriches)
- Pictures of people in winter gear
- Insulation from a sleeping bag or coat

Preparation / Set Up (if necessary): None

Engagement (Opening or Essential

Question: Why do birds have feathers, what are their uses? Can they be used for multiple things?

- In a class ask your students what they know about bird feathers
- What are they made of?
- Have them list the various uses of feathers

- Show them the diagram of a birds wing and walk them through what each type of feather is for.

Exploration:

1. Use the magnifying glass to compare both the flight feather and the downy feather
2. Compare the various parts (filaments and shafts) of the feathers including coloration. What are the similarities? The differences?
3. Due to their warm-blooded nature both birds and humans use coverings to help maintain their body temperature against their environment.
4. Have your students compare the pictures of humans in winter clothing and the penguins, ask them to note the similarities (ex. The air pockets that become trapped close to the body). Remind them that penguins are the only animals that can survive in Antarctica and despite the fact that they cannot fly, their feathers serve other purposes.

Explain:

Walk through the answers with your students and ask them to locate an area of the world without birds (exception being ocean floor). This will let them know just how adaptable the uses of feathers is.

Elaborate:

Introduce or bring students to the Cove River site, have them observe the local bird populations and compare the plumage of the various birds as well as potential uses for these animals.

Evaluate:

Ask your students to pick ten different birds from all over the world and to extrapolate the uses that each bird makes of its feathers

Supplementary Materials:

<http://www.birds.cornell.edu/AllAboutBirds/studying/feathers/>

http://askabiologist.asu.edu/research/bird_feathers/

Lesson 4: Winging It

A Study of Birds and the Principles of Flight

Overview: Students over the course of several classes will participate in several experiments meant to explain how birds utilize various types of flight using form and techniques.

Objectives (1-3): - Students will be able to recognize the various forms of flight utilized by birds and to understand the principles behind flight itself. Students will also be able to recognize the benefits inherent in each flight form.

Key Concepts: Flight, Wing Shape, Adaptation, Evolution, Bernoulli's Principle
Subjects: Science, Biology, Ecology
Duration: 3 class periods (120 minutes)
Setting: In the classroom with an outdoor field trip at the end.
Season: Mid/Late Spring, Early/Mid Fall
Interdisciplinary Connections
Frameworks:

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Introduction (background): Many bird experts have identified four types of flight found in birds. These four types are flapping, soaring, gliding and hovering. As the names indicate, these types of flight are different in the number of times that the bird moves the wings up and down during flight. All birds may use different types of flight to take off and land as well as in the air. These flying patterns may look totally different than the pattern of distance flying that the bird might use. A flapping bird can move its wings up and down in a repeated pattern with little time between beats. Most perching birds are flappers. These include robins, starlings and other common birds. A soaring bird can use its wings only occasionally with several minutes between beats. Soaring birds are also champions at using thermals to travel up and down within air columns, rising with warm air and descending with cold air. Many of these birds are birds of prey such as eagles, hawks and vultures. Gliding birds can use their wings by rarely flapping their wings except when taking off or landing. Many sea birds such as albatrosses fit in this category. These birds spend hours riding currents of air without a single wing beat. The hummingbirds and a few others represent hovering birds. Hummingbirds are true hoverers whereas other birds may use a flying pattern referred to as kiting. Time between wing beats for these birds is measured in milliseconds and instead of the up and down wing pattern of most birds, these birds use a modified figure 8 pattern. Some birds do not fly at all. There are scientific principals involved with flight.

Materials: The materials required for this lesson include:

- Pictures of various birds in flight (these can be obtained easily on the internet)
- Paper Airplane Experiment
 - Different varieties of 8.5 x 11 paper
 - Instructions to make the paper airplanes
- Air Pressure Experiment (each for every group you use)
 - Strip of notebook paper or newspaper, about 2 inches wide and 10 inches long
 - Hardcover book
 - Paper clips
 - Electric Fan

Preparation / Set Up (if necessary):

Make sure to have multiple copies of the airplane selections that you prepared a head of time.

Engagement (Opening or Essential

Question: What makes it possible for birds and other objects to fly?

What body characteristics allow birds to fly?

What do flying birds look like? If humans had the same body structures and weight as birds, what type of bird would we be? How could you prove this? There are flightless birds such as ostriches, rheas, emus and cassowaries. Give some reasons why these birds cannot fly using the facts given above. Penguins also cannot fly. What characteristics prove this fact?

Exploration:

Split the class into groups, from there; have them perform the following experiment:

1. Make an airfoil (wing) by placing one end of the strip of paper between the pages of the book so that the other end hangs over the top. Move the book swiftly through the air, or blow across the top of the strip of paper. It flutters upward
2. Hold the book in the breeze of an electric fan so the air blows over the top of the paper
3. Take the strip of paper out of the book. Grasp one end of the paper and set it against your chin, just below your mouth. Hold it in place with your thumb and blow over the top of the strip. The paper rises. Try the same thing after you have fastened a paper clip on the end of the strip. See how many paperclips you can lift in this way.

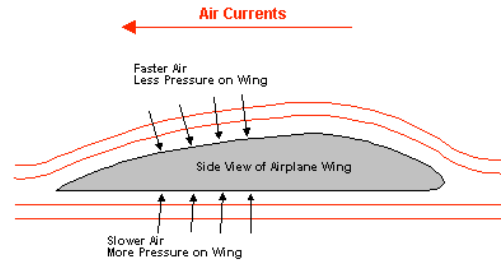
After they finish with the experiment have them perform the following:

4. Draw a sketch of an imaginary bird that represents each type of flight. Accurately use shape, length and width of the wings.
5. Construct a paper airplane that has the ability to fly using different wing shapes and write a descriptive paragraph about the flight pattern.
6. Allow each student to fly their favorite model for the class to see, have the class evaluate which model did the best and from there

Explain:

When birds fly, they are making use of Bernoulli's principle, this states: that an increase in the velocity of any fluid is always accompanied by a decrease in pressure. Air is a fluid. If you can cause the air to move rapidly on one side of a surface, the pressure on that side of the surface is less than that on its other side.

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Elaborate:

Take the class to the Cove River Site, from there have them watch and take note in a journal of the various forms of flight utilized by the birds that are present.

Evaluate:

Ask the students to turn in their notes from the field trip. Each student should then write a brief follow up with the following:

- Ask your students to take their observations from their own planes and to find a bird that they think flies like one of their models.
- Ask them to provide their reasons

Supplementary materials:

Templates for Paper Airplanes:

<http://www.funpaperairplanes.com/Plane%20Downloads.html>

Birds in Flight pictures:

<http://www.gregscott.com/rwscott/rwscott.htm>