Introduction to Ornithology

DESCRIPTION:

This session is designed to give students an appreciation of the important role birds play in our ecosystem. The students will have the opportunity to see and identify live birds at our feeders as well as simulated wooden birds placed along a trail. This trail is designed to give students practice locating and identifying common species of birds. The twelve stations that are part of the trail highlight a variety of birds and habitats. The trail is “teacher friendly” in that the accompanying teacher’s manual provides photographs and information about each bird along the trail.

OBJECTIVES:

• Students will be able to track the evolution of birds from their reptilian ancestors and recognize the first fossilized remains of a bird-like organism.
• Students will be able to list the adaptations that birds have evolved that allows them to fly, feed, build nests and mate.
• Students will gain experience using field guides and binoculars to identify birds.
• Students will gain insight into the study of ornithology, and to bird watching as a recreational pastime.
• Students will be able to state the value of birds, the role they play in the natural environment, the threats to their existence, and ways in which we can all help our feathered friends.
• Teachers will learn how to conduct a ‘bird activity’ that is user friendly and can be used to enrich their student’s knowledge of ‘back yard’ wildlife.

BACKGROUND INFORMATION:

Bird watching is an excellent tool to introduce students to the importance of wildlife. It is an activity that can easily be continued at home or at school and often continues as a life-long hobby. Learning to identify birds is a good first step, however the lessons should not end there.

The behavior of birds, the interaction of birds with their environment and the monitoring of birds as indicators species of the health of an environment are steps that should naturally progress over time.

Even if this activity is being utilized alone, teachers might want to consult with local ‘birders’ or ornithologists who can offer expertise. These local experts are in just about every community, since bird watching is an avid and passionate pastime for many people.

MATERIALS:

Pictures of a variety of birds; Bird nests collection; Bird field guides; Binoculars; Bird Trail Teacher’s Guide; iPad with bird app.
STUDENT ORIENTATION / PROCEDURES:

1. Start the session by asking the students what they know about birds. Elaborate on their knowledge in order to give everyone a good picture of this unique class (Aves) of animals. During this interaction period, the students will inevitably bring up topics like flight, food, songs, nest-building, feathers, eggs, etc. which will give the instructor the opportunity to discuss these topics in depth. All the information the instructor needs to lead this discussion can be found in the Bird Facts sheet included in this lesson plan package. This part of the session should last about one third of the total time allotted for the session.

2. Tell the students that they will have the opportunity to take a hike on the SOC bird trail to look for birds and identify them. Students will need two tools in order to fully utilize the bird trail; binoculars and a field guide. First it is important to talk about key terms/areas of the bird that are often used for identification. Use pictures of different birds on the bird poster to help students better understand these terms.

   Eye Ring or Line, Crest, Beak/Bill, Crown-top of head, Throat, Back, Breast, Wing Bars, Side, Tail Feathers

3. Have students investigate the field guides provided so that they understand the layout of the book. In order to acquaint students with the field guide you may want to ‘quiz’ them with questions such as: On what page can you find a purple finch? How did you determine this? If you see a very large bird in flight that you think may be a hawk, what would be your next step in using the field guide? If you see a bird that is bright red and orange, how could you narrow down what you think it may be?

4. Once students seem comfortable with the layout of the field guide it is important for them to practice using the binoculars. Using binoculars takes a bit of practice, which is why the wooden, non-moving birds on our bird trail provide a good start for beginning bird watchers. Pass out the binoculars and have the students adjust them for their eyes (see Using Binoculars study sheet). Have the students place the strap around their necks and proceed the to the outdoor bird feeders behind Big Timbers.

5. Students should first practice finding the bird feeders with their binoculars. Then gradually have them locate smaller fixed objects (rock, the pulley on a tree that holds the bird feeder line, etc.) a variety of distances away. For safety reasons, remind students not to walk while looking through the binoculars. Once you are comfortable with the students understanding of the key vocabulary words, the layout of the field guide and the use of the binoculars you can move on to the bird trail located behind Cabin # 2.

   THE BIRD TRAIL: The ‘bird trail’ utilizes the Green Darner trail, which begins behind cabin #2. The ‘bird trail’ portion consists of twelve different stations; a numbered falcon that is mounted on a post marks each of the twelve stations. The ‘bird trail’ makes a circle with the beginning markers on the right side of the trail. Once you reach the old beaver marsh (an unmistakable clearing) you have reached the top of the loop. At the mash you will see stations 7, 8 (the very top of the loop), and 9. After identifying these birds, proceed back down the trail you just cam up, looking for the remaining 3 stations (10, 11, and 12) on the right side of the trail which eventually terminates at cabin #2 once again.

6. Once you reached the first station marker students should try to locate a life size, wooden model of a bird. All of the birds are mounted 50 –100 feet directly behind each marker, it is intended that the group stays near the markers and use their binoculars to locate the birds. Birds are mounted in their natural setting, meaning if they are ground birds they will be found on the ground, if the are song birds they are in the trees etc. If the students are having trouble locating the wooden bird, use the Bird Hike Hint Sheet included in the lesson plan packet to help the students locate the bird.
7. Once the birds are located students should use the field guides to come to a consensus as to what the bird is, here is where a discussion of identification features is key. Once the group comes to a consensus on what bird they have located, the teacher’s manual will provide a photograph of the bird, its scientific and common name and additional scientific, social and conservation information about the bird. Some fun facts, trivia and jokes have been added as well. The birds in the teacher’s guide clearly correspond to the numbered markers on the trail. The teacher might also want to use the provided iPad app to play the song of the bird to give the students an appreciation of the diversity of vocalizations birds use and what they use them for (i.e. attract a mate and ward off a potential competitor) Note: only the males “sing” in most species but the females does utilize a variety of calls.

8. After the last bird is identified at station #12, lead the group back to the classroom for a wrap-up.

WRAP-UP:

• Have students identify which birds were located in what type of habitat, and discuss how that habitat is important to that birds’ survival. Diverse habitats contribute to species richness.
• Discuss which birds were easiest and which were the most difficult to identify. How would bird identification change if the birds were moving?
• What other birds are common or familiar?
• Discuss the value of birds (food chains and food webs – pest control; seed dispersal; flower pollination; recreation – aesthetics, pets, hobby; research; genetic vaults of irreplaceable information; environmental indicators).
• Discuss the importance of a clean environment and how pollution may affect different birds. Make a list of the threats to our wild bird population (Pesticides, oil spills, air pollution, light pollution, windmills, etc.)
• Help the students understand some of the things they can do to make sure our wild bird population is around for many generations to come.

FOLLOW-UP:

Have students set up bird feeders at school. (Discuss Black Bear issues with feeders)
Begin a class ‘life-list’ of birds they have seen.
Discuss/Research different nesting boxes or houses and build some.
Learn to identify birds by their songs.

Revised 2007 by R.W. FitzGerald
Bird Facts

Classification

Bird Characteristics:
- Possess feathers; forelimbs modified into wings; hind limbs adapted for walking, swimming or perching; scales present on feet; mandibles with no teeth (in living species); light skeleton with much fusion; four chambered heart; extensive air sacs throughout the body; warm blooded; no urinary bladder; oviparous.

Kingdom: Animalia
Phylum: Chordata
  Class: Aves
    Subclass: Archaeornithes = Fossil birds (e.g. archaeopteryx)
    Subclass: Neornithes = All modern birds
  Orders: 27
    Families: 166
  Genera:
  Species: 8700

Birds are (numerically speaking) the most successful terrestrial vertebrates on earth. There are about 8700 living species of birds compared with 3000 amphibians, 6000 reptiles, and 4100 mammals. Fishes, which live in a much less demanding aqueous environment, number around 20,000 living species. Among the invertebrates, the insects are overwhelmingly the most successful and dominant class, numbering over 800,000 species. They too owe much of their dominance to their ability to fly.

Evolution

- In 1861 the fossilized remains of what was thought to be the skeleton of a thecodont reptile were discovered in a limestone quarry in southern Germany. The fossil was dated at approximately 150-160 million years old (Jurassic period, 136-195 mya). However along with the fossilized skeleton were the unmistakable impressions of feathers along the forearm. The existence of feathers was enough to designate this fossil as the first known bird: Archaeopteryx lithographica (18 inches long). It had reptilian eyes, toothed jaw and from the structure of the breastbone, it probably had very limited powers of flight.

- It is thought that birds evolved from thecodont reptiles during the Jurassic Period some 150 to 160 million years ago. Thcodont reptiles were one of the dominant groups during the Triassic Period (195-230 mya). They were bipedal and lizard-like and were related to the dinosaurs and pterosaurs (the pteranodon was the largest-ever flying creature with a wingspan of better than 27 feet). The pterosaurs died out at the end of the Cretaceous Period (65-136 mya) along with the other dinosaurs.

- Unfortunately, the fragile structure of bird bones, and the speed with which they decompose is not conducive to fossilization, so knowledge of early avian evolution is scant. Little detail is available of the transitional stages in the evolution of the feather from the reptilian scale or of the stages by which the forelimb was modified into the avian wing.

- The next known birds in the fossil record occur 30 million years later (dated 120 mya) and show much more advanced avian characteristics. In the Cretaceous (65-136mya) shale of Texas, Kansas and Montana, six species of Gull-like birds were uncovered. In almost every detail they looked like modern birds: deeply keeled sternum and modern bird wings, indicating strong powers of flight. The vertebrae were still biconcave as in reptiles but the long tail found in archaeopteryx had disappeared. The size of the brain was intermediate between modern birds and reptiles, and the optic lobes were enlarged.
The Tertiary Period (10-60 mya) was a period of radiation for birds. About three-quarters of the present day families emerged over this time period.

-Birds show many reptile affinities such as their habit of laying eggs, the possession of scales on beaks and legs, and the arrangement of many internal structures.

For perceptive:

Another group of reptiles from the Triassic Period (195-230 mya) were the thrinazodons. These were mammal-like reptiles: quadrupeds, sharp canines, the beginning of a bony palate separating the nasal cavity from the mouth (a condition which enables mammals to breath continuous even while eating - reptiles lack this palate). These reptiles are thought to have given rise to the first mammals at the end of the Cretaceous Period (65 mya).

Flight

Over the 600 million year history of life on Earth, four life forms have forsaken their earthbound ancestors and evolved the power of flight.

- The insects were the first to exploit the aerial habitat, about 220 million years ago (mya) during the Triassic Period (195-230 mya). The flying reptiles (pterosaurs) were next, about 160 mya during the Jurassic Period (136-195mya), followed by the Birds (150-160 mya) and lastly the mammals (bats) during the Eocene about 40 mya.

-All other so-called flying creatures - flying fish, squirrels, tropical frogs, lizards and snakes - are capable of only controlled glides.

-Why did animals evolve the ability to fly?
  1. Open niches full of insects
  2. Escape from terrestrial predators
  3. Increased mobility = easy migration to follow favorable climate

Adaptations for flight

Weight-Reducing Adaptations:

1. Thin, hollow bones
2. Super light insulating body covering (i.e., feathers)
3. Elimination of skin glands
4. Elimination of teeth and heavy jaws
5. Elimination of tail vertebrae and some digits
6. Extensive bone fusion
7. Extensive branching air sacs
8. Oviparous rather than viviparous reproduction
9. Atrophy of gonads between breeding seasons
10. Selection of high-energy foods that are not bulky to maximize energy input while minimizing weight. They eat seeds, fruit, worms, insects, rodents, and fish.
11. Rapid and efficient digestion
12. Excretion of uric acid (low solubility: 1g with 2ml of H2O) instead of urea (1g needs 60ml of H2O) found in mammals.

Power-Increasing Adaptations:

1. Warm bloodedness (40-42°C) (Mammals =36-39°C)
2. Heat conserving plumage
3. Energy rich diet
4. Rapid and efficient digestion
5. High glucose content of the blood
6. Four chambered heart provides double circulation (respiratory and systemic) same as mammals
7. Rapid, high-pressure circulation (500-1000 beats per minute for a chickadee)
8. Highly efficient respiratory system
9. High rate of metabolism
Other Adaptation of birds
1. Excellent eyesight (navigational demands) (courtship)
2. Foot morphology
3. Beak morphology
4. Feather morphology

Feathers:
- No bird is without feathers, nor is there any other kind of animal that possesses feathers.
- Probably evolved from reptilian scales into a primitive heat conserving, fluffy insulation and later into highly complex epidermal structures.

4 basic types of feathers:
1. Vane or contour: Strong flight feathers with a central shaft and radiating filaments that are connected together with a multitude of tiny interlocking barbules. Primaries = propulsion; Secondaries = lift (airfoil)
2. Down: Insulation
3. Filoplume: fine hair-like fuzz around the bases of flight feathers appears to play a sensory role that aids in controlling feather position during flight.
4. Bristle: Modified vaneless contour feathers consisting of a small stiff rachis. These bristles are found around the eyes (eyelashes), nose (to filter dust), and mouth.

- Once formed, the feather is a dead horny structure without living cells, only receiving support from the body. These feathers are molted twice a year, once in the fall and once in the spring.

Migration

def: regular, extensive seasonal movements that animals make between their summer breeding regions and their wintering regions.

-Chief advantages
1. Live at optimal climate
2. Provides optimal conditions for rearing broods
   a. Broods are largest in the far north where the long summer days and abundance of insects combined to provide parents with ample food-gathering opportunity.
   b. Predation pressure is less in the north and the brief, once a year appearance of vulnerable young does not encourage a build-up of predator populations.
   c. Migration vastly increases the amount of space available for breeding.

Migration facts:
- 4000 migratory species
- "Instinctive" migrants migrate about on the same date each year (Catbirds)
- "Weather" migrants migrate based on local climatic changes (Robins)
- Most (90%) fly below 1500m. Some passerines fly as high as 6400 m (4 miles)
- The Arctic Tern is the greatest globe spanner of all: it breeds north of the arctic Circle and winters in Antarctica.

Stimulus for Migration:
- Photoperiod: Increasing day length stimulates the anterior lobe of the pituitary which produces gonadotrophic hormone. Gonadotrophic hormone promotes gonad growth, fat deposition, migration, courtship behavior, and care of the young.

Orientation and navigation:
1. Gravity
2. Magnetic field
3. Stars
4. Sun
Endangered and Threatened Birds of New Jersey

Information compiled from the New Jersey Department of Environmental Protection and Energy/Division of Fish, Game and Wildlife's Endangered and Nongame Species Program.

Endangered

Pied-billed Grebe, *Podilymbus podiceps*
Bald Eagle, **Haliaeetus leucocephalus**
Northern Harrier, *Circus cyaneus*
Cooper's Hawk, *Accipiter Cooperii*
Red-shouldered Hawk, *Buteo Lineatus* (Breeding)
Peregrine Falcon, **Falco Peregrinus**
Piping Plover, **Charadrius melodus**
Upland Sandpiper, *Bartramia longicauda*
Roseate Tern, *Sterna dougallii*
Least Tern, *Sterna antillarum*
Black Skimmer, *Rynchops niger*
Short-eared Owl, *Asio flammeus*
Sedge Wren, *Cistothorus platensis*
Loggerhead Shrike, *Lanius ludovicianus*
Vesper Saprow, *Poocetes gramineus*
Henslow's Sparrow, *Ammodramus henslowii*

Threatened

American Bittern, *Botaurus lentiginosos*
Great Blue Heron, *Ardea herodias*
Little Blue Heron, *Egretta caerulea*
Yellow-crowned Night Heron, *Nyctanassa violacea*
Osprey, *Pandion haliaetus*
Northern Goshawk, *Accipiter gentilis*
Red-shouldered Hawk, *Buteo lineatus* (non-breeding)
Black Rail, *Laterallus jamaicensis*
Long-eared Owl, *Asio otus*
Barred Owl, *Stix varia*
Red-headed Woodpecker, *Melanerpes erythrocephalus*
Cliff Swallow, *Hirundo pyrrhonota*
Savannah Sparrow, *Passerculus sandwichensis*
Ipswich Sparrow, *Passerculus sandwichensis princeps*
Grasshopper Sparrow, *Ammodramus savannarum*
Bobolink, *Dolichonyx oryzivorus*

*Only breeding population considered endangered or threatened
**Federally endangered or threaten*