

BIRDS

(Adapted with permission from "Birds: Exhibit Activity Guide" Friends of the National Zoo)

Background Information

I. What is a bird?

The ability to fly may be the first thing that pops into your head when you think of birds; however, not all birds fly. There are some traits that are common to all 9,000 species of birds, though. All birds:

- are *vertebrates**,
- are *endothermic**(warm-blooded),
- lay eggs,
- have *feathers**,
- and have wings (even the flightless species).

Beyond these general characteristics, birds vary tremendously in size, color, and diet. Birds range in size from the 250 pound/113 kilo ostrich to the one ounce/28 gram hummingbird. Some birds are *camouflaged** in shades of brown and gray. Others have brightly-colored feathers. Birds' diets also cover a broad spectrum. Some eat exclusively meat, some eat seeds and nuts, others eat fruit, and still others survive on aquatic vegetation.

II. Where do Birds Live?

Birds live practically everywhere on Earth. They can be found in warm, humid tropical rainforests as well as the frigid oceans near Antarctica.

They thrive in wetlands, temperate forests, deserts, grasslands, and cities. They build nests in tree branches, on the side of cliffs, inside tree trunks, and even in holes in the ground.

III. Interesting Characteristics and Adaptations

Flight

One of the most interesting characteristics of birds is their ability to fly. Bird bones are hollow, which helps to reduce overall weight. Feathers also help to reduce overall weight, and help with lift and steering in flight. Birds that fly have strong wing muscles that attach to a large keel on their breast bone. The combination of these three different *adaptations** enables birds to fly, a unique ability not seen in any other vertebrates except bats.

Egg Laying

Instead of bearing fully-developed offspring, female birds lay eggs and the young develop outside the mother. This is another weight-saving adaptation of birds. The eggs are laid one at a time over a period of hours or days. As the fertilized egg passes through the

*This word is on the vocabulary list.

*oviduct**, the egg shell is deposited by a lime-secreting gland, and other glands add pigments to the shell. The porous structure of the shell allows oxygen to enter and carbon dioxide to exit as the embryo develops inside.

Once eggs are laid, the job of incubation and protection begins. An egg's survival depends on a narrow range of temperatures. A sudden drop of several degrees can kill an embryo. Too much heat can also be destructive. Birds sit on eggs to maintain them at a constant, warm temperature. Some birds, like ducks, even line their nests with feathers to keep eggs from getting too cold. In warm climates, birds need to shield their eggs from the hot sun. Sometimes birds will stand over the nest to create shade, allowing air to flow over the eggs to help keep them from getting too warm.

Nests are built for *incubation**, but also to keep nutritious eggs out of the mouths of predators. Birds nests can be found on or dangling from tree branches, in tree cavities, under mounds, on cliffs, in caves, even on the back sides of large leaves. Many species have nests and eggs that are camouflaged. Nests can be built out of twigs, grass, leaves, pebbles, earth, and even unusual materials like yarn or dog hair.

Bills and Feet

Bill (also called beak) and feet shapes usually provide good clues as to where a bird lives and what it eats. For instance, the webbed feet of a duck are an adaptation for paddling in water. Its broad bill is an adaptation for feeding on aquatic vegetation. The sharp beak and clawed feet of an eagle help in tearing meat and gripping prey. The long toes of the house finch make perching in a tree much easier as it uses its narrow pointed beak to search out seeds and insects.

Coloring

A bird's coloring is also tied to how it functions in a particular environment. Mottled earth tones help a bird to blend in with its surroundings, an adaptation for avoiding predators, or for hunting prey. Many shorebirds, such as curlews and sandpipers, have this type of mottled coloration. Bright colors are often an advertisement to attract mates. Frequently the male of a species is brightly colored, while the female, who usually sits on the nest, is camouflaged from predators. Male and female mallards are an excellent example of this type of sex-based coloration.

Songs and Calls

A major form of communication among birds is through the use of songs and calls. The syrinx, a structure at the bottom of the windpipe, is the source of a bird's voice. The arrangement and length of the windpipe modifies the sound as it comes out of the bird, giving each species a distinct song.

*This word is on the vocabulary list.

A bird call is usually short, simple, and emitted by both males and females of a species. It is a sound that is inherited from the parents. A bird song, on the other hand, is longer, more complex, and usually sung by just the males of a species. Bird songs are partially inherited and partially learned from the parents. Each species of bird has a distinct song, but individuals within those species can also be identified by their song.

IV. Bird Conservation

Many bird species are *endangered**. Some, like the Dodo bird and the passenger pigeon, have gone *extinct**. Species can become endangered from natural changes in the environment, but as human populations increase, birds are more likely to be endangered because of *habitat** destruction, overuse of natural resources, and wildlife trade.

Zoos are actively trying to help *conserve** bird species through a cooperative program called the Species Survival Plan (SSP). Zoos and aquariums throughout North America have created SSP programs for a number of the world's most endangered birds. One of the purposes of the SSP program is to breed endangered species in order to maintain genetically healthy populations in zoos and aquariums. Some of the SSP species are being reintroduced into the wild.

In addition to zoos and aquariums, government agencies, nonprofit organizations and other groups are working to conserve birds. Individuals also can help by using natural resources wisely, protecting bird habitat (including keeping pet cats indoors), supporting the efforts of conservation organizations, and by becoming better informed about conservation issues.

*This word is on the vocabulary list.

VOCABULARY LIST

1. adaptation - a quality or characteristic of a species that helps it to survive and/or reproduce in its environment. Having webbed feet is an adaptation that enables ducks to paddle in water more efficiently.
2. camouflage - an organism's ability to blend in with its surroundings.
3. characteristic - a distinguishing trait, feature or quality
4. conservation - taking care of our environment by wisely managing natural resources.
5. endangered species - a plant or animal threatened with extinction by natural or man-made changes in the environment.
6. endothermic (warm-blooded) - an animal that maintains a constant body temperature through internal metabolic processes.
7. extinct - the condition when a species of plant or animal ceases to exist.
8. feathers - the body covering of birds. Feathers are made out of a protein called keratin, the same substance in hair and fingernails.
9. grassland - An area dominated by grasses or grass-like species that is too dry to grow a forest and too wet to be a desert.
10. habitat - the area where an animal, plant, or microorganism lives and finds the nutrients, water, sunlight, shelter, and space it needs to survive.
11. incubation - creating an ideal environment for eggs to develop and hatch.
12. nocturnal - an animal that is active at night instead of during the day.
13. omnivore - an animal that eats both plants and animals
14. oviduct - the internal passage through which the eggs travel from the ovary to the cloaca (external opening).
15. predator - an animal that kills and eats other animals.
16. prey - animals that are killed and eaten by other animals.
17. scavenger - an animal that feeds on dead plants and animals
18. vertebrate - an animal with a backbone.

Supplies Needed

- 1 - large world geography map
- 3 - 2 X 2 inch pieces of paper for each student
- 2 - copies of a kori bustard sketch (found at the end of this activity)
- 1 - photo of each kori bustard adaptation (found at the end of this activity)

Brainstorming!

Find out what your students already know about birds by holding a brainstorming session with your class. Create a list on the chalk board of things the class knows about birds. Use the following questions to get the discussion rolling:

- How are birds different from other groups of animals?
- Where do birds live?
- What do birds eat?
- How do birds reproduce?
- What types of sounds do birds make?
- How many different kinds of birds can you name?

Where the Kori Bustards Are

Birds live in just about every type of ecosystem on Earth. This exercise will help students investigate the kori bustard and its habitat (see Additional Information at the end of this activity for detailed information on the kori bustard and Grasslands).

Begin by having students select an adaptation the kori bustard possesses that interests them from the list below, and decide on how that adaptation fits into their habitat. For instance, if they decide they want to investigate the bustard's color, they will need to show how the bird's color helps with reproduction and camouflage. Here are the adaptations to choose from:

Mottled feather color of both male and female	Long legs
Three toes (lack hind toe)	Pointy beak
Inflatable esophagus	Eyes positioned on the side of its head

Next, tell students they need to find what makes up African grasslands and where grasslands are found in Africa. They can use the library or the Internet to track down the information.

Students should also be able to list at least two other animals that live in the African grasslands along with the kori bustard. Pass out the small pieces of paper and have each student create a labeled drawing of a grassland and the two animals they've chosen.

When everyone is ready, hang the map in the front of the class. Have the class show where African grasslands are found and describe a grassland. Then have each student describe the animals they found that live there. Finally, each student should attach their drawings to the map in the appropriate regions. After each student attaches their drawing, attach the picture of a kori bustard in both areas they are found. Using the adaptations the students chose discuss what makes the kori bustard uniquely adapted to its environment and its relationship (if any) to the animals they found.

***For older students** - Instead of drawing, have pre-printed photos of various African grassland animals and elements of the grasslands for the students to choose and research. As a closing, discuss what the impact would be if the kori bustard disappeared. For example, if the kori bustard became extinct how that would affect its predators such as hyenas, the insects it preys upon, and its "partnership" with the Carmine bee-eater?

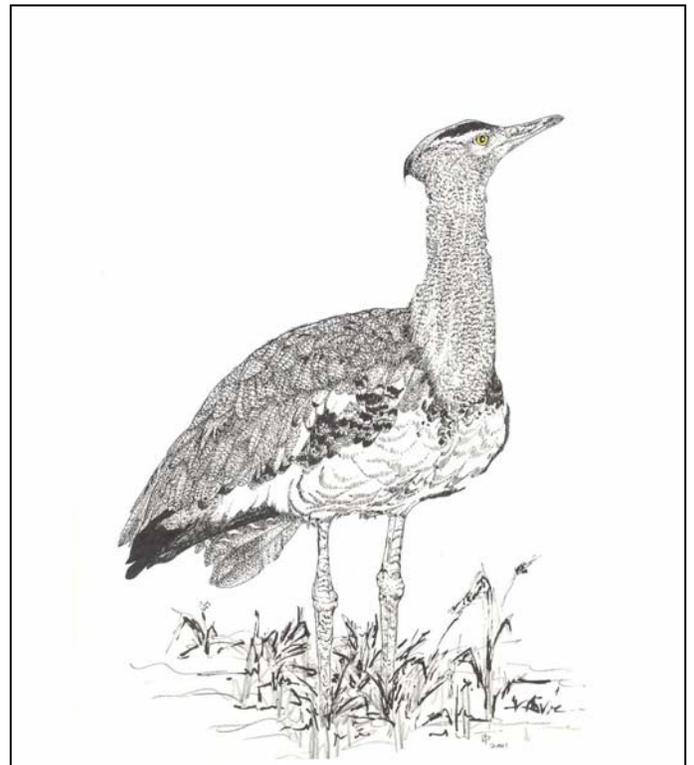
Additional Information

Kori bustard

The kori bustard (*Ardeotis kori*) is divided into two subspecies - *Ardeotis kori kori* (southern subspecies) and *Ardeotis kori struthiunculus* (eastern subspecies). These two populations are divided by the miombo woodland of Central Africa.

Description

Both males and females look similar but males are twice as big as females. They are mottled grayish-buff with dark brown, irregular lines and a black crest. The chin, throat, and neck are creamy white mixed with black bands. Male kori bustards stand about four and a half feet tall with females half the size with slimmer necks and thinner legs. The kori bustard has three toes on each foot and lacks a hind toe, making the bird strictly terrestrial. The kori bustard has no preen gland. In order to keep clean, they produce a powder down. Kori bustards also clean and maintain their feathers by



sun bathing and dust bathing. Males of the East African subspecies (*Ardeotis kori struthiunculus*) weigh between seven and 14 kilograms (15 to 31 pounds) with females weighing three to six kilograms (6.5 to 13 pounds). The southern subspecies (*Ardeotis kori kori*) is similar in appearance to the East African subspecies but is slightly taller. Males of this subspecies weigh between 13 and 18 kilograms (29 to 40 pounds) with females weighing six to seven kilograms (13 to 15 pounds). At these sizes, the kori bustard males approach the weight limit for flying!

Diet

Kori bustards are omnivorous (feeding on both animal and vegetable substances) with insects forming a large part of their diet. They also consume a variety of small vertebrates such as mammals, lizards, snakes and birds. Seeds and berries of a variety of plant materials are also eaten as well as the gum from Acacia trees, which has earned them the name 'Gompou' (Afrikaans for "gum-eating" bird). They feed mostly in the early morning and late afternoon and rest during the heat of the day. *Kori bustards are one of the few species of birds known to drink water using a sucking action rather than scooping it up with their bill.*

Predators and Defensive Behavior

Predators of kori bustards include the black-backed jackal, spotted hyena, lion, martial eagle, tawny eagle, Verreaux's eagle, leopard, caracal, and humans. The most vulnerable time for the birds is when they are chicks. Only about 18 percent survive the first year of life. Kori bustards generally prefer to run away from any danger, although they will fly. When alarmed, both males and females will emit a loud bark or perform the 'shock display' in which the bird bows forward, lifts its tail feathers, and spreads and inverts its wings to appear larger to potential predators.

Distribution

In the wild, there are two populations of kori bustard: *Ardeotis kori struthiunculus* in eastern Africa including Ethiopia, Uganda, Sudan, Kenya and Tanzania and *Ardeotis kori kori* in southern Africa including Botswana, Zimbabwe, Namibia, southern Angola, South Africa and Mozambique. The miombo woodland of Central Africa separates the two populations.

Habitat

The kori bustard is found in grasslands and wooded savannas. In arid grassland areas the southern subspecies (*A.k.kori*) can be found along dry watercourses where patches of trees offer shade during the heat of the day. The eastern subspecies can be found in areas of open grasslands, scrubland and savanna habitats.

Courtship

Breeding is closely tied with rainfall and, in drought years, may be reduced or not even occur. Kori bustard males mate with more than one female during the breeding season (polygynous). For the eastern subspecies (*A.k.struthiunculus*), breeding occurs between December and August. For the southern subspecies (*A.k.kori*) breeding is September to February. During

breeding season, males gather either singly or in loose lek like formations and perform "balloon" displays to attract females. Displays can occur throughout the day, but are usually most intense in the early morning and late afternoon/evening. During the height of the display, the male's esophagus inflates to as much as four times its normal size, resembling a balloon. With the neck expanded, the tail and wing feathers pointed downward, and the crest erected, the male gives a low-pitched booming noise as he snaps his bill open and shut. This display can be seen up to one kilometer (1.6 miles) away! Females are presumably attracted to the male with the most superior display. Actual copulation lasts no more than a few seconds. Once over, the male leaves and resumes displaying to attract another female. He does not assist in egg incubation or chick rearing. Outside of breeding season, kori bustards are generally solitary animals except for females with chicks.

Nest

The female makes a nest by making a shallow scrape in the ground and lays her green eggs. The nest is usually near a small clump of grass so the female is partially hidden. The clutch is usually one or green eggs. In captivity, the incubation period is 23 days. The precocial chicks are able to follow their mother around several hours after hatching and remain with her until the start of the next years breeding season. It's a tough beginning for kori bustard chicks - approximately 82 percent do not survive the first year of life.

Life Span

Life spans in the wild are unknown, but the longevity record in captivity is 29 years.

Relationship to Other Animals and Humans

Carmine bee-eaters (a small bird) can often be seen perching on the backs of foraging kori bustards. The bee-eaters eat insects stirred up by the koris as they move about. In return, the kori bustards may receive some form of predator detection - when the bee-eaters startle or fly away, it could be a signal that a predator is nearby.

Humans have also developed a relationship with kori bustards. These birds have been included in dances and songs of the Bushmen of Botswana. Drawings have been found in caves depicting the species. Although listed as "protected game" it is still hunted throughout its range. In Namibia, it is commonly referred to as the "Christmas turkey" and in South Africa it is called the "Kalahari Kentucky". The kori bustard feather is also popular for fly fishing lures.

Status in the Wild

Kori bustards are listed on Appendix II of CITES. The 2000 Eskom Red Data Book for Birds and the South African Red Data Book (1984) lists the status of the southern species (*A.k.kori*) as Vulnerable. The distribution of this subspecies is becoming fragmented with local extinctions recorded. In Eastern Africa, protected areas such as National Parks offer good protection for the species. Viable populations can be found outside protected areas but birds continue to be hunted. The total population size is unknown for both kori bustard subspecies.

Threats

Habitat loss has led to a major decline in all bustard species. Reasons for the decline are numerous and include habitat destruction from agriculture and development, bush encroachment caused by overgrazing from livestock, illegal hunting, and a general low tolerance of human activity. Collisions with overhead power lines also take their toll. As human populations increase and loss of habitat continues, the kori bustard population in Africa can be expected to decline further.

Kori Bustard Species Survival Plan

The kori bustard is part of a Species Survival Plan (SSP) that is working to learn more about this African bird and conserve this species. It involves many people, both in the zoo community and Africa. The plan will support and develop captive breeding programs, develop a husbandry manual for zoos, support field research, and educate the public both in Africa and abroad about issues related to bustard conservation. Visit the Kori Bustard SSP website at www.koribustard.com.

Adaptation Photos

Mottled feather color of both male and female



Three toes
(lack hind toe)



Long legs



Inflatable esophagus



Pointy beak/Eyes positioned on side of head



The KORI BUSTARD
(Ardeotis kori)
perfectly adapted to
its environment

Excellent eye sight
for predator
detection

Omnivorous bill allows
for feeding on a wide
variety of foods

Cryptic plumage
blends in with the
habitat

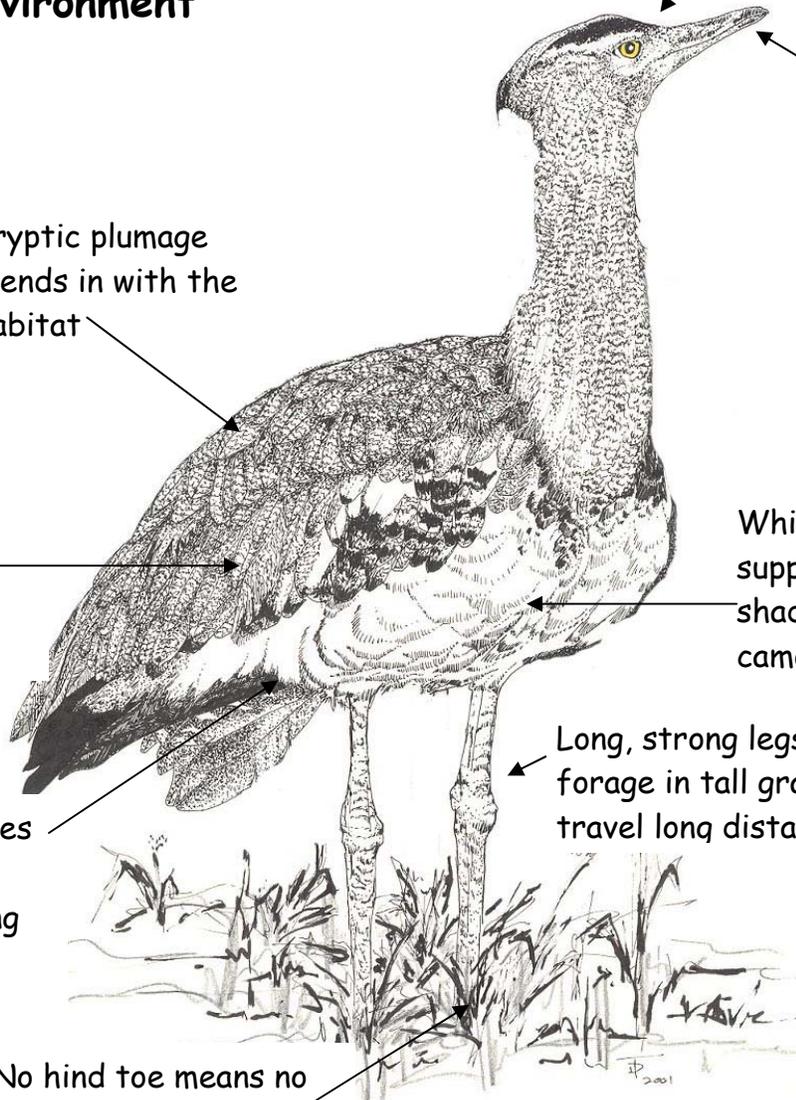
White underparts
supply-counter
shading and aid in
camouflage

Feathers are loosely
packed to aid in heat
dissipation

Long, strong legs let birds
forage in tall grasses and
travel long distances

Powder-down replaces
the preen gland and
aids in waterproofing

No hind toe means no
perching and indicates
a terrestrial existence



Grasslands

As the common name implies, grasslands are flat or gently rolling terrain covered by grasses. Having few or no trees, grasslands create a sense of "wide open spaces." Grasslands today cover one-quarter of the Earth's land surface. They occur on all continents except Antarctica. Grasslands have different names on different continents: in Asia, they are called "steppes"; in South America, "pampas"; in Africa, "savannas" or "velds"; and in North America, "prairies" or "plains." Regardless of what they are called, grasslands around the world have similar characteristics:

- Kinds of soil - Grasslands have alkaline, fine-grained soil that contains much organic matter and is almost completely covered by vegetation.
- Patterns of precipitation - In grassland areas, periods of rain are followed by periods of drought. Spring storms can bring more than three feet (0.9 m) of rain in a few hours.
- Presence of wind and fire - Winds can lead to powerful storms with gusts up to 60 mph (96.6 km) per hour in the winter, creating wind chills far below zero degrees Fahrenheit. Fire is a natural occurrence that helps to rejuvenate the grasslands.
- Grassland plants - Grasses are the most successful flowering plant family on Earth. They provide four to five pounds (1.8-2.3 kg) of plant matter per square yard of soil each year, making them one of the most efficient of all terrestrial ecosystems.

The grass above the surface is only 15 percent of the prairie's total biomass. At the end of the rainy season, grasses drop their seeds onto hard earth. There, until the next rains come, the seeds are a main food source for birds and rodents.

Grassland survival

The survival of grasslands throughout the world depends on several elements of ecosystem balance:

- intermittent fires
- long dry seasons with brief, heavy rains
- fast and efficient recycling of energy through scavengers
- grazing by large herbivores
- undisturbed sod

Natural and human forces of change that threaten the balance of grassland ecosystems are:

- lack of precipitation over a period of several years (drought),
- or long-term increase in precipitation,
- overgrazing by domestic stock,
- overuse of limited woody species for fuel,
- plowing,

- planting of homogenous crops,
- loss of topsoil,
- use of insecticides,
- fire prevention,
- drainage of wetlands and potholes for development, and
- introduction of new species of plants and animals.

Similar ecosystems throughout the world have similar plants, animals and environments. Animals living in grasslands have adapted to a life of extreme environmental conditions (wind, fire, cold, heat), few trees and little water.

Grassland animals protect themselves in many ways:

- They hide low in the grass or underground.
- Their camouflaged coats help them blend into their environment.
- Their senses of sight, smell and hearing are well developed.
- Those with long legs use their speed to elude predators.

African Savannas of the Past and Present

While pioneers ventured West across North America, settlers moved toward the interior of Africa. Invasion of wildlife habitats on both continents dramatically reduced or displaced animal populations. Both the northern and southern tips of the African continent began to be colonized by the French, English, and Dutch. The great herds of Central and East Africa remained all but untouched until the beginning of the 20th century. As settlers moved inward, they slaughtered wildlife to reduce competition with cattle and to protect crops. Poachers also drastically reduced animal numbers. Today, hunting in African savannas is now used as a successful management tool, much as it is in the United States. The small areas of remaining wild lands can support only a certain number of animals. The additional animals are culled from the herd, keeping the herds healthy. Conservation efforts led to the 1898 creation of the first African animal preserve, now called the Kruger National Park in South Africa.