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## Birds



Authors:

Jeff Betz, Science  
Communication Program,  
Laurentian University

Cyndy Parr, Encyclopedia of  
Life, National Museum of  
Natural History, Smithsonian  
Institution

Photo credit: Long-billed Curlew (*Numenius americanus*) by Mike Baird, Wikimedia Commons. CC BY

### Defining Birds

Birds form a class of animals that includes over 10,000 species worldwide (Clements 2007). These species were traditionally divided into 30 orders (Peters et al. 1931–1987) but more recent lists (in part based on molecular studies) group birds into 23 to 40 orders (Clement 2007, Gill and Donsker 2012). Passeriformes, commonly called perching birds or songbirds, are the most diverse order.

Birds range in size from the Small Bee Hummingbird (*Mellisuga helenae*) to the large flightless Ostrich (*Struthio camelus*). Compared to mammals, which range in size from shrews to the blue whale, birds that fly have a restricted size range. This restriction is imposed by the mechanical constraints of flight: the larger the bird the more muscular energy needed to stay airborne. Flightless birds have no such limit. Some extinct flightless birds, such as *Diatrymia gigantea*, were 7 feet tall, and the giant carnivorous ground birds of South America, the phororhacids, were also large.

### Habitat, Physiological Characteristics, and Behavior

Birds live in a wide range of environments, from tropical rainforests to the polar regions, though no one species is as widespread as *Homo sapiens*. The Barn Owl (*Tyto alba*) is one of the more widespread

species, found on every continent except Australia and Antarctica. In the tropics, there are a large number of species that have a restricted range.

Birds are ovivaporous—they reproduce by laying eggs rather than giving birth to live young. These eggs are adapted to survive in a terrestrial environment, and have a porous shell made of calcium carbonate. Birds are also homoeothermic (warm-blooded)—a trait they share with mammals—but that evolved independently. They all have bills (beaks) and are toothless, and swallow food without chewing. They have two-part stomachs: a glandular stomach and a gizzard. Many species swallow rocks or shells that collect in the gizzard and pulverize food. Bird forelimbs have evolved into wings for flight. Their bones are hollow, decreasing their body weight. All birds also have feathers, something that makes them unique among living animals.

## **Feathers**

Feathers are made of keratin, just like human fingernails and hair. They may have evolved for thermoregulation and/or to trap prey, but later were adapted for flight. Wings made of feathers are adjustable, and their lack of blood supply means that birds don't lose a lot of heat through their wings. The rigidity of feathers gives wings the necessary stiffness to fly. A damaged feather is also easy to repair as it is renewed in the next molt. Different types of feathers serve different purposes. Rigid, long, contoured feathers help birds fly. Fluffy down feathers keep them warm. Colorful plumes attract mates. Feathers provide a windproof and waterproof covering.

## **Flight**

Birds, like insects, reptiles (pterosaurs), and mammals (bats) have evolved the capability for flight. Most species fly, though a few, mostly island species, are flightless. Most small birds are flappers. Unlike aircraft that have fixed wings, these birds have moveable wings powered by muscles. Some birds, soaring birds like the albatross, can fly using fixed wings and air currents as a source of power (though they still have to flap their wings to get airborne). Many birds migrate. Because of low winter temperatures over large areas of Asia, northern Europe, and North America, there are relatively few birds that are permanent inhabitants. But during the summer months, hundreds of millions of birds from southern temperate and tropical areas migrate north. These travelers typically breed in one place and spend the winter in another, sometimes traveling thousands of kilometers to get back and forth. The Arctic Tern (*Sterna paradisaea*) spends its summers in the arctic and winters in the Antarctic.

## **Evolved from Dinosaurs**

In the 19th century, Thomas Henry Huxley analyzed the skeletons of dinosaurs and birds, concluding that the two groups were closely related. Bird feet have three toes, reptile-like scales, and a hind claw, like bipedal dinosaurs. More recently Chris Organ, a molecular biologist at Harvard University, analyzed the proteins of a 68-million-year-old leg fossil from a Tyrannosaurus rex. The dinosaur proteins more closely resembled those from chickens than crocodiles (Organ et al. 2008). Today, birds are believed to belong to a clade named Maniraptora, a branch of theropod dinosaurs. Theropods were bipedal, carnivorous dinosaurs. Some dinosaurs, even those not usually considered to be birds, had feathers. In spite of the enormous influence birds have on us—as sources of food such as the chicken (*Gallus gallus*), as pest controllers (many birds are insectivorous and reduce insect populations that would destroy human crops), or as plant pollinators—humans have decimated bird diversity. Over the past four centuries, over 100 cases of bird extinction have been documented. Human predation and habitat destruction, not to mention the introduction of invasive species like dogs and rats, have been responsible for 90% of these. There is evidence that the Earth is currently undergoing an episode of mass extinction. Unlike the asteroid that

probably caused the extinction of the dinosaurs 65 million years ago, the current mass extinction, that is destroying their descendants, has a different suspect.

### **Keystone Species**

The Red-naped Sapsucker of the Rocky Mountains (*Sphyrapicus nuchalis*) is a keystone species in two ways. First, it makes a brand-new cavity nest each year, leaving last year's home available to another cavity-nesting bird. Up to seven bird species depend on sapsucker nests.

The sapsucker got its name from its diet of tree sap. It drills "wells" in aspen, willow, and other trees, then sips up the oozing sap. After it departs, other sap-eating animals flock to the wells. More than 40 species of butterflies, squirrels, and birds rely on sapsucker nests.

The hornbills (Bucerotidae) of Africa's forests help trees spread and grow. How? The hornbill visits a tree to eat its fruit, then flies away. The fruit seeds gradually make their way through the hornbill's digestive tract. When the bird excretes, the seeds are expelled (with built-in fertilizer, thanks to the bird's feces). With enough luck, one of the seeds will sprout and take root, and a new tree will grow.

### **Indicator Species**

The Eurasian Curlew (*Numenius arquata*) is a world traveler, migrating across Europe, Africa, and Asia and is used as an indicator species. Its numbers have declined in recent years. One cause may be the loss of its grassy breeding grounds to farmland.

Scientists are concerned about the steady decline of the Arctic-dwelling Greater Scaup (*Aythya marila*). Studies suggest that its life cycle may be interrupted by a warming climate. Scaup bodies also contain unhealthy chemicals due to pollution.

### **Model Organisms**

The chicken (*Gallus gallus domesticus*) is a common model organism and has been part of many research projects, including the study of diseases like AIDS and multiple sclerosis.

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