



Aviaryum



B P P

COVER TO BE REVEALED

Large Flightless Birds

It only takes a glance to recognise that a group of heavy-legged, tall, running flightless giants, found in the southern continents, are completely different to all other birds. These are known as ratites, and they form a discrete group (the Palaeognathae), which include the world's largest and heaviest bird, the ostrich. Up until comparatively recent times, there were more species than there are now. The giant moa (*Dinornis robustus*) of New Zealand, which grew to 3.6m, was wiped out in the 15th century. In Madagascar, the elephant bird (*Aepyornis maximus*) was both taller (3m) and much more massive than the ostrich, but it has probably been extinct for 1000 years. It laid the largest known egg of any animal, dwarfing those even of the biggest dinosaurs. The moas and the elephant birds had no wings at all.

The biggest birds in the world today, alongside the ostrich, include the rheas of South America and the emus and cassowaries of Australasia. Surprisingly, they are all thought to have evolved from ancestors that could fly, although they have lost their keel, the bone to which the pectoral muscles are attached. They all have wings of a sort, but in emus and cassowaries they are much reduced and invisible under the plumage.

Most of these giant birds act like grazing animals, feeding on vegetation and wandering around open areas, often in groups. The cassowaries are the exception, being forest birds that are highly secretive and not sociable. Cassowaries eat large fruits and are crucial dispersers of rainforest trees.

All ratites are formidable birds that are not only bulky but are well armed with heavy legs and sharp claws. They can all kick, and the cassowaries have a long, sharp middle claw that can severely injure predators and has been known to kill humans.

Curiously, in all ratites it is the males that primarily incubate and look after the chicks. Emus may look after a brood for seven months, and cassowaries for as long as a year.

Key to plate

1a: Emu

1b: Emu chick / young
Dromaius novaehollandiae
150–190cm

The emu has odd "double" feathers, with the main shaft and a branch. It also has colourful bare skin on the head. In the breeding season it makes a booming sound.

2a: Greater rhea

2b: xxx chick / young
Rhea americana

1.27–1.4m (1.5m tall)

The rheas of the grasslands of South America have a feathered head and neck and three toes. They have well developed wings that are used as balance when running.

3: Common ostrich

Struthio camelus

Male 2.1–2.75m, female 1.75–1.9m

Ostriches are the world's largest, tallest and fastest running birds, and the only ones with just 2 toes. They

can reach 2m in height with neck raised and can run at 70km to escape from predators such as big cats.

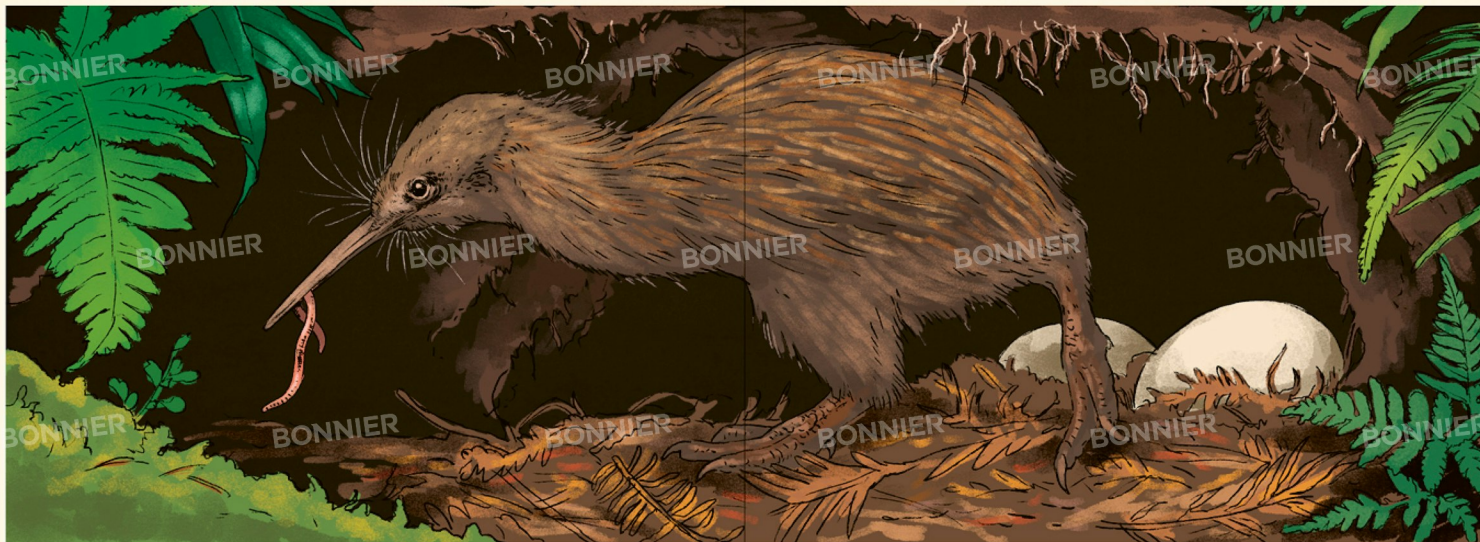
4: Northern cassowary

Cassinus unappendiculatus

1.2–1.5m

Cassowaries are forest dwellers, with sleek, black and decidedly hairlike plumage. The function of the peculiar casque is not known, but it might help the birds dig in the soil for food.





LARGE
FLIGHTLESS BIRDS

Southern Brown Kiwi

If there was a prize for the least bird-like bird in the world, it would probably go to the kiwi, of which there are five species in New Zealand. Its feathers look like hair; it obtains much of its food by smell; it cannot see particularly well; its body temperature is lower than that of birds (37–38°C, rather than 39–42°C); it is nocturnal and has no visible wings.

It does lay eggs, as just a handful of mammals do. The kiwi egg is the world's largest by relative size, six times normal for the size of bird, amounting to 25% of the female's body weight (the ostrich egg is relatively the smallest). When close to laying an egg, a female kiwi has no room in her stomach for food! Once it hatches, the kiwi chick is already so well nourished that it can become independent in two weeks. Amazingly, some kiwis lay clutches of two eggs!

Uniquely, the kiwi's nostrils open out at the end of its long, curved bill, and its sense of smell is very keen. It also has long bristles at the base of the bill, and a battery

of highly sensitive touch receptors at the tip. This allows for excellent detection of food such as worms and insects hidden in the soil. Together with an excellent sense of hearing, kiwis have a great set of senses for successful ground foraging at night.

Key to plate

1: Cyanobacteria

Prochlorococcus marinus
Diameter: Approx. 0.6µm
This minuscule plankton is one of the most abundant photosynthetic organisms on Earth. One millilitre of seawater can contain around 100,000 *P. marinus* cyanobacteria.

2: Dinoflagellate

Ceratium hirundinella
Diameter: Up to 200µm
During the day this dinoflagellate extends its 'fingers' into the water. These contain chloroplasts which are used in photosynthesis.

3: Diatom

Ditylum brightwellii
Length: Up to 300µm
This diatom is a tiny single-celled alga that makes its body out of glass-like silica – meaning it collectively lives in a glasshouse.

4: Coccolithophore

Emiliania huxleyi
Length: Approx. 3.5µm
Coccolithophores have a covering of chalky discs which reflect sunlight. When *E. huxleyi* blooms, this reflection of light is visible to satellites in space.

5: Sea sparkle

Noctiluca scintillans
Diameter: Up to 2,000µm
This species makes light via bioluminescence: when disturbed, producing an ethereal blue-green glow.

6: Chaetoceros debilis

Length: Up to 20µm
These microscopic algae join together to form long, spiral-shaped chains.

Habitat: Grasslands

Grassland forms in the climatic zone between deserts on the one hand and forests on the other. Different grasslands around the world go by different names, such as prairies in North America and steppe in Asia. They may be dotted with lakes and pools. Grasslands with scattered trees are often called savannas.

There are broadly two types. Temperate grasslands, such as those in North America, experience 300-600mm of rain annually, while tropical grasslands have about 500-1500mm. In temperate grasslands especially, birds need to cope with extremes of temperature, in similar fashion to deserts. A winter grassland can be ferociously cold, and many species migrate away.

However, grasslands are relatively rich habitats, providing an abundance of insects and seeds - any species that can eat grass seeds is going to thrive! Some grasslands have high concentrations of herbivorous mammals, providing their own opportunities. Cowbirds in North America were originally followers of bison, while oxpeckers (Buphagus) in Africa eat ticks from animal hides and cattle egrets (Ardea spp) feed on flushed insects at the feet of large animals.

Most grassland birds have cryptic plumage and the majority also nest on the ground. Quite a few are expert runners or have long legs - examples include the tinamous (Tinamidae) and the bustards (Otididae). By contrast, dense grassland doesn't contain many song-posts, so many of the birds here have loud songs or showy display-flights.

Key to plate

1: Brown-headed cowbird

Molothrus ater

Length: 16-22cm

Once confined to the Great Plains of North America, the cowbird is now an abundant farmland and urban bird. It lays its eggs in the nests of other birds, with almost 150 host species known.

2: Rosy-throated longclaw

Macropygia ameliae

Length: 19-20cm

A ground-living African savanna bird that has greatly elongated hind claws, which help it to walk in grass without losing balance. It eats insects, gathered on the ground, and the male, like many grassland birds, often sings in flight.

3: Lesser florican

Syrrhaptes indicus

Length: 46-51cm

In the breeding season, the male leaps above the long grass, flaps its wings with apparent desperation, holds

its legs up and drops down again - genuine wild bird comedy. The species lives in India.

4: Secretarybird

Sagittarius serpentarius

Length: 125-150cm

The secretarybird stalks African savannas in search of insects, mammals and famously, snakes. They kill large prey by powerful kicks of their long legs, which are densely scaled to protect from snake bites.

5: Spotted nothura

Nothura maculosa

Length: 23-26cm

A member of the primitive family of Tinamous (Tinamidae) closely related to ostriches and other flightless birds. This species occurs in the plains of central South America. The female may lay four clutches of five eggs a year.

6: Demoiselle crane

Anthropoides virgo

Length: 90-100cm

It breeds on the broad steppes of Central Asia, usually near water, and feeds mainly on seeds and insects, which it picks from the ground while walking slowly. It migrates south in winter, travelling in elegant V-formations.

7: White monjita

Xolmis rupestris

Length: 17-18cm

The startling white plumage stands out in the South American savanna as this bird perches boldly by tracks or on bushes. It perches high and drops down to catch insects on the ground, often hovering for long periods.

8: Ground tit

Pseudopodiceps humilis

Length: 19-20cm

This is an extraordinary bird that bounds over low vegetation in long



Habitat: Cliffs and Islands

Seabirds are highly adapted to the marine environment, but because they have to lay eggs and incubate them, they must at some point go to dry land to breed. This presents problems, because land doesn't suit them. They have webbed feet, which makes perching awkward; their legs are often set far back on the body for back-propulsion in water; and that may make walking difficult. Many have long wings, making the mechanics of approaching land tricky.

Seabirds' discomfort on land means that they are exceptionally vulnerable to ground predators, usually mammals such as rats, and that often limits them to breeding in places that either lack predators, such as islands, or sites that are hazardous to predators, such as tall cliffs and precipices. The limited availability of such sites means that the visitors all have to pack together, and virtually all seabirds are colonial.

Not every cliff or island will do. The location must be close to the sea, and it must be within reasonable reach of productive fishing areas. Many seabirds will commute up to about 50km, sometimes much further, but if food is too far away, feeding young may be impossible.

With so much crowding, it isn't surprising that different birds occupy different parts of islands or cliffs. Some live on boulders close to the sea, while others pack on to narrow ledges on tall cliffs. Crevices, holes or burrows are sought after refuges for many species, while others, especially bigger birds, need flat, wide ledges – these may need to be windy to help them take off. Sea caves may be ideal, as may be grassland above cliffs, or very low, sandy islands. One of the great delights of this habitat is seeing many types of seabirds, each contributing to the noise, smell and general melee.

Key to plate

1: Red-legged kittiwake

Rissa brevirostris
Length: 37cm

Three-quarters of the world population of this small gull (200,000 pairs) breeds on St George Island in the Aleutians, on towering cliffs. It feeds over deep Arctic waters, catching fish near the surface.

2: Guanay cormorant

Leucocarbo bougainvillorum
Length: 71-76cm

Cormorants are seabirds but their plumage is only semi-waterproof. The feathers become soaked, reducing their buoyancy and making diving more efficient. After swimming, they must hold their wings out to dry. This

bird is named after the guano that builds up at its colonies, once a major source of fertiliser.

3: Crested auklet

Aethya cristatella
Length: 23-27cm

A seabird of the North Pacific that breeds in large colonies on cliffs. Remarkably, it produces a tangerine-like body odour in the breeding season that helps in sexual attraction. The scent can be detected by humans far away from the breeding islands.

4: Atlantic puffin

Fratercula arctica
Length: 26-29cm

The remarkable bill of the Atlantic

puffin, with its backward-facing spines, allows the bird to grip multiple fish at a time to deliver to the roof of the mouth by the spiny tongue.

5: Southern rockhopper penguin

Eudyptes chrysocome
Length: 51-62cm

Being flightless, penguins can only breed on cliffs or rocks accessible from the ocean. These birds progress up slopes with two-footed hops. The Southern rockhopper lays two eggs, although usually only one hatches.



Kingfishers

The best-known members of this family are celebrated for their dramatic plunge-dives into water to snatch fish from the surface, but kingfishers as a whole have a wide range of habitats and feeding strategies. The kookaburra of Australia, for example, catches a range of small animals in the bush, often far from water, and many other species live in forests.

All kingfishers, though, are perch-hunters, watching for prey from an elevated position. The eyes don't move much within their sockets, so kingfishers often bob their heads and move them from side to side to keep focused. Those that hunt over water must compensate for refraction when they dive. Kingfishers have a large head and a disproportionately long, straight bill which enables them to grab what they spot. They frequently subdue fish and other animals by beating them against a perch repeatedly. For a bird that spends hours perching, the feet are surprisingly short and weak.

The family is highly successful and is found all over the world. Many species are extremely colourful, with bold patterns and glistening iridescence.

All members of the family use holes for nesting, which they usually dig out themselves, and for this purpose kingfishers' second and third toes are partially fused together. Even in small species, such tunnels often measure a metre or so long. Most species excavate earth banks, but tree holes and even termite mounds can be appropriated.

Key to plate

1: Stork-billed kingfisher

Pelargopsis capensis

Length: 35–41 cm

With its powerful bill, this species has a broad diet encompassing frogs, insects, small mammals and crabs, as well as frogs. Larger prey is beaten to death on the perch before consumption.

2: Laughing kookaburra

Dacelo novaeguineae

Length: 39–42 cm

An unusual member of the family that often lives far from water, even in Australian cities and backyards. Its famous 'laughing' call is uttered especially at dawn, often a duet between male and female.

3: Common paradise-kingfisher

Troglodytes aedon

Length: 33–43 cm, including streamers
The unusual nest-site of this kingfisher is a termite colony in the trees, where the birds will excavate a tunnel up to 1.5 cm, despite attempts by the inhabitants to repair it. This bird lives in New Guinea.

4: Common kingfisher

Alcedo atthis

Length: 16–18 cm

Found widely in Eurasia, this is a small species that flies rapidly on whirling wings low down over the water surface. It specialises on fish, which it catches with a plunge-dive and swallows head-first.

5: Pied kingfisher

Ceryle rudis

Length: 25–30 cm

Common in Africa and Asia, this kingfisher typically hunts by hovering over the water before diving in. Most unusually, it is sociable, and breeding pairs occur in clusters.

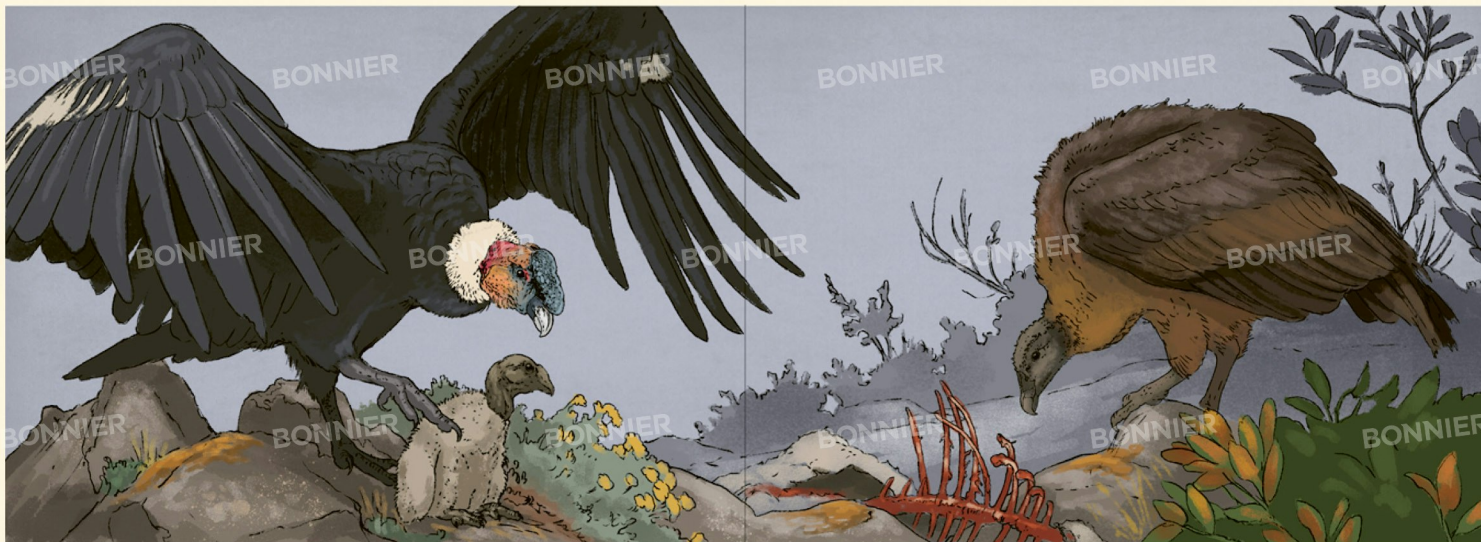
6: Ringed kingfisher

Megascyle torquata

Length: 38–42 cm

This is a big kingfisher of South and Central America. It will often sit on an elevated perch above fresh water for anything between 10 minutes and 2 hours eventually diving down head-first with a splash.





BIRDS OF PREY

Andean Condor

The Andean condor is massive, one of the largest flying birds in the world, with a wingspan that may exceed 3m. It also has a formidable bill with fearsome cutting edges that enables it to slice through the hides of large animals, and its head and neck are bare so that it doesn't have to soak its feathers with blood and body fluids. Yet the Andean condor is not a killer but a scavenger. It won't attack you, but it will wait patiently until you are dead!

Few birds fly with the effortless grace of the mighty condor. Its entire lifestyle depends on spotting carcasses, often from high in the sky. Each day it waits until thermals have formed in its territory, or it can work mountain updrafts, and it then may stay aloft riding the rising winds for the whole day, travelling 200km or more with scarcely a wingbeat. In the Andes, its core range, it eats llamas, alpacas, deer, rheas, and on the coast, it feasts on dead seals and cetaceans. In many parts of its range, it also takes advantage of domestic animals that have come to grief.

Carcasses are a scarce resource, so once they have found them, condors must

take advantage. They are adapted to gobbling down large amounts of food at once and might become flightless after a large meal. They have relatively short claws and long toes for walking and are unable to carry food away with them. They have powerful gut bacteria that make them immune to putrid flesh. Even when confined to the ground, they have few enemies. They are even capable of robbing a puma of its kill, especially

Key to plate

Ja: xxxxxx

Condors at carcass

Maybe a young bird too (takes five years to mature)

Long, very broad wings for soaring

"Slots" in wings aid in stabilising flight

Bare head and neck ensure that fluids and bacteria don't foul the plumage.

Long claws for walking

Huge, hooked bill for breaking through hides and skin of carcasses

Owls

Owls are among the most recognisable of all birds. They also make some of the world's most evocative natural sounds, their far-carrying hoots an unmistakable part of the night-time atmosphere.

They fill the nocturnal niche of raptorial, hunting birds. They prey on a wide range of birds, mammals, reptiles and insects, even some fish and frogs. In common with day-flying birds of prey, they have a sharp, pointed bill and formidable talons. They tend to drop down on to prey from a height, talons-first, and the sharp claws do the killing.

Owls have many adaptations to their lifestyle. They have very large, forward-facing eyes, which given them overlapping ("binocular") vision and excellent judgment of distance, and their retinas are packed with rod cells, which confer excellent contrast in low light. The average owl can see roughly twice as well as a human in the dark. They are far from blind in daylight, though, and will often exploit artificial light sources, such as streetlamps. Many hunt at dusk and dawn. Some are active by day.

Some species, though, can successfully hunt in complete darkness, and they owe this astounding ability to their hearing. Quite commonly, one ear (often the left) is placed slightly lower on the skull than the other. Directional hearing relies on the fractional difference between one ear receiving a sound signal and the other receiving the same. By having non-symmetrical ears, owls can detect differentials in both the horizontal and vertical plane, hence they can pinpoint sounds, such as a mouse's squeak, to great accuracy. Meanwhile, the facial discs of owls help to deflect incoming sound waves towards the ears. Incidentally, the long "ears" of many owls are simply tufts of feathers.

The other well-known adaptation of owls is their soft feathering, which makes them look "cuddly". Owl feathers are generally large and the flight feathers are covered with velvet-like structures that dampen noise, and serrations along the edge of the main flight feathers stabilise the flow of air. All these adaptations allow owls to fly almost silently, so that they can hear prey but prey cannot hear them.

Key to plate

1: Pei's fishing owl

Scotopelia peli
Length: 51–61cm
This really is an owl that fishes, at night. It perches a few metres above a river or pool and flies down to snatch fish from just below the water surface. It lives in Africa.

2: Western barn owl

Tyto alba
Length: 29–44cm
These owls can hunt in total darkness using hearing alone. They spend much time flying low over open ground and rank vegetation, plunging down talons-first when they detect a movement.

3: Spot-bellied eagle owl

Katopis nimbata
Length: 51–63cm
The fantastic ear-tufts have nothing to do with hearing, but can be raised when the bird is excited, and may also break up the head-shape in low light. This is a big, powerful species that eats large birds and mammals such as hares.

4: Great grey owl

Strix nebulosa
Length: 61–84cm
This impressive owl boasts the ability to catch voles under the snow using its extraordinary hearing to locate

them, and the power of its talons to "punch" up to 60cm through the surface.

5: Burrowing owl

Athene cuculata
Length: 19–25cm
It breaks owl mould by being active by day as well as night, and also by frequently nesting in loose colonies. It lives in burrows vacated by small mammals such as ground squirrels.





GROUND BIRDS

Superb Lyrebird

Many birds are heard before they are seen, but in the case of the lyrebird, you tend to hear the "wrong" bird before you see it. That's because this unique songbird of eastern Australia is one of the world's most accurate bird mimics. About three-quarters of its loud song consists of imitations, and in any given location, it will copy 25 percent of all species present in the moist temperate and subtropical forest where it occurs. It has an extraordinary ability to broadcast the sound of a whole flock of birds, including a chorus of kookaburras. It can do a rendition of trees creaking in the wind, and occasionally human sounds, too.

The song is part of the lyrebird's impressive display. The rest is like that of a peacock that ran out of money for bright colours. The male displays on a mound that it constructs for itself, and in the breeding season, which is the winter, it will sing almost all day.

Lyrebirds are among the world's largest songbirds and look like chicken-sized pheasants. In similar vein they obtain their invertebrate food, such as worms, by scratching and digging in the ground.

The female lyrebird lays just a single egg and is remarkably relaxed with it, often spending only half the day incubating. As a result, it takes a remarkable 50 days, almost twice as long for a bird of equivalent size.

Key to plate

1a: xxxxxx (xxxxxx)

Full display of male, with tail over head

Filamentaries (filament-like feathers)

Lyrates (the two lyre-like feathers)

Scratching

Female with single egg

Singing mound

Hummingbirds

There are almost 400 species of hummingbirds, all found in the Americas, where they delight and astonish with their diminutive size and glittering, gemlike colours. They flourish wherever flowers grow to give them a supply of nectar to drink; their diet is 90% nectar, washed down with small invertebrates such as insects and spiders. Most feed in a unique way, by hovering in front of blooms and inserting their tubular, forked tongues to lick about 13 times a second. Some hummingbirds visit 2,000 blooms a day. Some are highly specialised and have coevolved bills to match the shape of their favourite flowers, allowing themselves to be dusted with pollen each time and thus helping the plants. Some "cheat" by making holes in the flowers and drinking while perched. They find what they need with acute colour vision, and their ability to detect ultraviolet radiation enables them to see how nectar-heavy each bloom is.

The physiology of hummingbirds is superlative. When they hover, they beat their wings about 70 times a second, but this can reach 200 beats a second during chases, when they can also clock a speed of 80kph. The wings beat in a figure of eight pattern, which confers such stability that they can fly backwards and upside down, and of course their wings produce the hum that gives them their name. When flying, their heartbeat rate can be 1000 a minute, and is 500 at rest, while they can take 500 breaths a minute. Fortunately, they have more haemoglobin than any other animal, enabling to take up the oxygen they need.

Hummingbirds occur in most habitats – there's even one confined to mangroves. In particular, different species are found at different altitudes in the Andes. Some become torpid at night or in cold weather to save energy.

The hummingbird family contains most of the world's smallest birds, and they also lay the smallest eggs. In most species, the female makes a simple cup nest and produces a clutch of two eggs.

Key to plate

1: Peacock coquette

Lophornis peyanus

Length: 9.7cm

Aptly named for the male's remarkable cheek-tufts, whose pattern resembles the eyes of a peacock's train. This glorious hummer is found in the spectacular terrain of the tepuis, the table-top mountains of northern South America.

2: Velvet-purple coronet

Boissonneaua jardini

Length: 11–12.7cm

One of so many improbably coloured hummingbirds, the velvet-purple coronet is also among a significant contingent with restricted ranges, only found in the cloud-forest of southern

Colombia and Ecuador. It often raises its wings above its head before perching.

3: Bee hummingbird

Mellisuga helenae

Length: 5–6cm

The world's smallest bird, the aptly named bee hummingbird is only found in Cuba. When it flies, its wings make the sound like the buzzing of a bee. It is smaller than an ostrich's eye.

4: Green-fronted lancebill

XOCOPIXIA

Length: xxxxxx

Not surprisingly in view of its appearance, this is a hummingbird adapted to drinking nectar from

long, tubular flowers. It also regularly catches grubs with short sorties from a perch, often beside rivers.

5: Marvellous spatuletail

Loddigesia mirabilis

Length: Male 15–17cm, female

9–10cm, Tail 11–13cm.

Just found in a restricted part of northern Peru, this extraordinary hummer has only four tail feathers, with the male having long, almost bare outer feathers that cross over and end in rackets (or spatules). These have a life of their own during the hovering display and mesmerise the females.

6: Ruby-throated hummingbird





TROPICAL BIRDS

Great Hornbill

You often hear a great hornbill before you see it, but not necessarily because of its loud growling call. These huge forest birds make a tremendous swishing sound with their wings, which can be heard a kilometre away, and when a pair decides to swap one fruiting tree for another, the whole forest knows it!

The hornbills are a family of medium to large birds found in Africa and Asia. The great hornbill occurs from India to Malaysia and Sumatra. It bears the casque that immediately identifies the family and gives it its name. The function of the casque, which is an extension of the upper mandible, is not fully known, but males have larger casques than females or young, and rivals sometimes embark of aerial jousts, each hitting the other's bill. The casque is hollow and, in this species, divided into two.

Hornbills have a unique breeding system, in which the female seals itself into a large hole in a tree, becoming more dependent on its mate than any other bird. It uses mud, excreta and scraps of food to cover the entrance to the cavity, leaving only a slit through which the male delivers food. In this species the female may remain sealed in for four months as it incubates the eggs and tends the young. It can, however, break out at any time.

Key to plate

♂ - Whale shark

Rhincodon typus
Length: Up to 10m

This huge animal is named for its large size and for its filter-feeding behaviour, which it has in common with baleen whales. Whale sharks live in open tropical waters around the world. Although nobody can be sure, they are thought to grow up to 10m long and to live for as long as 70

to 100 years, reaching sexual maturity at around 30 years old.

♀ - Golden trevally pilotfish

Gnathodon speciosus
Length: Up to 12m
These brightly coloured pilot fish are often found alongside whale sharks. They are attracted by the leftover food the whale shark leaves behind when it is feeding.

♂ - Remora

Remora remora
Length: Approx. 40cm

Remora fish suction on to larger animals such as whale sharks and use them to hitch a lift over long distances. The whale shark is not affected positively or negatively by this.

Cotingas and Manakins

Bright colours, astonishing displays, otherworldly sounds and peculiar breeding behaviour make cotingas and manakins among the most exciting of all songbirds. Confined to the American tropics, they live mostly in dense forests.

This flamboyant group's fame stems entirely from what the males do. On the whole, the females are inconspicuous. Such extreme differences between the sexes reflect very different roles. The females are responsible for all breeding duties, from nest building to feeding young. Their burden of care means that they can be extremely choosy about who they mate with – hopeful males must pull out all the stops to woo them and prove themselves worthy.

In both cotingas and manakins, males may perform in a group. This is known as a lek, with birds next to each other or within audible contact, each male on its own display perch or in a cleared arena on the ground. The accompanying displays are stunning. Birds may dance, they may somersault, saunter along a perch, jump, flutter their wings, bow, hover and ruffle the colourful parts of their plumage. Some birds, such as cock-of-the-rock, display in duos; in some manakins, three or more males may take part. Each species has a differently choreographed display. Males may spend all year – and much of every day – on their display grounds.

And, of course, they make sounds too. Two cotingas, the white bellbird and the screaming piha (*Lipaugus vociferans*), produce the bird world's loudest sounds, at 125 and 116 decibels respectively. The capuchinbird (*Perissocephalus tricolor*) makes a sound like a chainsaw, and the Andean cock-of-the-rock emits a weird braying. Meanwhile, the manakins frequently make a loud wing-snap, a familiar sound in tropical forests, caused by beating their wings at great speed.

Key to plate

1: White bellbird

Procnitis alba

Lengths 27–28cm

The male is famous for delivering the world's loudest bird call, a double clanging sound that can reach 125 decibels. That's about the same as a fire alarm. Scientists don't know why the singing bird doesn't deafen itself.

2: Swallow-tailed cotinga

Phibalura flavoviridis

Lengths 21–23cm

This species is unusual within the cotinga family in that both male and female take part in nesting duties. The nest is constructed on a branch or tree fork and is almost entirely made up from lichens.

3: Andean cock-of-the-rock

Rupicola peruviana

Lengths 30–32cm

Males gather in leks on perches well above ground, where they jump, flutter and bow, all the time making weird grating, clucking sounds like malfunctioning robots. Oddly, male duos often cooperate in display, although only one individual gets to copulate with visiting females.

4: Lovely cotinga

Cotinga amabilis

Lengths 18–19cm

The vivid strong-blue plumage is seen only in the male; the female is dull brown and speckled. Both sexes feed on fruit in the forest canopy.

5: Wire-tailed manakin

Pipilo fuscatus

Lengths 11.5cm, plus tail 2.5cm

(female) to 4cm (male)

The extraordinary display of this forest gem involves the male bending down, lifting its tail over its back and 'flicking' the female's chin with its filaments.

6a: Blue-backed manakin (female)

Chirochloa parvula

Lengths 12cm

Several males may take part in a display in which each hovers in front of a female in turn, as if in a relay. The female chooses just one male to mate with and takes care of all breeding duties on its own.



Woodpeckers

The woodpeckers are familiar from almost every corner of the world, with two significant island exceptions – Australia and Madagascar. They are typically birds of forested habitats, where their most celebrated skill lies in their ability to excavate holes in trees, both dead and alive. To do this, they cling tightly to tree trunks in a vertical position, held in place by their strong, sharply clawed toes, two of which face forward and two back. Their specially stiffened tail acts as a brace. Their bills are long, chisel shaped and sharp at the tip, so that they can inflict a powerful and highly targeted blow. In order to cope with the shock of heavy strikes, they have a spongy skull which is reinforced at the base of the bill, and the brain is held tightly encased.

The main function of making holes is to reach insect larvae embedded deep in the wood, but the talent is easily transferred into constructing a nesting chamber, and most woodpeckers create their own each year. This leaves a good many vacant chambers in their environment, which are eagerly taken up by a variety of birds, small mammals or even insects.

The talent is also transferred into another skill – “drumming.” This is the sharp series of rat-a-tats that many woodpeckers make in spring. When drumming, woodpeckers hit but don’t penetrate wood, the idea is only to make the sound, which takes the place of a bird song, a declaration of territory.

Woodpeckers have a long tongue – so long, indeed, that when retracted it wraps around the base of the skull and may reach the eye sockets or nostrils. Many woodpecker tongues have barbs that help grip on to slippery prey. Woodpeckers don’t only eat insects, but they also drink sap and use their skills to break open nuts and fruits.

Key to plate

1: Rufous-bellied woodpecker

Dendrocopos hyperythrus
Length: 20–25cm

This woodpecker of the Himalayan foothills is one of several species that commonly drink sap. It uses its powerful bill to make incisions in trunks through which the sap exudes.

2: Northern Flicker

Colaptes auratus
Length: 30–35cm

A common and familiar woodpecker of North America, usually seen on the ground. It excavates a hole in a dead tree for nesting in the north of its range, where snow cover is routine in winter; it is a migrant and may move up to 2,000km.

3: Acorn woodpecker

Medeopsis formicivorus
Length: 23cm

This woodpecker is famous for its unusual habit of typically living in groups and using tree trunks and sometimes utility poles for “granaries”, where birds may store hundreds of acorns.

4: Eurasian green woodpecker

Picus viridis
Length: 31–33cm

This woodpecker spends large amounts of time on the ground seeking ants; its main diet throughout the year. It has large salivary glands and laps the ants up using its 10cm long tongue.

5: Great slaty woodpecker

Mulipicus pulverulentus
Length: 45–50cm

The world’s largest living woodpecker, the great slaty of Asia is only found in large tracts of relatively undisturbed woodland with, not surprisingly, tall trees with large trunks and branches.





FOREST AND
GARDEN BIRDS

Great Tit

The great tit is one of Europe's commonest birds and is a familiar visitor to gardens and bird feeders. The great tit, blue tit (*Cyanistes caeruleus*) and the black-capped chickadee (*Parus atricapillus*) are among the most intensively studied birds in the world, aided by the fact that they readily accept nestboxes for breeding.

Members of the tit family are small, restless birds that live in woodlands and forests. They have strong leg muscles, and these help them to grip perches tightly, so they are comfortable and acrobatic in the treetops, often hanging upside down. Their short bill is a multipurpose instrument. Many species, including great tits, make a dramatic shift from a diet of seeds, nuts and fruits in autumn and winter to a primarily insectivorous one in spring and summer, and as the diet shifts from meat-eating to vegetarian the gut lengthens. Great tits time their breeding season to coincide with an annual glut of caterpillars in temperate woodlands. They have a large clutch of 9-11 eggs which all hatch at the same time; in mid-production a pair might bring in 1000 food deliveries a day. They have a wide diet besides this and have been known to eat small birds and even, occasionally, bats.

The lengthening of day in early spring stimulates song in males. Careful studies have shown that great tits in woods with dense foliage sing lower pitched songs which carry better through leaves, while great tits in cities sing higher pitched songs than normal to be heard above traffic!

Studies of the plumage of great tits have shown that the brightness of the yellow breast varies between individuals, and this might have a link to a bird's ability to find caterpillars, whose body fluids provide the yellow pigment. At the same time, the ultraviolet reflectance on the blue plumage also varies between individuals and may also provide cues as to a bird's health and fitness.

Key to plate

I: xxxx

Bird on ground, in trees, at nest hole
Bird singing

Breast stripe wider in males than
females

Strength of yellow colour varies among
individuals

Crows

The crow family includes most of the world's largest songbirds, although their voices are typically harsh. Many species caw loudly, although even these, birds such as ravens and American crows, can utter all sorts of gentle sounds "under the breath," so to speak. Many are expert imitators, and some pairs of crows have their own personal "language".

About a third of the species, and most of the best-known species, are unrelentingly black in colour and have often been associated in human minds with death, partly because they eat carcasses. Many are extremely common around human environments, including cities. On the other hand, the rest include many vividly coloured and patterned species, featuring greens, blues and brownish pink some with impressive long tails, and these are typically forest birds. They all have powerful bills and legs, and they are all omnivores, but the groups look very different.

One of the key features of crows is their exceptional intelligence. The New Caledonian crow is one of the few birds that creates and uses tools. It will break off a leaf and use it to impale a grub in a hole and may even bend a stem to make a hook to extract a less accessible meal. Several crow species drop snails and nuts on to hard surfaces to crack them, and others indulge in play behaviour. In captivity, crows have been shown to be able to solve puzzles and they can recognise individual human faces.

A few species store away food to help them survive the winter, or other times of hardship. The Eurasian jay (*Garrulus glandarius*) will cache several thousand acorns away in autumn, each in a different location in the territory, some of which are buried in the soil. A single pinyon jay can store away 20,000 nuts in a season. This storage only works because crows have an excellent memory to relocate food. Their memory also enables them to remember the faces of humans who have "wronged" them!

Key to plate

1: Pinyon jay

Gymnokitta cyanocephala
Length: 26–27cm

This gregarious crow is entirely dependent upon an abundance of conifer seeds, especially of the Pinyon pine (*Pinus sp.* group *Cembroides*) which it stores away in bark fissures or in the ground. These are its go-to diet, although it does eat berries, grain and animals.

2: Common green-magpie

Cissa chinensis
Length: 37–39cm

A shy species of forests, this species travels along in small parties on the lookout for large insects, frogs, small birds and fruit, a typically varied diet for the crow family

3: Blue jay

Cyanocitta cristata
Length: 25–30cm

One of the most familiar of birds in the north-east of North America, the bold blue jay often attacks or harasses hawks and other predatory birds. It can also produce a very accurate rendition of hawk calls, possibly to test whether they are in the vicinity.

4: New Caledonian crow

Corvus moneduloides
Length: 40–43cm

It comes from an island off Australia and has proven itself to be one of the most intelligent of all birds tested. In the wild it often fashions tools out of *Pandanus* leaves which it uses to extract juicy grubs from holes or crevices.

5: Eurasian magpie

Pica pica
Length: 46–50cm

A common and highly intelligent crow of Eurasia, which has adapted to human created habitats, often feeding on roadkill. It builds an impressive domed nest of large sticks, often low down in a tree.

6: Thick-billed raven

Corvus crassirostris
Length: 60–64cm

The huge bill of this raven from the Horn of Africa is laterally compressed. It is sometimes used to scythe open dungheils so that the bird can reach large insects, and the birds also dig out the holes of mole-rats.



Weavers and Sparrows

These seed-eating birds are particularly abundant in Africa, although the sparrows are famous the world over. They have a thick conical bill for de-husking seeds. The mouth has a solid roof, or palate, and the bird manipulates a seed with its tongue (which is uniquely strengthened by a bony structure in sparrows) so that the sharp sides of the bill can pierce the outer part of the seed, rotate it like a tin opener, and detach it. Seeds have a high carbohydrate content (80 per cent in grass seeds) and also release water as they are broken down, allowing these families to live in arid environments.

There are birds in the Americas called 'sparrows' which are in a different family from the Old World sparrows featured here. American sparrows tend to build neat nests and have memorable songs, while the Old World sparrows cheep and chirp and build messy, domed nests out of grass. They are extremely sociable and often live in colonies. The house sparrow and the tree sparrow have both adapted to city living, the house sparrow all over the world.

The weavers are unusual because it is easier to see their nests than the birds themselves. You can see their handiwork, which is unique, throughout sub-Saharan Africa and the warmer parts of Asia. The birds build by weaving grasses into spherical nests, stitching with great care and dexterity, with different shapes for each species. Hundreds of nests may hang in the same tree, as many weavers are colonial.

The colourful male weavers construct the nests and the females only mate with them if they are satisfied with the building ability on show, although males also perform displays to show off their colours. Males may build many different structures in a season and a weaver bird colony is a lively and busy place.

Key to plate

1: Long-tailed widowbird

Euplectes progne
Length: 15–21 cm, plus plumes of male that extend 30–50 cm

In the widowbirds of Africa, males grow long and copious tail feathers in the breeding season and undertake thrilling flight displays to show them off. Females prefer mates with the longest tails.

2: Village indigobird

Vidua chalybeat
Length: 10–11 cm
This unusual seed-eater always lays its eggs in the nest of another bird, the red-bellied firefinch (*Lagonosticta senegalensis*). The male indigobird even imitates the firefinch's song to attract a mate.

3a: Village weaver (female)

3b: Village weaver (male)

Ploceus cucullatus
Length: 17 cm

Throughout Africa, weaver nests are highly conspicuous, and colonies can be seen everywhere, often in isolated trees and near villages. The males weave structures in order to impress females and in some species may build ten or more in a season.

4: House sparrow

Passer domesticus
Length: 15–17 cm
This is probably the only bird in the world that would become extinct if humanity was to disappear. It has been eating grain spilled from people's tables, houses and fields for thousands of years.

5: Arabian golden sparrow

Passer euchlorus
Length: 12–13 cm

A step up from most people's view of a dull sparrow, this species is still a long-established consumer of seeds from human cultivation, as well as wild grasses.

6: Red-cheeked cordon blue

Uraeginthus bengalus
Length: 12–13 cm
This pastel-coloured gem is a common bird of the African savannas, where grass seeds are abundant. Males and females often huddle together when perched.

