Species Description

The Furry Critter Network

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Rosies Cockatoo

Eolophus Roseicappilus

Species Organization

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Classification

The classification of the Galah was difficult. It was separated in the monotypic genus Eolophus, but the further relationships were not clear. There are obvious morphological similarities between the galah and the white cockatoos that make up the genus Cacatua and indeed the galah was initially described as Cacatua roseicapilla. Early DNA studies allied the galah with the cockatiel or placed it close to some Cacatua species of completely different appearance. In consequence, it was thought that the ancestors of the galah, the cockatiel and Major Mitchell's Cockatoo diverged from the main white cockatoo line at some stage prior to that group's main radiation; this was indeed correct except for the placement of the cockatiel. Ignorance of this fact, however, led to attempts to resolve the evolutionary history and prehistoric biogeography of the cockatoos, which ultimately proved fruitless because they were based on invalid assumptions to start with.

It fell to the study of Brown & Toft (1999) to compare the previously available data with their mitochondrial 12S rRNA sequence research and resolve the issue. Today, the galah is seen, along with Major Mitchell's Cockatoo, as an early divergence from the white cockatoo lineage which have not completely lost their ability to produce an overall pink (Major Mitchell's) or pink and grey (galah) body plumage, while already being light in color and non-sexually dimorphic. The significance of these two (and other) characters shared by the Cacatuinae had previously been explained away in earlier studies by strict application of parsimony on misinterpreted data.

Aviary-bred crosses of galahs and Major Mitchell's Cockatoos have been bred in Sydney, with the tapered wings of the galah and the crest and colours of the Major Mitchell's, as well as its plaintive cry. The Galah has also been shown to be capable of hybridizing with the Cockatiel, producing offspring described by the media as 'Galatiels'.

Other Names

Galah, Rose Breasted, Roseate

Species Description

Galahs are about 35 cm (14 in) long. They have a pale grey to mid-grey back, a pink face and chest, and a light pink crest. The sexes appear similar, however generally adult birds differ in eye color; the male has a very dark brown (almost black) iris, and the female has a mid-brown/red iris. Typical birds are about 350mm long and weigh between 300 and 400 grams.

Habitat

Forests and woodlands.

Distribution

Galahs are found in all Australian states, and are absent only from the driest areas and the far north of Cape York Peninsula. They appear to have been self-introduced to Tasmania. They are common in some metropolitan areas, for example Perth and Melbourne, and common to abundant in open habitats which offer at least some scattered trees for shelter. The changes wrought by European settlement, a disaster for many species, have been highly beneficial for the galah because of the clearing of forests in fertile areas and the provision of stock watering points in arid zones.

Captivity

Galahs are highly social and very long-lived; though they are sometimes kept as pets, this is not something to be undertaken lightly as they bond socially with their owners and may well outlive them, and like most cockatoos, are noisy and require a great deal of attention and care. Although they are generally considered one of the easier to keep species. They are more closely related to the cockatiel than to the white cockatoos that are more commonly seen as pets. Both male and female galahs are great talkers, but the male is thought to be the better talker. They're very loving and affectionate birds which form a very strong bond with their owner and like to think of themselves as 'part of the family'. However, they do like their privacy at times and are quite happy to simply be around the family rather than be handled all hours of the day.

Summary

Fairly noisy cockatoo with pleasant character; especially noisy when excited, but also during early morning and late afternoon; initially shy; wild-caught birds often extremely nervous; will then often only leave nestbox to feed; however young birds quickly become confiding; very hard chewers; regular supply of wood necessary; rotten wood and planks quickly chewed; colony system only possible in very large flight; trouble-free and not susceptible when acclimatised. Like other parrots, they have short tarsi but strong claws, and walk with a slow waddle, often using their strong bill as a third limb when climbing branches. They generally have long narrow wings used in rapid flight, with speeds of 70 km/h being recorded for some species. The black cockatoos, however, along with the Major Mitchell's Cockatoo, have shorted more rounded wings and a more leisurely flight.

The cockatoos have large bills which are kept sharp by rasping the two mandibles together when resting. The huge bills are complemented by large muscular tongues which help manipulate seeds inside the bills so that they can be de-husked before eating. During the de-husking the lower mandible applies the pressure, the tongue holds the seed in place and the upper mandible acts as an anvil.

The plumage of the cockatoos is less brightly colored than that of the other parrots, with species generally being either black, grey or white. Many species have smaller areas of color on their plumage, often yellow, pink and red, and usually on the crest or tail. A few species, like the Galah, have larger areas of color. In addition to their plumage many species have brightly colored bare areas around the eye and face, with the Palm Cockatoo having a large red patch of bare skin across the face. A few species exhibit sexual dimorphism in the plumage, with this being most pronounced in the Gang-gang Cockatoo and the Cockateil. Sexual differences in plumage are more common in the black cockatoos, but many cockatoos vary slightly in overall size and weight, with the males being on average larger. The iris color is often brown in adult females and differs from the black irises often seen in adult males, but this may not be totally reliable to identify the gender of a cockatoo.

Behavior: Cockatoos are diurnal, requiring daylight to find their food. They are not early risers, instead waiting until the sun has warmed their roosting sites before feeding. The 21 species are generally highly social and will roost, forage and travel together, often in large flocks. All species require roosting sites that are sometimes located near drinking sites, but many species may travel great distances between the roosting sites and feeding sites.

Cockatoos have several characteristic methods of bathing; they may hang upside down or fly about in the rain, or flutter in wet leaves in the canopy.

Calls and Communication: The vocalisations of cockatoos are loud and harsh. They serve a number of functions, including allowing individuals to recognize one another, warning others of predators, indicating individual moods, maintaining the cohesion of a flock and as warnings when defending nests. The use of calls and number of specific calls varies by species, some like the Short-billed Black Cockatoo have as many as 15 different calls, whereas others like the Major Mitchell's Cockatoo have far fewer. Some species, like the Gang-gang Cockatoo are comparatively quiet, but do have softer growling calls when feeding. In addition to vocalisations, the Palm Cockatoos communicate

over large distances by drumming a dead branch with a stick. Cockatoo species also make a characteristic hissing sound when threatened.

Diet and Feeding: The cockatoos are versatile feeders and consume a range of food items. Seeds form a large part of the diet of all species; these are opened with their large and powerful bills. Cockatoos may feed either individually or in flocks that range in size from small to quite immense. The Galahs, corellas and some of the black cockatoos feed primarily on the ground, others feed mostly in trees. The ground feeding species tend to feed in flocks, which can wither feed in tight, squabbling groups where seeds are concentrated, or in more dispersed lines where the seeds are less concentrated and more widely distributed.

While some cockatoos are generalists taking a wide range of seeds, others are specialists. The Glossy Black Cockatoo specializes in the cones of Allocasuarina, often a single species, which it holds in its food and shreds with its powerful bill before removing the seeds with its tongue. Some species take large numbers of insects, particularly when breeding. The large bill is used in order to extract grubs and larvae from rotting wood. The amount of time cockatoos have to spend foraging varies with the season. During times of plenty, they may only need to feed for a few hours in the day, in the morning and evening, and spend the rest of the day loafing, but during the winter most of the day may be spent foraging. During hard times the cockatoos also display versatility in their diet, travelling widely in order to find food, feeding on more green plant material and in some species using their large bills to dig up corms.

Breeding: Cockatoos are monogamous breeders, with pair bonds that can last many years. They may also display site fidelity, returning to the same nesting sites in consecutive years. Courtship is generally simple, particularly for established pairs, with the black cockatoos alone engaging in courtship feeding. Established pairs do engage in allopreening, but all forms of courtship drop off after incubation begins, possibly due to the strength of the pair-bond.

Like most parrots the cockatoos are cavity nesters, nesting in holes in trees. In many places these holes are scarce and the source of competition, both with other members of the same species and with other species and types of animal. This competition is particularly intense amongst larger species.

The nesting hollows are lined with sticks, wood chips and branches with leaves. The eggs of cockatoos are oval and initially white, although they become discoloured over the course of incubation. They range in size from 55*40 mm in the Palm Cockatoo to 26*18 mm in the Cockateil. Clutch size varies amongst the family, with the Palm Cockatoo and some other larger cockatoos laying only a single egg, and the smaller species laying anywhere between two to eight eggs. Amongst the cockatoos incubation and brooding responsibilities may either be undertaken by the female alone in the case of the black cockatoos or shared amongst the sexes as happens in the other species. In the case of the black cockatoos the female is provisioned by the male several times a day.

Aviculture: Cockatoos are very popular as pets, not only for their appearance but also for their intelligence and engaging personalities. Well-socialized cockatoos are often affectionate not only to their owner but to strangers as well. In spite of their attractiveness as pets there are drawbacks; they are potentially destructive, with the larger cockatoos in particular prone to destructive behavior. Cockatoos may show aggression during the breeding season; cockatoos are capable of very strong and painful bites.

They also require attention, although experts warn against "spoiling" young birds with too much attention as it makes the bird dependent on the owner, leading to problems later in life. Another drawback as a pet is the fact that most cockatoo species are very loud birds, though they naturally only vocalize for short periods of time twice a day. They can be expensive pets, with a cost which typically ranges from $500-$2000 for the more commonly available species. In addition to the actual cost, cockatoos require a very large cage for their size.

Cockatoos also require an out of cage gym or perch and a steady supply of toys, branches, cardboard boxes, or other chewable items, which prevents future self destructive behavior such as feather plucking. Cockatoos are capable of living up to 30-70 years depending upon species (around 20 years for the smaller Cockateils) and as such they require a long term commitment from their owners. Their longevity is also considered a positive trait as it reduces instances of the loss of a pet.

Cockatoos are popular for use in trained bird shows, and they can also be trained as pets. Cockatoos are generally less food motivated than other birds; some birds may be more motivated by a reward of petting or praise than of food. Cockatoos can often be trained to accept a parrot harness, enabling their owners to take them outdoors. Cockatoos have been used in animal-assisted therapy, generally in nursing homes.

In general, the smaller cockatoo species such as Galahs and Goffin's Cockatoos are considered to be much easier to keep as pets than large cockatoos such as Moluccans. In Australia, where Galah cockatoos are extremely abundant and inexpensive, they are often considered to be good first birds. The smallest species of cockatoo, the Cockatiel is a non-destructive and less demanding alternative making them extremely popular as pets, and among the species most often recommended to new bird owners.

Physical Characteristics - General Avian Information

Compared with other vertebrates, birds have a body plan that shows many unusual adaptations, mostly to facilitate flight. The skeleton consists of very lightweight bones. They have large air-filled cavities (called pneumatic cavities) which connect with the respiratory system. The skull bones are fused and do not show cranial sutures. The orbits are large and separated by a bony septum. The spine has cervical, thoracic, lumbar and caudal regions with the number of cervical (neck) vertebrae highly variable and especially flexible, but movement is reduced in the anterior thoracic vertebrae and absent in the later vertebrae. The last few are fused with the pelvis to form the synsacrum. The ribs are flattened and the sternum is keeled for the attachment of flight muscles except in the flightless bird orders. The forelimbs are modified into wings.

Like the reptiles, birds are primarily uricotelic, that is, their kidneys extract nitrogenous wastes from their bloodstream and excrete it as uric acid instead of urea or ammonia via the ureters into the intestine. Birds do not have a urinary bladder or external urethral opening and uric acid is excreted along with feces as a semisolid waste. However, birds such as hummingbirds can be facultatively ammonotelic, excreting most of the nitrogenous wastes as ammonia. They also excrete creatine, rather than creatinine like mammals. This material, as well as the output of the intestines, emerges from the bird's cloaca. The cloaca is a multi-purpose opening: waste is expelled through it, birds mate by joining cloaca, and females lay eggs from it.

In addition, many species of birds regurgitate pellets.

The digestive system of birds is unique, with a crop for storage and a gizzard that contains swallowed stones for grinding food to compensate for the lack of teeth. Most birds are highly adapted for rapid digestion to aid with flight. Some migratory birds have adapted to use protein from many parts of their bodies, including protein from the intestines, as additional energy during migration.

Birds have one of the most complex respiratory systems of all animal groups. Upon inhalation, 75% of the fresh air bypasses the lungs and flows directly into a posterior air sac which extends from the lungs and connects with air spaces in the bones and fills them with air. The other 25% of the air goes directly into the lungs. When the bird exhales, the used air flows out of the lung and the stored fresh air from the posterior air sac is simultaneously forced into the lungs. Thus, a bird's lungs receive a constant supply of fresh air during both inhalation and exhalation. Sound production is achieved using the syrinx, a muscular chamber with several tympanic membranes which is situated at the lower end of the trachea, from where it separates. The bird's heart has four chambers and the right aortic arch gives rise to systemic circulation (unlike in the mammals where the left arch is involved). The postcava receives blood from the limbs via the renal portal system. Unlike in mammals, the red blood cells in birds have a nucleus.

The nervous system is large relative to the bird's size. The most developed part of the brain is the one that controls the flight-related functions, while the cerebellum coordinates movement and the cerebrum controls behavior patterns, navigation, mating and nest building. Most birds have a poor sense of smell with notable exceptions including kiwis, New World vultures and tubenoses. The avian visual system is usually highly developed. Water birds have special flexible lenses, allowing accommodation for vision in air and water. Some species also have dual fovea. Birds are tetrachromatic, possessing ultraviolet (UV) sensitive cone cells in the eye as well as green, red and blue ones. This allows them to perceive ultraviolet light, which is involved in courtship. Many birds show plumage patterns in ultraviolet that are invisible to the human eye; some birds whose sexes appear similar to the naked eye are

distinguished by the presence of ultraviolet reflective patches on their feathers. Male Blue Tits have an ultraviolet reflective crown patch which is displayed in courtship by posturing and raising of their nape feathers. Ultraviolet light is also used in foraging—kestrels have been shown to search for prey by detecting the UV reflective urine trail marks left on the ground by rodents. The eyelids of a bird are not used in blinking. Instead the eye is lubricated by the nictitating membrane, a third eyelid that moves horizontally. The nictitating membrane also covers the eye and acts as a contact lens in many aquatic birds. The bird retina has a fan shaped blood supply system called the pecten. Most birds cannot move their eyes, although there are exceptions, such as the Great Cormorant. Birds with eyes on the sides of their heads have a wide visual field, while birds with eyes on the front of their heads, such as owls, have binocular vision and can estimate the depth of field. The avian ear lacks external pinnae but is covered by feathers, although in some birds, such as the Asio, Bubo and Otus owls, these feathers form tufts which resemble ears. The inner ear has a cochlea, but it is not spiral as in mammals.

A few species are able to use chemical defenses against predators; some Procellariiformes can eject an unpleasant oil against an aggressor, and some species of pitohuis from New Guinea have a powerful neurotoxin in their skin and feathers.

Feathers, Plumage, and Scales

The plumage of the African Scops Owl allows it to blend in with its surroundings. Feathers are a feature unique to birds. They facilitate flight, provide insulation that aids in thermoregulation, and are used in display, camouflage, and signaling. There are several types of feathers, each serving its own set of purposes. Feathers are epidermal growths attached to the skin and arise only in specific tracts of skin called pterylae. The distribution pattern of these feather tracts (pterylosis) is used in taxonomy and systematics. The arrangement and appearance of feathers on the body, called plumage, may vary within species by age, social status, and sex.

Plumage is regularly moulted; the standard plumage of a bird that has moulted after breeding is known as the "non-breeding" plumage, or – in the Humphrey-Parkes terminology – "basic" plumage; breeding plumages or variations of the basic plumage are known under the Humphrey-Parkes system as "alternate" plumages. Moulting is annual in most species, although some may have two moults a year, and large birds of prey may moult only once every few years. Moulting patterns vary across species. In passerines, flight feathers are replaced one at a time with the innermost primary being the first. When the fifth of sixth primary is replaced, the outermost tertiaries begin to drop. After the innermost tertiaries are moulted, the secondaries starting from the innermost begin to drop and this proceeds to the outer feathers (centrifugal moult). The greater primary coverts are moulted in synchrony with the primary that they overlap. A small number of species, such as ducks and geese, lose all of their flight feathers at once, temporarily becoming flightless. As a general rule, the tail feathers are moulted and replaced starting with the innermost pair. Centripetal moults of tail feathers are however seen in the Phasianidae. The centrifugal moult is modified in the tail feathers of woodpeckers and treecreepers, in that it begins with the second innermost pair of feathers and finishes with the central pair of feathers so that the bird maintains a functional climbing tail. The general pattern seen in passerines is that the primaries are replaced outward, secondaries inward, and the tail from center outward. Before nesting, the females of most bird species gain a bare brood patch by losing feathers close to the belly. The skin there is well supplied with blood vessels and helps the bird in incubation.

Feathers require maintenance and birds preen or groom them daily, spending an average of around 9% of their daily time on this. The bill is used to brush away foreign particles and to apply waxy secretions from the uropygial gland; these secretions protect the feathers' flexibility and act as an antimicrobial agent, inhibiting the growth of feather-degrading bacteria. This may be supplemented with the secretions of formic acid from ants, which birds receive through a behavior known as anting, to remove feather parasites.

The scales of birds are composed of the same keratin as beaks, claws, and spurs. They are found mainly on the toes and metatarsus, but may be found further up on the ankle in some birds. Most bird scales do not overlap significantly, except in the cases of kingfishers and woodpeckers. The scales of birds are thought to be homologous to those of reptiles and mammals.

Flight

Most birds can fly, which distinguishes them from almost all other vertebrates. Flight is the primary means of locomotion for most bird species and is used for breeding, feeding, and predator avoidance and escape. Birds have

various adaptations for flight, including a lightweight skeleton, two large flight muscles (the pectoralis—accounting for 15% of the total mass of the bird—and the supracoracoideus), and a modified forelimb (wing) that serves as an aerofoil. Wing shape and size generally determine a bird species' type of flight; many birds combine powered, flapping flight with less energy-intensive soaring flight. About 60 extant bird species are flightless, as were many extinct birds. Flightlessness often arises in birds on isolated islands, probably due to limited resources and the absence of land predators. Though flightless, penguins use similar musculature and movements to "fly" through the water, as do auks, shearwaters and dippers.

Diet and Feeding

Birds' diets are varied and often include nectar, fruit, plants, seeds, carrion, and various small animals, including other birds. Because birds have no teeth, their digestive system is adapted to process unmasticated food items that are swallowed whole.

Birds that employ many strategies to obtain food or feed on a variety of food items are called generalists, while others that concentrate time and effort on specific food items or have a single strategy to obtain food are considered specialists. Birds' feeding strategies vary by species. Many birds glean for insects, invertebrates, fruit, or seeds. Some hunt insects by suddenly attacking from a branch. Nectar feeders such as hummingbirds, sunbirds, lories, and lorikeets amongst others have specially adapted brushy tongues and in many cases bills designed to fit co-adapted flowers. Kiwis and shorebirds with long bills probe for invertebrates; shorebirds' varied bill lengths and feeding methods result in the separation of ecological niches. Loons, diving ducks, penguins and auks pursue their prey underwater, using their wings or feet for propulsion, while aerial predators such as sulids, kingfishers and terns plunge dive after their prey. Flamingos, three species of prion, and some ducks are filter feeders. Geese and dabbling ducks are primarily grazers. Some species, including frigatebirds, gulls, and skuas, engage in kleptoparasitism, stealing food items from other birds. Kleptoparasitism is thought to be a supplement to food obtained by hunting, rather than a significant part of any species' diet; a study of Great Frigatebirds stealing from Masked Boobies estimated that the frigatebirds stole at most 40% of their food and on average stole only 5%. Other birds are scavengers; some of these, like vultures, are specialised carrion eaters, while others, like gulls, corvids, or other birds of prey, are opportunists.

Water and Drinking

Water is needed by many birds although their mode of excretion and lack of sweat glands reduces the physiological demands. Some desert birds can obtain their water needs entirely from moisture in their food. They may also have other adaptations such as allowing their body temperature to rise, saving on moisture loss from evaporative cooling or panting. Seabirds can drink seawater and have salt glands inside the head that eliminate excess salt out of the nostrils.

Most birds scoop water in their beaks and raise their head to let water run down the throat. Some species, especially of arid zones, belonging to the pigeon, finch, mousebird, button-quail and bustard families are capable of sucking up water without the need to tilt back their heads. Some desert birds depend on water sources and sandgrouse are particularly well-known for their daily congregations at waterholes. Nesting sandgrouse carry water to their young by wetting their belly feathers.

Migration

Many bird species migrate to take advantage of global differences of seasonal temperatures, therefore optimising availability of food sources and breeding habitat. These migrations vary among the different groups. Many landbirds, shorebirds, and waterbirds undertake annual long distance migrations, usually triggered by the length of daylight as well as weather conditions. These birds are characterised by a breeding season spent in the temperate or arctic/antarctic regions and a non-breeding season in the tropical regions or opposite hemisphere. Before migration, birds substantially increase body fats and reserves and reduce the size of some of their organs. Migration is highly demanding energetically, particularly as birds need to cross deserts and oceans without refuelling. Landbirds have a flight range of around 2,500 km (1,600 mi) and shorebirds can fly up to 4,000 km (2,500 mi), although the Bar-tailed Godwit is capable of non-stop flights of up to 10,200 km (6,300 mi). Seabirds also undertake long migrations, the longest annual migration being those of Sooty Shearwaters, which nest in New Zealand and Chile and spend the northern summer feeding in the North Pacific off Japan, Alaska and California, an annual round trip of 64,000 km

(39,800 mi). Other seabirds disperse after breeding, travelling widely but having no set migration route. Albatrosses nesting in the Southern Ocean often undertake circumpolar trips between breeding seasons.

The routes of satellite tagged Bar-tailed Godwits migrating north from New Zealand. This species has the longest known non-stop migration of any species, up to 10,200 km (6,300 mi).Some bird species undertake shorter migrations, travelling only as far as is required to avoid bad weather or obtain food. Irruptive species such as the boreal finches are one such group and can commonly be found at a location in one year and absent the next. This type of migration is normally associated with food availability. Species may also travel shorter distances over part of their range, with individuals from higher latitudes travelling into the existing range of conspecifics; others undertake partial migrations, where only a fraction of the population, usually females and subdominant males, migrates. Partial migration can form a large percentage of the migration behavior of birds in some regions; in Australia, surveys found that 44% of non-passerine birds and 32% of passerines were partially migratory. Altitudinal migration is a form of short distance migration in which birds spend the breeding season at higher altitudes elevations and move to lower ones during suboptimal conditions. It is most often triggered by temperature changes and usually occurs when the normal territories also become inhospitable due to lack of food. Some species may also be nomadic, holding no fixed territory and moving according to weather and food availability. Parrots as a family are overwhelmingly neither migratory nor sedentary but considered to either be dispersive, irruptive, nomadic or undertake small and irregular migrations.

The ability of birds to return to precise locations across vast distances has been known for some time; in an experiment conducted in the 1950s a Manx Shearwater released in Boston returned to its colony in Skomer, Wales within 13 days, a distance of 5,150 km (3,200 mi). Birds navigate during migration using a variety of methods. For diurnal migrants, the sun is used to navigate by day, and a stellar compass is used at night. Birds that use the sun compensate for the changing position of the sun during the day by the use of an internal clock. Orientation with the stellar compass depends on the position of the constellations surrounding Polaris. These are backed up in some species by their ability to sense the Earth's geomagnetism through specialised photoreceptors.

Communication

Birds communicate using primarily visual and auditory signals. Signals can be interspecific (between species) and intraspecific (within species).

Birds sometimes use plumage to assess and assert social dominance, to display breeding condition in sexually selected species, or to make threatening displays, as in the Sunbittern's mimicry of a large predator to ward off hawks and protect young chicks. Variation in plumage also allows for the identification of birds, particularly between species. Visual communication among birds may also involve ritualised displays, which have developed from non-signalling actions such as preening, the adjustments of feather position, pecking, or other behavior. These displays may signal aggression or submission or may contribute to the formation of pair-bonds.[38] The most elaborate displays occur during courtship, where "dances" are often formed from complex combinations of many possible component movements; males' breeding success may depend on the quality of such displays.

Bird calls and songs, which are produced in the syrinx, are the major means by which birds communicate with sound. This communication can be very complex; some species can operate the two sides of the syrinx independently, allowing the simultaneous production of two different songs. Calls are used for a variety of purposes, including mate attraction, evaluation of potential mates, bond formation, the claiming and maintenance of territories, the identification of other individuals (such as when parents look for chicks in colonies or when mates reunite at the start of breeding season), and the warning of other birds of potential predators, sometimes with specific information about the nature of the threat. Some birds also use mechanical sounds for auditory communication. The Coenocorypha snipes of New Zealand drive air through their feathers, woodpeckers drum territorially, and Palm Cockatoos use tools to drum.

Flocking and Other Associations

Red-billed Queleas, the most numerous species of bird, form enormous flocks—sometimes tens of thousands strong. While some birds are essentially territorial or live in small family groups, other birds may form large flocks. The principal benefits of flocking are safety in numbers and increased foraging efficiency. Defense against predators is particularly important in closed habitats like forests, where ambush predation is common and multiple eyes can provide a valuable early warning system. This has led to the development of many mixed-species feeding flocks,

which are usually composed of small numbers of many species; these flocks provide safety in numbers but reduce potential competition for resources. Costs of flocking include bullying of socially subordinate birds by more dominant birds and the reduction of feeding efficiency in certain cases.

Birds sometimes also form associations with non-avian species. Plunge-diving seabirds associate with dolphins and tuna, which push shoaling fish towards the surface. Hornbills have a mutualistic relationship with Dwarf Mongooses, in which they forage together and warn each other of nearby birds of prey and other predators.

Resting and Roosting

The high metabolic rates of birds during the active part of the day is supplemented by rest at other times. Sleeping birds often use a type of sleep known as vigilant sleep, where periods of rest are interspersed with quick eye-opening 'peeks', allowing them to be sensitive to disturbances and enable rapid escape from threats. Swifts are believed to be able to sleep in flight and radar observations suggest that they orient themselves to face the wind in their roosting flight. It has been suggested that there may be certain kinds of sleep which are possible even when in flight. Some birds have also demonstrated the capacity to fall into slow-wave sleep one hemisphere of the brain at a time. The birds tend to exercise this ability depending upon its position relative to the outside of the flock. This may allow the eye opposite the sleeping hemisphere to remain vigilant for predators by viewing the outer margins of the flock. This adaptation is also known from marine mammals. Communal roosting is common because it lowers the loss of body heat and decreases the risks associated with predators. Roosting sites are often chosen with regard to thermoregulation and safety.

Many sleeping birds bend their heads over their backs and tuck their bills in their back feathers, although others place their beaks among their breast feathers. Many birds rest on one leg, while some may pull up their legs into their feathers, especially in cold weather. Perching birds have a tendon locking mechanism that helps them hold on to the perch when they are asleep. Many ground birds, such as quails and pheasants, roost in trees. A few parrots of the genus Loriculus roost hanging upside down. Some hummingbirds go into a nightly state of torpor accompanied with a reduction of their metabolic rates. This physiological adaptation shows nearly a hundred other species, including owlet-nightjars, nightjars, and woodswallows. One species, the Common Poorwill, even enters a state of hibernation. Birds do not have sweat glands, but they may cool themselves by moving to shade, standing in water, panting, increasing their surface area, fluttering their throat or by using special behaviors like urohydrosis to cool themselves.

Breeding: Social Systems

Red-necked Phalaropes have an unusual polyandrous mating system where males care for the eggs and chicks and brightly colored females compete for males. Ninety-five percent of bird species are socially monogamous. These species pair for at least the length of the breeding season or—in some cases—for several years or until the death of one mate. Monogamy allows for biparental care, which is especially important for species in which females require males' assistance for successful brood-rearing. Among many socially monogamous species, extra-pair copulation (infidelity) is common. Such behavior typically occurs between dominant males and females paired with subordinate males, but may also be the result of forced copulation in ducks and other anatids. For females, possible benefits of extra-pair copulation include getting better genes for her offspring and insuring against the possibility of infertility in her mate. Males of species that engage in extra-pair copulations will closely guard their mates to ensure the parentage of the offspring that they raise.

Other mating systems, including polygyny, polyandry, polygamy, polygynandry, and promiscuity, also occur. Polygamous breeding systems arise when females are able to raise broods without the help of males. Some species may use more than one system depending on the circumstances.

Breeding usually involves some form of courtship display, typically performed by the male. Most displays are rather simple and involve some type of song. Some displays, however, are quite elaborate. Depending on the species, these may include wing or tail drumming, dancing, aerial flights, or communal lekking. Females are generally the ones that drive partner selection, although in the polyandrous phalaropes, this is reversed: plainer males choose brightly colored females. Courtship feeding, billing and allopreening are commonly performed between partners, generally after the birds have paired and mated.

Territories, Nesting and Incubation

Many birds actively defend a territory from others of the same species during the breeding season; maintenance of territories protects the food source for their chicks. Species that are unable to defend feeding territories, such as seabirds and swifts, often breed in colonies instead; this is thought to offer protection from predators. Colonial breeders defend small nesting sites, and competition between and within species for nesting sites can be intense.

The nesting colonies of the Sociable Weaver are amongst the largest bird-created structures. All birds lay amniotic eggs with hard shells made mostly of calcium carbonate. Hole and burrow nesting species tend to lay white or pale eggs, while open nesters lay camouflaged eggs. There are many exceptions to this pattern, however; the ground-nesting nightjars have pale eggs, and camouflage is instead provided by their plumage. Species that are victims of brood parasites have varying egg colors to improve the chances of spotting a parasite's egg, which forces female parasites to match their eggs to those of their hosts.

Bird eggs are usually laid in a nest. Most species create somewhat elaborate nests, which can be cups, domes, plates, beds scrapes, mounds, or burrows. Some bird nests, however, are extremely primitive; albatross nests are no more than a scrape on the ground. Most birds build nests in sheltered, hidden areas to avoid predation, but large or colonial birds—which are more capable of defence—may build more open nests. During nest construction, some species seek out plant matter from plants with parasite-reducing toxins to improve chick survival, and feathers are often used for nest insulation. Some bird species have no nests; the cliff-nesting Common Guillemot lays its eggs on bare rock, and male Emperor Penguins keep eggs between their body and feet. The absence of nests is especially prevalent in ground-nesting species where the newly hatched young are precocial.

Incubation, which optimises temperature for chick development, usually begins after the last egg has been laid. In monogamous species incubation duties are often shared, whereas in polygamous species one parent is wholly responsible for incubation. Warmth from parents passes to the eggs through brood patches, areas of bare skin on the abdomen or breast of the incubating birds. Incubation can be an energetically demanding process; adult albatrosses, for instance, lose as much as 83 grams (2.9 oz) of body weight per day of incubation. The warmth for the incubation of the eggs of megapodes comes from the sun, decaying vegetation or volcanic sources. Incubation periods range from 10 days (in woodpeckers, cuckoos and passerine birds) to over 80 days (in albatrosses and kiwis).

Parental Care and Fledging

At the time of their hatching, chicks range in development from helpless to independent, depending on their species. Helpless chicks are termed altricial, and tend to be born small, blind, immobile and naked; chicks that are mobile and feathered upon hatching are termed precocial. Altricial chicks need help thermoregulating and must be brooded for longer than precocial chicks. Chicks at neither of these extremes can be semi-precocial or semi-altricial.

The length and nature of parental care varies widely amongst different orders and species. At one extreme, parental care in megapodes ends at hatching; the newly-hatched chick digs itself out of the nest mound without parental assistance and can fend for itself immediately. At the other extreme, many seabirds have extended periods of parental care, the longest being that of the Great Frigatebird, whose chicks take up to six months to fledge and are fed by the parents for up to an additional 14 months.

Great Blue Heron parents and chicks at the nestIn some species, both parents care for nestlings and fledglings; in others, such care is the responsibility of only one sex. In some species, other members of the same species—usually close relatives of the breeding pair, such as offspring from previous broods—will help with the raising of the young. Such alloparenting is particularly common among the Corvida, which includes such birds as the true crows, Australian Magpie and Fairy-wrens, but has been observed in species as different as the Rifleman and Red Kite. Among most groups of animals, male parental care is rare. In birds, however, it is quite common—more so than in any other vertebrate class. Though territory and nest site defence, incubation, and chick feeding are often shared tasks, there is sometimes a division of labor in which one mate undertakes all or most of a particular duty.

The point at which chicks fledge varies dramatically. The chicks of the Synthliboramphus murrelets, like the Ancient Murrelet, leave the nest the night after they hatch, following their parents out to sea, where they are raised away from terrestrial predators. Some other species, such as ducks, move their chicks away from the nest at an early age. In most species, chicks leave the nest just before, or soon after, they are able to fly. The amount of parental care after

fledging varies; albatross chicks leave the nest on their own and receive no further help, while other species continue some supplementary feeding after fledging. Chicks may also follow their parents during their first migration.

Conservation

Though human activities have allowed the expansion of a few species, such as the Barn Swallow and European Starling, they have caused population decreases or extinction in many other species. Over a hundred bird species have gone extinct in historical times, although the most dramatic human-caused avian extinctions, eradicating an estimated 750–1800 species, occurred during the human colonisation of Melanesian, Polynesian, and Micronesian islands. Many bird populations are declining worldwide, with 1,221 species listed as threatened by Birdlife International and the IUCN in 2007. The most commonly cited human threat to birds is habitat loss. Other threats include overhunting, accidental mortality due to structural collisions or long-line fishing bycatch, pollution (including oil spills and pesticide use), competition and predation from nonnative invasive species, and climate change. Governments and conservation groups work to protect birds, either by passing laws that preserve and restore bird habitat or by establishing captive populations for reintroductions. Such projects have produced some successes; one study estimated that conservation efforts saved 16 species of bird that would otherwise have gone extinct between 1994 and 2004, including the California Condor and Norfolk Island Green Parrot.