all together now

ISAK PRETORIUS

WHY DO BIRDS FORM GROUPS?

At different times, many birds gather in groups, numbering from a handful of individuals to hundreds, thousands or even millions. Some birds gather to breed in colonies but disperse when not breeding; others breed solitarily but come together in flocks at other times of year. Some join groups to feed, others to roost. Some aggregate with members of their own species, while others join forces with different species. To persist, these behaviours should confer advantages on the individuals involved. Based on a draft written by the late **Phil Hockey**, Peter Ryan explores the factors that drive birds to flock. >

PETER RYAN (2)

Birds can elect to occur singly or in groups, and their decision often rests on their activity. Among the many different flocks shown here, most Pied Avocets are tightly clustered together to roost, but a few feeding birds are away from the group. The Cape Shovelers are loosely aggregated, and could be considered to be a single flock or several subgroups with scattered birds in between.

THINK OF spectacular flocks of birds and images spring to mind of vast seabird colonies, pink carpets of flamingos, locust-like swarms of queleas, or spirals of raptors at key migration points. In each case, the birds gather for different reasons. The aggregation of migrating raptors is easy to understand because they typically rely on thermals to gain height with little effort, gliding from one thermal to the next. But thermals only form over land, so raptor migration routes cross water bodies at their narrowest point. Palearctic-breeding raptors migrating into Africa avoid the Mediterranean Sea by passing through the Straits of Gibraltar, the Bosphorus and the Sinai Peninsula. Mostly, however, the reasons for birds forming groups have a more biological basis.

Many species aggregate to breed. For oceanic seabirds, coloniality is enforced by the paucity of breeding opportunities. Vast tracts of the ocean are rich in food for seabirds but have few islands. Unlike whales, seabirds and seals are locked into their evolutionary legacy of breeding on land, forcing them to crowd onto the few, tiny islands to breed. Limited breeding habitat also contributes to coloniality in terrestrial species with specific nest requirements, such as bee-eaters and martins that breed in sandbanks.

Indeed, the more specific your breeding requirements, the more likely you are to be forced to breed in groups. Flamingos' mud nests need to last for at least one breeding season, but not all types of mud are up to the task. And they have to breed close to a reliable source of food, in an area relatively inaccessible to predators. As a result, Africa's vast flamingo population breeds regularly at only a handful of sites.

Crab Plovers are another interesting example. Their dependence on crabs requires them to breed in summer when crabs are most active, but the searing heat in the Middle East forces them to breed underground. There are only a few areas where the sand is not too coarse or dry to prevent their burrows collapsing, and so they breed in colonies wherever there is suitable habitat.

SEABIRDS ... ARE LOCKED INTO THEIR EVOLUTIONARY LEGACY OF BREEDING ON LAND, **FORCING THEM TO CROWD ONTO THE FEW, TINY ISLANDS TO BREED**

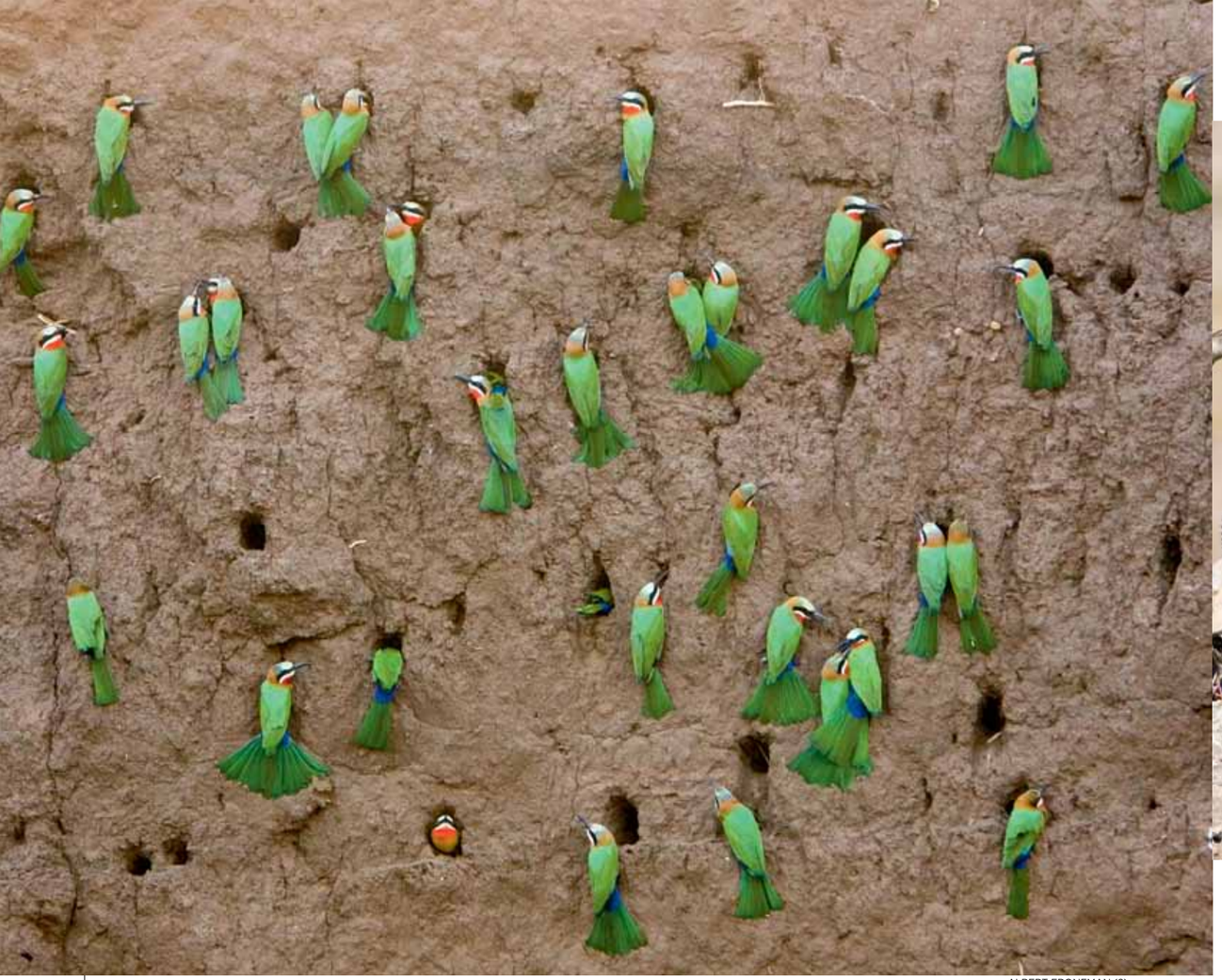
Although colonial species typically return to the same breeding site year after year, some do not. These tend to be species whose food is unpredictable in space and time. In Africa, such 'mobile colonialists' include the sparrow-larks and Wattled Starlings. Conditions favourable for breeding occur after rain for these arid-zone species, where it is the food that they need to provision their chicks rather than the breeding site that determines where and when they breed.

Most seabirds breeding along continental margins are also colonial breeders, but for a rather different reason from their oceanic cousins: they gather at sites that are inaccessible to terrestrial predators. This also explains why many waterbirds breed together in tall trees and large reedbeds as well as on islands and cliffs. Breeding in colonies provides the additional benefit of group defence against predators that can access the colony – a flock of birds can see off a maurauding crow whereas a single pair would stand little chance.

This explains some unusual nest mates. Even though Caspian Terns spend a fair amount of time and effort deterring gulls from trying to steal their eggs or chicks, they often breed in Kelp Gull colonies because the more numerous gulls help to protect them from more dangerous predators such as water mongooses. And even if a predator can't be deterred by mobbing, there is safety in numbers: the predation risk to an individual nest is less in a colony simply because there are many other possible targets.

However, colonial breeding is not without its costs. Large groups of birds tend to be more conspicuous, and can attract the attention of predators. In the case of the vast colonies of Red-billed Queleas, the birds rely on their sheer numbers to swamp predator demand. The close proximity of birds also increases the potential for the transmission of diseases and parasites. For example, in recent years there have been several outbreaks of >

One of the main advantages of being in a group is the enhanced vigilance against predators. However, this only works if birds can assess how many individuals in the flock are actually keeping watch. As a result many birds, such as ducks and these Caspian Terns, have distinctively coloured eyelids to signal when they are asleep.



ALBERT FRONEMAN (2)

The specialised nest habitat of bank-nesting birds, such as these White-fronted Bee-eaters, probably encourages group nesting, but they may also gain other benefits such as increased vigilance, safety in numbers and even group mobbing of predators.

avian cholera in Cape Cormorant colonies, which sometimes spill over to other species breeding in the area. And on the guano islands off Peru, the numbers of ticks become so high in some years that seabirds have to abandon their colonies, sometimes only returning years later once tick numbers have decreased.

Finally, the very fact that many birds breed together places pressure on food supplies around the colony. This effect was first described by Philip Ashmole for large colonies of Sooty Terns breeding on tropical islands. Early in the breeding season the terns hunt close to their colony, but as nearshore fish supplies become increasingly scarce, they are forced to forage further away, in a phenomenon known as 'Ashmole's Halo'. We now know that many seabird colonies have more or less exclusive foraging areas, the size of which depends on the number of birds in the colony.

Given the competition for food that occurs around breeding colonies, it might seem odd that many birds flock together when feeding. Such flocks can form simply because there is a concentration of available food. For example, many birds aggregate at termite emergences, flowering aloes, fruiting fig trees, and even at artificial food sources, such as behind trawlers. But in some cases foraging efficiency is increased when a group of birds works together, such as the synchronised herding of fish schools by Great White Pelicans and cormorants. Little Egrets have a rather less elegant version of the same behaviour, using foot stamping and wing slapping to drive shoals of small fish into the shallows. Groups of African Penguins herd pelagic fish by swimming rapidly around schools, concentrating them into a tight bait ball to make them easier to catch. This was fine when there were plenty of penguins, but as

FOR MANY SPECIES, SHARING THE NEED FOR VIGILANCE AGAINST PREDATORS MORE THAN **OFFSETS THE LOSSES CAUSED BY COMPETITION WITH OTHER BIRDS**

their numbers have dwindled, their ability to form feeding groups has been reduced – an example of an 'Allee effect', whereby the very fact that a population is small causes it to struggle to survive.

Working together can also help to locate patchy prey. In highveld grasslands, Crowned and Black-winged lapwings feed together, advancing line abreast while monitoring the foraging success of neighbouring birds. When one bird encounters a patch of high prey density, other birds converge on the area. This association has benefits that extend beyond foraging. When in mixed-species flocks, Crowned Lapwings reduce their vigilance levels (and can thus spend more time feeding), whereas Black-winged Lapwings do not. This might seem to be a one-sided relationship, yet Black-winged Lapwings benefit when a predator appears, because most of the effort expended in driving the intruder away is made by the more aggressive Crowned Lapwings.

This further highlights one of the key advantages of being in a group: reducing the risk of predation. For many species, sharing the need for vigilance against predators more than offsets the losses caused by competition with other birds. And one way to reduce competition without diluting the advantage of many eyes scanning for predators is to associate with other species that have different food preferences. This probably explains why many woodland and forest birds travel in bird 'parties' when not breeding. In parts of Africa and Asia, drongos act as specialist sentries within these flocks, allowing other birds to spend more time foraging. However, in the Kalahari, Fork-tailed Drongos exact a fee for their services. When another bird locates a particularly large prey item, a drongo might cause it to flee by giving a false alarm call, allowing the drongo to swoop down and steal the spoils.

Many birds that are otherwise solitary come together to roost. This may be for one of three possible >

Granivores, such as these Red-billed Queleas, get very little water in their food, so most are compelled to come to water to drink, exposing them to a host of avian predators. The risk to an individual is reduced by travelling in groups, and the large numbers can also confuse their attackers.

LIZ HART

right *Some birds huddle together for warmth, such as this trio of European Bee-eaters. Their fluffed-out plumage is another indication that the birds are trying to retain as much heat as possible.*

below *Black-winged Pratincoles feed on insects flushed by ploughing activity. In the past they occurred in vast flocks associated with brown locust swarms, but the control of locusts has caused their flock size (and numbers) to diminish.*

reasons. In the same way that foraging flocks diminish the need for individual vigilance, communal roosts may fulfil the same function. For example, African Oystercatchers are territorial, but only forage at low tide. When roosting at high tide, especially at night, they are at risk from terrestrial predators such as Cape foxes. By roosting together, they realise the benefits of group vigilance. They further decrease the risk of predation by roosting in sites with extensive, all-round visibility, such as at estuary mouths, or on promontories that limit the direction from which predators can approach. In the breeding season, adults must remain with their eggs or chicks, and it is at this time of year that most adult oystercatchers are killed by predators.

Another benefit of roosting in groups is to help keep warm. Green Wood-Hoopoes invariably roost communally in tree cavities, and studies show that energy expenditure at night is lower for members of large groups. Mousebirds also obtain a physiological benefit from roosting together. Experiments on captive birds showed that they allowed their body temperature to fall at night, going into torpor to save energy. However, this makes them sluggish and easy prey for nocturnal predators. Subsequent experiments on wild birds found that their body temperatures don't fall, even on cold nights, because they huddle together in a ball. By reducing their surface area, they greatly reduce the rate of heat loss. Indeed, communal roosting is more common in small birds simply because their relatively large surface area causes them to lose heat much faster at night than large birds. It is no coincidence that our smallest birds, the penduline-tits, roost in groups.

The third possible advantage of roosting together is that roosts may act as 'information centres'. This was first mooted by Peter Ward and Amotz Zahavi, who suggested that birds like Red-billed Queleas and Common Starlings that forage in small groups during the day gather in large roosts at night in part to assess the condition of their neighbours. Birds that have done poorly can follow neighbours that have had a better day back to their foraging grounds the next morning. It's a nice idea, but despite being proposed 40 years ago, there is still no compelling evidence that this behaviour occurs in nature.

To conclude, there are numerous reasons why birds form flocks to breed, forage or roost. In each case there is a reason, telling a biological story. And although many of these stories are fairly well understood, some are still far from being resolved. One of the simplest observations of bird behaviour is less well understood than the Theory of Relativity. Maybe that's what drives biologists to try to understand it. ◆

WARWICK TARBOTON

Changing group size as an index of environmental change

Just as the decision of whether or not to flock depends on the balance between the costs and benefits of group living, so too does the ideal group size. Monitoring changes in bird flocking behaviour has been neglected as a way to track environmental change.

One species that has changed its flocking behaviour over the past century is the Black-winged Pratincole. Although this species probably has become less common, this trend cannot account for the marked reduction in flock size. Whereas now a flock of more than a few hundred birds is noteworthy, accounts from the 19th century described pratincoles 'darkening the air' and 'coming in their millions'. This change in behaviour presumably is linked to changes in the swarming behaviour of locusts. A newspaper account in 1870 described how millions of pratincoles associated with a swarm of locusts caused 'a continuous shower of locusts' wings falling on the ground'. Locust control measures have led to smaller, more frequent locust outbreaks, forcing the pratincoles into smaller groups. We predict the opposite trend among granivorous birds, where flock sizes might increase thanks to increasingly large areas of cereal crop monoculture.