WHERE AND WHEN TO go?

Questions for nomadic birds

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A great many birds in arid and semi-arid parts of the world spend much of their lives seeking solutions to those two simple questions. Richard Dean too spent much of his life puzzling, talking and writing about potential answers, so it seems fitting to present this article as a tribute to him and to extend the conversation to a broader group of people. Many of the ideas and observations described here came from our discussions with Richard and from his unpublished notes.

Biological production across the world largely follows time scales that are perennial, seasonal or ephemeral. Perennial production happens steadily and slowly during the year, with relatively few changes between one area or time and another. This is typical of tropical environments. Seasonal changes in production are usually substantial and predictable, as in temperate climates where blooms and booms of life in spring and summer follow months of autumn and winter dormancy.

Challenges of where and when to go seldom arise in perennial and seasonal environments where most forms of life simply wait or move regularly between known areas. These questions prevail, however, where ephemeral production is largely driven by unpredictable changes in arid and semi-arid areas, especially after significant amounts of rainfall. Life then explodes, as countless seeds, spores and eggs germinate or hatch, aestivating animals wake, termites emerge, plants and animals grow, and most forms of life reproduce as rapidly as possible. What was a quiet, sleepy environment becomes a hustle and bustle of productive life.

Where and when this happens is never certain, but this is where many birds want to be to exploit new and abundant supplies of food. In southern Africa, the species include non-breeding migrants from the northern hemisphere, such as Common Swifts, Lesser Kestrels, Red-backed and Lesser Grey shrikes, Amur, Red-footed and Hobby falcons, Lesser >

above *Many nomadic and opportunistic birds, such as these Amur Falcons, often gather in large flocks and communal roosts. While the flocks are the consequence of many birds being attracted to localised food sources, they perhaps also provide information about the location of abundant supplies. This 'information centre' hypothesis was first proposed in 1973 by Peter Ward, who studied Red-billed Queleas for many years in West Africa.*

opposite *Finding abundant ephemeral food is the greatest challenge, but conditions apply, as the fine print often says. For example, rails, crakes and gallinules need to hide and breed in the dense cover of reeds and sedges, which take some weeks to grow after wetlands are first flooded. Monteiro's and Damara (shown here) hornbills breed in holes, which are in short supply in many semi-arid areas. This raises the interesting possibility that hornbills develop mental maps of potential nest holes in different areas, allowing them to begin breeding soon after moving to newly emerged supplies of insects and other animal food.*

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Spotted and Steppe eagles and Abdim's and White storks; and dozens of African species of larks, weavers and finches, sunbirds, flycatchers, canaries, buntings, starlings; ducks and geese; herons, bitterns and egrets; rails, crakes, gallinules and moorhens; cormorants, pelicans, storks, grebes, terns; sandgrouse, bustards, coursers; and flamingos, for example. Many young African raptors also move around opportunistically before settling down on breeding territories. In a 1997 paper, Richard listed 39 nomadic and semi-nomadic bird species that sporadically visited the Karoo, where he and Sue lived for so many years.

Finding areas where productive rain has fallen is not easy, especially if it fell far away. But there are also choices to be made. Rainfall is usually patchy in dry areas, often because rain fronts are localised or neighbouring thunderstorm showers differ much in extent and size. Circumstances often change as well. Some storms are followed by hot, dry weather that quashes the effects of rain, while others are followed by more rain and periods of cool, humid weather that further boost and sustain production. Several good falls of rain in succession are often needed to saturate the soil and then to fill temporary pans. Levels of production in one season also depend on when life last blossomed, because decomposition in dry areas is slow. Thus, relatively few nutrients may be available in places that saw good rain and production in recent years, whereas abundant nutrient stocks will have accumulated after many years of continued decomposition of biomass last produced years ago. This is true for both ephemeral wetlands and terrestrial environments in dry areas.

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Ephemeral food is sometimes extremely abundant, which makes large clutches and broods possible, such as these eight eggs in a Goliath Heron nest (opposite, middle) and the 21 Red-billed Teal ducklings (above). But food supplies are also generally short-lived, making speed of the essence, especially while breeding birds are tied to eggs and chicks. Red-billed Queleas (opposite, below) complete their breeding very rapidly: they build and lay within a week, the eggs hatch nine to 10 days later, and the chicks fledge and become independent within three weeks. Male and female Chestnut Weavers (left) seemingly save time by moving around separately to test food supplies and the potential for breeding. Thus females arrive after males have built nests. If conditions seem good, eggs can be laid immediately or if the prospects for breeding look less favourable, females can move elsewhere.

Think of the vast arid and semi-arid areas in southern Africa that stretch from south-western Angola east across Botswana to the northern provinces of South Africa and south to Namibia and much of the Cape. Add to this the many thunderstorms and rain fronts that may or may not bring productive water to the thousands of ephemeral pans, dams and other wetlands and stretches of drylands in this area, and it soon becomes obvious that birds have many potential choices when good rains fall. But much more than a Michelin map and Trip Advisor ratings are needed to make useful choices.

There is another major challenge: when to go? This requires a time sheet that figuratively records for different places when and how much rain fell; after all, 40 millimetres of rain today is not the same as 40 millimetres spread over a month or the 40 millimetres that fell one afternoon two weeks ago. The time sheet must also track how subsequent conditions have affected evaporation, the growth of plant cover and reproduction of plant and animal foods, and the levels and chemistry of standing water, for example. These quantities vary in importance. Birds that replenish their reserves with termite alates or that feed on tiny brine shrimps and other aquatic animals that soon hatch in saline pans have little to wait for and assess. They can respond to major rain events >

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within days, perhaps even hours. Others that feed on frogs or fish or that nest in dense reeds and sedges must wait several weeks before venturing off to their wetlands of choice, assuming of course that water levels have been maintained during that period. Granivorous finches, larks and buntings will also have to wait some weeks before grass seeds and insects are available to feed them and their nestlings, respectively.

We hope that this gives a reasonable and simple overview of the many challenges faced by birds in unpredictable environments. Each *where* and *when* question has different dimensions and a variety of potential answers. Frustratingly, we know little about how birds finally decide where and when to go, or for that matter, where and when to stay put. It has been suggested that birds can detect distant thunderstorms via low frequency sound that carries great distances or temperature or pressure gradients. They may also smell the distant effects of rain, for example in petrichor and geosmin odours. Or birds may cover large areas to monitor conditions in different places, especially ephemeral wetlands that can be expected to fill from time to time. Perhaps birds use rain-associated environmental cues such as changes in pressure or temperature to predict heavy falls of rain. And they might follow rain fronts, enabling them to arrive hours after pans have been filled by local storms.

Many of these questions may seem academic and of interest only to pure science. We dispute that view, if only because the more humanity knows about the functioning of its environment the better its chance of being a useful passenger on planet earth. For instance, do birds use sensory, communication or navigation systems about which we know nothing?

above *Young and non-breeding raptors of several species, such as these Lanner Falcons, move around semi-arid areas nomadically to capitalise on ephemeral food supplies.*

above, right *Many birds move from one emergence of termites to another, the masses of alates providing great injections of fat and protein. Aggregations of giant bullfrog tadpoles are another rich source of food that attracts numbers of aquatic birds and migrants, such as the hundreds of Abdim's Storks seen here at a temporary pan in Etosha.*

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There are also immediate conservation concerns associated with these questions, in particular those about ephemeral wetlands where many, perhaps most African waterbirds breed. In southern Africa, we know of lakes Ngami, Liambezi and Xau, the Nyae Nyae pans, Makgadikgadi and Etosha pans, parts of the Cuvelai drainage, Brandvlei and Nylsvley, for example. Some of these are protected, but most are not. But what other ephemeral wetlands are important for breeding?

If these puzzles are not enough, we should also be keen to know where these opportunistic birds live when it is dry. What places in southern Africa are important refuges for skulking, seldom-seen gallinules and crakes, or moulting ducks, for example? We hope that these examples demonstrate the significance of the simple questions in the title of this article. We hope too that more research can be addressed to answering these questions.

Richard Dean, who died in August 2022 (see *African Birdlife* 11 (1): 18–19), did African ornithology and ecology a great service in his explorations of nomadism and episodic production. Many of his major publications touched on these subjects, some much more fully than others. Among many losses, Richard's death also reduces the number of self-made, highly dedicated scientists who had no undergraduate training in their fields of study. They too deserve much tribute and acclaim. African ornithology benefited from the labours of these giants, such as Richard Brooke, Warwick Tarboton, Hugh Chittenden, Jack and David Skead, Phillip Clancey and Michael Irwin. Few of this generation remain. Being self-made is one attribute; the other is dedication. Much must be done to cultivate more dedicated scientists to follow in their footsteps. It troubled Richard deeply that so few students are curious or passionate about observing animals in their natural habitats, choosing rather to be office-based. He was disparaging about 'twitchers', believing that one should go beyond identifying birds to understanding how they live and interact with their environments. ◆

Further reading

A selection of Richard Dean's major publications and those related to questions of where and when birds go.

1994 with Lombard AT. 'The protection of nomadic birds in the semi-arid Karoo: the problems of stochastic rainfall and patchy habitat use by larks.' *Journal für Ornitologie* 135: 281.

1997 with Siegfried R. 'The protection of endemic and nomadic avian diversity in the Karoo, South Africa.' *South African Journal of Wildlife Research* 27: 11–21.

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1998 with Fahse L and Wissel C. 'Modelling the size and distribution of protected areas for nomadic birds: Alaudidae in the Nama-Karoo, South Africa.' *Biological Conservation* 85: 105–112.

2000. *Birds of Angola*. British Ornithological Union.

2001 with Milton S. 'Responses of birds to rainfall and seed abundance in the southern Karoo, South Africa.' *Journal of Arid Environments* 47: 101–121.

2004. *Nomadic Desert Birds*. Springer, Berlin.

2005 with Hockey P et al. *Roberts Birds of Southern Africa*. John Voelcker Bird Book Fund, Cape Town.

2009 with Barnard P and Anderson M. 'When to stay, when to go: trade-offs for southern African arid-zone birds in times of drought.' *South African Journal of Science* 105: 24–28.

2015 with Milton S, Forsyth HP and Tissiman D. 'Fluctuations in bird numbers on sewage treatment ponds in an arid environment, South Africa.' *Ostrich* 86. Special memorial issue commemorating the work of the late Philip Hockey, 145–153.