LIVING AT THE LIMITS

Survival mechanisms of desert larks

It was Henry Ford who said 'if I owned Hell and Texas, I'd live in Hell and rent out Texas'. Texas is hot, but it's not that hot! But some birds do manage to survive in the world's most inhospitable deserts, such as the Fezzan Desert of southern Libya and the Rub'al Khali of Saudi Arabia. For animals that are diurnal, do not burrow below the sand and have high metabolic rates, these deserts pose real problems related to both heat and aridity. Richard Dean of the Fitztitute and Joe Williams of Ohio State University recently reviewed how desert larks cope with these environmental stresses.

Only 44 of the world's more than 9 730 bird species spend most of their lives in hyper-arid environments, and of these, 14 are larks. An additional 71 of the world's 96 lark species have at least parts of their ranges in semi-arid or desert environments.

In most deserts, food is in short supply and bird densities are low. One potential adaptation to counter food scarcity is a reduced metabolic rate – this requires less food to fuel the bird, and also results in reduced water loss and reduced heat production. Recent field studies have shown that this does happen, with the metabolic rate of desert birds being approximately 40–50 per cent lower than that of equivalently sized birds living in more mesic habitats. Another adaptation to food shortage is to be a dietary generalist (don't be too fussy!). Larks eat both seeds and insects, and move about over short to long distances (nomadism) to exploit flushes of food, with the more granivorous species generally moving more than the predominantly insectivorous ones.

But solving the food problem on its own is not enough – water is also a critically scarce resource. Birds lose water both through respiration and via the skin. Studies have shown that the rate of water loss in desert birds is slower than in species in other habitats, and this appears to be achieved mainly through reducing water loss via the skin.

Although individuals may have adaptations to reduce energy expenditure and water loss, they still have to breed. This is an energy-costly exercise and one where desert larks seem to have also cut corners, putting almost 30 per cent less energy into reproduction than birds in mesic habitats. One consequence of this is that desert larks experience a higher nestling mortality rate, although in the long term this seems to be offset by higher adult survival. They also do not breed with the same regularity as other bird species, often delaying breeding until an (unpredictable) rainfall event temporarily increases the food supply.

Even though food and water may be scarce, anyone who has spent time in Africa or Arabia's hyper-arid deserts will also know that the midday heat can be formidable. There are limits to what warm-blooded animals can cope with physiologically and, as temperatures rise, behavioural heat avoidance comes into play. Most desert species are characterised by being pale, and for a long time it was thought that this was an adaptation for reducing heat gain from the sun. However, evidence now points more strongly to this being an adaptation for reducing predation. This is further supported by some species, such as the Desert Lark *Ammomanes deserti* of North Africa, Arabia and India, differing in upper part coloration regionally, such that their colour matches that of the soil. But physiology aside, there are several behavioural options open to reduce heat loading, one of the most common being to confine activity to the cooler times of day. Dune Larks *Calendulauda erythrochlamys* do this, retreating to the shade of a grass clump to avoid the heat. Gray's Larks *Ammomanopsis grayi* have a different solution, perching a few centimetres above the ground, facing into the wind and spreading their folded wings to expose their thinly feathered sides to the breeze. Spike-heeled Larks *Chersomanes albofasciata* have yet another solution – they forage around the burrows of ground squirrels, retreating into the burrows when the heat gets too much. These burrows can be 20°C cooler than the surrounding soil.

In the past it was thought that birds lived in deserts because they were pre-adapted to do so. More recent research, however, convincingly demonstrates that they have in fact evolved both physiological and behavioural traits that have allowed them to be successful in one of the most punishing habitats on the planet. □

ALBERT FRONEMAN

Spike-heeled Larks lessen the impact of the midday sun by either perching on a raised object or retreating down rodent burrows.

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