dying for a drink

Dehydration risk for desert birds

The English word 'desert' comes from the Latin *desertus*, or abandoned. This linguistic derivation may prove prophetic; new findings suggest that rapid climate change during the 21st century may render the hottest deserts uninhabitable for even the most hardy and arid-adapted birds.

Desert birds must routinely tolerate ambient temperatures far above their own body temperatures. Under these circumstances, the only way they can avoid lethal hyperthermia is by perching in the coolest sites they can find and dissipating heat via evaporation, which in most passerines occurs by panting. An observer foolish enough to go for a mid-afternoon stroll in the Kalahari when the mercury hits 43 degrees will quickly notice that activity has almost completely ceased and most birds are panting to keep cool in the deepest shade they can find.

Panting to offload heat is usually an effective strategy for avoiding heat stroke, but it exposes birds to another potential killer: dehydration. Small birds panting in the shade on an extremely hot day can lose water at rates greater than five per cent of their own body mass an hour. Under these conditions, even small increments in air temperature cause large increases in water requirements for evaporative cooling. If temperatures are high enough and the duration of the period of inactivity is long enough, birds can become severely dehydrated, which can lead to a breakdown of physiological processes and consequent death.

Climate change has the potential to dramatically affect this fine line between survival and death for desert birds. To explore the impacts of a four-degree increase in maximum temperatures, we recently conducted a dehydration risk analysis for birds in the extremely hot deserts of the American south-west. We combined new measurements of evaporative water loss in five passerines with long-term climate data from NASA, and evaluated how frequently birds are exposed to life-threatening conditions at present. We then modelled how this exposure will change by the end of the century. Dehydration risk will increase dramatically, particularly for small species. For instance, by the 2080s the Lesser Goldfinch will be exposed to lethal conditions on 60 to 120 days a year in the hottest parts of its range; it is difficult to imagine goldfinch populations persisting in these areas.

Increases in exposure to lethal conditions will be less pronounced for larger species like the Cactus Wren and Curve-billed Thrasher. But there is a catch: unlike the goldfinch, these arid-zone specialists are restricted to deserts. So although they will be exposed to lethal conditions less frequently than smaller species, the risk they face in terms of species-level declines is far greater. For both the wren and thrasher, more than 80 per cent of their ranges falls within the future danger zone for regular exposure to lethal dehydration.

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A study of how climate change increases dehydration risk underscores the threat to arid-zone passerines, such as Crimson-breasted Shrikes.

The increase in dehydration risk associated with global warming will probably not be quite as severe for birds of the southern African deserts, since temperatures there tend to be slightly cooler than in the US south-west. Nevertheless, increased water requirements are likely to have a suite of negative impacts, and dehydration risk during critical periods such as breeding will become a significant concern. Shannon Conradie, an MSc student at the University of Pretoria, is currently conducting a similar study of water requirements of birds in the Kalahari.

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Reference

Albright, T.P. et al. 2017. 'Mapping evaporative water loss in desert passerines reveals an expanding threat of lethal dehydration.' *Proceedings of the National Academy of Sciences* 114(9): 2283-2288. doi:10.1073/pnas.1613625114.