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The Kalahari Desert is becoming too hot for birds: new study

Many species are likely to disappear before the end of the century due to climate warming

The Kalahari Desert, one of the world's last true wilderness areas, will lose much of its birdlife before the end of this century due to climate warming, according to a new scientific study by four South African authors, including University of Cape Town's (UCT) Dr Susan Cunningham, published in the American scientific journal, PNAS.

Hotter weather over much of the southern African interior will ultimately erase many species from the famous desert region considered a cradle of avian evolution. But it is not killer heat waves that are the main problem for Kalahari birds, rather the gradual increase in the number of hotter days that will make conditions unsustainable, the study found.

The result highlights how long-term exposure to rising temperature reduces body weight, foraging ability, and breeding rates, resulting in more species damage than more dramatic temperature 'spikes'.

In other words, birds are at risk even in areas, like the Kalahari, where maximum daily temperatures are not expected to exceed lethal tolerance limits during the next century.

"The risk of dramatic mass mortalities of birds and animals in heatwave events (such as those of flying foxes in Australia) captures the imagine, but the role of chronic sublethal effects of high temperatures in driving future species declines remains largely unexplored," the authors said.

"Our analysis reveals that risks of costly heat exposure will increase substantially for arid-zone birds over large parts of southern Africa during the course of the 21st century."

"The risks of lethal hyperthermia and dehydration will remain low for most Kalahari species modelled here. In contrast, the risk of fitness costs of chronic exposure to sustained hot weather will increase dramatically, resulting in conditions over much of the region where birds will, at best, encounter severe challenges to maintaining body condition and/or breeding in summer."

Researchers combined climate, behavioural and physiological data to model expected species response to different climate change scenarios in the Kalahari region, where average maximum temperatures have already increased by 1.95 °C since 1960. Results revealed a low risk of acute lethal hyperthermia and dehydration for eleven sample species, with the most at risk being the Burchell's Starling.

However, a closer analysis of three species – Southern Fiscals, Southern Yellow-billed Hornbills and Southern Pied Babblers, whose ability to cope behaviourally with temperature increase had already been documented in the field – revealed a much bleaker picture. Trade-offs between foraging and thermoregulatory behaviours mean chronic exposure to elevated temperature would most likely result in these birds struggling to maintain the necessary body condition to survive or breed successfully. By comparing the behaviour data with current climate warming predictions, researchers concluded that all three of these species face an uphill battle to persist, either through cumulative mass losses causing adult mortality or through breeding failure.

The researchers believe the same negative trend in survival and breeding success most likely applies to other Kalahari birds whose behaviour in response to elevated temperatures is still unknown: if their foraging ability is similarly reduced they too would battle to offset body weight loss at night or to raise healthy chicks, ultimately resulting in weakening of populations.

"At present, days on which air temperatures exceed these thresholds are rare, and birds are likely able to recoup mass losses after heat exposure," the authors said. "However, our models predict that, by the end of the century, heat waves of 20 or more consecutive days above these thresholds for the species studied will be part of the average Kalahari summer. Under these conditions, birds face risk of massive cumulative mass losses, which may directly affect survival," they said.

"For instance, by the 2080s the region will experience 10-20 consecutive days per year on which Southern Pied Babblers will lose around 4% of body mass per day, conditions under which this species' persistence will be extremely unlikely."

The negative effects of climate warming in the Kalahari are likely to be found in other arid regions where bird species endure similarly harsh conditions, the study authors concluded.

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A colour-ringed Southern Yellow-billed Hornbill gapes its beak and droops its wings to offload excess heat. **Credit:** Tanja van de Ven

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Two Southern Pied Babblers feeling the heat. The birds panting to aid in evaporative cooling and wing-drooping to assist passive loss of excess heat on a hot afternoon in the Kalahari Desert. **Credit:** Nicholas Pattinson

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Note to editors:

Study: Conradie, S. R., Woodborne, S. M., Cunningham, S. J., & McKechnie, A. E. (2019). Chronic, sublethal effects of high temperatures will cause severe declines in southern African arid-zone birds during the 21st Century. PNAS: *in press.*

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