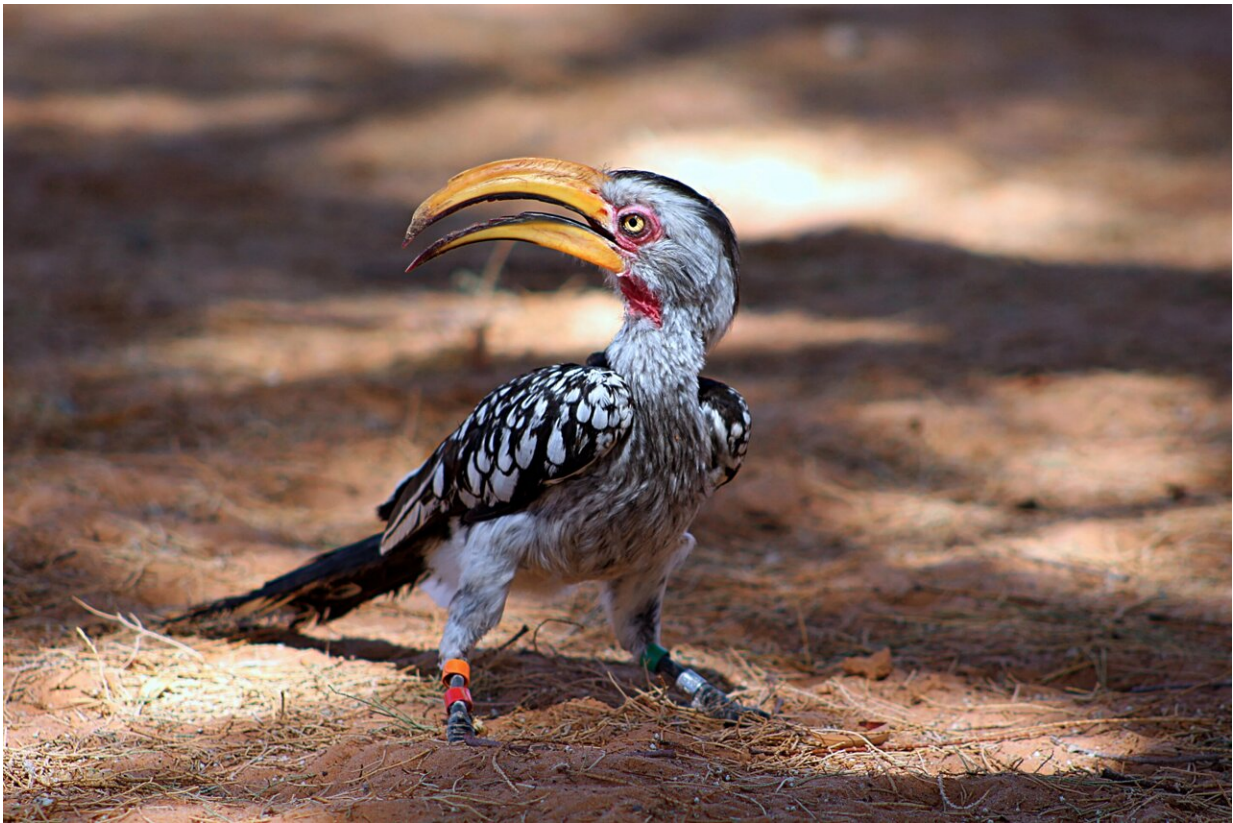


Climate crisis is driving yellow-billed hornbill to local extinction

May 19 2022



Southern yellow-billed hornbill at study site. Credit: Nicholas Pattinson

The yellow-billed hornbill, a cousin of fan-favorite Zazu from *The Lion King*, faces local extinction due to the climate crisis. Researchers investigated the effects of high air temperature and drought on the

breeding success of southern yellow-billed hornbills in the Kalahari Desert between 2008 and 2019. This study is one of the first to research the impact of the climate crisis on population-level breeding success over a longer timescale.

The climate crisis is worsening the harsh conditions of extreme climates, such as the high temperatures and the frequency and intensity of drought periods associated with arid regions.

The animals that inhabit these regions are already suffering the consequences. For example, previous research has shown that the breeding success of multiple bird species is affected by a warming climate. They are breeding earlier and for a shorter amount of time.

"There is rapidly growing evidence for the negative effects of high temperatures on the behavior, physiology, breeding, and survival of various bird, mammal, and reptile species around the world," said first author Dr. Nicholas Pattinson, of the University of Cape Town.

"For example, heat-related mass die-off events over the period of a few days are increasingly being recorded, which no doubt pose a threat to population persistence and ecosystem function."

Pattinson and his colleagues have researched whether rapid climate warming influenced the breeding success of the southern yellow-bill hornbill, an arid-zone bird, over a period of 10 years. The study was published in *Frontiers in Ecology and Evolution*.

The yellow-billed hornbill

The southern yellow-billed hornbill's distribution includes most of southern Africa, with a large portion falling within the Kalahari Desert. It is thought that their population numbers are declining.

Known for its peculiar breeding and nesting strategy, the southern yellow-billed hornbill is a socially monogamous species. They are cavity nesters; the female seals herself into the nest cavity and stays there for an average of 50 days to brood and care for chicks. The only opening is a narrow vertical slit, through which the male feeds the female and chicks.

This type of nesting largely protects from predation, which means that breeding success depends primarily on other factors such as climate and food availability. For example, yellow-billed hornbills initiate breeding in response to rainfall, which corresponds with the hottest days of the year. This makes it difficult for them to shift breeding dates outside of the hottest periods.

Population collapse

Pattinson and his team studied a population of southern yellow-billed hornbills at Kuruman River Reserve in the southern Kalahari Desert in South Africa between 2008 and 2019. Data was exclusively collected from pairs breeding in wooden nest boxes. They looked at the breeding success at broad and fine scales (long term trends and individual breeding attempts, respectively). The team also analyzed climate trends for the region.

The results showed that breeding output collapsed during the monitoring period (2008-2019) due to the increased maximum air temperature.

"During the monitoring period, sub-lethal effects of high temperatures (including compromised foraging, provisioning, and body mass maintenance) reduced the chance of hornbills breeding successfully or even breeding at all," explained Pattinson.

When comparing the first three seasons (between 2008 and 2011) to the last three (between 2016 and 2019), the researchers found that the

average percentage of occupied nest boxes declined from 52% to 12%, nest success (successfully raising and fledging at least one chick) declined from 58% to 17%, and the average of chicks produced per breeding attempt decreased from 1.1 to 0.4.

No successful breeding attempts were recorded above the threshold air temperature of 35.7°C. Breeding output was negatively correlated with increasing days on which the maximum air temperature exceeded the threshold at which the hornbills displayed heat dissipation behavior and normal breeding and nesting behavior. These effects were present even in non-drought years.

Fast paced climate crisis

The study shows the fast pace at which the climate crisis is taking place is having severe negative effects for charismatic species over alarmingly short time periods. Current warming predictions at the study site show that the hornbill's threshold for successful breeding will be exceeded during the entire breeding season by approximately 2027.

"Much of the public perception of the effects of the climate crisis is related to scenarios calculated for 2050 and beyond," Pattinson continued. "Yet the effects of the [climate crisis](#) are current and can manifest not just within our lifetime, but even over a single decade."

"Despite no striking large die-off events, our prediction in this study is that southern yellow-billed hornbills could be extirpated from the hottest parts of their range as soon as 2027."

"Sub-lethal consequences of high temperatures may drive local extinctions by resulting in recruitment failure (i.e., no young animals joining the population) and changes to the ecosystems on which we all depend."

More information: *Frontiers in Ecology and Evolution* (2022). [DOI: 10.3389/fevo.2022.842264](https://doi.org/10.3389/fevo.2022.842264) , [www.frontiersin.org/articles/1 ...
evo.2022.842264/full](http://www.frontiersin.org/articles/1...evo.2022.842264/full)

Provided by Frontiers

Citation: Climate crisis is driving yellow-billed hornbill to local extinction (2022, May 19)
retrieved 26 June 2024 from [https://phys.org/news/2022-05-climate-crisis-yellow-billed-hornbill-
local.html](https://phys.org/news/2022-05-climate-crisis-yellow-billed-hornbill-local.html)

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