

INSIDE JEB

Smallest Iberian songbirds at risk from lethal heat in warming world



Two house sparrows (*Passer domesticus*) on a twig. Photo credit: Andrés Rodríguez-Rodríguez.

According to the World Meteorological Organization, temperatures in Europe are increasing at more than twice the global average. And in 2022, the mercury rocketed as a summer-long heatwave engulfed the continent – hitting an all-time high in Pinhão, Portugal, of 47°C – triggering wildfires as rivers ran dry and the European maize harvest crashed. ‘The Mediterranean Basin... [has] experienced a 1.5°C increase in mean annual surface temperatures since pre-industrial values’, says Julián Cabello-Vergel, from the University of Badajoz, Spain, adding that the smallest warm-blooded (endothermic) creatures are some of the most susceptible to these dramatic climate shifts. ‘Small songbirds are especially vulnerable to heatwaves due to their diurnal habitats, small body sizes with large area to volume ratios and high metabolic rates’, says Cabello-Vergel. To remain cool, many small songbirds pant like dogs; however, this strategy is costly, consuming energy and scarce water, placing the birds at risk during extreme heat. So just how vulnerable are the songbirds of Spain?

Cabello-Vergel, José Abad-Gómez, Núria Playà-Montmany and Auxiliadora Villegas, with support from Erick

González-Medina, Jose Masero and Jorge Gutiérrez, all from University of Badajoz, headed out into the surrounding countryside to catch birds from a range of habitats, including open landscapes and dense riverside woods. ‘We captured birds by setting up nets’, Cabello-Vergel explains. Eventually, the team transported the eight species, including house sparrows (*Passer domesticus*), crested larks (*Galerida cristata*) and goldfinches (*Carduelis carduelis*), back to the lab. There, they calculated the amount of energy each bird used as the temperature rose to 40°C by measuring their oxygen consumption, as well as body temperature and the amount of water they exhaled, before raising the temperature in 2°C blocks above 40°C until each bird began to struggle in the heat, at which point the team released the animal back to its home.

After analysing the responses of the songbirds to the increasing heat, it was clear that they were not well prepared for extreme temperatures. Although desert songbirds can withstand temperatures ranging from 46 to 54°C, the highest temperatures that the Mediterranean songbirds could cope with peaked between 40 and 46°C, placing the

Mediterranean residents at risk from extreme heatwaves, such as the one they endured in 2022. In addition, the songbirds had to work physically harder at the higher temperatures to keep cool, increasing their resting metabolic rate by 40% at the highest temperatures, as well as losing significantly more water as they panted harder to maintain a safe body temperature during the laboratory-simulated heatwave. By comparing the birds’ cooling efficiencies, the team realised that the crested lark – the largest species that the team caught – was the only bird that was able to keep itself cool when the air temperature exceeded its body temperature, and Cabello-Vergel adds, ‘Because small songbirds lose water at higher rates, they dehydrate faster than larger ones, resulting in greater risk of death during extremely hot days’.

But what does this mean for Mediterranean songbirds facing warmer summers and more extreme heatwaves? ‘Although the studied species are not currently experiencing lethal dehydration risks, they all are experiencing several summer days in which their thermoregulatory capacities are challenged’, says Cabello-Vergel, which suggests that the long-term future for the Iberian Peninsula’s smallest songsters is bleak. However, the team recommends that conservation managers prioritise the protection of wooded areas and cool riverbanks, where vulnerable songbirds could retreat to, seeking shade and protection in bushes and tree hollows on the most searing days.

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Kathryn Knight
kathryn.knight@biologists.com