

Changes in body size and shape of Alpine swifts in response to climate change

Giulia Masoero^{1,2}, Julien Martin¹, Pierre Bize²

¹ Department of Biology, University of Ottawa, Canada

² Swiss Ornithological Institute, CH-6204 Sempach, Switzerland

Changes in body size and shape have become a flagship response to climate change, but there is still little understanding of the mechanisms driving those changes. Using data on Alpine swifts (*Tachymarptis melba*) from 1999 to 2023 at breeding colonies in Switzerland, we investigated climate-induced changes in nestling growth and adult body size. First, we show that climate has significant effects on the wing growth of nestlings and that nestlings have grown their wings faster in recent decades, which is linked with an earlier age at fledging. We also found selection on nestling wing length over the years, as fewer and fewer nestlings with shorter wings were recruited as breeders in the population. Adult birds showed an increase in wing and tail length but not in body mass or sternum. Within-individual centring models show that these changes were explained by demographic effects, with new recruits (especially females) having longer wings and tails over the years (no change in recruitment age), and by plasticity, with individuals moulting and growing longer feathers over the first few years after recruitment. All adult and nestling traits were heritable, with genetic correlations among most of them, but we found no evidence of microevolution in adult size, despite evidence of selection on nestling wing size. Our study highlights the importance of plasticity in explaining changes in adult shape and provides an insightful explanation of trait evolutionary constraints.