Interactive effects of body mass changes and species-specific morphology on flight behaviour of chick-rearing Antarctic fulmarine petrels under diurnal wind patterns

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Abstract

For procellariiform seabirds, wind and body morphology are crucial determinants of flight costs and flight speeds. During chick-rearing, parental seabirds commute frequently to provision their chicks, and their body mass changes between outbound and return legs. In Antarctica, the typical diurnal katabatic winds which blow stronger in the mornings, form al natural experiment to investigate flight behaviours in response to wind conditions. We GPS-tracked three closely related species of sympatrically breeding Antarctic fulmarine petrels which differ in wing loading and aspect ratio and investigated their flight behaviour in response to wind and changes in body mass. All three species reached higher flight speeds under stronger tailwinds, especially on return legs from foraging, when wing loading was increased since birds carried food for their chicks. Flight speeds decreased under stronger headwinds. Antarctic petrels (Thalassoica antarctica; intermediate body mass, highest wind loading and aspect ratio) responded stronger to changes in wind speed and direction than cape petrels (Daption capense; lowest body mass, wing loading and aspect ratio) or southern fulmars (Fulmarus glacialoides; highest body mass, intermediate wing loading and aspect ratio). Birds did not adjust their flight direction in relation to wind direction nor maximum distance to nest when they encountered strong headwinds on their outbound commutes. However, birds appeared to adjust the timing of commutes to those hours of the day when headwinds were weakest and they were more likely to encounter favourable tail- and crosswinds. Despite these adaptations to the predictable diurnal wind conditions, birds frequently encountered unfavourably strong headwinds, possibly as a result of weather systems disrupting the katabatics coupled with the need to feed. How the predicted decrease in Antarctic near-coastal wind speeds over the remainder of the century will affect flight costs and breeding success which ultimately drives population trajectories remains to be seen.

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