Modelling movement and activity patterns in black eagles *Aquila verreauxii*

T. Photopoulou[a], **M. Murgatroyd**[b], **L. Underhill**[b], **A. Jenkins**[c] and **R. Altwegg**[a]

[a]Centre for Statistics in Ecology, Environment and Conservation
Department of Statistical Sciences
University of Cape Town
Rondebosch 7701, South Africa
theoni.photopoulou@uct.ac.za

[b]Animal Demography Unit
University of Cape Town
Rondebosch 7701, South Africa
verreauxs@gmail.com

[b]Animal Demography Unit
University of Cape Town
Rondebosch 7701, South Africa
les.underhill@uct.ac.za

[c]AVISENSE Consulting
10 Harrier Circle, Imhoff's Gift
Kommetjie 7975, South Africa
andrew@avisense.co.za

[a]Centre for Statistics in Ecology, Environment and Conservation
Department of Statistical Sciences
University of Cape Town
Rondebosch 7701, South Africa
res.altwegg@gmail.com

Abstract: Tracking data from black eagles were collected to investigate their movement and activity patterns, as part of the first dedicated study of their breeding ecology and conservation status in the Western Cape, South Africa. Telemetry tags were deployed on five adult birds in 2012 and 2013, in two areas. Two tags were deployed on birds in the relatively pristine Cederberg mountains, and three in the heavily agricultural Sandveld region. The Cederberg has low prey diversity and a high variability in temperature, compared to the Sandveld where there is higher prey diversity, but less suitable nesting habitat, and a milder climate. These factors, among others, are likely to result in different movement and activity patterns of eagles living in the two areas. The movement data include high temporal resolution GPS location data, altitude, and three-axis acceleration data. Speed is problematic for inferring movement in soaring birds, since they can appear stationary in terms of speed relative to the ground while soaring. In addition, the steep relief of the cliffs they nest on and the outcrops they perch on, regularly results in poor quality GPS locations while they are stationary. Acceleration measurements are comparatively noise-free and can be used to infer activity patterns and posture. We develop

a two-state Bayesian mechanistic model, using minimum specific acceleration to estimate the behavioural state associated with each GPS location. We use a simple distinction between "flying" and "perched". This approach allows for an early comparison of activity patterns in the two regions where birds were tagged, and provides a starting point for the development of more complex models of bird movement e.g., including environmental covariates.