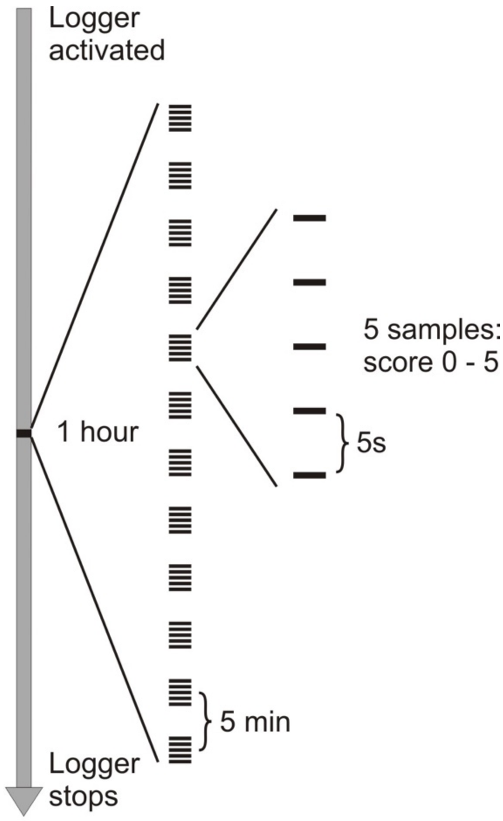
Journal of Avian Biology

JAV-01972
Hedenström, A., Norevik, G., Boano, G., Andersson, A., Bäckman, J. and Åkesson, S. 2019. Non-breeding flight activity in pallid swifts *Apus pallidus*. – J. Avian Biol. 2019: e01972

Supplementary material

Appendix 1

Figure 1. Accelerometry measurements from a 1.3 s flight sequence of a common swift Apus apus sampled at frequency 25 Hz along three (X, Y, Z) perpendicular axes. The axes are aligned with the horizontal body axis (X), the horizontal span wise axis (Y), and the vertical axis parallel with gravity (Z). The wing beat frequency is about 8 Hz and in our accelerometer device, 25 Hz is the nearest available frequency fulfilling the Nyquist sampling criterion. The measurements are normalized with respect to the acceleration due to gravity (1g ! 9.81 m s^{-2}). The illustrated sequence shows continuous flapping light for the first 0.8 s, followed by a glide.



	Activity score						
hour	0	1	2	3	4	5	
1	0	0	0	0	0	12	maximum activity
2	12	0	0	0	0	0	no activity, resting
3	6	0	0	0	0	6	intermediate activity
4	0	0	0	1	3	8	intermediate activity

Figure A2. Diagram illustrating the overall sampling routine for the data logger used to determine flight activity based on measurements of body acceleration in the vertical axis on pallid swifts *Apus pallidus*. The upper panel shows a time line, where 12 runs, consisting of 5 samples separated by 5 seconds, are recorded every hour. Every sample consists of 10 measurements of momentarily body acceleration. A sample is scored as indicative of active flight if 3 (of 10) measurements deviate from the average acceleration by more than $|g/3|$. If all 5 samples of a run fulfil the criterion of active flight the run scores a '5', while if no sample fulfils the criterion of active flight the run score is '0', with intermediate values '1' to '4' represent the number of samples scoring active flight. Every hour the number of scores for each run are counted and stored in a table that summarises the flight activity scores during the preceding hour (lower panel). In the illustrated example the first row (1) shows that all runs scored a '5', which indicates a bird in continuous flight. In the second row (2) all runs scored '0', suggesting the bird is not flying actively and is probably roosting (in principle this bird could be in continuous gliding flight during one hour, but this is highly unlikely). During the subsequent two hours (3, 4) the bird showed intermediate run scores. For example, in hour 3 the bird showed high flight activity during 6 runs and no flight activity during another 6 runs, which indicates it was flying actively for half the time and was perched motionless for the other half. In hour 4 the scores indicated that during 8 runs the bird was flying actively, while during 3 runs four samples indicated active flight and one did not, and during 1 run three samples suggested active flight and two did not. The scores of hour 4 is indicative of a bird flying with intermittent flap-gliding flight, although flapping is dominating.

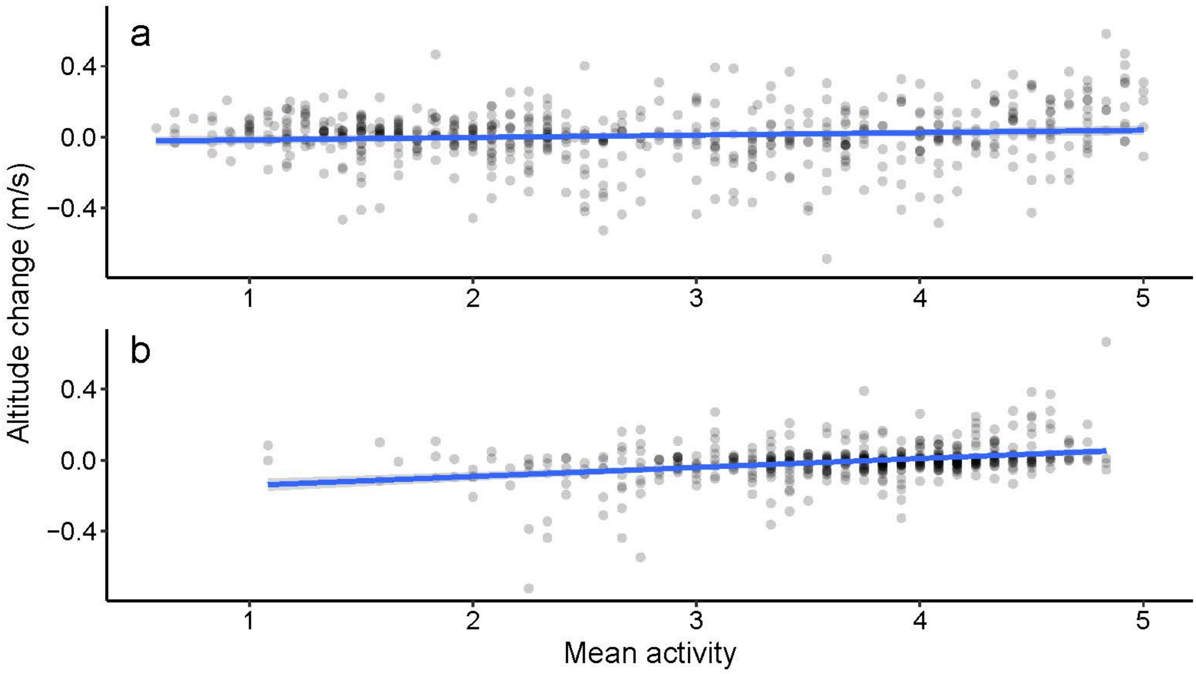


Figure A3. The relationship between change in altitude (y-axis) and the mean flight activity (0-12; x-axis) as recorded during the preceding hour for day flights (a) and nocturnal flights (b). The linear regression lines are y = -0.0302+0.0137x (day) and y = -0.194+0.0507x, respectively. The shadowed band around the lines indicate 95% confidence intervals for the linear models. For this bird (#310) we analysed the change in altitude in relation to recorded mean flapping flight activity during the preceding hour, which showed there is a significant positive effect of flight activity on altitude change (linear mixed model, $F_{1,1125}$=45.6, P<0.0001), as well as an interaction between activity and time (day/night) ($F_{1,1125}$= 15.1, P<0.0001). This implies that flight activity had a bigger effect on altitudinal change in the night time compared with daytime, when vertical displacement is also influenced by thermal soaring.