Journal of Avian Biology

JAV-00829
Lindström, Å., Alerstam, T., Bahlenberg, P., Ekblom, R., Fox, J. W., Råghall, J. and Klaassen, R. H. G. 2015. The migration of the great snipe *Gallinago media*: intriguing variations on a grand theme. – J. Avian Biol. doi: 10.1111/jav.00829

Supplementary material

Figure A2. A practical example of Hill-Ekstrom calibration using great snipe geolocator data. Positions were estimated using the BASTrak software (BAS) for different sun angles (here: -5.5°, -4.5°, -3.5°). Theoretically, longitude is independent of Sun angle or calibration, hence only longitude estimates for a sun angle of -4.5° are shown (panel a). Note that longitude is not affected by equinox, and that there are no systematic changes in longitude for this period, which strongly suggests that the bird was stationary during this time (a key assumption for Hill-Ekstrom calibration). Panel b-d provide estimates for latitude for different sun angles. These latitude estimates are strongly affected by the equinox, and in fact it is not possible to estimate latitude very close to the equinox. For a sun angle of -5.5° (panel b) clear Hill-Ekstrom patterns can be observed: (1) estimates for latitude before equinox are higher than estimates for latitude after equinox (i.e. mismatch in estimates for latitude before and after equinox), and (2) estimate for latitude increases exponentially just before equinox, flips at equinox, and increases asymptotically after equinox (i.e. amplification of latitudinal error at equinox). Similar Hill-Ekstrom patters are observed for a sun angle of -3.5°, with reversed directions of patterns. Hence, the 'correct' best-fitting sun angle should be in between, and indeed for 4.5° (panel c) Hill-Ekstrom patterns are no longer observed. The latter sun angle was used to estimate positions throughout the year.

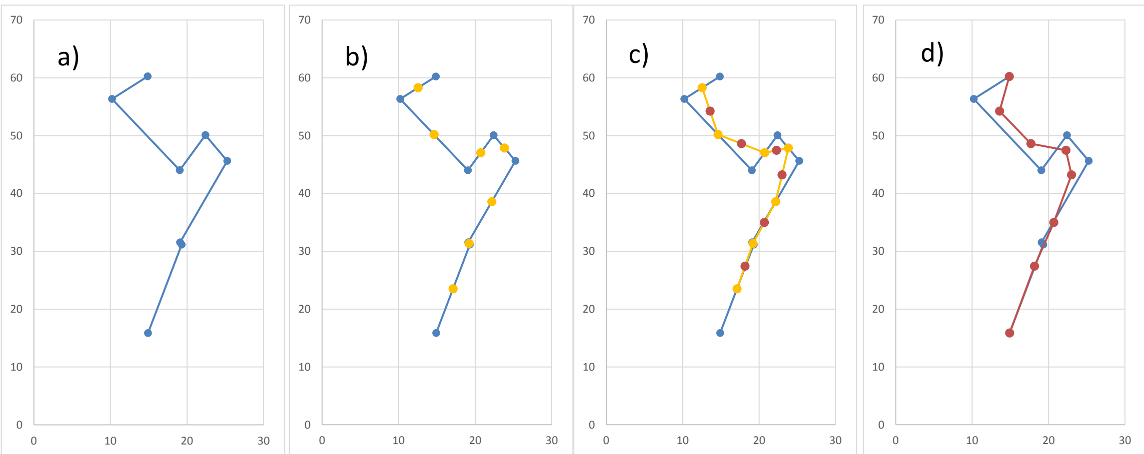
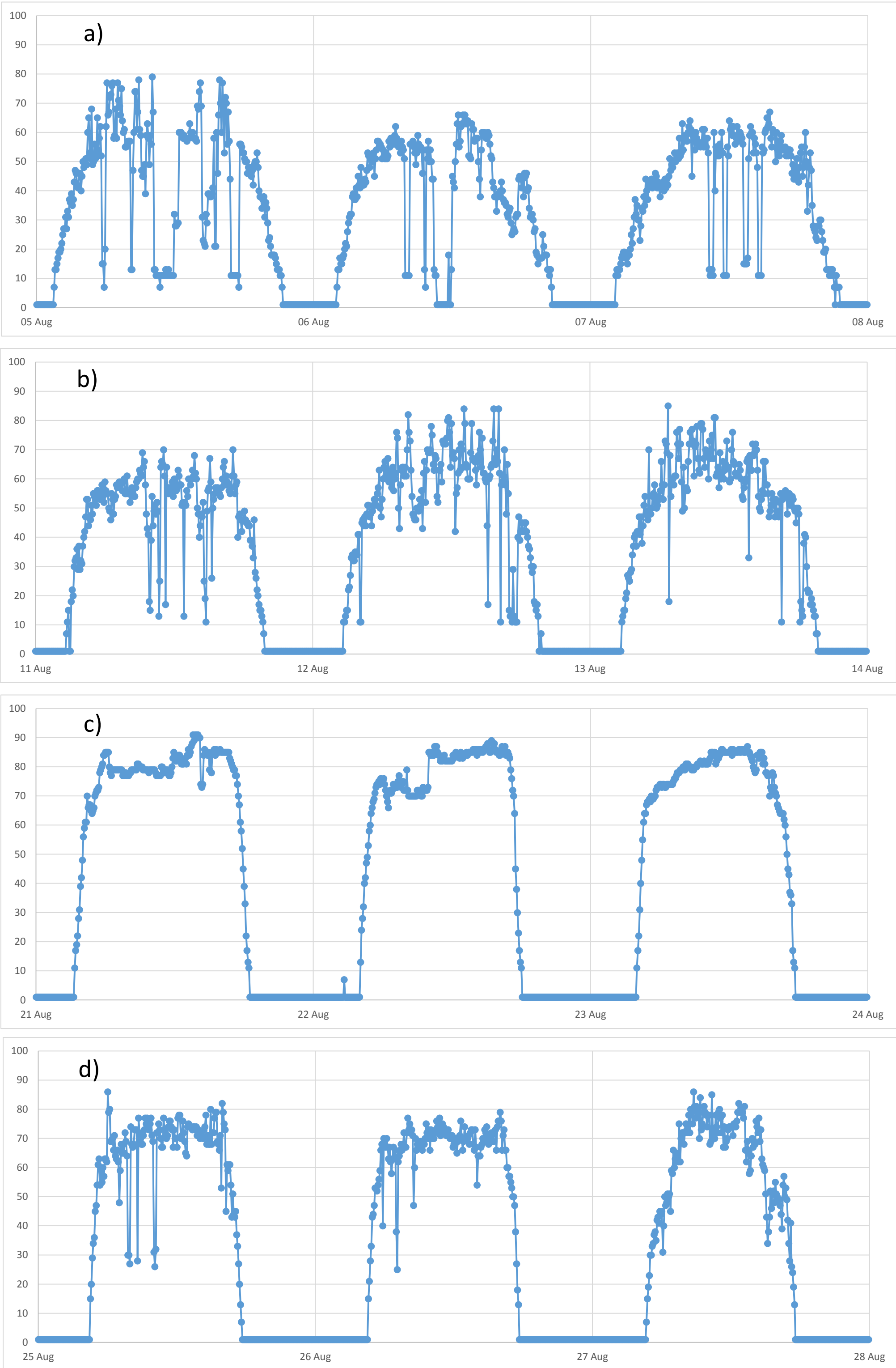


Figure A3. A practical example of Pütz-smoothing of a geolocator track (see Pütz 2002). (a) Raw geolocator positioning data. (b) First Pütz-smoothing: the middle of each raw-data segment (blue lines) is calculated (orange dots). (c) Second Pütz-smoothing: the middle of each smoothed segment (orange lines) is calculated (red dots). (d) Resulted track after smoothing twice (red) along with the raw geolocator positioning data (blue).



a)
05 Aug
06 Aug
07 Aug
08 Aug
b)
11 Aug
12 Aug
13 Aug
14 Aug
c)
21 Aug
22 Aug
23 Aug
24 Aug
d)
25 Aug
26 Aug
27 Aug
28 Aug
0
10
20
30
40
50
60
70
80
90
100

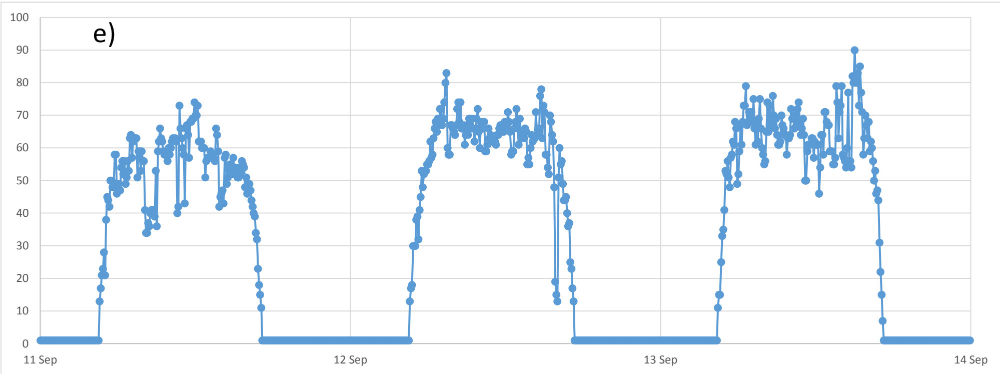


Figure A4. Typical raw light data from near full light range recording geolocators [MT] including data from (a) breeding ground, (b) stopover in Europe, (c) non-stop trans-Sahara flight, (d) stopover in Sahel, (e) wintering in Congo.