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Supplementary material

Appendix 1

Table A1. Summary of migration of five adult African cuckoos *C. gularis* tracked from central Nigeria. Second and third annual cycles in brackets.

Departure location	**Bird**	**Sex**	**Migration season**			**Total distance (km)**	**Total time (days)**	**Average speed (km/day)**	**Destination direction**
			2013 – 2014	**2014 -2015**	**2015 – 2016**				
Breeding ground	126694	Male	05 Oct − 08 Jan	21 Sep – 11 Jan	27 Nov – 2 Jan	1,180	<96	12	121°
						(1271, 981)	(<112, <36)	(11, 27)	(115°, 123°)
	126695*	Female							
	126696*	Male	26 Dec − 29 Dec	18 Jan – 20 Jan		488 (487)	<3 (<5)	163 (97)	135° (136°)
	126697*	Male	29 Jul − 21 Jan	13 Dec – 18 Dec	14 Dec – 17 Dec *	607	<176	3	137°
						(442, 401*)	(<5, 3)	(88, 134)	(140°, 136°)
	126698*	Male	15 Aug − 17 Aug*			28*	<2*	4*	35°
	Average†		**06 Nov − 06 Jan**			**781**†	**62**†	**57**†	**131**†
Non-breeding ground	126694	Male	11 Mar − 14 Mar	23 Feb - 22 Mar	2 Mar – 18 Mar	1,022	<3	340	
						(1024, 966)	(<28, 16)	(37, 60)	
	126696	Male	03 Feb − 23 Mar	05 Feb – 20 Mar		571	<49 (<44)	12 (12)	
						(539)			
	126697	Male	05 Mar − 30 Mar	13 Mar – 24 Mar		608 (716)	>25 (<11)	24 (65)	
	Average†		**26 Feb − 22 Mar**			**778**†	**25**†	**79**†	

*Transmitter stopped before migration was completed

†Only complete migrations are included in averages pooled for the 3 migration seasons

Appendix 2. Timing of daily flights

We investigated the daily timing of flights by identifying movements within the 10-hour transmission periods indicated by consecutive high-quality positions separated by more than 5 mins and more than 10 km and with a speed of less than 25 m s^{-1} (N=33). As these movements are biased by outlier positions, we removed movements that were either preceded or succeeded by a movement in the opposite direction resulting in 11 flight legs. The standard error of the corresponding distance estimates is less than 2.1 km. The directions of these flights generally coincided with the migration movements of the corresponding period and they are all likely to represent migratory flights.

Evidence for nocturnal flights was found in all three individuals (Fig. A1) and no day-time flights of more than 10 km were recorded. Speeds of the flights, all lasting more than an hour and covering up to more than 100 km, ranged from 2.3 – 10.0 m s^{-1}. The longest documented nocturnal movement was 184 km in a single night between 18:22 hrs and 00:25 hrs (#126697).

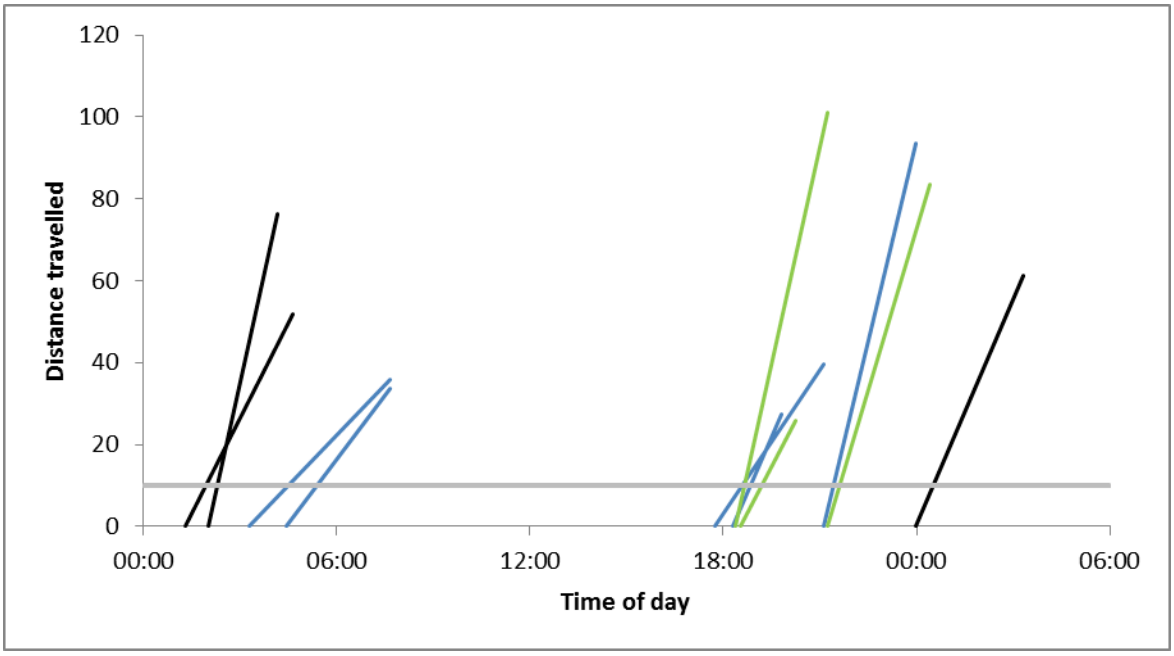

Figure A1. Timing and extent of nocturnal movements performed by three African Cuckoos tracked from the breeding ground in central Nigeria over two migration seasons.

Appendix 3. Climate and habitats

Average rainfall on the breeding grounds in Amurum is 1,337 mm per year, with the rainy season spread between April – October (Cox et al. 2013).

The habitat at stopover sites used by the tracked birds ranged from savannah scrubs, woody savannahs to sub-montane forests. One important stopover site which all the birds used at least in one year is the Gashaka Gumti National Park, northeast Nigeria. The park is partly located on the mountainous Mambilla Plateau and is characterized by a mixture of montane forests and grasslands, riparian forests and Sudan-Guinea Savanna woodlands.

The two general stopover areas in Central Africa used by the African Cuckoos, separated by a distance of *c.* 550 km, had similar woodland vegetation characteristics (Molua and Lambi 2006) but at different altitudes. Furthermore, the sites were generally more wooded than the breeding ground of the species.

We investigated the vegetation greenness at stationary locations throughout the year based on NDVI (Normalized Difference Vegetation Index). NDVI was downloaded using the function MODISSubsets from the package MODISTools (Tuck et al. 2014) in R 3.3.2. We used values from within ±1 km of the location of the stopover with a 16-day temporal resolution.

The vegetation greenness showed considerable seasonal variation at all sites visited (Fig. A2). At the breeding site the greenness was generally highest at the middle of the stay. Birds departed the breeding grounds during decreasing greenness and moving resulted in a considerable gain in greenness. The seasonal greenness patterns were similar at all non-breeding sites but differed from those at the breeding grounds. Greenness increased sharply at the non-breeding sites soon

after the birds arrived there. Return to breeding grounds coincided with the lowest local greenness just before greenness started to increase at the breeding grounds.

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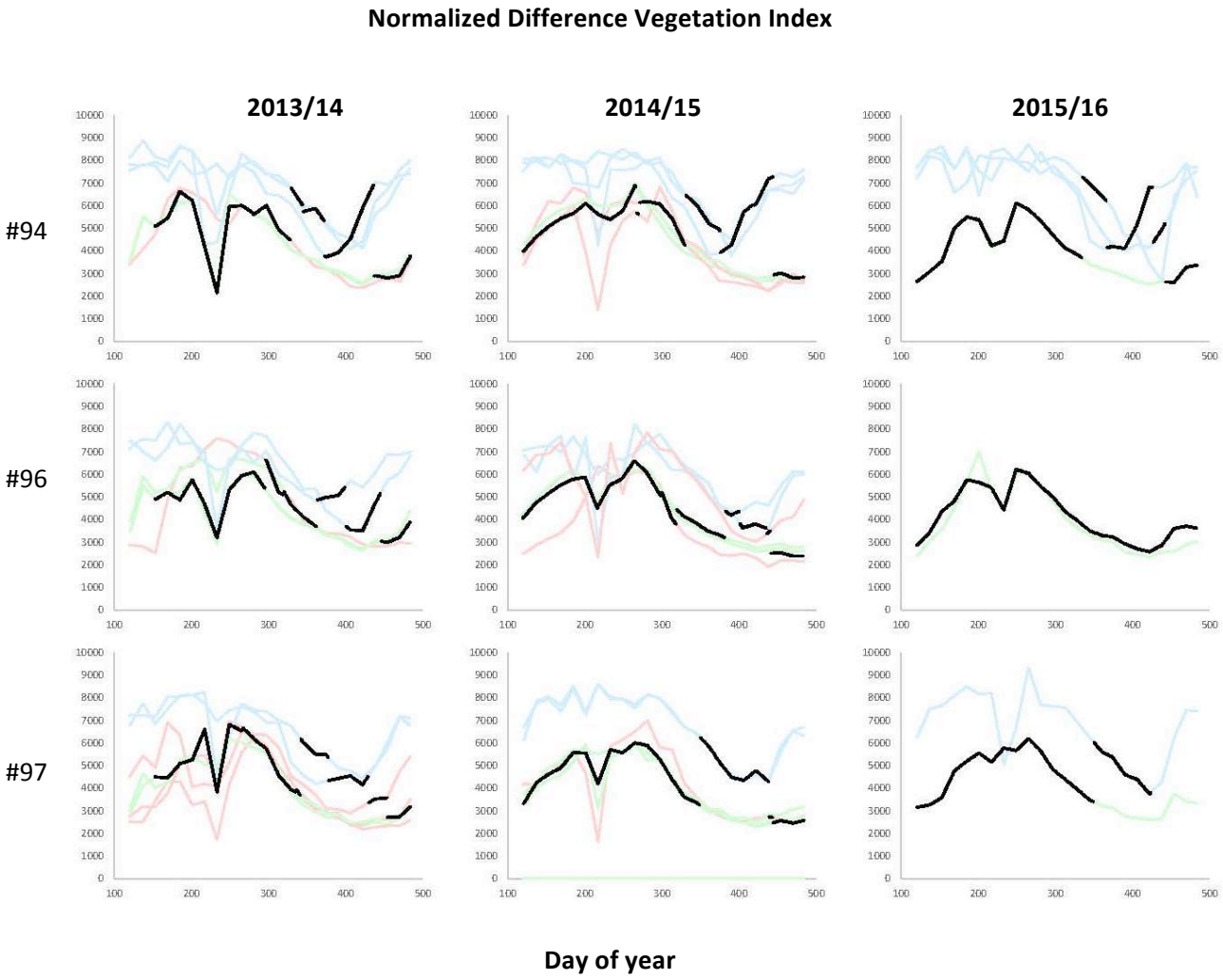

Figure A2. Vegetation greenness (NDVI) at stationary locations throughout the year. For positions where the individual was stationary for at least five days during the year, the vegetation greenneess is indicated (black line). Colours separate breeding grounds (green), the most distant non-breeding stay (blue) and in-between areas (red). Most individuals stayed at more than one location during each of these periods; Hence, there are several lines for each period.

References

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Tuck, S. L., Phillips, H. R., Hintzen. R. E., Scharlemann, J. P., Purvis A and Hudson, L. N. 2014. MODISTools - downloading and processing MODIS remotely sensed data in R. – Ecol. Evol. 4: 4658-4668. doi: 10.1002/ece3.1273