

Notes on the ecology of Ethiopian Bush-crow *Zavattariornis stresemanni*

Ben Ross, Mengistu Wondafrash, Mihiret Ewnetu, Sandy Watt, Celia Broadhurst, Rob Critchlow, Aman Dadesa, Tom Deas, Chere Enawgaw, Berihun Gebremedhin, Eilidh Graham, Sarah Maclean and Richard J. Mellanby

Summary

We used the focal sampling method to conduct a behavioural study of the endemic Ethiopian Bush-crow *Zavattariornis stresemanni* in the Yabelo-Mega area of southern Ethiopia. We found that feeding rates were lower in areas with low sward height and low numbers of trees. This was particularly concerning given the degradation of natural habitat in this area.

Introduction

The Ethiopian Bush-crow *Zavattariornis stresemanni* is an endemic bird found in the Yabelo-Mega region of southern Ethiopia (Birdlife International 2009). Little is known about this species' ecology; notably, the factors contributing to its remarkably restricted range. There are only a few reports on the status of this species and most are descriptive reports of brief field observations (Ash & Gullick 1989, Syvertsen & Dellelegn 1991, Gedeon 2006). Borghesio & Gianetti (2005) reported a dramatic decline in the number of Ethiopian Bush-crow sightings between 1989 and 2003, which they attributed to dramatic changes in the local habitats. The results of that study prompted the upgrading of the species' conservation status from vulnerable to endangered (Birdlife International 2009). In July and August 2005 a team of ornithologists visited the Yabelo and Mega regions to carry out further studies on this species. The distribution, abundance and habitat preferences of the Ethiopian Bush-crow are described in Mellanby *et al.* (2008). This paper builds on that study and describes the feeding ecology of the bush-crow using intensive behavioural observations.

Study area

Fieldwork was carried out in the Yabelo-Mega area of Southern Ethiopia's Borana region. Observations were recorded in and around the Yabelo Sanctuary, the boundaries of which are ill-defined but taken to lie between 05°12' and 04°37' N, and 38°09' and 38°35' E. The altitude of the sanctuary ranges from 1430 m to 2000 m and the annual rainfall is *c.*700 mm, with a

principal rainy season between April and May (Fishpool & Evans 2001). The Yabelo Sanctuary is the only protected area within the range of the Ethiopian Bush-crow (EWNHS 1996, Fishpool & Evans 2001). The most common habitat within the Yabelo Sanctuary is woodland savannah dominated by several species of *Acacia* (*A. tortilis*, *A. brevispica*, *A. horrida* and *A. drepanolobium*), *Terminalia* and *Commiphora* spp. (Borghesio & Giannetti 2005). The dominant land use is pastoralism by the Borana tribe although agriculture has increased in recent years (EWNHS 1996, Borghesio & Giannetti 2005).

Methods

The study was undertaken between 15 July and 29 August 2005. Behavioural observations were made using the focal sampling method. Individual Ethiopian Bush-crows were observed through binoculars and their position and behaviour was recorded every 45 seconds for up to 10 minutes at a time. Periods of at least 10 minutes were left between samples and no more than three observation periods were undertaken on any one flock. The number of bush-crows in each flock was recorded at the start of each observation period. A bird was defined as being in a flock if it was within 10 m of another bush-crow. The number and species of other birds within the flock were also recorded at the start of each observation period. Observations were made on an opportunistic basis whenever bush-crows were encountered during a wider survey of the Yabelo region.

Positions were recorded as either on the ground, perched in trees or vegetation, in air, in nest, or obscured. Behaviours observed were placed in one of the following 16 categories:

- | | |
|-----------------------------------|--|
| 1) feeding on vegetation | 10) preening another bush-crow |
| 2) feeding on bare earth | 11) being preened by another bush-crow |
| 3) feeding on dung | 12) calling |
| 4) feeding on wasp nest | 13) interacting with other species |
| 5) hawking for insects | 14) nest repair |
| 6) walking | 15) collecting nest material |
| 7) inactive | 16) obscured |
| 8) preening | |
| 9) being fed by another bush-crow | |

Observation periods with less than 10 behavioural recordings were excluded from further analysis. At the end of each observation period, habitat variables were recorded within a 25 m radius of the spot where the last bird was seen (see Mellanby *et al.* 2008). Habitat variables recorded included:

- 1) % of bare earth visible
- 2) % shrub cover
- 3) mean sward height
- 4) % canopy cover

- 5) number of trees < 6 m high
- 6) number of trees > 6 m high
- 7) number of termite mounds
- 8) houses present within 200 m of the spot where the last bird was seen

To examine the effect of time of day, the day was split into four equal periods: early morning (06:00 to 09:00), late morning (09:00 to 12:00), early afternoon (12:00 to 15:00) and late afternoon (15:00 to 18:00). A Mann Whitney U-test was used to compare habitat variables for observations with low and high levels of feeding activity. Low levels of feeding activity were defined as samples where 20% or less of observations indicated feeding activity; any samples with > 20% of observations indicating feeding activity were defined as high levels of feeding. A Chi-square test was used to test for relationships between the presence and absence of termite mounds or villages, and observations where feeding was the dominant behaviour. Variation between flock size and time of day was tested using a Kruskal-Wallis test.

Results

A total of 1897 individual behavioural observations were recorded during 169 observation periods. The overall proportion of time that individuals were observed in each of the positions or activities, and their respective times of day, are shown in Table 1. Feeding was the most common behaviour observed overall, accounting for 41% of all observations. The most common feeding position was on the ground amongst vegetation, which accounted for 79% of all foraging locations. Additional foraging was in trees or termite mounds (2% each), amongst rubbish or on wasp nests (1% each) or by hawking (<1%). When habitat characteristics were compared between observations with low and high-feeding levels, sward height and the total number of trees were found to be higher in areas where feeding activity was greater ($W = 4803$, $P = 0.001$, and $W = 4906$, $P = 0.028$ respectively) (Table 2).

Table 1. Percentage of three-hour periods spent by Ethiopian Bush-crow in different positions or activities.

Position	No. individual observations	% Of Three-Hour Period				Overall %
		06:00-09:00	09:00-12:00	12:00-15:00	15:00-18:00	
Ground	1251	81%	61%	53%	66%	66%
Tree	584	16%	35%	45%	30%	31%
Nest	11	0%	0%	1%	0%	1%
In air	50	3%	4%	1%	3%	3%
Activity						
Feeding	722	47%	37%	34%	44%	41%
Walking	430	33%	24%	19%	22%	25%
Preening	207	6%	12%	21%	10%	12%
Socializing	70	1%	7%	6%	3%	4%
Inactive	318	14%	20%	18%	20%	18%

Table 2. Habitat characteristics for Ethiopian Bush-crow in areas of low and high levels of feeding activity (*notes significant difference).

Habitat variables	All observations (n=124); Mean \pm SD	Low feeding (n=85); Mean \pm SD	High Feeding (n=39); Mean \pm SD	P value
% bare earth	21.7 \pm 16.5	22.2 \pm 16.7	20.7 \pm 16.2	0.600
% scrub cover	12.1 \pm 8.3	11.6 \pm 8.5	13.2 \pm 7.7	0.149
Sward height (cm)	7.9 \pm 5.9	6.7 \pm 4.3	10.6 \pm 7.7	0.001*
% canopy cover	8.8 \pm 14.7	9.2 \pm 15.0	8.1 \pm 14.0	0.862
No. trees <6 m high	5.3 \pm 10.4	4.7 \pm 10.7	6.7 \pm 9.7	0.110
No. trees >6 m high	2.2 \pm 3.2	2.1 \pm 3.2	2.6 \pm 2.8	0.092
All trees	7.6 \pm 10.5	6.7 \pm 10.8	9.0 \pm 9.7	0.028*
No. observations with termite mounds	66 (53%)	41 (48%)	15 (38%)	NS
No. observations near villages	59 (48%)	43 (51%)	16 (41%)	NS

The average flock-size was four (range: 1–12). There was no significant difference in flock-sizes at different times of day. Other birds were seen with bush-crows in 51% of observations. The mean flock size (including other species) was six (range: 1–29). Twenty-seven different species were seen with bush-crows. The most common species found in flocks with bush-crows were Superb Starlings *Lamprotornis superbus* found in 27% of observations, followed by White-browed Sparrow-weavers *Plocepasser mahali* (8%), Red-billed Buffalo Weavers *Bubalornis niger* (6%), Red-billed Hornbills *Tockus erythrorhynchus* (5%), White-headed Buffalo Weavers *Dinemellia dinemelli* (5%), and Ring-necked Doves *Streptopelia capicola* (2%).

Discussion

Ethiopian Bush-crows feed mainly on invertebrates and favour habitats characterised by a low density of bushes, the presence of tall trees and loosely-packed soils (Gedeon 2006, Mellanby *et al.* 2008). This study supports these findings, highlighting the range of foraging locations used by bush-crows, but demonstrating that the dominant foraging position is on the ground and preferentially amongst vegetation. The fact that this study showed that feeding activity was lower in areas with low sward height and fewer trees is of particular concern given the degradation of natural habitat in the area. The traditional land-use in the area is nomadic pastoralism. However, cultivation for cereal crops is becoming more prevalent, and subsequently grazing pressure by cattle is increasing. This trend is consistent with other studies conducted in this area (EWNHS 1996, Bassi 2002, Borghesio & Gianetti 2005, Solomon *et al.* 2007, Mellanby *et al.* in press). Recent studies have highlighted large-scale habitat changes within the range of the bush-crow (Borghesio & Giannetti 2005, Mellanby *et al.* 2008). These include increases in cultivation for cereal production, increasing dense shrub cover, heightened grazing-pressure and a loss of trees (Mellanby *et al.*, in press). In the absence of any

direct habitat management to benefit nature conservation, and with potential widespread changes in land-use in the area, it is essential that habitat changes and any impacts on Ethiopian Bush-crow populations continue to be closely monitored. The future of this species may be dependent on its ability to adapt to a rapidly changing environment.

Acknowledgements

The authors of the study are very grateful to the BP Conservation Awards Programme, Carnegie Trust, University of Glasgow, People's Trust for Endangered Species, Royal Geographical Society, African Bird Club, Glasgow Natural History Society and Edinburgh Trust 1 for their generous financial support of this project. We would also like to thank the local guides and drivers. We are also very grateful to Luca Borghesio for his excellent advice throughout the development of the project; Luca and Paul Kariuki provided useful comments on an earlier version of the manuscript. The project would not have been possible without the initial assistance from Yilma Dellelegn, Claire Spottiswoode and Nigel Collar to whom the authors are very grateful. We are also grateful to John Ash and Per Ole Syvertsen for their advice and guidance.

References

- Ash, J.S. & Gullick, T.M. 1989. The present situation regarding the endemic breeding birds of Ethiopia. *Scopus* 13: 90-96.
- Bassi, M. 2002. The making of unsustainable livelihoods: an ongoing tragedy in the Ethiopian drylands. *Policy Matters* 10: 7-12.
- BirdLife International 2009. Species factsheet: *Zavattariornis stresemanni*. Downloaded from <http://www.birdlife.org> on 22/1/2009.
- Borghesio, L. & Giannetti, F. 2005. Habitat degradation threatens the survival of the Ethiopian bush crow, *Zavattariornis stresemanni*. *Oryx* 39: 44-49.
- EWNHS [Ethiopian Wildlife and Natural History Society] 1996. *Important Bird Areas of Ethiopia*. Ethiopian Wildlife and Natural History Society, Addis Ababa, Ethiopia. Pp. 185-187.
- Fishpool, L.D.C. & Evans, M.I. 2001 (Eds.). *Important Bird Areas in Africa and associated islands: priority sites for conservation*. 1st Ed. Newbury and Cambridge, UK: Pisces Publications and Birdlife International.
- Gedeon, K. 2006. Observations on the biology of the Ethiopian Bush Crow, *Zavattariornis stresemanni*. *Bulletin of African Bird Club* 13: 178-188.
- Mellanby, R.J., Ross, B., Watt, A., Wondafrash, M., Ewnetu, M., Broadhurst, C., Crtichlow, R., Dadesa, A., Deas, T., Enawgaw, C., Gebremedhin, B., Graham, E., MacLean, S., McKean, M., Collar, N.J. & Spottiswoode, C.N. 2008. Distribution, abundance and habitat preferences of White-tailed Swallow, *Hirundo megaensis* and Ethiopian Bush-crow *Zavattariornis stresemanni*, two southern Ethiopian endemics. *Bird Conservation International* 18: 395-412.
- Mellanby, R.J., Broadhurst, C., Wondafrash, M., Ewnetu, M., Watt, A., Crtichlow, R., Dadesa, A., Deas, T., Enawgaw, C., Gebremedhin, B., Graham, E., MacLean, S., McKean, & Ross, B. *In press*. Perceptions of habitat changes in the Yabelo Sanctuary and surrounding areas. *African Journal of Ecology*.
- Solomon, T., Snyman, H. A. & Smit, G. N. 2007. Rangeland dynamics in southern

Ethiopia: (1) Botanical composition of grasses and soil characteristics in relation to land-use and distance from water in semi-arid Borana rangelands. *Journal of Environmental Management* 85: 429-442.

Syvvertsen, P.O. & Dellelegn, Y. 1991. The status of some bird species endemic to south Ethiopia. *Scopus* 15, 30-34.

Ben Ross^{1,2,*}, Mengistu Wondafrash^{2,3}, Mihiret Ewnetu^{2,4}, Sandy Watt², Celia Broadhurst², Rob Critchlow², Aman Dadesa^{2,5}, Tom Deas², Chere Enawgaw^{2,4}, Berihun Gebremedhin^{2,6}, Eilidh Graham², Sarah Maclean² and Richard J. Mellanby²

¹ *Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW.*

² *Project Yabelo, Institute of Biomedical Sciences, Graham Kerr Building, University of Glasgow, Glasgow, G12 8QQ, U.K.*

³ *Ethiopian Wildlife and Natural History Society, PO Box 13303, Addis Ababa, Ethiopia.*

⁴ *Ministry of Agriculture and Rural Development, Wildlife Conservation Department, PO Box 10-22-98, Addis Ababa, Ethiopia.*

⁵ *Yabelo Wildlife Sanctuary, PO Box 34, Yabelo, Ethiopia.*

⁶ *Institute of Biodiversity and Conservation, Addis Ababa, Ethiopia.*

**E-mail for correspondence: Ben.Ross@snh.gov.uk*

Scopus 29: 1-6, December 2009

Received June 2008