Afring News

An electronic journal published by SAFRING, Animal Demography Unit at the University of Cape Town

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Editor: H. Dieter Oschadleus

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Recommended citation format: Craig AJFK, Hulley PE, Galpin MP, Kuiper T, Smith DL, Wolmarans MHL. 2015. Winter's boon: ringing birds at Eastern Cape *Aloe* patches. Afring News 44: 1-8

URL: http://safring.adu.org.za/content.php?id=14

Published online: 11 August 2015

- ISSN 2222-341X -

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Introduction

Many *Aloe* species in southern Africa flower primarily in winter (Van Wyk & Smith 2003), at a time of year when nectar resources are sparse. Thus they may attract large numbers of nectar-feeding birds of different species (cf. Symes et al. 2008, Engelbrecht et al. 2014). In the Eastern Cape, Malachite Sunbirds *Nectarinia famosa* are often a conspicuous component of the bird activity at patches of flowering aloes, along with weavers (*Ploceus* spp.). We have thus targeted such sites during our winter ringing activities, particularly since they also offer a range of projects for students during the standard South African academic year of February to November.

Study sites and methods

Our study sites all lie north of Grahamstown, in a zone with markedly lower rainfall than the coastal belt. The main vegetation type is described as "Albany broken veld" (Mucina & Rutherford 2006). Rangers on Kwandwe Private Game Reserve, where Mark Galpin was working at the time, had named a track on the crest of a low hill passing through a patch of *Aloe ferox* "Malachite Road" (33°09'S 26°30'E), because of the abundance of Malachite Sunbirds during the winter flowering of the aloes. From 2003-2008 we set mist-nets here each year in June-July, but by 2009 this dense stand of aloes had been effectively destroyed by feeding elephants. In that year we made one ringing trip to a site on the former farm "Brandeston" (33°06'S 26°36'E), now incorporated in Kwandwe. In the same month we also set nets at aloes on the farm "Brakfontein" (33°27'S 26°02'E) just outside the western boundary of Shamwari Private Game Reserve, in the Paterson district. We also have a single sample from the farm "Slaaikraal" (33°17'S 26°26'E) near Grahamstown.

Ringing on Kwandwe was problematic, as access to the site depended on tourist traffic and the availability of reserve staff to provide protection from dangerous animals (e.g. lion, buffalo, elephant). Consequently since 2007 we have focused on a large stand of aloes on the farm "Hounslow" (33°11'S 26°24'E) which lies directly to the west of Kwandwe. This sector of the farm is used for sheep and goats, which have not interfered with the nets. Here point counts of birds and studies of pollination have been done in addition to mist-netting; these results have been described elsewhere (Forbes et al. 2009, Kuiper et al. 2015); here we consider only the ringing data.

We used standard 4-shelf mist-nets in 9 m and 12 m lengths. In 2008 and 2009 at "Hounslow" on each day when point counts were done, we set up two rows of 4 x 12 m nets parallel to the point count areas, designed to serve as a "measured-effort" site. This produced lower catch rates than expected, and in all other years nets were set opportunistically, both singly and in groups, based on the patterns of flowering and the observed bird movements on the day.

Results

"Malachite Road"

A feature of this site was the high proportion (60%) of Malachite Sunbirds in the catch (Appendix 1), while very few birds which did not feed on nectar were captured (7%). There were two notable recaptures of Malachite Sunbirds in June 2007: a bird ringed in June 2005, and one ringed in June 2003. Another Malachite Sunbird

ringed here in June 2005 was recaptured at “Hounslow” (approx. 15 km away) in June 2007. Malachite Road is a rather exposed hillside, with very open grassy areas, which may explain the dearth of typical bush birds. However, in each year no more than two full days were spent on site, so these samples will be unrepresentative of the occurrence of birds over a more extended period.

Four different sites

In Appendix 2 we compare the catches from single visits to three different sites in the same month, and a single visit to a site not far from “Hounslow” and “Brandeston”, but in a different month and year. At all four localities the catch was dominated by nectar-feeding birds, and at three of the sites the occasional or opportunistic nectar feeding species greatly outnumbered the sunbirds. At “Brakfontein” and “Brandeston” there was much denser thicket vegetation, which could account for the greater numbers of white-eyes, which were always uncommon at the “Hounslow” site. Cape White-eyes make up the bulk of our catches in the Grahamstown Botanical Gardens, where they regularly feed on nectar from *Aloe ferox*, *A. africana* and *A. pluridens*. The differences in abundance of Cape Weavers and Spotted-backed Weavers can be easily accounted for by the presence of a single passing flock of a particular species. The lower frequency of Malachite Sunbirds at two sites could be ascribed to the relative density of the vegetation, but without more extensive sampling no firm deductions are possible.

“Hounslow”

At this site, in each year except for 2007, our ringing visits included samples outside the flowering period of the aloes, which normally extends over about 6-8 weeks in June-July. Thus on some occasions we caught only ‘resident’ species, whose presence was unrelated to the availability of nectar. The full list of birds ringed at this site is shown in Appendix 3. In total 52 different species were ringed, with the catch dominated by the occasional nectar feeders (720 birds of 16 species) of which 506 belonged to three species of *Ploceus* weavers. Although we have caught five different sunbird species, 138 of the 152 sunbirds ringed were Malachite Sunbirds. There were also 207 captures of 31 bird species not recorded as feeding on aloe nectar. It is notable that only two species were captured in every year: Cape Weavers *Ploceus capensis*, and Malachite Sunbirds. However, catching effort was significantly lower in 2014. For the mousebirds, there is a striking difference in the capture rate of the two species, with Speckled Mousebirds *Colius striatus* rarely found in the aloes; this is also reflected in the point-count data for this period (Kuiper et al. in press).

Of the birds feeding on nectar, a Malachite Sunbird originally ringed on Kwandwe was recaptured here two years later, as mentioned above. We also recaptured one Malachite Sunbird, two Southern Masked Weavers *Ploceus velatus* and one Red-billed Quelea *Quelea quelea*, one year after ringing. Two weavers provided our longest capture-recapture intervals, 3 years for a Cape Weaver, and 4 years for a Southern Masked Weaver. Other recaptures of six Red-faced Mousebirds *Urocolius indicus*, one Dark-capped Bulbul *Pycnonotus layardi*, one Greater Double-collared Sunbird *Cinnyris afer*, two Malachite Sunbirds, one Spotted-backed Weaver *Ploceus cucullatus* and one Southern Masked Weaver occurred within the same flowering season, i.e. within the same calendar year < 3 months after ringing. Two Cape Weavers ringed at “Hounslow” were recaptured in Grahamstown (straight-line distance 22 km) within two months of ringing, which indicates that they forage widely in winter.

Recaptures of the resident species are listed separately (Table 1). There is a row of sisal plants *Agave mexicana* along the track through the aloe patch, with barbets, woodpeckers and other hole-nesting species in regular attendance, thus it is unsurprising that most recaptures are Acacia Pied Barbets *Tricholaema leucomelas*, which was also the most-ringed species of those not attracted to nectar (Appendix 3). However, the recapture of a Long-billed Crombec *Sylvietta rufescens* nearly 4 years later is of some interest.

It is difficult to compare catches in different months, since our mist-netting has been opportunistic, and we have not attempted to standardise catching sites, numbers of nets or net-hours. However, seven catching sessions in April have produced no Malachite Sunbirds and no *Ploceus* weavers over the years, while seven sessions in May caught just one Malachite Sunbird and 15 weavers. At the other end of the aloe flowering season, four sessions in September yielded six Malachite Sunbirds and two weavers, while during a single October visit in 2009 we captured 18 birds (including two weavers and no sunbirds). So it is clear that these nectar-feeding birds are present in numbers only during the months of June to August, for which the combined totals are 131 Malachite Sunbirds and 443 *Ploceus* weavers.

Discussion

Based on earlier ringing of sunbirds in the Grahamstown Botanical Gardens, two of us had proposed some models for their movements (Craig & Hulley 1994). For the Malachite Sunbird, which we recorded only in winter, we suggested that it might be either a 'nomad', moving opportunistically in search of food, or a 'tourist', following a regular annual schedule which would track the flowering cycle of particular plant species. Our ringing at the aloe patches has provided some evidence that individual sunbirds and weavers do return to the same site in subsequent years, and are probably not present during the period when the aloes are not in flower. Unfortunately with ringers so sparse in the Eastern Cape, we have no information on where these birds may be at other times of year. Thus until we are able to track individual birds throughout the year, we cannot determine which of these two models best describes their annual cycle. The Dusky Sunbird *Cinnyris fuscus* appears to occur in small numbers in the Great Fish River valley region each winter; this arid-country species is sometimes considered nomadic, and is also subject to irruptive movements (Bowie 2005). Greater Double-collared Sunbirds on the other hand appear to be resident, present at low densities throughout the year, without any notable fluctuation in numbers in the Grahamstown area. However, on the coast there is evidence of seasonal passage in this species in some years (Tree 2005, 2013, 2014).

Cape White-eyes, regular visitors to aloes in town, to the extent that many birds undergo a supplementary head moult to replace feathers clogged with nectar and pollen (Craig & Hulley 1996), are rare at the out-of-town aloe patches that we have visited (Appendix 3). Only one Amethyst Sunbird, the most numerous species in town and often seen feeding at aloes in gardens, was captured at any of these sites, although occasional birds were sighted. We have also recorded Southern Double-collared Sunbirds infrequently, except for the year 2005 at "Malachite Road" (Appendix 1). For both of these sunbird species, regular passage of birds has been recorded on the coast (Tree 2005, 2013, 2014) whereas we have not seen any evidence of such movements inland.

Earlier pollination studies of *Aloe ferox* (Hoffmann 1988, Botes et al. 2009) have confirmed that this aloe is bird pollinated, and that it is the occasional nectarivores such as the weavers which are the important pollinators. Student projects at "Hounslow" have shown clearly that while weavers carry heavy pollen loads, the Malachite Sunbirds with their longer bills can take nectar without picking up any significant amounts of pollen, and are effectively "nectar robbers" for this plant.

Acknowledgements

We thank Brian Olver and the other rangers then at Kwandwe Private Game Reserve for their assistance at sites in the reserve, Gay Papenfus for access to "Brakfontein" and Trevor Hoole for access to the "Slaaikraal" site. Our special thanks to John and Robert Dell for unrestricted access to "Hounslow" farm over the past eight years. We also thank Bo Bonnevie, Ross Forbes, Tim Hulley, Sara Jones, Daniel Danckwerts, and Dan Parker for assistance in the field. This project has been funded over the years by the National Research Foundation, and by Rhodes University.

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Table 1. Recaptures of probable resident species at "Hounslow".

Species	No. recaptured	Interval (months)
Red-throated Wryneck	2	2
Acacia Pied Barbet	10	1-27 (5 after > 12 months)
Long-billed Crombec	1	44
Bar-throated Apalis	1	22
Neddicky	3	2-16 (2 after > 12 months)
Grey-backed Cisticola	1	1
Karoo Prinia	1	9

Appendix 1. Numbers of birds ringed at "Malachite Road", Kwandwe Private Game Reserve

Species	2003	2004	2005	2006	2007	2008	Total
Occasional nectar feeders							
Red-faced Mousebird *Urocolius indicus*	2	2		1	4	5	14
Fork-tailed Drongo *Dicrurus adsimilis*					1		1
Dark-capped Bulbul *Pycnonotus tricolor*			2				2
Red-billed Quelea *Quelea quelea*			2				2
Cape Weaver *Ploceus capensis*	19		16	1	1	4	41
Spotted-backed Weaver *Ploceus cucullatus*			3				3
Streaky-headed Seedeater *Crithagra gularis*			2	2		3	7
Nectarivores							
Southern D-collared Sunbird *Cinnyris chalybeus*	1		10		2		13
Greater D-collared Sunbird *Cinnyris afer*	1		1		2		4
Dusky Sunbird *Cinnyris fuscus*	2						2
Malachite Sunbird *Nectarinia famosa*	52	12	50	13	25	13	165
Others							
Acacia Pied Barbet *Tricholaema leucomelas*					1	4	5
Karoo Scrub-robin *Erythropygia coryphoeus*			2	2			4
Grey-backed Cisticola *Cisticola subruficapilla*	1		1	2			4
Fiscal Shrike *Lanius collaris*			1			1	2
Cape Bunting *Emberiza capensis*			1				1
Golden-breasted Bunting *Emberiza flaviventris*				1	2		3
Total	78	14	91	22	38	30	273

Appendix 2. Single catches from four different sites.

Species	Brakfontein July 2009	Brandeston July 2009	Hounslow July 2009	Slaaikraal May 2007
Occasional nectar feeders				
Speckled Mousebird *Colius striatus*	1	1	1	
Red-faced Mousebird *Urocolius indicus*			8	
Black-headed Oriole *Oriolus larvatus*	1			
Dark-capped Bulbul *Pycnonotus tricolor*		11	9	1
Cape White-eye *Zosterops virens*	9	18	2	1
Pied Starling *Lamprotornis bicolor*			1	
Red-winged Starling *Onychognathus morio*			1	
Cape Weaver *Ploceus capensis*	5		26	37
Spotted-backed Weaver *Ploceus cucullatus*		25	4	1
Southern Masked Weaver *Ploceus velatus*	1	5	2	
Streaky-headed Seedeater *Crithagra gularis*	4	14	1	
Nectarivores				
Southern D-collared Sunbird *Cinnyris chalybeus*		7		
Greater D-collared Sunbird *Cinnyris afer*	11	6	2	2
Malachite Sunbird *Nectarinia famosa*	2	14	11	8
Others				
Acacia Pied Barbet	1			
Red-fronted Tinkerbarbet *Pogoniulus pusillus*	1			
Cape Robin *Cossypha caffra*				1
Sombre Greenbul *Andropadus importunus*	2	1	1	
Bar-throated Apalis *Apalis thoracica*				1
Neddicky *Cisticola fulvicapilla*	1		1	1
Grey-backed Cisticola *Cisticola subruficapilla*			1	
Chinspot Batis *Batis molitor*				1
Cape Sparrow *Passer melanurus*			1	
Blue-billed Firefinch *Lagonosticta rubricata*			1	
Total	39	102	73	54

Appendix 3. Birds ringed at the "Hounslow" aloe patch each year to date; n = number of ringing visits.

Species	2007 n = 3	2008 n = 10	2009 n = 8	2010 n = 6	2011 n = 7	2012 n = 7	2013 n = 9	2014 n = 7	**Total**
	Occasional nectar feeders								
Speckled Mousebird *Colius striatus*			1	3		1	2	1	8
Red-faced Mousebird *Urocolius indicus*		28	27	12	2	8	11		88
Fork-tailed Drongo *Dicrurus adsimilis*						1			1
Cape Rock Thrush *Monticola rupestris*		1				1			2
Dark-capped Bulbul *Pycnonotus tricolor*	1	9	9		7	7	2		35
Karoo Prinia *Prinia maculosa*	1	2	1	2		4	4		14
Cape White-eye *Zosterops virens*			4		2		2		8
Pied Starling *Lamprotornis bicolor*	2		1						3
Cape Glossy Starling *Lamprotornis nitens*					1		2	3	6
Red-winged Starling *Onychognathus morio*			1			1	1		3
Yellow-throated Petronia *Gymnoris superciliaris*	1	2							3
Red-billed Quelea *Quelea quelea*	4	1	3	3	1	1			13
Cape Weaver *Ploceus capensis*	27	51	50	9	35	11	61	16	260
Spotted-backed Weaver *Ploceus cucullatus*	56	40	41	19	16	3	10		185
Southern Masked Weaver *Ploceus velatus*	4	13	6	2	6	30	16		77
Streaky-headed Seedeater *Crithagra gularis*	5	8	12	1		3	5		34
	True nectarivores								
Southern D-c Sunbird *Cinnyris chalybeus*	1	1	1				1	1	5
Greater D-c Sunbird *Cinnyris afer*			5			1	2	6	14
Dusky Sunbird *Cinnyris fuscus*			1						1
Amethyst Sunbird *Chalcomitra amethystina*							1		1
Malachite Sunbird *Nectarinia famosa*	19	12	23	24	18	13	29	7	145

Other Species	2007 n = 3	2008 n = 10	2009 n = 8	2010 n = 6	2011 n = 7	2012 n = 7	2013 n = 9	2014 n = 7	**Total**
Cape Turtle Dove *Streptopelia capicola*		1		1		1	1	1	5
Laughing Dove *Streptopelia senegalensis*		4	2		1	3	7	2	19
Crowned Hornbill *Tockus alboterminatus*						1			1
Red-throated Wryneck *Jynx ruficollis*		2			2	3			7
Acacia Pied Barbet *Tricholaema leucomelas*		10	3	1	5	9	8	3	39
Black-collared Barbet *Lybius torquatus*						1			1
Greater Honeyguide *Indicator indicator*							1		1
Lesser Honeyguide *Indicator minor*			1				1		2
Cape Robin *Cossypha caffra*			2				1	1	4
Karoo Scrub-robin *Erythropygia coryphoeus*	1		1			2	4	2	10
White-browed Scrub-robin *Erythropygia leucophrys*		3					2		5
Familiar Chat *Cercomela familiaris*			2			2			4
Cape Penduline Tit *Anthoscopus minutus*			2						2
Southern Black Tit *Parus niger*						1	1		2
Sombre Greenbul *Andropadus importunus*		1	2		3	2	1		9
Barthroated Apalis *Apalis thoracica*		1	2		4	1	2		10
Long-billed Crombec *Sylvietta rufescens*		1	3				1	1	6
Neddicky *Cisticola fulvicapilla*	3	4	4		6	1	4	1	23
Grey-backed Cisticola *Cisticola subruficapilla*	2	1	3						6
Chestnut-vented Titbabbler *Sylvia subcaerulea*			1	1	3	1	2		8
Fiscal Flycatcher *Sigelus silens*	3	2		1	1	10	3		20
Chinspot Batis *Batis molitor*			2						2
Fiscal Shrike *Lanius collaris*						3			3
Bokmakierie *Telophorus zeylonus*								1	1
Southern Tchagra *Tchagra tchagra*					1				1
Grey-headed Bush Shrike *Malaconotus blanchoti*		1							1
House Sparrow *Passer domesticus*							3		3
Southern Grey-h Sparrow *Passer diffusus*		2				3	1		6
Cape Sparrow *Passer melanurus*			2			2	4		8
Blue-billed Firefinch *Lagonosticta rubricata*			1						1
Yellow-fronted Canary *Serinus mozambicus*						8			8
Cape Bunting *Emberiza capensis*						1			1
Total	130	201	219	79	114	140	195	47	1125