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Biometric data for ten species from the families Malaconotidae, Platysteiridae and Laniidae based on museum specimens and ringing data

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Abstract

Biometric data is vital for species identification, taxonomic studies, ageing, and sexing. Museum collections and ringing data sets are important sources of biometric data for birds. We present biometric data for ten species from the families Malaconotidae, Platysteiridae and Laniidae based on 271 museum specimens and 184 ringing records. The species reported on are Bokmakierie, Brown-crowned Tchagra, Crimson-breasted Shrike, Brubru, Cape Batis, Chinspot Batis, Pririt Batis, Magpie Shrike, Southern Fiscal, and Red-backed Shrike. The biometric data were compared between the sexes and to published data.

Keywords: sexual dimorphism, subspecies, citizen science, museum study skins, SAFRING, bird ringing.

Introduction

Biometric data are used for species identification, in taxonomic studies, investigating geographic size variation, ageing and sexing of individuals (Kühl and Burghardt 2013, Rowley et al. 2020). For southern African birds, Hockey et al. (2005) provide the most comprehensive summary of biometric data, but, in many instances, the data are incomplete and don't distinguish between subspecies or the sexes. For some species, no biometric data are reported. Many museums and research institutes hold collections of biological material that can provide valuable biometric data sets for taxonomic and systematic studies (Suarez and Tsutsui 2004). For example, the National Museum, Bloemfontein, has an extensive bird collection (>5,000 skins and >2,000 skeletons; https://nasmus.co.za/ornithology), each with corresponding collection data, e.g., location, date, and biometric data recorded upon collection. Additional biometric data are available from regional ringing initiatives using trained citizen scientists, such as southern Africa's SAFRING (de Beer et al. 2000). Rose et al. (2020) summarised biometric data from the SAFRING database, highlighting the importance of recording complete and accurate biometric information. Although Rose et al. (2020) reported sex-specific differences in species for which sufficient data were available, the authors did not distinguish between subspecies in their analyses. Comparisons of biometric data for subspecies and the sexes have been completed using regional ringing data, e.g., Karoo Prinia *Prinia maculosa* (de Swardt et al. 2018) and Namibian passerines (Paijmans and Bryson 2023), museum skins, e.g., Sabota Lark *Calendulauda sabota* (Marr et al. 2017), and combining museum and ringing data, e.g., Malachite Sunbirds *Nectarinia famosa*, Karoo Prinia, Drakensberg Prinia *Prinia hypoxantha*, and African Rock Pipit *Anthus crenatus* (de Swardt et al. 2003, de Swardt et al. 2018, de Swardt 2022). In this paper, we summarise selected biometric data for four species in the family Malaconotidae, three in the Platysteiridae, and three in the Laniidae based on specimens from the ornithology collection of the National Museum, Bloemfontein, and ringing data.

Methods

Representatives of the family Laniidae (Southern Fiscal *Lanius collaris*, Red-backed Shrike *Lanius collurio*, and Magpie Shrike *Lanius melanoleucus*), the Malaconotidae (Crimson-breasted Shrike *Laniarius atrococcineus*, Brubru *Nilaus afer*, Brown-crowned Tchagra *Tchagra australis*, and Bokmakierie *Telophorus zeylonus*, and the Platysteiridae (Cape Batis *Batis capensis*, Chinspot Batis *Batis molitor*, and Pririt Batis *Batis pririt*) were selected for this study. Ringing surveys by DHDS from 1987 to 2023 were conducted at sites in the Free State, Northern Cape, Mpumalanga, and KwaZulu-Natal provinces as part of National Museum, Bloemfontein, research projects. Data were recorded as described by de Beer et al. (2000) and included culmen and tarsus lengths (± 0.1 mm) using Vernier callipers, wing and tail lengths (± 1 mm) using graduated rulers, and mass (± 0.1 g) using spring and electronic balances. Individuals were sexed in hand, where possible, based on size and plumage differences.

Two data sets were available for the museum specimens: dry skins collected pre-1995 and dry skins and skeletons prepared from fresh material post-1995 by DHDS. For the pre-1995 dry skins, hereafter Dry specimens, the mass as given on the collection card was used and the culmen, wing and tail lengths were taken following Eck et al. (2011). Tarsus measurements were excluded due to difficulty measuring the tarsus in study skins and shrinkage as the skins dry out (Kuczyński et al. 2002). For the specimens prepared from fresh material post-1995 (hereafter Fresh specimens), the sex, culmen, tarsus, wing, and tail lengths and mass were recorded for each specimen upon collection. For monomorphic species, e.g., tchagras, the bird was sexed during the preparation of the skin or skeletal specimens. Following the recommendation of Kuczyński et al. (2002), all measurements were recorded by one researcher (DHDS). For the statistical analyses, the post-1995 museum data were combined with the ringing data and analysed as Fresh specimens.

All statistical analyses were done using the R statistical software (R Development Core Team 2023).

Table 1. Sample sizes for biometric data obtained from selected species in the families Malaconotidae, Platysteiridae, and Laniidae, obtained from skin and skeleton specimens from the collection of the Ornithology Department, National Museum, Bloemfontein, and SAFRING data collected by DHDS from 1987 to 2023.

Species	Museum						Ringing		Combined		
	Dry		Fresh		Total		Fresh		F	M	Total
	F	M	F	M	F	M	F	M			
Malaconotidae											
Bokmakierie	4	10	7	10	11	20			11	20	31
Brown-crowned Tchagra	6	6	7	21	13	27			13	27	40
Brubru	1	4	3	18	4	22			4	22	26
Crimson-breasted Shrike		6	1	10	1	16		2	1	18	19
Platysteiridae											
Cape Batis	5	2	1	4	6	6	12	7	18	13	31
Chinspot Batis	1	2	2	5	3	7		1	3	8	11
Pririt Batis	4	8	31	30	35	38	20	20	55	58	113
Laniidae											
Magpie Shrike	6	7	4	6	10	13	1		11	13	24
Red-backed Shrike	1	2	2	3	3	5	8	5	11	10	21
Southern Fiscal	12	25	4	6	16	31	55	53	71	84	155
	40	72	62	113	102	185	96	88	198	273	471

Statistical significance was determined at $p < 0.05$. The Shapiro-Wilk test was used to evaluate the normality of the data (shapiro.test). Differences in biometric parameters between the sexes were analysed using Analysis of Variance for normal data (aov) and the Kruskal-Wallis test for non-parametric data (kruskal.test). The data for Fresh and Dry specimens were analysed separately, but the respective biometric parameters' ranges were compared to those for Fresh male specimens.

Results and Discussion

Biometric data for the four species in the Malaconotidae, three in the Platysteiridae, and three in the Laniidae included in this study were obtained from 287 museum specimens, 112 Dry and 175 Fresh specimens, and 184 ringed birds (Table 1). The sex of the specimens was strongly biased towards males for the museum specimens, while the ringing data was marginally biased towards females (Table 1). Recording of the five biometric parameters varied; only 44% of the records contained all five parameters, while only one parameter was missing for a further 21%. Mass was recorded for 95% of the records, wing length for 86%, tail length for 76%, culmen length for 67%, and tarsus length for 47%.

Malaconotidae

Bokmakierie *Telophorus zeylonus zeylonus*

Biometric data for 17 Fresh and 14 Dry specimens of *T. z. zeylonus* are summarised in Tables 2a.1 and 2b.1, respectively. The wing lengths of Fresh male specimens were significantly longer than the Fresh females (Table 2a.1). No significant differences were found between the sexes for the Dry samples (Table 2b.1). The minimum wing length for the Dry males and female and Fresh females were outside the range of the Fresh males. Similarly, the minimum tarsus length of the Dry females, maximum tarsus length of the Fresh females, minimum tail length of the Dry males, maximum length of the Fresh females, and maximum mass of the Dry males all exceeded the respective ranges of the Fresh males.

The biometrics reported here are within the ranges and mean values of Oatley (2005) and Rose et al. (2020), although our maximum tail length is longer. The mean body mass of the Namibian subspecies *T. z. thermophiles* (Paijmans and Bryson 2023) is lower than reported here for both sexes. Similarly, the culmen lengths for the Namibian subspecies are also longer than reported here (Paijmans and Bryson 2023), but differences may be due to the skull line measurement being used for the Namibian study.

Brown-crowned Tchagra *Tchagra australis damarensis*

Biometric data for 28 Fresh and 12 Dry specimens of *Tchagra australis damarensis* are summarised in Tables 2a.2 and 2b.2, respectively. We followed the classification of Bowie (2005a) and Fry (2009). Dry specimen males have significantly longer culmen lengths than Dry females (Table 2b.2). The sample size for the Fresh males was three times greater than those for the Dry specimen males and both female groups, which might have influenced the results. The maximum tail length of the Fresh females exceeded that of the Fresh males.

The culmen, wing and tarsus lengths and the masses reported here are within the ranges of Bowie (2005a) and Rose et al. (2020); however, Bowie (2005a) reported unsexed biometric data for most of the biometric parameters. The mean tail lengths were longer than those of Bowie (2005a) and Rose et al. (2020) but similar to those of Paijmans and Bryson (2023). However, Namibian birds' body masses were lower than reported here (Paijmans and Bryson 2023).

Brubru *Nilaus afer brubru*

Biometric data for 21 Fresh and 5 Dry *Nilaus afer brubru* specimens are summarised in Tables 2a.3 and 2b.3, respectively. Only the mass for the Fresh male specimens was significantly larger than that of the females (Table 2a.3); however, there were only three Fresh female specimens (for one of which only mass was recorded) and 18 Fresh male specimens (Table 2a.3). There were insufficient specimens for statistical analyses to be conducted for the Dry specimens (Table 2b.3). The minimum mass and minimum tarsus length for the Fresh females and the maximum tail length and maximum mass for the Dry males exceeded the range established by the Fresh males.

The wing lengths and masses were similar to those given by Bowie (2005b), Rose et al. (2020), and Paijmans and Bryson (2023). The remaining parameters were within the ranges presented by Bowie (2005b). The mean tail lengths of males and females were longer than those of Rose et al. (2020), although our sample size for females was low. The culmen

Table 2a. Summary statistics of biometric data for selected species in the Malaconotidae based on SAFRING data collected by DHDS from 1987 to 2023 and samples curated after 1995 by DHDS at the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except in cases where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by "KW" besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

1. Bokmakierie *Telephorus zeylonus zeylonus*												
	F (n = 7)					M (n = 10)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	6	23.2 ± 0.9	22.9	22.2	24.7	9	22.4 ± 2.4	21.9	19.5	26.3	0.489	
Tarsus	5	33.6 ± 2.5	32.5	30.8	37.0	7	33.1 ± 1.6	33.0	30.5	35.5	0.637	
Wing	7	97.4 ± 2.7	97.0	95.0	101.0	10	100.9 ± 3.3	100.5	97.0	107.0	**0.037**	
Tail	7	102.3 ± 9.5	100.0	88.0	118.0	9	100.1 ± 7.4	100.0	88.0	115.0	0.615	
Mass	4	66.8 ± 6.2	67.8	59.7	72.0	8	63.3 ± 7.6	64.8	47.4	72.5	0.447	
2. Brown-crowned Tchagra *Tchagra australis damarensis*												
	F (n = 7)					M (n = 21)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	6	17.3 ± 0.9	17.1	16.5	18.9	20	17.9 ± 1.3	18.1	15.1	20.1	0.222	
Tarsus	4	26.4 ± 0.3	26.3	26.2	26.8	15	25.9 ± 0.7	25.9	24.4	27.3	0.428	
Wing	6	77.2 ± 1.8	77.0	75.0	80.0	20	77.0 ± 3.1	77.5	72.0	83.0	0.910	
Tail	5	101.4 ± 6.7	100.0	95.0	112.0	20	96.2 ± 5.6	96.5	84.0	110.0	0.093	
Mass	7	36.6 ± 2.7	36.0	33.1	40.0	21	35.8 ± 4.5	36.1	25.0	43.0	0.727	
3. Brubru *Nilaus afer brubru*												
	F (n = 3)					M (n = 18)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	2	14.9 ± 0.1	14.9	14.8	14.9	16	15.2 ± 1.3	15.1	12.1	16.9	0.763	
Tarsus	2	21.7 ± 0.6	21.7	21.3	22.1	11	22.5 ± 0.4	22.6	21.5	22.9	0.057	KW
Wing	2	85.5 ± 2.1	85.5	84.0	87.0	18	85.2 ± 2.9	85.0	78.0	90.0	0.876	
Tail	2	57.5 ± 0.7	57.5	57.0	58.0	17	58.3 ± 2.5	59.0	54.0	62.0	0.667	
Mass	3	21.9 ± 1.8	22.3	20.0	23.5	18	25.2 ± 1.8	25.0	21.2	29.4	**0.008**	
4. Crimson-breasted Shrike *Laniarius atrococcoineus*												
	F (n = 1)					M (n = 11)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	1	20.0	20.0	20.0	20.0	9	20.8 ± 1.3	20.9	18.2	23.3	#	
Tarsus	1	31.1	31.1	31.1	31.1	8	32.9 ± 2.7	32.5	30.3	39.0	#	
Wing	1	94.0	94.0	94.0	94.0	11	99.2 ± 3.3	100.0	93.0	104.0	#	
Tail	1	98.0	98.0	98.0	98.0	10	101.1 ± 2.7	100.0	98.0	107.0	#	KW
Mass	1	42.0	42.0	42.0	42.0	11	47.4 ± 3.4	47.0	41.6	53.3	#	

Table 2b. Summary statistics of biometric data for selected species in the Malaconotidae based on museum skin specimens collected pre-1995 (Dry specimens) and held in the ornithological collection of the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by "KW" besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

1. Bokmakierie *Telephorus zeylonus zeylonus*												
	F (n = 4)					M (n = 10)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	3	22.4 ± 1.4	23.2	20.8	23.2	4	21.9 ± 1.1	21.6	21.1	23.4	0.631	
Tarsus	3	31.2 ± 1.6	30.8	29.8	32.9	5	32.7 ± 1.3	32.5	31.2	34.0	0.437	
Wing	3	96.0 ± 3.6	95.0	93.0	100.0	6	98.2 ± 2.0	98.5	96.0	100.0	**0.275**	
Tail	3	96.7 ± 5.7	95.0	92.0	103.0	6	97.3 ± 8.8	96.5	87.0	112.0	0.909	
Mass	3	64.2 ± 4.2	65.0	59.7	68.0	10	69.4 ± 10.3	69.7	54.5	84.0	0.429	
2. Brown-crowned Tchagra *Tchagra australis damarensis*												
	F (n = 6)					M (n = 6)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	5	16.7 ± 1.1	16.7	15.3	17.9	4	18.5 ± 0.8	18.2	17.8	19.6	**0.038**	
Tarsus	4	27.0 ± 2.6	26.6	24.8	30.0	3	25.6 ± 1.2	25.1	24.7	26.9	0.882	KW
Wing	5	76.0 ± 1.9	76.0	73.0	78.0	4	76.8 ± 1.7	76.5	75.0	79.0	0.555	
Tail	5	95.2 ± 6.4	95.0	88.0	103.0	4	91.8 ± 4.6	92.5	86.0	96.0	0.397	
Mass	6	35.4 ± 1.8	35.0	33.5	38.5	6	34.9 ± 4.0	35.0	29.5	40.6	0.801	
3. Brubru *Nilaus afer brubru*												
	F (n = 1)					M (n = 4)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen						3	14.7 ± 0.6	14.8	14.1	15.2	#	
Tarsus						1	21.5	21.5	21.5	21.5	#	
Wing						3	87.3 ± 1.5	87.0	86.0	89.0	#	
Tail						3	61 ± 1.7	60.0	60.0	63.0	#	
Mass	1	26.1	26.1	26.1	26.1	4	26.2 ± 3.7	26.5	21.5	30.1	**#**	
4. Crimson-breasted Shrike *Laniarius atrococcoineus*												
	F (n = 0)					M (n = 6)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen						5	21.3 ± 0.8	21.5	20.0	21.9	#	
Tarsus						1	33.1	33.1	33.1	33.1	#	
Wing						5	102.8 ± 4.5	101.0	98.0	110.0	#	
Tail						5	108.6 ± 5.2	110.0	100.0	113.0	#	
Mass						6	52.1 ± 6.7	53.0	40.2	60.0	#	

lengths of Namibian birds are longer than reported here, but this may be due to Paijmans and Bryson (2023) using the skull line measurement.

Crimson-breasted Shrike *Laniarius atrococcineus*
Biometric data for 12 Fresh and 6 Dry *Laniarius atrococcineus* specimens are summarised in Tables 2a.4 and 2b.4, respectively. No statistical comparisons between the sexes were possible because, for females, only one Fresh specimen was measured. The maximum tail length and maximum mass for Dry males exceeded those of Fresh males.

The tarsus, wing, and tail lengths and mass reported here are within the ranges recorded by Bowie (2005c), Rose et al. (2020), and Paijmans and Bryson (2023). However, the mean body mass for males, mainly from Free State Kalahari thornveld, was lower than those of Rose et al. (2020) but similar to Paijmans and Bryson's (2023) value. However,

Table 3a. Summary statistics of biometric data for selected species in the Platysteiridae based on SAFRING data collected by DHDS from 1987 to 2023 and samples curated after 1995 by DHDS at the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except in cases where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by "KW" besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

1. Cape Batis *Batis capensis hollidayi*												
	F (n = 13)					M (n = 11)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	6	11.6 ± 0.7	11.6	10.8	12.6	9	11.9 ± 0.7	11.9	10.8	12.9	0.155	
Tarsus	5	22.0 ± 0.5	21.9	21.6	22.8	7	21.2 ± 1.0	21.1	20.1	23.0	0.881	
Wing	13	64.0 ± 3.4	63.0	58.0	70.0	10	64.7 ± 2.8	65.5	60.0	68.0	0.949	
Tail	8	48.4 ± 4.1	49.0	40.0	53.0	10	51.3 ± 4.7	52.5	45.0	60.0	0.264	
Mass	12	12.3 ± 1.1	12.5	9.9	13.9	9	13.4 ± 1.2	13.5	10.9	14.5	0.046	
2. Chinspot Batis *Batis molitor palliditergum*												
	F (n = 2)					M (n = 6)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	2	12.5 ± 0.1	12.5	12.4	12.5	6	12.6 ± 1	12.5	11.2	14.2	0.884	
Tarsus	2	18.4 ± 0.6	18.4	17.9	18.8	5	18.3 ± 1.1	18.0	16.8	19.8	0.940	
Wing	2	60.0 ± 2.8	60.0	58.0	62.0	6	61.5 ± 1.6	61.0	60.0	64.0	0.369	
Tail	2	48.5 ± 0.7	48.5	48.0	49.0	6	47.3 ± 2.3	47.0	45.0	50.0	0.532	
Mass	2	11.0 ± 1.2	11.0	10.1	11.8	6	11.5 ± 0.8	11.4	10.4	12.5	0.468	
3. Pririt Batis *Batis pririt pririt*												
	F (n = 51)					M (n = 50)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	37	10.4 ± 0.8	10.3	8.3	11.6	39	11.1 ± 0.8	10.9	9.8	12.9	**0.001**	
Tarsus	33	17.7 ± 1.0	17.8	16.2	20.4	28	17.5 ± 1.4	17.5	13.8	21.3	0.648	KW
Wing	46	55.9 ± 1.9	56.0	52.0	65.0	48	56.9 ± 2.4	57.0	48.0	68.0	**0.001**	KW
Tail	41	46.1 ± 2.9	46.0	40.0	55.0	44	46.0 ± 2.8	45.0	40.0	51.0	0.776	KW
Mass	51	9.1 ± 1.2	8.9	6.9	12.5	50	9.1 ± 1	8.9	7.5	12.0	0.788	KW

the culmen lengths of Namibian birds were longer than reported here (Paijmans and Bryson 2023).

Platysteiridae
Cape Batis *Batis capensis hollidayi*
Biometric data for 24 Fresh and 7 Dry *Batis capensis hollidayi* specimens are summarised in Tables 3a.1 and 3b.1, respectively. Only the mass of the Fresh male and female specimens differed significantly (Table 3a.1). There were insufficient Dry male samples for statistical analyses. The following measurements were outside the ranges for the Fresh male specimens: maximum culmen length for the Dry females, minimum tarsus length for the Dry males, and both minimum and maximum wing lengths, minimum tail length and minimum mass for the Fresh females. The data for *B. c. hollidayi* represents newly published biometric data for this subspecies, as Smith (2005a) only listed biometric data of *B. c. capensis*.

Table 3b.Summary statistics of biometric data for selected species in the Platysteiridae based on museum skin specimens collected pre-1995 (Dry specimens) and held in the ornithological collection of the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by "KW" besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

1. Cape Batis *Batis capensis hollidayi*												
	F (n = 5)					M (n = 2)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	2	13.1 ± 0.1	13.1	13.0	13.2	1	11.3	11.3	11.3	11.3	#	
Tarsus	1	23.0	23.0	23.0	23.0	1	19.7	19.7	19.7	19.7	#	
Wing	2	63 ± 2.0	63.0	61.0	65.0	1	67.0	67.0	67.0	67.0	#	
Tail	2	50 ± 0.0	50.0	50.0	50.0	1	51.0	51.0	51.0	51.0	#	
Mass	5	12.4 ± 0.9	12.5	11.1	13.3	2	13.1 ± 1.5	13.2	12.1	14.2	0.410	
2. Chinspot Batis *Batis molitor palliditergum*												
	F (n = 1)					M (n = 2)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	1	12.2	12.2	12.2	12.2						#	
Tarsus											#	
Wing	1	55.0	55.0	55.0	55.0						#	
Tail	1	46.0	46.0	46.0	46.0						#	
Mass	1	9.0	9.0	9.0	9.0	2	11.7 ± 0.9	11.7	10.8	12.6	#	
3. Pririt Batis *Batis pririt pririt*												
	F (n = 4)					M (n = 8)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	4	11.4 ± 0.7	11.7	10.3	11.9	8	11.6 ± 0.8	11.7	10.5	12.8	**0.620**	
Tarsus	1	15.3	15.3	15.3	15.3	3	17.7 ± 0.1	17.8	17.6	17.8	0.157	KW
Wing	4	56 ± 1.8	56.0	54.0	58.0	8	56.5 ± 1.4	57.0	54.0	58.0	0.610	
Tail	4	46.8 ± 4.1	46.0	43.0	52.0	7	47.1 ± 2.9	47.0	42.0	50.0	0.855	
Mass	4	9.4 ± 0.9	9.8	8.0	10.0	7	9.8 ± 1.1	10.0	8.4	11.0	0.539	

The wing and tail lengths reported here were longer than those of Smith (2005a) and Rose et al. (2020), while the culmen lengths were shorter. Smith (2005a) only presented mass data for *B. c. erythrophthalma* from the eastern highlands of Zimbabwe. The mass data of Rose et al. (2020) (for all subspecies) was similar to the values reported here.

Chinspot Batis *Batis molitor palliditergum*

Biometric data for 8 Fresh and 3 Dry *Batis molitor palliditergum* specimens are summarised in Tables 3a.2 and 3b.2, respectively. There were insufficient Dry samples for statistical analyses. No significant differences between the sexes were found for the Fresh specimens (Table 3a.2); however, only two female specimens were included in the analyses. The minimum wing length and minimum mass for the Fresh and Dry female specimens exceeded the range of the Fresh male specimens.

The biometric data reported here for *B. m. palliditergum* are similar to those of Smith (2005b) and Rose et al. (2020). However, Smith (2005b) only reported on *B. m. molitor*, and Rose et al. (2020) did not distinguish between subspecies.

Pririt Batis *Batis pririt pririt*

Biometric data for 101 Fresh and 12 Dry *Batis pririt pririt* specimens are summarised in Tables 3a.3 and 3b.3, respectively. No significant differences were found for the Dry specimens (Table 3b.3). The culmen length and wing length of the Fresh males were significantly larger than those of the Fresh females (Table 3b.3). The maximum tail length of both the Fresh and Dry female specimens and the minimum and maximum mass for the Fresh female specimens exceeded the range of the Fresh male specimens.

Tarsus, wing and tail lengths of *B. p. pririt* in this study were similar to those of Spottiswoode (2005) and Rose et al. (2020), but the culmen lengths were shorter than those of Spottiswoode (2005). The Namibian subspecies *B. p. affinis* have similar ranges for all biometrics except mass, which was lower than reported here for *B. p. pririt* (Paijmans and Bryson 2023).

Laniidae

Southern Fiscal *Lanius collaris* (mixed subspecies *L. c. collaris* and *L. c. subcoronatus*)

Biometric data for 118 Fresh and 37 Dry *Lanius collaris* specimens are summarised in Tables 4a.1 and 4b.1, respectively. The data set was not recorded on the subspecies level because Fuchs et al. (2011) found extensive gene flow among southern African populations and limited molecular divergence between *L. collaris* subspecies characterised by eyebrow markings. The white eyebrow is a phenotypic adaptation for foraging in arid environments (Fuchs et al. 2011). Significant differences between the sexes were found in wing length for both the Dry and Fresh specimens (Tables 4a.1 and 4b.1). In addition, significant differences were found in mass for the Fresh specimens (Table 4a.1) and tail length for the Dry specimens (Table 4b.1). The minimum culmen length of the females and Dry males exceeded the range of the Fresh male specimens (Tables 4a.1 and 4b.1).

The wing and tail lengths and masses reported here have similar ranges and means to those of Rose et al. (2020). Dean (2005a) did not report means for wing, tail, tarsus, and culmen lengths but reported mass data for both sexes lower than those reported here. Biometric data for the Namibian subspecies *L. c. aridicolus* reported similar ranges for all parameters except the masses, which were also lower than those reported here (Paijmans and Bryson, 2023).

Red-backed Shrike *Lanius collurio*

Biometric data for 18 Fresh and 3 Dry *Lanius collurio* specimens are summarised in Tables 4a.2 and 4b.2, respectively. No statistical comparisons were possible for the Dry specimens due to the low sample numbers (Table 4b.2). No significant differences between the sexes were found for the Fresh specimens (Table 4a.2). Only the minimum tail length for the Dry male specimens exceeded the range for the Fresh males.

Herremans (2005) listed biometric data for mixed Palaearctic subspecies of *Lanius collurio* similar to those in this study. The wing and tail lengths and mass reported here fall within the range of values reported by Rose et al. (2020) and Paijmans and Bryson (2023).

Magpie Shrike *Lanius melanoleucus melanoleucus*

Biometric data for 11 Fresh and 13 Dry *Lanius melanoleucus melanoleucus* specimens are summarised in Tables 4a.3 and 4b.3, respectively. No significant differences were recorded between biometric data for the Fresh males and females (Table 4a.2), but the culmen lengths for the Dry specimens were significantly different (Table 4b.2). The following parameters exceeded the

Table 4a. Summary statistics of biometric data for selected species in the Laniidae based on SAFRING data collected by DHDS from 1987 to 2023 and samples curated after 1995 by DHDS at the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except in cases where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by “KW” besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

	F					M					p	Test
1. Southern Fiscal *Lanius collaris* (mixed subspecies *L. c. collaris* and *L. c. subcoronatus*)												
	F (n = 59)					M (n = 59)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	34	16.1 ± 1.8	15.8	13.3	20.3	37	16.7 ± 1.2	16.5	15.1	20.5	0.137	
Tarsus	24	26.1 ± 2.3	25.8	22.2	31.0	26	27.4 ± 2.2	27.3	22.1	31.5	0.078	
Wing	57	97.2 ± 2.6	98.0	89.0	103.0	64	100.2 ± 5.7	99.0	88.0	130.0	**< 0.001**	KW
Tail	44	109.5 ± 6.6	110.0	91.0	121.0	52	111.5 ± 10.9	112.0	77.0	130.0	0.109	KW
Mass	57	41.6 ± 4.8	41.5	30.2	60.0	64	43.9 ± 4.5	43.5	30.0	55.5	**0.001**	KW
2. Red-backed Shrike *Lanius collurio*												
	F (n = 10)					M (n = 8)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	6	14.3 ± 1.1	14.7	12.3	15.3	6	14.5 ± 1.8	13.9	13.0	17.8	0.808	
Tarsus	4	22.5 ± 6.3	23.9	13.8	28.5	5	23.3 ± 2.1	22.3	22.1	27.0	0.796	
Wing	10	91.3 ± 3.2	90.5	87.0	96.0	8	90.0 ± 3.3	89.0	86.0	95.0	0.428	
Tail	6	77.0 ± 2.8	78.0	72.0	80.0	6	76.7 ± 3.2	76.5	72.0	82.0	0.851	
Mass	10	27.3 ± 2.3	28.5	23.0	29.1	8	28.7 ± 2.2	29.1	25.5	31.0	0.206	
3. Magpie Shrike *Lanius melanoleucus melanoleucus*												
	F (n = 5)					M (n = 6)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	4	19.6 ± 0.4	19.7	19.1	20.0	6	19.1 ± 2	19.2	16.1	21.2	0.617	
Tarsus	3	33.7 ± 2.0	33.1	32.1	35.9	5	35.3 ± 1.6	35.4	33.2	36.8	0.251	
Wing	5	135.4 ± 2.6	136.0	132.0	139.0	6	138.7 ± 3.2	140.0	133.0	142.0	0.101	
Tail	4	269.0 ± 20.0	272.5	245.0	286.0	5	280.4 ± 33.9	293.0	220.0	300.0	0.142	KW
Mass	5	84.8 ± 8.0	83.0	76.0	98.0	6	95.3 ± 8.2	95.0	83.4	106.2	0.062	

range of the Fresh male specimens: minimum tarsus length for both Fresh and Dry females, minimum wing length for Fresh females and Dry males, minimum tail length for Dry females, maximum tail length for both Dry males and females, minimum mass for Fresh females, and maximum mass for Dry females.

The tail lengths found in the study were considerably shorter than the >340.0 mm maximum tail lengths reported by Dean (2005b). Wing and tail biometrics were within the ranges reported by Dean (2005b) and Rose et al. (2020), although higher mean body masses are recorded for males and females here. Dean (2005b) listed unsexed data for culmen and tarsus lengths.

Conclusions

This paper demonstrates the use of museum and ringing data to generate biometric data comparable to those of other studies. The study emphasises the importance of compiling comprehensive biometric data for birds ringed or sacrificed for museum collections. We concur with Rose et al. (2020) that a ringed or sacrificed “bird

Table 4b. Summary statistics of biometric data for selected species in the Laniidae based on museum skin specimens collected pre-1995 (Dry specimens) and held in the ornithological collection of the National Museum, Bloemfontein. Sex-based differences in the biometric data were evaluated using Analysis of Variance except where the data were not normally distributed, in which case the Kruskal-Wallis test was used (indicated by “KW” besides the p-value). The p-values in bold indicate significant differences in biometric parameters between the sexes. Where statistical analyses were not possible due to insufficient sample numbers, the p-value is replaced with #.

1. Southern Fiscal *Lanius collaris* (mixed subspecies *L. c. collaris* and *L. c. subcoronatus*)												
	F (n = 12)					M (n = 25)					p	Test
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	5	14.6 ± 1.0	15.2	13.1	15.4	6	15.8 ± 0.6	15.7	14.9	16.8	0.048	
Tarsus	1	26.2	26.2	26.2	26.2						#	
Wing	5	95.6 ± 4.7	97.0	89.0	101.0	6	101.3 ± 3.2	100.0	98.0	107.0	**0.039**	KW
Tail	5	105.2 ± 4.5	103.0	100.0	110.0	6	111.5 ± 2.9	110.5	108.0	115.0	**0.021**	KW
Mass	12	41.6 ± 6.2	40.0	34.7	52.0	25	40.7 ± 6.1	40.9	27.2	50.0	0.676	KW
2. Red-backed Shrike *Lanius collurio*												
	F (n = 1)					M (n = 2)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	1	13.8	13.8	13.8	13.8	2	15.1 ± 0.1	15.1	15.0	15.1	#	
Tarsus						2	26.2 ± 1.2	26.2	25.3	27.0	#	
Wing	1	90.0	90.0	90.0	90.0	2	91.0 ± 1.4	91.0	90.0	92.0	#	
Tail	1	75.0	75.0	75.0	75.0	2	74.0 ± 8.5	74.0	68.0	80.0	#	
Mass						2	31.9 ± 4.5	31.9	28.7	35.0	#	
3. Magpie Shrike *Lanius melanoleucus melanoleucus*												
	F (n = 6)					M (n = 7)						
	n	mean ± SD	median	min	max	n	mean ± SD	median	min	max		
Culmen	3	18.7 ± 0.8	19.1	17.8	19.1	5	20.1 ± 0.6	20.0	19.2	20.8	**0.029**	
Tarsus	3	34.2 ± 1.4	34.8	32.6	35.1	4	35.4 ± 0.8	35.5	34.5	36.1	0.196	
Wing	3	137.7 ± 1.5	138.0	136.0	139.0	5	134.4 ± 5.6	135.0	125.0	140.0	0.294	KW
Tail	3	271.3 ± 53.8	285.0	212.0	317.0	5	293.6 ± 9.5	295.0	283.0	305.0	0.764	KW
Mass	6	100.2 ± 14.8	95.5	85.0	125.0	7	95.7 ± 4.1	95.5	89.0	102.0	0.886	KW

with no associated data has limited scientific use”, highlighting the responsibility of researchers and bird ringers to record all reasonable biometric parameters as comprehensively and as accurately as possible.

Even though there are very low sample numbers for some of the species included in this study, the data presented represents the first published biometric data records for several subspecies in the Malaconotidae, Platysteiridae, and Laniidae. The biometric data for these subspecies could be improved by including specimens from other museum collections and incorporating ringing data from other bird ringers operating in the study area. The data could be supplemented with SAFRING data if the sex of the bird is specified in the biometric data and a subspecies can be confidently assigned to the record.

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