

# THE MOUNTAIN PIPIT *ANTHUS HOESCHI*: MUSEUM SPECIMENS REVISITED

A.J.F.K. CRAIG

*Department of Zoology & Entomology, Rhodes University, Grahamstown 6140, South Africa*  
*email: A.Craig@ru.ac.za*

**C**raig, A.J.F.K. 2015. The Mountain Pipit *Anthus hoeschi*: museum specimens revisited. *Durban Natural Science Museum Novitates* 38: 28-40. The current name for the Mountain Pipit, which breeds in summer in the high Drakensberg of South Africa and Lesotho, is *Anthus hoeschi* (type specimen from Namibia), with the taxa *editus* (Lesotho) and *lwenarum* (Zambia) as synonyms. Critical examination of the museum material on which this decision was based, comparing measurements and plumage characteristics of these taxa, suggests that *Anthus editus* should be the name used for this breeding population and it should not be lumped with Namibian and Zambian birds. The proposed long-distance migration to the north-west beyond the borders of South Africa is not supported by the available data and it is likely that the Mountain Pipit is a local altitudinal migrant.

KEYWORDS: Mountain Pipit, *Anthus hoeschi*, *editus*, *lwenarum*, moult, morphology, taxonomy, museum specimens.

## INTRODUCTION

The Mountain Pipit *Anthus hoeschi* has been recognised as a species separate from the Grassveld (now African) Pipit *A. cinnamomeus* for some 30 years (Clancey 1984). The decision to treat as conspecific the taxa *A. c. editus* from Lesotho (Vincent 1951), *A. c. lwenarum* from Zambia (White 1946) and *A. hoeschi* from Namibia (Stresemann 1938) led Clancey (1984) to the conclusion that the birds breeding at high altitude in the Drakensberg in summer migrate to the north-west, wintering in Namibia, south-western Zambia and perhaps adjoining regions (c.f. Fig. 1). Although Johnson & Maclean (1994) referred to *hoeschi* as “a known long-distance migrant” they produced no evidence for this claim. Yet this assumption is gradually starting to appear as a simple statement of fact in both field-guides (e.g. Sinclair & Ryan 2003) and major handbooks (e.g. Keith *et al.* 1992, Tyler 2004), so that many people will be unaware that there is no direct evidence of such a migration and that this interpretation depends entirely on a taxonomic opinion based on museum specimens collected many years apart. Fortunately the texts by Hockey *et al.* (2005), Peacock (2012) and Taylor *et al.* (2015) are more cautious, emphasizing our lack of knowledge of the birds in the non-breeding season.

Vincent originally consulted Clancey before describing the pipits breeding at high altitude in Lesotho as a distinctive race of what was then considered Richard's Pipit *richardi* (Vincent 1951) and Clancey later suggested that a bird collected in the KwaZulu-Natal midlands in winter represented this taxon, thus indicating altitudinal migration to the east of the breeding range (Clancey & Holliday 1952). While Clancey had examined material of the taxa *editus* and *lwenarum* from the Natural History Museum (Tring, UK), the type material of *hoeschi* was then in East Berlin and not readily accessible. Through Dr H.E. Wolters in Bonn, he was sent measurements and black-and-white photographs of these two specimens (Clancey 1978). Although both Hall (1961) and White (1957) had seen and commented on the type specimen of *hoeschi*, it would appear that Wolters was the last person to examine the type material, in 1977. Thus it seemed important to re-examine the original specimens in relation to the taxonomic conclusions.

Voelker (1999a, b) reviewed the phylogeny of the genus *Anthus*, and collected material in South Africa for DNA studies. However, he did not sample tissues from existing museum material. He concluded that *hoeschi*, based on two specimens from a locality “90 km N and 50 km E of Umtata” (Voelker 1999a p. 86) was genetically distinct from the lowland *cinnamomeus*. In his phylogeny, *hoeschi* was shown as the sister taxon of the Striped Pipit *A. lineiventris* and African Rock Pipit *A. crenatus*, with the Himalayan species *A. sylvanus* basal to this clade (Voelker 1999a, b). However, this grouping has been questioned in the light of the close similarity in morphology and biology of *hoeschi* (as currently defined) and *cinnamomeus* (Davies & Peacock 2014). Pipit identification in the field has been greatly stimulated by two publications by Peacock (2006, 2012). Nevertheless with this group one should be cautious in drawing conclusions; two recently-described pipit species, the Kimberley Pipit *A. pseudosimilis* (Liversidge & Voelcker 2002) and the Long-tailed Pipit *A. longicaudatus* (Liversidge 1996) have failed to withstand critical scrutiny (Davies & Peacock 2014). This has also cast doubt on the identity of some of the specimens included in the molecular studies.

The present paper will attempt to re-assess the evidence, on the basis of the morphology and plumage characteristics, of the museum specimens which have been assigned to the taxa *editus*, *hoeschi*, and *lwenarum*. These are also compared to the lowland populations of the *cinnamomeus*.

## TAXONOMIC HISTORY

Initially the pipits of open grassland throughout Africa and the Palearctic region were incorporated in the species *A. richardi* Vieillot 1818 known as Richard's Pipit, with a number of African subspecies (cf. Sclater 1930). However, after the publication of Vaurie *et al.* (1960), this taxon was included in the Australasian species *A. novaeseelandiae* (Gmelin 1789), although in southern Africa the common name “Richard's Pipit” was retained (Clancey 1980). Finally this species was split again, with *A. novaeseelandiae* restricted to Australasia, *A. richardi* and *A. rufulus* in the Palearctic, and *A. cinnamomeus* for the African breeding populations, with the common

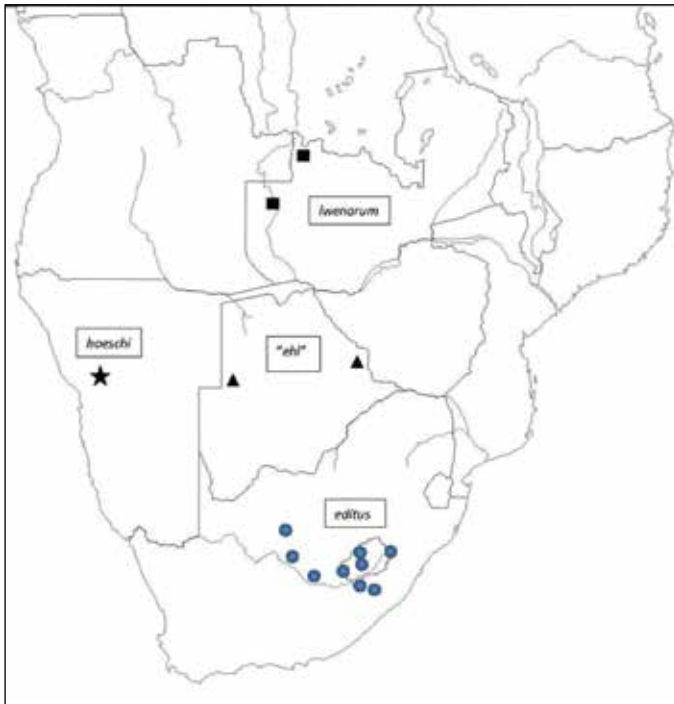


Fig. 1. Collecting localities for Mountain Pipit (*Anthus editus*, *A. hoeschi*, *A. lwenarum*, 'ehl') specimens examined in this study.

name of Grassveld Pipit (Clancey *et al.* 1987). More recently in an attempt to achieve a uniform set of English common names for birds, Grassveld Pipit has been replaced by the unhelpful name "African Pipit" (see Hockey *et al.* 2005).

Stresemann (1938) described *hoeschi* as a full species, noting differences from *A. similis leucocraspedon* (similar size, but remix 5 not emarginated) and *A. richardi bocagii* (larger size and different tail pattern). In some later accounts of Namibian birds, *hoeschi* was treated as a full species based on these two specimens, with no comment on where this taxon might breed (Hoesch & Niethammer 1940, Hoesch 1955), while Winterbottom (1971) included *hoeschi* as a synonym of *A. c. bocagii*. However, the regional handbooks by Mackworth-Præd & Grant (1963) and the various editions of "Roberts" (e.g. McLachlan & Liversidge 1957) do not mention this taxon, until the major revision by Maclean (1985).

When White (1946) described *A. richardi lwenarum*, he compared it in dorsal coloration to *A. r. katangae* described by Chapin (1937). He noted Stresemann's description of *hoeschi*, and commented that "If the type were a male, it would be similar in size to *A. r. rufuloides* and none of the colour characters seem to be of any value" (White 1946 p. 9). Vincent (1951) compared his new taxon *A. richardi editus* with other South African birds, noting that it was larger and darker; he also commented on seasonal movements of *A. richardi* (= *cinnamomeus*) which he referred to as local migration within South Africa. The checklist by Vincent (1952) listed *hoeschi* as a full species, whereas both *editus* and *lwenarum* were included as sub-species of *richardi*.

In a discussion of racial variation in *A. novaeseelandiae* (= *cinnamomeus*), White (1957 p. 31) commented that this species showed a "tremendous amount of local variation which is irregular, broken and repetitive." He considered *lwenarum* not specifically distinct, noting in East African birds a tendency for reduction of the pale markings on the penultimate rectrix, but he did not compare *editus* with *lwenarum*, treating both as subspecies of *novaeseelandiae*. After examining the type of *hoeschi* he took the view that it was a synonym of *bocagii* since "Individually all its characters can be found in other examples from South-West Africa." (White 1957 p. 33).

Vaurie *et al.* (1960) recognised the following African subspecies of *novaeseelandiae*, which at that time still included African, Asian and Australasian birds: *cameroonensis* and *lynesi* in West Africa, *cinnamomeus* in East and Central Africa south to the Zambezi, *bocagii* in western Angola, Namibia and northern Botswana, *rufuloides* in Zimbabwe, southern Botswana and South Africa, *lwenarum* in north-western Zambia, and *editus* in Lesotho. White was evidently primarily responsible for the African taxa in this volume of what has been known as "Peters' Checklist" and in his own African checklist he recognised the same taxa (White 1961). Here *hoeschi* was treated as a synonym of *bocagii* (White chose to correct the original spelling by Nicholson (1884)).

Hall (1961) reviewed the genus *Anthus* after the publication of Vaurie *et al.* (1960), but she did not cite White (1961). She too examined the type specimen of *hoeschi*, and considered that *lwenarum*, *editus* and *hoeschi* might be more closely associated with each other than with the populations adjoining them. Her conclusion was that *hoeschi* was distinct from *A. n. bocagii* and "possibly will prove a good race allied to *A. n. lwenarum* and *A. n. editus*." (Hall 1961 p. 288). On their map showing the distribution of *novaeseelandiae* specimens in Africa, Hall & Moreau (1970) circled three localised populations (*editus*, *hoeschi*, *lwenarum*), all comprising large, dark birds with reduced white in the tail. They also commented that in this species breeding ranges were obscured by considerable local movement.

In South Africa, Clancey initially recognised the sub-species *A. r. editus* Vincent, with the comment "Breeds on the massif of Basutoland – a winter visitor to Natal." (Clancey 1953 p. 38). Clancey (1954) refers to eight specimens of the race *editus* collected by Vincent (six are now in Tring), one male in the South African Museum, and a female in the Albany Museum. I have examined the latter specimen (AM2750), and am satisfied that it is in fact *A. c. rufuloides* with pure white outer rectrices and the typical tail pattern and measurements (see Appendix 1). Clancey (1966) retained *editus* as a sub-species (with *lwenarum* not mentioned, since it was defined as extralimital), and included *hoeschi* as a probable synonym of *bocagii*, designated with a question mark.

Clancey (1978) discussed these three taxa in some detail, and personally examined specimens of both *editus* and *lwenarum*. However, his statement that the second example of *hoeschi* was taken in Oct. 1938 is slightly misleading (the date of collection is given as 1 Nov.). H.E. Wolters in Bonn had on loan both specimens of *hoeschi*, and also material of *editus* and *lwenarum*; he concluded that on the basis of size and tail pattern, *hoeschi* could not be treated as a synonym of *bocagii* (cf. Clancey 1978 p. 155). Clancey thus proposed that *hoeschi* should be provisionally treated as a race of *novaeseelandiae*, and speculated that these were non-breeding visitors to Namibia, probably from the Huambo Highlands of Angola. With regard to the other two taxa, he also obtained information from C.W. Benson, who had examined the type specimens in Tring, and then concluded "The names *lwenarum* and *editus* therefore represent one and the same subspecies.", hence these birds were breeding migrants in Lesotho (Clancey 1978 p. 158).

Consequently, in the southern African checklist, Clancey (1980) included *hoeschi* and *lwenarum* as subspecies of *novaeseelandiae*, with *editus* treated as a synonym of *lwenarum*. He wrote of *lwenarum*: "Breeds at high elevations in the Maluti Mts of Lesotho, wintering May-Oct. in eastern Angola, southern Shaba, Zaïre, and Zambia. Recorded on passage northern Cape (Kimberley), Botswana (Francistown), and Namibia (Okahandja)"; but was less dogmatic about *hoeschi*: "Known from only two specimens taken in western Damaraland in the Erongo Mts and at Friedrichsfelde, Namibia, just prior to the outbreak of the 1939-1945 War. Non-breeding visitors, believed from a population breeding in the Huambo Highlands of Angola" (Clancey 1980 p. 232).

With field observations of pipits in the Drakensberg confirming

that the birds breeding at high altitude behaved as a species separate to *rufuloides* (Mendelsohn 1984), Clancey (1984) took the further step of synonymising the three taxa *editus*, *lwenarum* and *hoeschi*, with the oldest name taking precedence in terms of the code. Thus in the first updating report of the southern African checklist, the Mountain Pipit was recorded as an additional species *hoeschi* with the statement "Spends non-breeding season at lower elevations from eastern Angola and Shaba, Zaïre, to northern Zambia." (Clancey *et al.* 1987 p. 28). Recordings of the song of breeding birds in the Drakensberg compared to Grassveld Pipits supported the specific status of *hoeschi* (Dowsett-Lemaire 1989). In subsequent review papers on African pipits, he was quite explicit about the breeding and non-breeding ranges of this species, and the migration routes followed, even though no new data were available beyond the deductions based on the original specimens (Clancey 1989, 1990). In "Birds of Africa" Clancey's decisions are discussed under "Taxonomic note", but the text treats the proposed migration route and non-breeding range as established (Keith *et al.* 1992 p. 220-221).

Previously there had been some speculation that montane pipits both south and north of the equator might be conspecific, representing an ancient population now consisting of isolated relicts. Clancey (1984) concluded that this was not the case, and thus the name *A. cameroonensis* Shelley 1900 was not applicable to South African birds. However, Wolters (1982) did include all the montane populations under *cameroonensis* with *lwenarum* (including *editus*) and *hoeschi* as subspecies. In a footnote, he mentioned the possibility that *hoeschi* might be a good species, which would then include *lwenarum* and *editus* (Wolters 1982 p. 314). The name *cameroonensis* for the Mountain Pipit did appear in the South African literature in Brooke (1984 p.159), but has not been used subsequently.

#### STUDY MATERIAL AND METHODS

While dark-plumaged pipits from other montane areas in Africa have been tentatively linked with southern African birds (cf. Chapin 1937, White 1957, Prigogine 1981, Wolters 1982, Clancey 1989), I will not consider the taxa *cameroonensis*, *lynesi*, and *latistriatus* here. Pipit specimens identified as the taxa "*editus*", "*hoeschi*" and "*lwenarum*", as well as specimens identified as African Pipits *cinnamomeus* (primarily from Namibia and South Africa), were examined from the following collections (acronyms as used to denote specimen numbers): Naturkunde Museum (Berlin, Germany – 24; ZMB), Museum Alexander Koenig (Bonn, Germany – 4; MAK), Natural History Museum (Tring, UK – 28; BM), Durban Natural Science Museum (Durban, South Africa – 40; DM), Ditsong Museum (Pretoria, South Africa – 7; TM), East London Museum (East London, South Africa – 48; ELM), Albany Museum (Grahamstown, South Africa – 39; AM), National Museum (Bloemfontein, South Africa – 15; NMB). A full list of the specimens and their details is presented in Appendix I. For each specimen I took standard measurements in millimetres (maximum chord wing-length and tail-length with a wing-rule; bill length to the skull, bill depth and bill width at the anterior border of the nostril, tarsal length, and hind-claw length, with Vernier callipers). The emargination of the primaries was noted, as well as the coloration and pattern of the outer two rectrices by subjective visual inspection, and each specimen was checked for moult. Primaries and rectrices were numbered from the centre outwards, with the outermost rectrix R6, the outer primary P9. Moult of the primary remiges was scored according to the standard scheme used by bird-ringers (0 = old feather, 1 = new feather still in pin, 2-4 = successive growth stages of a new feather, 5 = fully-grown new feather, cf. Ginn & Melville 1983); moult of the head, body and tail feathers was noted as present or absent; I lifted feathers in these tracts with a dissecting needle to check for sheaths on the feather bases.

Hoesch typically included a statement on the size of the gonads, often with a small illustration, on the label of his specimens, as did Vincent. Most other collectors did not do so, and the note "br" or "breeding" on some labels may have been based on behaviour (e.g. song flights) rather than dissection. In addition, for some specimens (e.g. those in the East London Museum) the original labels are sadly missing; here catalogue entries indicate that some data have been incorrectly transcribed on the new labels (e.g. a specimen from Somerville Mission in the former Transkei (ELM18200) is labelled "King Williamstown" – it was formerly in the Amathole Museum collection in King Williamstown).

For the initial comparisons of plumage and measurements, I grouped the specimens as follows: *hoeschi* was restricted to the two specimens from Berlin, collected by Hoesch in Namibia; *lwenarum* was used for the six specimens collected by White in Zambia; *editus* was the name applied to all South African and Lesotho specimens which matched the material collected by Vincent; 'ehl' (= *editus-hoeschi-lwenarum*) as an indeterminate designation was applied to five specimens from Botswana; *bocagii* was used for birds from Namibia which were identified as *A. cinnamomeus*; while *rufuloides* was used for all Lesotho and South African specimens which matched the plumage characters of *cinnamomeus*. The measurements were analysed using t-tests, and principal component analysis in R (R Development Core Team 2013). Since sample sizes for some taxa were too small for valid statistical comparisons, principal component analysis incorporating all measurements taken was employed to see whether the specimens formed discrete clusters which accorded with their taxonomic designation.

## RESULTS AND DISCUSSION

#### Plumage characters

In general the birds considered Mountain Pipits (*editus*, *hoeschi*, *lwenarum*, 'ehl') are larger and darker than the other specimens, but the overall appearance of the plumage is variable in this regard in all the taxa examined. Two *rufuloides* specimens from the Transkei region range from very dark (ELM3239) to very pale (ELM14968) in general appearance. Certainly at first sight the two birds labelled *hoeschi* stand out from the other pipits collected by Hoesch in 1937-38 (Fig. 2). However, closer examination of the Namibian specimens in the Berlin collection assigned to *bocagii* shows that there is overlap both in measurements and in plumage characters. All the birds discussed here have the same basic wing formula, with primaries 6, 7 and 8 emarginated on the outer vane, and these three feathers are notably longer than primary 5. The extent of spotting on the ventral areas is highly variable, though Mountain Pipits tend to be heavily marked on the breast. Davies & Peacock (2014) suggested that dark streaks on the under tail-coverts characterise *editus/hoeschi* whereas this streaking is absent on *rufuloides*, but I have not found this to be a consistent feature of the specimens which I have examined.

The one striking feature of the specimens identified as Mountain Pipits is that the light-coloured areas on the outer rectrices are much reduced; on some specimens the penultimate rectrix (R5) is wholly dark brown. However, there is marked individual variation in the pigmentation of this feather, and the pattern is often asymmetrical on the left and right sides of the same bird. In Fig. 3 the specimen of *bocagii* has R5 almost wholly brown. In most birds assigned to the group *editus* the outer rectrices appear clearly buffy rather than white (Fig. 3, BMI1956.35.67, also DM33376, DM8836, NMBV05137) but some birds have whitish outer rectrices (e.g. DM33733, DM34172). However, in the two specimens of *hoeschi* (cf. Fig. 3) and in some *lwenarum* (e.g. BMI1956.16.42) these feathers have what I would consider dull white margins; in the 'ehl' (MAK1946.347-350) birds from Botswana they are more buff in appearance. Nevertheless the



**Fig. 2.** Dorsal views of three pipits collected by Walter Hoesch in Namibia in 1938, now in the Naturkunde Museum, Berlin. Left: type specimen of *Anthus hoeschi*; centre: *A. cinnamomeus bocagii* showing lighter dorsal coloration, right: a second *A. hoeschi* - note the white crown and nape feathers, clearly an individual aberration. The small appearance of the bird on the right is an artefact of preparation; the measurements are similar to those of the type specimen (see Appendix 1).

discrimination between “buffy” and “white” is not always clear-cut, and some specimens of *cinnamomeus* may have distinctly buffy rectrices (e.g. ELM5391 from Barkly East). The shaft in birds with buffy rectrices is usually dull to dark coloured, white in birds with pure white rectrices; but again there are exceptions in both cases.

Although Reichenow (1904) in his description of *cinnamomeus* remarked that the white areas on the tail were sometimes buffy and that the second rectrix (from the outer feather inwards) in some cases had only a small white wedge near the tip, neither White (1946)

nor Vincent (1951) made any mention of the pattern or coloration of the rectrices in the new taxa which they described. Later White (1957 p.33) commented that the “dark second outermost tail feather which appears sporadically in Richard’s Pipit . . . seems to be associated for some curious reason with a rather large size,” and he particularly mentioned this as characteristic of *editus*, *hoeschi* and *lwenarum*. Stresemann (1938) highlighted the lack of white on the second last rectrix of the type of *hoeschi* as a feature distinguishing it from *bocagii*, and also described the outermost rectrix as washed with buff, not pure white. However, in my opinion the coloration is clearly whiter than in the type series of *editus* (Fig. 3). Hustler (1993) considered only birds with buff outer tail feathers as meeting the criteria which Clancey (1990) had described for *hoeschi*, but noted that on the penultimate rectrix *A. cinnamomeus lichenya* in Zimbabwe often has a reduced or vestigial amount of white. He suggested that in the central African region the amount of white or buff on the penultimate rectrix is not a reliable taxonomic character.

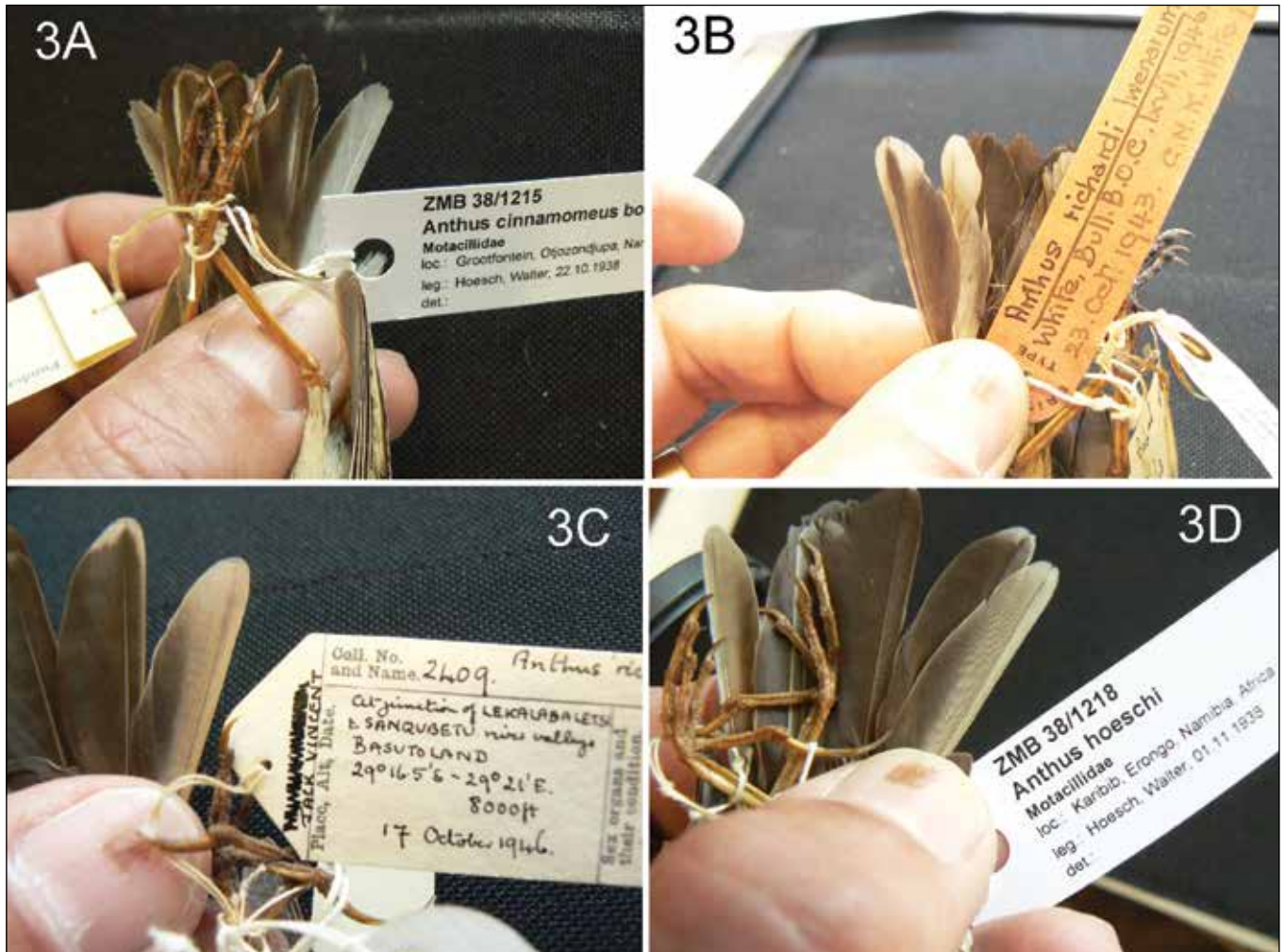
The second specimen of *hoeschi* from Friederichsfelde in the Erongo region of Namibia is an unusual bird, with large patches of white feathers on the crown and nape, suggesting a partially leucistic individual (Fig. 2). This has not been mentioned in the literature, although it would appear that Wolters was the only person who has recently examined this specimen – the photograph taken in Bonn (Fig. 2 in Clancey 1978) shows only the ventral surface of the study skins.

**Soft parts**

Hardly any of the museum specimens have notes on iris coloration, bill and leg colour. However, neither leg nor iris coloration are useful characters in separating these pipit taxa. Mendelsohn (1984) noted that the base of the bill in Mountain Pipits was pink, yet this is recorded on the labels of only two specimens in the Durban collection (DM 34169, DM34171), and on one skin which is clearly *editus* on all morphological characters, the label states “yellow bill base” (DM34175); one of Vincent’s specimens (BM1956.35.67, a

**Table I.** Mean measurements of male and female African and putative Mountain pipits in mm with standard deviations (sd).

TAXON	Sex	No.	Wing	sd	Tail	sd	Tarsus	sd	Bill Length	sd	Bill Depth	sd	Bill Width	sd	Hind claw	sd
<i>bocagii</i>	m	16	88.6	2.8	66.0	3.5	27.2	1.3	17.5	0.9	4.2	0.2	4.5	0.3	12.1	1.1
range			82.0-93.5		61.0-71.0		25.9-28.8		16.8-19.4		3.8-4.5		4.0-5.0		10.1-13.8	
<i>bocagii</i>	f	6	84.7	3.6	63.0	2.9	27.9	1.0	17.1	0.6	4.0	0.3	4.2	0.2	12.6	1.6
range			80.0-89.5		61.0-69.0		27.0-29.7		16.7-18.3		3.8-4.2		4.0-4.4		10.3-15.0	
<i>editus</i>	m	22	92.8	2.9	69.0	2.7	28.6	1.3	18.3	1.0	4.4	0.2	4.5	0.3	10.8	1.1
range			87.0-97.0		67.0-76.0		26.3-31.0		15.2-19.5		4.0-4.9		3.8-5.1		9.0-13.2	
<i>editus</i>	f	8	88.6	1.1	64.0	2.3	27.7	0.9	17.7	0.5	4.4	0.2	4.5	0.2	10.5	0.9
range			87.0-90.0		61.0-68.0		26.4-30.0		16.8-18.2		4.0-4.8		4.0-4.9		9.0-11.5	
<i>hoeschi</i>	f	2	93.0		74.0		29.7		17.8		4.3		4.2		12.3	
range			90.5-95.0		72.0-76.0		29.4-30.0		17.6-17.9		4.0-4.6		4.0-4.4		12.3-12.4	
<i>lwenarum</i>	m	6	94.3	2.2	70.0	2.4	28.9	1.2	18.8	0.5	4.5	0.1	4.2	0.3	11.4	1.3
range			91.5-97.5		67.0-73.0		27.5-30.6		18.3-19.7		4.4-4.6		4.0-4.6		10.3-13.8	
<i>rufuloides</i>	m	49	88.4	2.5	64.0	3.0	28.3	1.3	17.7	0.8	4.1	0.3	4.3	0.9	11.2	1.2
range			83.0-93.0		59.0-72.0		25.4-31.5		16.0-18.8		3.5-4.7		3.6-5.3			
<i>rufuloides</i>	f	29	84.4	2.7	63.0	2.6	26.9	1.1	17.2	0.8	4.0	0.2	4.2	0.3	11.3	1.2
range			80.0-91.0		59.0-68.0		25.0-29.1		15.4-18.5		3.6-5.0		3.6-5.0		9.3-14.7	
‘ehl’	m	3	95.0		75.0		29.0		18.6		4.3		4.3		11.4	
range			94.0-96.0		72.0-78.0		28.1-29.9		17.0-20.2		4.1-4.5		4.0-4.7		10.0-13.2	
‘ehl’	f	2	93.0		72.5		27.6		18.6		4.7		4.1		13.2	
range			91.0-95.0		70.0-75.0		27.5-27.6		18.3-18.8		4.3-5.0		4.0-4.2		11.4-15.0	



**Fig. 3.** Ventral view of the rectrices of four pipit specimens, showing the variation in pattern and coloration of R5 and R6. Outer rectrices of *Anthus cinnamomeus bocagii* from Namibia (3A); *A. lwenarum* from Zambia (3B, note R 5 is positioned to the left of R 6); *A. editus* from Lesotho (3C); *hoeschii* (3D).

breeding male), also records a yellowish base to the lower mandible. There are specimens of *rufuloides* collected on the same Durban museum trip for which the colour at the base of the bill is recorded as pink in some cases (DM34159), yellow in others (DM34166). This suggests that bill coloration may not be a reliable field characteristic, although it is highlighted as a feature separating *hoeschii* and *cinnamomeus* in several field-guides (Peacock 2012, Sinclair *et al.* 2011). However, Peacock (2012) comments that it is often difficult to be sure of the colour of the lower mandible in the field, and notes that juvenile Grassveld (African) Pipits may also have a pinkish lower mandible.

### Measurements

There is some sexual dimorphism in all populations for which adequate samples are available, with males on average larger than females (Table 1). Although there is considerable overlap, differences between males and females are statistically significant for *bocagii* (2-tailed t-test, wing  $p < 0.01$ ) *editus* (2-tailed t-test, wing, tail  $p < 0.001$ ) and *rufuloides* (2-tailed t-test, wing, tail, tarsus  $p < 0.001$ ). Bill width and depth are the least informative measurements, with little variation between males and females.

While hind-claw length has been proposed as a character to separate pipit species (e.g. Peacock 2006), this measurement should be used with caution, as noted by Hall (1961). On birds in which both hind claws were apparently undamaged, I often found that one claw was significantly shorter than the other; the difference could be more

than 3 mm in some instances (e.g. BM1937.2.17.51 claws 13.8, 9.6 mm; ZMB 38/1212 claws 12.1, 8.0 mm). This may represent a broken claw tip, later worn smooth, or could arise through wear, if one foot is used preferentially for scratching the ground, or on landing. However, this implies that when one claw is damaged or missing, the maximum claw length for that bird is indeterminate. Nevertheless of the specimens examined here, it would appear that the hind claw is typically longest in *bocagii* and *hoeschii*, shortest in *editus*, and intermediate in 'ehl', *rufuloides* and *lwenarum*.

Based on this small sample, the 'ehl' birds from Botswana are larger than *editus* with notably longer tails; overall their measurements are more like those of *hoeschii* and *lwenarum*. Statistical comparisons between the taxa have been restricted to those cases where more than five specimens of the same sex were available (Table 2). As suggested above, *bocagii* has significantly longer hind claws than *editus* or *rufuloides* in both sexes. The two subspecies of *cinnamomeus* are otherwise hardly distinguishable on measurements, except for tarsal length, longer in male *rufuloides* than in *bocagii*, whereas the reverse situation pertains in females. Male *editus* have significantly longer wings, tails and bills than *bocagii* or *rufuloides*, but females differ statistically only in wing-length from both taxa. The most striking result is that *editus* and *lwenarum* are not separable on any of these measurements; however, the small sample size for *lwenarum* ( $n = 6$ , males only) must be taken into consideration.

Comparing my measurements with those quoted in the literature is instructive (Table 3). Bill length has been excluded, since both

**Table 2.** Statistical comparisons (t-tests) of measurements of some pipit populations.

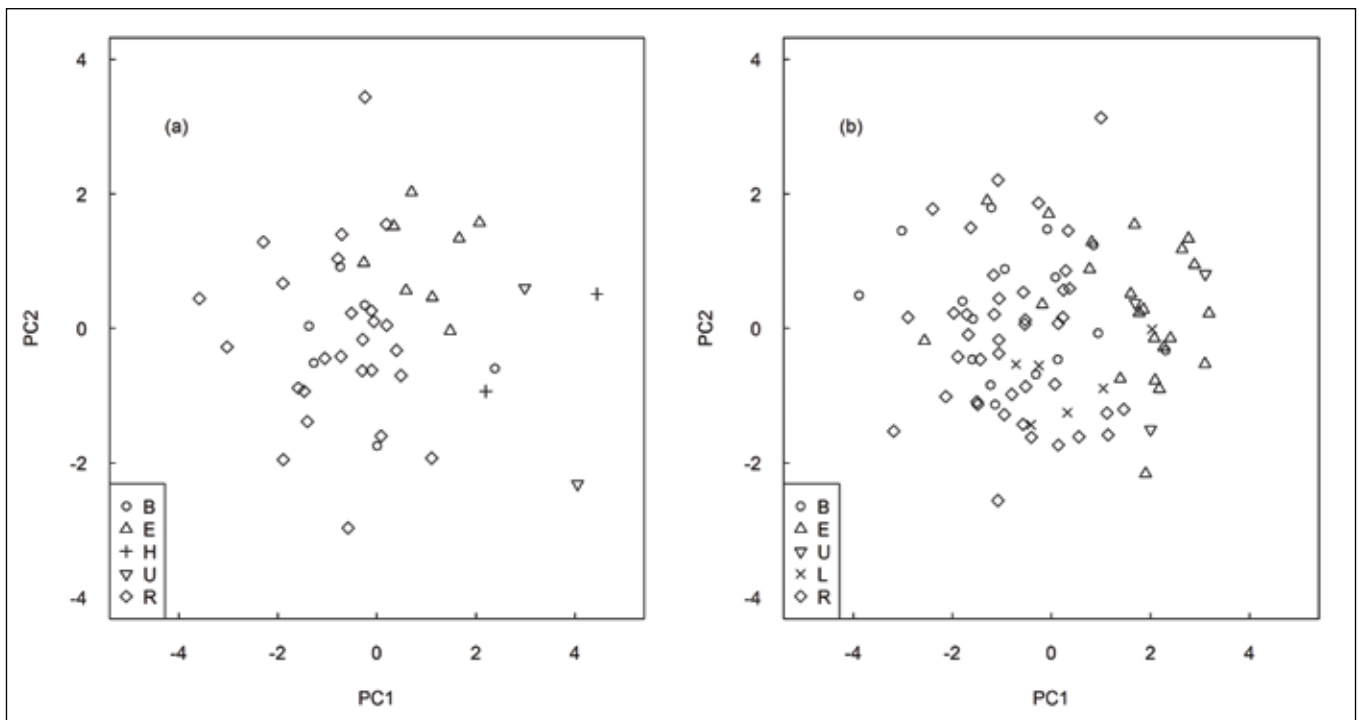
Taxa compared	Sex	Wing	Tail	Tarsus	Bill Length	Bill Depth	Bill Width	Hind claw
Probability								
<i>bocagii/editus</i>	m	<0.001	<0.001	<0.01	<0.05	<0.05	0.68	<0.01
<i>bocagii/editus</i>	f	<0.05	0.41	0.65	<0.05	0.07	0.07	<0.05
<i>bocagii/rufuloides</i>	m	0.81	0.95	<0.01	0.48	0.18	<0.05	<0.05
<i>bocagii/rufuloides</i>	f	0.87	0.64	<0.05	0.78	0.94	0.67	<0.05
<i>editus/rufuloides</i>	m	<0.001	<0.001	0.26	<0.01	<0.001	0.08	0.33
<i>editus/rufuloides</i>	f	<0.01	0.09	0.06	0.13	<0.001	<0.05	0.16
<i>editus/lwenarum</i>	m	0.23	0.58	0.60	0.26	0.51	0.27	0.36
<i>bocagii/lwenarum</i>	m	<0.001	<0.05	<0.01	<0.01	<0.05	0.13	0.20
<i>rufuloides/lwenarum</i>	m	<0.001	<0.01	0.22	<0.01	<0.01	0.86	0.74

Stresemann (1938) and Herroelen (2007) measured bills to the feathers. Unfortunately Hustler (1993) took measurements reported by Clancey (1990) as a guide, and excluded from further discussion birds which he considered too small to be *hoeschi/lwenarum*. However, I have included in Table 2 the specimens from NW Zambia which Hustler considered were either *A. c. lichenya* or *hoeschi/lwenarum* (Hustler 1993, Tables 1 and 2). Wing measurements are the most consistent between different people, whereas tail measurements may vary significantly, as was shown previously by Hall (1961 p.249). Clearly both differences in measurement technique and sample size have a strong influence, and thus using measurements from different sources as a guide is problematic.

For the principal components analysis, male and female birds were plotted separately (Fig. 4a, b). Wing- and tail-length are the most important components contributing to the PCA, since these are the largest measurements. In males there is no clear separation of the different taxa, with *bocagii* mostly overlapping with *rufuloides*, whereas *editus*, *lwenarum* and ‘*ehl*’ are predominantly at the larger end

of the range. In the females, *editus* forms a cluster of larger individuals distinct from *bocagii* and *rufuloides*. The most striking feature is that ‘*ehl*’ and *hoeschi* are outliers, which do not fall within the *editus* cluster. The two specimens of *hoeschi* are far apart, one close to an outlying *bocagii*, the other nearest to a ‘*ehl*’ outlier. The birds that have been designated “Mountain Pipits” generally have longer wings and tails than the typical African (Grassveld) Pipits, but this is probably all that we can safely conclude from the mensural data. As noted also by Hustler (1993), some specimens of *bocagii* fall within the size range ascribed to *hoeschi* in respect of wing and tail measurements.

Voelker (2001) examined morphology in relation to migration and flight display in the genus *Anthus*, controlling for phylogenetic effects based on the phylogeny in his earlier publications. In his Table 2 he listed *hoeschi* with a migration distance of 2000 km, yet the data presented showed little correlation with the morphology of typical migratory pipits, nor with the species placed in the same clade (*lineaventr*, *crenatus*, *sylvanus*). It is also not clear which of the taxa considered here were included in this sample of *hoeschi*. Voelker



**Fig. 4 (a)** Principal Components Analysis of measurements of female pipits; **(b)** Principal Components Analysis of measurements of male pipits. R = *Anthus rufuloides*, U = ‘*ehl*’, E = *A. editus*, B = *A. bocagii*, H = *A. hoeschi*, L = *A. lwenarum*.

**Table 3.** Comparative measurements of samples of specimens of pipits from different published sources compared with data from this study.

Taxon	Number	Sex	Wing	SD	Tail	SD	Tarsus	Hind claw	Source
<i>bocagii</i>	16 birds	m	88.6	2.8	66	3.5			This study
<i>bocagii</i>	14 birds	m	89.6	1.6	62.3	3.0			Clancey 1986a
<i>bocagii</i>	6 birds	f	84.7	3.6	63	2.9			This study
<i>bocagii</i>	14 birds	f	83.1	1.6	58.1	2.3			Clancey 1986a
<i>editus</i>	22 birds	m	92.8	2.9	69.3	2.7		10.8	This study
<i>editus</i>	9 birds	m	95.1	1.2	67.2	2.6		10.6	Clancey 1984
<i>editus</i>	8 birds	f	88.6	1.1	64.0	2.3		10.5	This study
<i>editus</i>	6 birds	f	89.7	1.3	64.1	1.9		11.0	Clancey 1984
<i>editus</i>	BM1956.35.66	m	94		67		29.5	9.7	This study
<i>editus</i>	BM1956.35.66	m	97.5		68		29	12	Herroelen 2007
<i>'ehl'</i>	3 birds	m	95.5	0.2	75	1.5			This study
<i>'ehl'</i>	3 birds	m	96.8	0.3	69	1.0			Clancey 1986b
<i>'ehl'</i>	MAK1966.348	f	91		70				This study
<i>'ehl'</i>	MAK1966.348	f	91		66				Clancey 1986b
<i>hoeschi</i>	ZMB 38/1218	f	90.5		72		29.4	12.4	This study
<i>hoeschi</i>	ZMB 38/1218	f	91		68.5		28.5	13	Herroelen 2007
<i>hoeschi</i>	ZMB 38/1218	f	91					12.5	Hoesch & Niethammer 1940
<i>hoeschi</i>	ZMB 38/1062	f	95		76		30.0	12.3	This study
<i>hoeschi</i>	ZMB 38/1062	f	96		75		29.0	13	Stresemann 1938
<i>lwenarum</i>	BM1953.54.206	m	94.5		68			10.3	This study
<i>lwenarum</i>	BM1953.54.206	m	95		71			10-11	Herroelen 2007
<i>lwenarum</i>	BM1956.16.41	m	94		72			10.8	This study
<i>lwenarum</i>	BM1956.16.41	m	95		74			10-11	Herroelen 2007
<i>lwenarum</i>	6 birds	m	94.5	1.9	71.0	2.4			This study
<i>lwenarum</i>	10 birds	m	90.0	2.9	67.8	3.3			Hustler 1993
<i>rufuloides</i>	49 birds	m	88.4	2.5	64	3.0			This study
<i>rufuloides</i>	16 birds	m	90.5	1.2	63.4	1.9			Clancey 1986a
<i>rufuloides</i>	29 birds	f	84.4	2.7	63.0	2.6			This study
<i>rufuloides</i>	15 birds	f	85.0	1.6	59.0	1.5			Clancey 1986a

argued that secondary remix 7 was correlated with flight display in males, but not in females; but the figures presented for *hoeschi* show this feather as on average longer in females, even though males are placed in the group of pipits with a circling flight display (Voelker 2001). These data thus provide no support for categorising *hoeschi* as a long-distance migrant.

### Moult

There were relatively few moulting birds in the sample examined. The two specimens of *hoeschi* from May and Nov. have no moult in any body regions, nor do the *'ehl'* specimens from Botswana, collected in May and Oct. The six *lwenarum* were collected at two different

localities in Jun. and Oct. in successive years, and none of them are moulting. Most of the *editus* specimens were collected in the breeding season (Dec. 13, Jan. 12, Feb. 1); birds from Sept. (1) and Oct. (4) are also not in moult. However, two birds in Apr. have active wing-moult (NMBV05137, NMBV05140), and a third specimen from the same month has body and tail moult (DM8836). Thus it seems likely that a post-breeding moult occurs in this population, and the moulting birds are not far from the breeding range. There are no cases of interrupted/suspended moult which might be found in migratory birds. For *bocagii* there are 11 specimens from May to Sept., with wing-moult in two birds from Jun.; 14 birds collected in Oct. (mostly by Walter Hoesch) are not moulting.

The data for *rufuloides* are summarised in Table 4. There is wing-moult in a Jan. specimen from Oranjemund in the Northern Cape, South Africa (ELM18206), and in a specimen from Oct. collected at Selukwe in Zimbabwe (ELM9757). Voelker (1999c) also found wing and tail moult in one Oct. specimen of *cinnamomeus*. However, these would seem to be anomalous individuals. Some birds from Mar. are in the early stages of wing-moult. For the Apr. birds, all are either growing the outer primary remiges, or have new remiges with no growing feathers. The birds with wing-moult in May are growing the 9<sup>th</sup> remix, while six birds have new wing feathers; in the six other specimens the age of the feathers was indeterminate. Other birds with clearly new wing feathers were noted in Jun. Thus it seems that in this taxon, there is a post-breeding moult starting in Mar. or perhaps Feb., and typically completed during Apr.-May. Paterson (1959) concluded from specimens in the Bulawayo museum that in Zimbabwe this species moulted during Apr. and May, while Clancey (1986a) stated that moult starts in Feb. and is completed by May/June in southern Africa.

Stresemann & Stresemann (1968) reported that in migratory Palearctic populations of *A. campestris* and *A. richardi*, wing moult was often only completed on the non-breeding grounds, so that on migration birds might be found with a mixture of old and new feathers. They also noted some cases in which the replacement of the remiges of *richardi* did not follow the usual descendent pattern. I have not seen any cases of interrupted or suspended wing moult, nor of departures from the normal moult sequence in any of the southern African specimens of *cinnamomeus* which I examined.

#### Non-breeding distribution

Both specimens of *hoeschi* come from the Erongo region in Namibia. The type specimen was collected in May 1938 and the ovary is small, but the second specimen was collected on 1 Nov. of the same year, with the ovary clearly enlarged (label illustration by the collector, Walter Hoesch). This would suggest a bird which might breed within the region, rather than fly on to breeding grounds some 1400 km away in a direct line. Keith *et al.* (1992 p.220-221) refer to records from Erongo, near Karibib and Okahandja, as “probably on passage” but also give a date of Mar. – I am not aware of the source of this record.

Keith *et al.* (1992) and Penry (1994) noted that the only records of Mountain Pipit from Botswana were four birds collected near Francistown in Oct. 1965. Penry stated “A migration of this species is postulated through northeastern Botswana from wintering grounds along the Zaire/Zambezi watershed to the Drakensberg massif in southeastern Africa.” (Penry 1994 p.294). Clancey (1986b) had seen the Bonn specimens, and considered them to be Mountain Pipits on southward migration; these birds were originally identified as *editus* by B.P. Hall (see Niethammer & Wolters 1966). There is an earlier Botswana specimen from the Vernay-Lang expedition, collected at Gemsbok Pan (21°43'S, 21°38'E) on 3 May 1930 (Roberts 1935), at a similar latitude though on the opposite side of the country, which was later identified as a Mountain Pipit (Davies & Peacock 2014 p.204); I have also seen this specimen and assigned it to the ‘ehl’ group (TM17588, Appendix 1). On both tail pattern and measurements (Table 1), I would suggest that these five specimens from Botswana are closer to *hoeschi* or *lwenarum* than to *editus*. Tyler (2008) reported two accepted sight records of Mountain Pipit for Botswana in Apr.

2001, at Manamodi Pan (25°03'S, 22°08'E) and Masetleng Pan (23°42'S, 20°55'E). April is the period during which some birds closer to the breeding area were in wing-moult (see above); the origin of these birds could be either from the north or the south.

The non-breeding season range of the Mountain Pipit in “Birds of Africa” includes “E Angola (N Luanda), and southern Zaïre (L Kabwe and Palenge, Shaba Province)” (Keith *et al.* 1992 p.220). Louette & Hasson (2011) listed *hoeschi* as a possible species for Katanga (Democratic Republic of Congo), based on Herroelen’s (2007) identification of two specimens from the Upemba area as *lwenarum*. I have not seen these specimens; Herroelen (2007) also lists two birds from Camissombo in north-western Angola; these are in the Smithsonian collection in Washington, currently identified as *hoeschi*. In their review of the birds of Zambia, Dowsett *et al.* (2008, p. 324) stated that *lwenarum* had been recorded “apparently as a non-breeding visitor” to the north-west by White (1946), but was not encountered during a detailed survey in 1974. They noted that this taxon “has been considered conspecific with the Mountain Pipit *hoeschi* of South Africa (Afromontane), but this remains unproven” (Dowsett *et al.* 2008 p.324). In Malawi, *A. cinnamomeus lichenya* has been described as a dark-plumaged, montane pipit breeding up to 2450 m on the Nyika Plateau, and possibly showing altitudinal migration (Dowsett-Lemaire & Dowsett 2006). Could this region be the source of *lwenarum*?

Hustler (1993) examined all the pipit material in the Bulawayo museum, and found that only three specimens from Zambia or Botswana in this collection, and none from Zimbabwe, could be attributed to *hoeschi* as defined by Clancey (1978, 1984, 1990); he also noted that some specimens of *A. cinnamomeus bocagii* are comparable in size to Mountain Pipits, while *A. nyassae* is similar in size and has buffy outer rectrices (but a different wing formula), while *lichenya* often has much reduced pale areas on the rectrices. Hustler concluded that there was little evidence that Mountain Pipits migrated to central Africa. Irwin (2010) also questioned the evidence for any migration of Mountain Pipits through Zimbabwe and Botswana, and suggested that local altitudinal movements within South Africa were more probable. This was the opinion expressed earlier by Dowsett & Dowsett-Lemaire (1993).

The *editus* specimens from South Africa include five birds away from the breeding areas, from Jacobsdal and Phillipolis in the Free State (NMBV05137, 05140, 05041) and Kimberley in the Northern Cape (DM8836) and a specimen from Somerville in the Transkei (ELM18200) which I identified as this taxon on the basis of tail pattern, dark plumage and size (see Appendix 1). There has been a recent report of sightings at the Ezemvelo Nature Reserve in Gauteng in Oct. (Marais 2015); the photographs certainly show a bird with the characteristics of *editus*. The Natal specimen collected in Jun. 1951 by Clancey & Holliday (1952), later apparently ignored by Clancey, is TM40672: “wing 83 mm, tail 62.5 mm, primaries 6-8 emarginated, and distinctly white 6<sup>th</sup> rectrix and 5<sup>th</sup> rectrix with broad white wedges (no buffy or dusky suffusion)” (Greg Davies, pers. comm.). Thus the only evidence to date for non-breeding distribution of birds from the Drakensberg is to the south, west, and perhaps north; but not to the east.

#### Field identification

Pipits pose perhaps the greatest challenge in field identification of

**Table 4.** Primary wing-moult by month in museum specimens of *Anthus cinnamomeus rufuloides*.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
No. birds	15	2	13	13	15	29	9	6	18	28	20	13	181
Moult	1	0	4	9	3	0	0	0	0	1	0	0	18



African birds, especially in the non-breeding season when many species undertake movements which are poorly understood, so that several species are likely to occur alongside each other. Unfortunately this examination of museum material has suggested that none of the morphological features used to define Mountain Pipits *sensu lato* are completely reliable. *Anthus cinnamomeus* is generally a smaller bird, not as dark in general appearance, with a pure white R6, and large areas of white on R5, and a yellowish base to the lower mandible. In comparison *editus*, *hoeschi* and *lwenarum* are larger, darker, with dull white to buffy R6, little or no pale area on R5, and a pinkish base to the lower mandible in *editus*. However, it appears that there are also large, dark Grassveld Pipits with reduced pigmentation on the rectrices and at least sometimes pink bases to the bill. Equally the rectrices of Mountain Pipits may be whitish, and the base to the bill can appear yellowish. We need much more information on live birds in the hand, and accurate data on their movements. Tracking birds of this size is now feasible (Briedis et al. 2016) although still prohibitively expensive.

### Conclusion

On the basis of the museum material, I suggest the following interpretation of the taxa currently synonymised under "Mountain Pipit":

- (1) The two specimens of *hoeschi* from Namibia are not from the same population as the birds named *editus* from the Drakensberg, based on both plumage and mensural data. They also differ in some respects from the Zambian pipits described as *lwenarum*.
- (2) The five specimens from Botswana designated 'ehl' also do not match *editus* in body proportions, and are probably not from the same population.
- (3) Although in both measurements and plumage characters the six birds representing *lwenarum* are not separable from *editus*, with no new information on this taxon from the past 70 years, there seem to be no good grounds for lumping these two taxa.

Thus I propose that the name of the pipits breeding in the Drakensberg at high altitude should be *Anthus editus* Vincent 1951. Present evidence suggests that in winter these birds occur at low altitude in the Free State, Northern Cape and Eastern Cape; records from other regions are not currently represented by museum specimens. The status and breeding range of the taxa *hoeschi* and *lwenarum* remains to be determined.

### ACKNOWLEDGEMENTS

This study has been supported by funding from Rhodes University and the National Research Foundation. I am most grateful to the following museum curators for their assistance during visits or for the loan of specimens: David Allan (Durban Natural Science Museum, Durban, South Africa), Greg Davies (Ditsong Museum, Pretoria, South Africa), Dawie de Swardt (National Museum, Bloemfontein, South Africa), Sylke Frahnert (Naturkunde Museum, Berlin, Germany), John Midgley (Albany Museum, Grahamstown, South Africa), Robert Prys-Jones (Natural History Museum, Tring, UK), Till Töpfer (Museum Alexander Koenig, Bonn, Germany), Phil Whittington (East London Museum, East London, South Africa). My thanks to Bo Bonnevie for running the PCA analysis of the measurements and for discussion of the MS, and to Greg Davies and Faansie Peacock for their reviews, which have significantly improved the final paper.

### REFERENCES

BRIEDIS, M., BERAN, V., HAHN, S. & ADAMK, P. 2016. Annual cycle and migration strategies of a habitat specialist, the Tawny Pipit *Anthus campestris*, revealed by geolocators. *Journal of Ornithology* 157 : 619-626.

- BROOKE, R.K. 1984. *South African Red Data Book – Birds*. South African National Scientific Programmes Report 97. Foundation for Research Development: Pretoria.
- CHAPIN, J.P. 1937. The pipits of the Belgian Congo. *Revue de Zoologie et de Botanique africaines* 29: 336-345.
- CLANCEY, P.A. 1953. *A preliminary list of the birds of Natal and Zululand*. Durban Museum: Durban.
- CLANCEY, P.A. 1954. A revision of the South African races of Richard's Pipit *Anthus richardi* Vieillot. *Durban Museum Novitates* 4: 101-115.
- CLANCEY, P.A. 1966. A catalogue of birds of the South African sub-region. (Part IV: Families Sylviidae – Prionopidae). *Durban Museum Novitates* 7(12): 465-544.
- CLANCEY, P.A. 1978. On some enigmatic pipits associated with *Anthus novaeseelandiae* (Gmelin) from central and southern Africa. *Bonner zoologische Beiträge* 29: 148-164.
- CLANCEY, P.A. (Ed.) 1980. *S.A.O.S. checklist of southern African birds*. Southern African Ornithological Society: Johannesburg.
- CLANCEY, P.A. 1984. On the so-called Mountain Pipit of the Afrotropics. *Durban Museum Novitates* 13(15): 189-194.
- CLANCEY, P.A. 1986a. Subspeciation in the pipit *Anthus cinnamomeus* Rüppell of the Afrotropics. *Le Gerfaut* 76: 187-211.
- CLANCEY, P.A. 1986b. On the mountain pipit in Botswana. *Honeyguide* 32: 44.
- CLANCEY, P.A. 1989. Zonal distribution in Afrotropical montane pipits (*Anthus*: Motacillidae). *Durban Museum Novitates* 14(9): 157-172.
- CLANCEY, P.A. 1990. A review of the indigenous pipits (Genus *Anthus* Bechstein: Motacillidae) of the Afrotropics. *Durban Museum Novitates* 15: 42-72.
- CLANCEY, P.A., BROOKE, R.K., CROWE, T.M. & MENDELSON, J.M. 1987. *SAOS checklist of southern African birds (1980): First updating report*. Southern African Ornithological Society: Johannesburg.
- CLANCEY, P.A. & HOLLIDAY, C.S. 1952. A specimen of *Anthus richardi editus* Basutoland, obtained in central Natal. *Ostrich* 23(1): 54.
- DAVIES, G.B.P. & PEACOCK, D.S. 2014. Reassessment of plumage characters and morphometrics of *Anthus longicaudatus* Liversidge, 1996 and *Anthus pseudosimilis* Liversidge and Voelker, 2002 (Aves: Motacillidae). *Annals of the Ditsong National Museum of Natural History* 4: 187-206.
- DOWSETT, R.J., ASPINWALL, D.R. & DOWSETT-LEMAIRE, F. 2008. *The birds of Zambia*. Tauraco Press & Aves: Liège.
- DOWSETT, R.J. & DOWSETT-LEMAIRE, F. 1993. Comments on the taxonomy of some Afrotropical bird species. *Tauraco Research Report* 5: 323-389.
- DOWSETT-LEMAIRE, F. 1989. On the voice of the Mountain Pipit. *Ostrich* 60: 85-87.
- DOWSETT-LEMAIRE, F. & DOWSETT, R.J. 2006. *The birds of Malawi*. Tauraco Press & Aves: Liège.
- GINN, H.B. & MELVILLE, D.S. 1983. *Moult in birds*. British Trust for Ornithology: Tring.
- HALL, B.P. 1961. The taxonomy and identification of pipits (genus *Anthus*). *Bulletin of the British Museum (Natural History) Zoology* 7(5): 243-289.
- HALL, B.P. & MOREAU, R.E. 1970. *Atlas of speciation of African passerine birds*. British Museum (Natural History): London.
- HERROELEN, P. 2007. Comments on the identification of pipits (Aves, Motacillidae: genus *Anthus*) from central and southern Africa in the hand. *Journal of Afrotropical Zoology* 3: 23-34.
- HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. (eds) 2005. *Roberts – birds of southern Africa*. VII<sup>th</sup> Edition. The Trustees of the John Voelker Bird Book Fund: Cape Town.
- HOESCH, W. 1955. *Die Vogelwelt Südwestafrikas*. S.W.A. Wissenschaftliche Gesellschaft: Windhoek.
- HOESCH, W. & NIETHAMMER, G. 1940. *Die Vogelwelt Deutsch-*

- Südwestafrikas, namentlich des Damara- und Namalandes. *Journal für Ornithologie* 88: Sonderheft.
- HUSTLER, K. 1993. On the occurrence of the Mountain Pipit (*Anthus hoeschi*) in central Africa. *Arnoldia (Zimbabwe)* 9(39): 549-555.
- IRWIN, M.P.S. 2010. Some itinerant thoughts on the Mountain Pipit *Anthus hoeschi*. *Honeyguide* 56(2): 161-162.
- JOHNSON, D.N. & MACLEAN, G.L. 1994. Altitudinal migration in Natal. *Ostrich* 65: 86-94.
- KEITH, S., URBAN, E.K. & FRY, C.H. 1992. *The birds of Africa*. Vol. IV. Academic Press: London.
- LIVERSIDGE, R. 1996. A new species of pipit in southern Africa. *Bulletin of the British Ornithologists' Club* 116: 211-215.
- LIVERSIDGE, R. & VOELKER, G. 2002. The Kimberley Pipit: a new African species. *Bulletin of the British Ornithologists' Club* 122: 93-109.
- LOUETTE, M. & HASSON, M. 2011. *Birds of Katanga*. Royal Museum for Central Africa: Tervuren.
- MACKWORTH-PRAED, C.W. & GRANT, C.H.B. 1963. *Birds of the southern third of Africa*. Vol. 2. Longmans: London.
- MACLEAN, G.L. 1985. *Roberts' birds of southern Africa*. 5<sup>th</sup> ed. Trustees of the John Voelcker Bird Book Fund: Cape Town.
- MARAIS, E. 2015. Mountain Pipits: a piece of the puzzle. <http://faansiepeacock.com/mountain-pipits-a-piece-of-the-puzzle/>. Accessed 27 April 2016.
- McLACHLAN, G.R. & LIVERSIDGE, R. 1957. *Roberts birds of South Africa*. 2<sup>nd</sup> edition. Trustees of the South African Bird Book Fund: Cape Town.
- MENDELSON, J. 1984. The Mountain Pipit in the Drakensberg. *Bokmakierie* 36(2): 40-44.
- NICHOLSON, F. 1884. [Letters]. *Ibis* 2 (5th series): 469.
- NIETHAMMER, G. & WOLTERS, H.E. 1966. Kritische Bemerkungen über einige südafrikanische Vögel im Museum A. Koenig, Bonn. *Bonner zoologische Beiträge* 17: 168-185.
- PATERSON, M.S. 1959. Richard's Pipit *Anthus novaeseelandiae* in Southern Rhodesia. *Ostrich Supplement* 3: 435-439.
- PEACOCK, F. 2006. *Pipits of southern Africa*. The Author: Pretoria.
- PEACOCK, F. 2012. *Chamberlain's LBJs*. Mirafr Publishing: Cape Town.
- PENRY, H. 1994. *Bird atlas of Botswana*. University of Natal Press: Pietermaritzburg.
- PRIGOGINE, A. 1981. The status of *Anthus latistriatus* Jackson, and the description of a new subspecies of *Anthus cinnamomeus* from Itombwe. *Gerfaut* 71: 537-573.
- R DEVELOPMENT CORE TEAM. 2013. *R: A language and environment for statistical computing*. The R Foundation for Statistical Computing: Vienna. <http://www.r-project.org/>.
- REICHENOW, A. 1904. *Die Vögel Afrikas*. Dritter Band. Neumann: Neudamm.
- ROBERTS, A. 1935. Scientific results of the Vernay-Lang Kalahari Expedition, March to September, 1930. *Birds. Annals of the Transvaal Museum* 16: 1-185.
- SINCLAIR, I., HOCKEY, P., TARBOTON, W. & RYAN, P. 2011. *Birds of southern Africa*. 4th ed. Struik: Cape Town.
- SINCLAIR, I. & RYAN, P. 2003. *Birds of Africa south of the Sahara*. Struik: Cape Town.
- STRESEMANN, E. 1938. *Anthus hoeschi* species nova, ein neuer Pieper aus Südwest-Afrika. *Ornithologische Monatsberichte* 46: 149-151.
- STRESEMANN, E. & STRESEMANN, V. 1968. Die Mauser von *Anthus campestris* und *Anthus richardi*. *Journal für Ornithologie* 109: 17-21.
- TAYLOR, M.R., PEACOCK, F. & WANLESS, R.M. 2015. *The 2015 Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa: Johannesburg.
- TYLER, S.J. 2004. Family Motacillidae (Wagtails and Pipits). In: DEL HOYO, J., ELLIOTT, A. & CHRISTIE, D. (eds) *Handbook of the Birds of the World*. Vol. 9: 686-786. Lynx Edicions: Barcelona.
- TYLER, S.J., RANDALL, R.D. & BREWSTER, C.A. 2008. New bird records for Botswana and additional information on some rarities. *Bulletin of the African Bird Club* 15(1): 36-52.
- VAURIE, C.H., WHITE, C.M.N., MAYR, E. & GREENWAY, J.C. 1960. Family Motacillidae. In: MAYR, E. & GREENWAY, J.C. (eds) *Check-list of birds of the world*. Vol. 9. Museum of Comparative Zoology: Cambridge, Massachusetts.
- VINCENT, J. 1951. The description of a new race of Richard's Pipit *Anthus richardi* Vieillot from Basutoland. *Annals of the Natal Museum* 12: 135-136.
- VINCENT, J. 1952. *A check list of the birds of South Africa*. Southern African Ornithological Society: Cape Town.
- VOELKER, G. 1999a. Molecular evolutionary relationships in the avian genus *Anthus* (pipits, Motacillidae). *Molecular Phylogenetics and Evolution* 11(1): 84-94.
- VOELKER, G. 1999b. Dispersal, vicariance, and clocks: historical biogeography and speciation in a cosmopolitan passerine genus (*Anthus*: Motacillidae). *Evolution* 53: 1536-1552.
- VOELKER, G. 1999c. Body mass and moult data for South African motacillids, with body mass data for 47 additional South African species. *Ostrich* 70: 233-235.
- VOELKER, G. 2001. Morphological correlates of migratory distance and flight display in the avian genus *Anthus*. *Biological Journal of the Linnean Society* 73: 425-435.
- WHITE, C.M.N. 1946. Notes on pipits of the *Anthus richardi* group and a new race of waxbill from Northern Rhodesia. *Bulletin of the British Ornithologists' Club* 67: 8-10.
- WHITE, C.M.N. 1957. Taxonomic notes on African pipits with the description of a new race of *Anthus similis*. *Bulletin of the British Ornithologists' Club* 77: 30-34.
- WHITE, C.M.N. 1961. *A revised check list of African broadbills, pittas, larks, swallows, wagtails and pipits*. Government Printer: Lusaka.
- WINTERBOTTOM, J.M. 1971. *A preliminary check list of the birds of South-West Africa*. South West African Scientific Society: Windhoek.
- WOLTERS, H.E. 1982. *Die Vogelarten der Erde*. Paul Parey: Berlin.

**Appendix 1.** List of museum specimens examined and measured, with measurements in mm.

Taxon	Museum number	Date collected	Locality	Sex	Wing	Tail	Tarsus	Bill l	Bill d	Bill w	Hind claws
<i>bocagii</i>	ZMB 38/1215	22/10/1938	Otavi Bergland, Namibia	f	80	62	29.7	17.2	4.2	4.2	12.7
<i>bocagii</i>	ZMB 38/1205	02/10/1938	Klein Otavi, Namibia	f	82	62	27.6	16.7	4.3	4.4	11.9
<i>bocagii</i>	ZMB 38/1210	08/10/1938	Grootfontein, Namibia	f	89.5	69	27.9	18.3	4.3	4.4	13.8
<i>bocagii</i>	ZMB 38/1216	22/10/1938	Rietfontein, Namibia	f	83.5	63	27.0	16.8	3.7	4.2	11.9
<i>bocagii</i>	ELM6672	19/05/1959	Okahandja, Namibia	f	88	62	28.3	16.7	3.8	4.0	15
<i>bocagii</i>	ELM5795	06/08/1958	Brandkaros, Namibia	f	85	61	27.0	16.9	3.8	4.2	10.3
<i>bocagii</i>	ZMB 2000/6053	11/10/1905	Benguella, Angola	m	75.5	53	25.0	14.9	4.0	4.1	12.9
<i>bocagii</i>	ZMB 38/1209	02/10/1938	Klein Otavi, Namibia	m	86.5	70	23.6	17.7	4.1	4.0	11.1
<i>bocagii</i>	ZMB 38/1212	03/10/1938	Klein Otavi, Namibia	m	93.5	69	28.7	16.9	4.5	4.7	12.1
<i>bocagii</i>	ZMB 38/1211	07/10/1938	Klein Otavi, Namibia	m	89	66	27.1	17.7	4.0	4.1	12.6
<i>bocagii</i>	ZMB 38/1207	07/10/1938	Klein Otavi, Namibia	m	87	69	27.3	16.8	4.2	4.6	11.5
<i>bocagii</i>	ZMB 38/1214	06/10/1938	Klein Otavi, Namibia	m	87	62	26.4	19.4	4.1	4.3	12.1
<i>bocagii</i>	ZMB 38/1204	04/10/1938	Klein Otavi, Namibia	m	92	70	28.1	18.4	4.4	4.5	13.0
<i>bocagii</i>	ZMB 37/363	03/07/1937	Omaruru, Namibia	m	85	64	26.0	16.2	4.0	5.0	13.7
<i>bocagii</i>	ZMB 38/1208	07/10/1938	Grootfontein, Namibia	m	88	63	27.3	17.4	3.8	4.7	11
<i>bocagii</i>	ZMB 38/1203	04/10/1938	Klein Otavi, Namibia	m	90	64	28.3	18.2	4.4	4.6	11
<i>bocagii</i>	BM1937.2.17.51	22/09/1936	Ougume, Etosha, Namibia	m	90	68	27.8	18.9	4.2	4.6	13.8
<i>bocagii</i>	BM1937.2.17.50	24/10/1936	Ougume, Etosha, Namibia	m	91	71	27.2	17.4	4.2		13.5
<i>bocagii</i>	ELM 5493	31/07/1956	Lusaka, Zambia	m	87.5	61	28.0	17.2	4.5	4.9	12.4
<i>bocagii</i>	ELM 5494	31/07/1956	Lusaka, Zambia	m	88.5	61	26.9	17.1	4.4	4.2	12.5
<i>bocagii</i>	ELM5904	12/08/1958	Brandkaros, Namibia	m	90	67	28.8	17.5	3.9	4.2	10.1
<i>bocagii</i>	ELM5905	12/08/1958	Brandkaros, Namibia	m	91	66	27.3	17.3	4.4	4.7	10.7
<i>bocagii</i>	ELM6525	12/05/1959	Windhoek, Namibia	m	82	61	25.9	16.0	4.0	4.4	12.5
<i>editus</i>	BM1956.35.69	02/12/1947	Lekhalabalets, Lesotho	f	88	62	27.1	17.7	4.4	4.6	9.5
<i>editus</i>	BM1956.35.68	10/01/1947	Lekhalabalets, Lesotho	f	88	61	29.0	17.3	4.3	4.9	10.8
<i>editus</i>	ELM 13639	18/09/1968	Moletsane, Lesotho	f	87	64	27.7	16.8	4.0	4.5	10.3
<i>editus</i>	DM34173	28/12/1983	Naudesnek, E Cape, S Africa	f	90	68	26.4	18.1	4.3	4.4	11.5
<i>editus</i>	DM34178	?/12/1983	Naudesnek, E Cape, S Africa	f	89	64	28.6	17.6	4.4	4.2	10.9
<i>editus</i>	DM 34175	21/01/1984	Naudesnek, E Cape, S Africa	f	88	67	27.5	18.2	4.5	4.7	10.7
<i>editus</i>	DM 34174	30/12/1983	Naudesnek, E Cape, S Africa	f	89	65	27.1	17.6	4.5	4.0	9
<i>editus</i>	DM 34171	21/01/1984	Naudesnek, E Cape, S Africa	f	90	64	28.1	18.0	4.8	4.7	11.5
<i>editus</i>	BM 1963.29.7	03/12/1947	Lekhalabalets, Lesotho	m	97	69	29.4	18.3	4.6	4.2	11.9
<i>editus</i>	TM 18853	04/02/1933	Maluthi mountains, Lesotho	m	96.5	71	28.8	18.8	4.7	4.6	10.5
<i>editus</i>	BM1956.35.70	03/12/1947	Lekhalabalets, Lesotho	m	95	71	28.9	19.1	4.4	4.2	11.8
<i>editus</i>	BM1956.35.67	17/10/1946	Lekhalabalets, Lesotho	m	94	68	27.6	18	4.3	4.9	11.3
<i>editus</i>	BM1956.35.66	18/10/1946	Sanquletu, Lesotho	m	94	67	29.5	19.2	4.3	4.6	9.7
<i>editus</i>	NMBV05137	15/04/1997	Jacobsdal, Free State, S Africa	m	89	70	26.5	17.5	4.3	4.3	10.7
<i>editus</i>	ELM 18200	12/10/1916	Somerville, Transkei, S Africa	m	92	68	27.6	18.5	4.0	4.0	
<i>editus</i>	NMBV05140	15/04/1997	Jacobsdal, Free State, S Africa	m	87	66	28.0	15.2	4.5	4.5	10.7
<i>editus</i>	NMBV04048	10/12/1991	Phalang, Semongkong, Lesotho	m	89.5	68	30.3	18.1		4.1	9.2
<i>editus</i>	NMBV05041	24/10/1996	Philippolis, Free State, S Africa	m	96	76	27.4	18.8	4.4	4.5	12.5
<i>editus</i>	DM34179	xx/12/1983	Naudesnek, E Cape, S Africa	m	93	73	30.0	18.6	4.9	3.8	10
<i>editus</i>	DM33736	14/01/1982	Naudesnek, E Cape, S Africa	m	91	70	30.7	19.4	4.4	4.4	9.8
<i>editus</i>	DM33734	14/01/1982	Naudesnek, E Cape, S Africa	m	94	69	31.0	19.0	4.6	5.0	11.5
<i>editus</i>	DM34172	30/12/1983	Naudesnek, E Cape, S Africa	m	87	63	26.3	16.3	4.1	4.2	13.2
<i>editus</i>	DM33733	14/01/1982	Naudesnek, E Cape, S Africa	m	90	68	26.4	18.1	4.3	5.0	11.1
<i>editus</i>	DM33730	14/01/1982	Naudesnek, E Cape, S Africa	m	92	67	28.7	19.5	4.6	5.1	11.6
<i>editus</i>	DM34177	?/12/1983	Naudesnek, E Cape, S Africa	m	92	67	29.6	19.2	4.4	4.3	12

**Appendix I.** List of museum specimens examined and measured, with measurements in mm. *continued*

Taxon	Museum number	Date collected	Locality	Sex	Wing	Tail	Tarsus	Bill l	Bill d	Bill w	Hind claws
<i>editus</i>	DM 8836	29/04/1959	Kimberley, N Cape, S Africa	m	92	70	28.9	17.7	4.0	4.8	9.4
<i>editus</i>	DM 34176	?/12/1983	Naudesnek, E Cape, S Africa	m	94.5	70	28.4	18.1	4.4	4.5	10.6
<i>editus</i>	DM 34170	28/12/1983	Naudesnek, E Cape, S Africa	m	93.5	70	28.0	18.3	4.7	4.2	11
<i>editus</i>	DM 33735	14/01/1982	Naudesnek, E Cape, S Africa	m	96	73	28.7	18.0	4.7	4.6	10
<i>editus</i>	DM 33731	14/01/1982	Naudesnek, E Cape, S Africa	m	95.5	71	29.0	18.8	4.2	4.2	10.1
<i>hoeschi</i>	ZMB 38/1218	01/11/1938	Friederichsfelde, Erongo, Namibia	f	90.5	72	29.4	17.6	4.0	4.0	12.4
<i>hoeschi</i>	ZMB 38/1062	10/05/1938	Erongo Plateau, Namibia	f	95	76	30.0	17.9	4.6	4.4	12.3
'ehl'	TM 17588	03/05/1930	Gemsbok Pan, Botswana	m	94	75	28.5	20.2	4.5	4.7	10.9
'ehl'	MAK 1966.349	14/10/1965	Francistown, Botswana	m	95	78	28.1	17.0	4.3	4.1	10
'ehl'	MAK 1966.350	22/10/1965	Francistown, Botswana	m	96	72	29.9	18.6	4.1	4.0	13.2
'ehl'	MAK 1966.347	22/10/1965	Francistown, Botswana	f	95	75	27.5	18.8	4.3	4.0	15
'ehl'	MAK 1966.348	20/10/1965	Francistown, Botswana	f	91	70	27.6	18.3	5.0	4.2	11.4
<i>lwenarum</i>	BMI1953.54.207	03/06/1944	Mwinilunga, Zambia	f	97.5	73	28.7	18.7	4.6	4.6	10.4
<i>lwenarum</i>	TM 25785	21/10/1943	Balovale, Zambia	m	96	71	30.6	18.3		4.4	13.8
<i>lwenarum</i>	BMI1953.54.206	23/10/1943	Balovale, Zambia	m	94.5	68	28.8	18.6	4.4	4.5	10.3
<i>lwenarum</i>	BMI1956.16.42	05/06/1944	Mwinilunga, Zambia	m	92.5	69	29.6	19.7	4.4	4.0	11.3
<i>lwenarum</i>	BMI1956.16.41	23/10/1943	Balovale, Zambia	m	94	72	27.5	18.7	4.6	4.2	10.8
<i>lwenarum</i>	BMI1953.54.205	23/10/1943	Balovale, Zambia	m	91.5	67	28.4	18.7		4.0	11.6
<i>rufuloides</i>	ELM 10088	01/06/1962	Hofmeyer, E Cape, S Africa	f	84	66	27.2	17.0	3.6	4.1	10.4
<i>rufuloides</i>	ELM 14710	07/11/1970	Floukraal, E Cape, S Africa	f	85	65	26.2	17.3	4.0	4.0	10.4
<i>rufuloides</i>	ELM 12844	01/10/1967	Rossouw, E Cape, S Africa	f	84.0	62	25.5	16.6	3.8	3.6	12.4
<i>rufuloides</i>	ELM 10103	01/06/1962	Hofmeyer, E Cape, S Africa	f	81	61	26.0	17.6	3.8	4.2	12.6
<i>rufuloides</i>	ELM 10089	01/06/1962	Hofmeyer, E Cape, S Africa	f	87	66	27.0	18.3	4.0	4.1	14.7
<i>rufuloides</i>	NMBV06226	21/07/2004	Brandfort, Free State, S Africa	f	91	66	26.0	17.7	4.1	4.0	10.3
<i>rufuloides</i>	NMBV05935	18/10/2001	Fauresmith, Free State, S Africa	f	85	64	26.4	18.0	4.1	4.1	11.4
<i>rufuloides</i>	NMBV04857	10/05/1995	Heilbron, Free State, S Africa	f	85	68	27.3	17.4	3.9	4.4	11.5
<i>rufuloides</i>	ELM14968	01/10/1972	Setabata, Transkei, S Africa	f	86	63	27.3	17.0	4.3	4.2	11.6
<i>rufuloides</i>	ELM14990	03/10/1972	Setabata, Transkei, S Africa	f	84	66	28.4	16.6	4.0	5.0	12.7
<i>rufuloides</i>	DM8747	19/07/1960	Colenso, Natal, S Africa	f	82	62	27.7	17.1	4.2	4.4	10.7
<i>rufuloides</i>	DM8735	15/07/1960	Lake Chrissie, Transvaal, S Africa	f	80	61	23.3	15.4	3.8	4.5	11.6
<i>rufuloides</i>	DM34158	?/12/1983	Franklin, Natal, S Africa	f	82	60	27.2	15.8	4.0	4.3	9.7
<i>rufuloides</i>	ELM5398	30/03/1958	Dordrecht, E Cape, S Africa	f	81		26.9	17.3	3.9	4.2	11
<i>rufuloides</i>	ELM3239	22/06/1956	Cofimvaba, Transkei, S Africa	f	84	62	25.0	17.7	3.7	4.1	11.9
<i>rufuloides</i>	ELM7915	07/05/1960	Elandshoek, E Cape, S Africa	f	82.5	61	27.9	16.8	4.4	4.4	10.8
<i>rufuloides</i>	AM 2750	?/01/1926	Maletsunyane Falls, Lesotho	f	86	59	26.6	18.5	3.8	3.5	13
<i>rufuloides</i>	DM 34165	29/12/1983	Rhodes, E Cape, S Africa	f	89	61	27.0	18.5	4.1	4.2	10.3
<i>rufuloides</i>	DM 34161	30/12/1983	Naudesnek, E Cape, S Africa	f	84	60	27.4	17.6	4.2	4.3	12.8
<i>rufuloides</i>	DM 33729	14/01/1982	Naudesnek, E Cape, S Africa	f	87	60	27.6	18.1	3.8	4.2	11
<i>rufuloides</i>	DM 34162	29/12/1983	Rhodes, E Cape, S Africa	f	87	63	26.5	18.0	4.1	3.8	12.3
<i>rufuloides</i>	AM2748	04/11/1931	Grahamstown, E Cape, S Africa	f	84.5	63	28.0	17.1		4.1	11
<i>rufuloides</i>	AM2743	26/04/1973	Botswana; Peter Ginn?	f	85.5	61	27.0	16.5	3.8	3.8	11
<i>rufuloides</i>	AM2744	09/09/1901	Leeuwspruit, Free State, S Africa	f	80	68	26.2	16.4	5.0	4.8	9.5
<i>rufuloides</i>	AM2746	?/08/1897	Uitenhage, E Cape, S Africa	f	80	61	26.2	16.3	3.7	3.8	9.3
<i>rufuloides</i>	AM2761	14/09/1931	Grahamstown, E Cape, S Africa	f	87.5	60	26.8	17.5	4.0	4.4	10.7
<i>rufuloides</i>	AM2764	10/09/1926	Fort Brown, E Cape, S Africa	f	88	62	29.1	16.3	3.8	4.5	13.3
<i>rufuloides</i>	AM2754	23/11/1912	Pirie, E Cape, S Africa	f	81	60	28.2	16.2	4.0	4.1	10.5
<i>rufuloides</i>	AM2757	no date	Grahamstown, E Cape, S Africa	f	86	62		18.1	4.3	4.0	8.3
<i>rufuloides</i>	ELM 9521	16/09/1961	Kuruman, N Cape, S Africa	m	93	72	28.0	18.2	4.2	4.2	12.2

**Appendix 1.** List of museum specimens examined and measured, with measurements in mm. *continued*

<b>Taxon</b>	<b>Museum number</b>	<b>Date collected</b>	<b>Locality</b>	<b>Sex</b>	<b>Wing</b>	<b>Tail</b>	<b>Tarsus</b>	<b>Bill l</b>	<b>Bill d</b>	<b>Bill w</b>	<b>Hind claws</b>
<i>rufuloides</i>	ELM 14700	06/11/1970	Floukraal, E Cape, S Africa	m	90	64	27.1	18.3	4.4	4.0	11.2
<i>rufuloides</i>	ELM 12854	02/10/1967	Rossouw, E Cape, S Africa	m	91.5	63	28.2	18.1	4.1	3.9	11.5
<i>rufuloides</i>	ELM 14103	27/10/1969	Nieu-Bethesda, E Cape, S Africa	m	87	67	28.5	17.6	4.0	4.2	10.3
<i>rufuloides</i>	ELM 12513	24/05/1967	Adelaide, E Cape, S Africa	m	93	71	28.8	17.7	3.7	4.3	11.4
<i>rufuloides</i>	ELM 10102	01/06/1962	Hofmeyer, E Cape, S Africa	m	88.5	67	28.6	17.8	4.0	4.0	11.8
<i>rufuloides</i>	AM2736	03/06/1902	Vrededorst Road, Free State, S Africa	m	91	68	27.3	17.4	3.8	4.2	12.9
<i>rufuloides</i>	AM2747	03/06/1902	Vrededorst Road, Free State, S Africa	m	90	67	28.6	17.8	4.4	4.5	11
<i>rufuloides</i>	ELM 12121	03/12/1962	Makarikari, Botswana	m	87	63	28.3	17.7	4.0	4.1	12.2
<i>rufuloides</i>	ELM 18198	14/01/1951	Inyanga, Zimbabwe	m	90	64	27.3	18.1	4.1	4.6	10.4
<i>rufuloides</i>	ELM 14108	27/01/1969	Nieu-Bethesda, E Cape, S Africa	m	91	68	28.2	18.5	4.3	3.8	11.8
<i>rufuloides</i>	ELM 12603	26/05/1957	Adelaide, E Cape, S Africa	m	89	66		17.3	4.2	3.6	12.5
<i>rufuloides</i>	ELM 13981	12/06/1969	Tsolo, Transkei, S Africa	m	86	65	27.0	16.6	4.1	3.9	12.8
<i>rufuloides</i>	ELM 14699	07/11/1970	Floukraal, E Cape, S Africa	m	88	66	28.0	17.7	4.1	4.3	9.6
<i>rufuloides</i>	NMBV05903	21/06/2001	Jagersfontein, Free State, S Africa	m	88	67	25.9	17.2	3.9	4.4	13.2
<i>rufuloides</i>	NMBV03788	05/10/1998	Ficksburg, Free State, S Africa	m	89	67	28.3	17.9	4.3	4.4	9.3
<i>rufuloides</i>	NMBV05921	16/10/2001	Fauresmith, Free State, S Africa	m	86	67	26	18	4.3	4.4	12.2
<i>rufuloides</i>	NMBV06992	08/12/2010	Rouxville, Free State, S Africa	m	87	64	28.2	16.0	4.5	4.7	10.1
<i>rufuloides</i>	NMBV01872	24/10/1997	Lindley, Transvaal, S Africa	m	90.5	70	30.0	18.1	3.7	4.3	12.4
<i>rufuloides</i>	NMBV05904	21/06/2001	Jagersfontein, Free State, S Africa	m	89	70	30.2	16.6	4.2	4.4	11.6
<i>rufuloides</i>	NMBV06663	16/11/2000	Fauresmith, Free State, S Africa	m	91	70	29.1	19.6	4.4	4.3	13.5
<i>rufuloides</i>	NMBV07172	10/05/2012	Wesselsbron, Free State, S Africa	m	90	69	25.5	17.2	4.1	4.3	12.6
<i>rufuloides</i>	ELM5390	29/03/1958	Barkly East, E Cape, S Africa	m	86	66	25.4	17.8	4.0	4.9	10
<i>rufuloides</i>	ELM794	13/10/1953	Elandshoek, E Cape, S Africa	m	83	62	27.6	16.9	4.0	4.6	13.5
<i>rufuloides</i>	ELM792	12/10/1953	Elandshoek, E Cape, S Africa	m	85.5	61	27.0	17.9	4.1	4.1	8.9
<i>rufuloides</i>	ELM3332	30/06/1956	Tabankulu, Transkei, S Africa	m	88	63	26.8	17.7	4.0	4.1	10
<i>rufuloides</i>	ELM790	07/10/1953	Sterkstroom, E Cape, S Africa	m	87	64	28.7	17.9	4.2	4.0	11.4
<i>rufuloides</i>	ELM3333	30/06/1956	Mt Ayliff, Transkei, S Africa	m	88	68	29.6	18.8	3.8	4.5	10.5
<i>rufuloides</i>	ELM14963	01/10/1972	Setabata, Transkei, S Africa	m	89	68	28.6	17.3	4.0	4.6	11.8
<i>rufuloides</i>	ELM14998	04/10/1972	Setabata, Transkei, S Africa	m	91	62	28.6	16.0	4.1	4.4	10
<i>rufuloides</i>	DM8665	09/06/1960	Glen, Bloemfontein, Free State, S Africa	m	90.5	66	31.5	17.4	4.0	4.8	12
<i>rufuloides</i>	DM24520	11/10/1968	Ashburton, Pmb, Natal, S Africa	m	93	68	29.9	18.2	4.1	4.0	10.2
<i>rufuloides</i>	DM8722	01/04/1961	Cedarville, East Griqualand, S Africa	m	87		31.1	17.7	3.7	4.4	10.7
<i>rufuloides</i>	DM18055	24/11/1964	Colenso, Natal, S Africa	m	88	65	29.1	16.5	4.1	4.1	10.9
<i>rufuloides</i>	ELM5392	29/03/1958	Barkly East, E Cape, S Africa	m	84	61	27.0	17.4	3.5	4.0	10.5
<i>rufuloides</i>	DM18239	25/11/1964	Frere, Natal, S Africa	m	92	68	28.3	17.3	4.7	5.3	11.1
<i>rufuloides</i>	DM26590	15/01/1971	Bethal, Transvaal, S Africa	m	86	65	28.0	17.5	4.6	4.6	9
<i>rufuloides</i>	DM27840	08/01/1971	Kinross, Transvaal, S Africa	m	85	59	30.0	17.2	4.0	4.6	11.5
<i>rufuloides</i>	ELM1058	08/05/1954	Rossouw, E Cape, S Africa	m	90	70	28.6	19.5	4.2	4.0	11
<i>rufuloides</i>	ELM18205	13/10/1957	Molteno, E Cape, S Africa	m	87	65	28.3	18.3	4.1	4.0	9.6
<i>rufuloides</i>	ELM3267	25/06/1956	Tabankulu, Transkei, S Africa	m	88	64	30.0	18.5	4.0	4.1	12
<i>rufuloides</i>	ELM12458	14/04/1967	Mt Ayliff, Transkei, S Africa	m	91	66	27.1	16.8	3.8		11.2
<i>rufuloides</i>	ELM18204	13/10/1957	Molteno, E Cape, S Africa	m	86.5	62	28.2	17.6	3.9	4.6	10.9
<i>rufuloides</i>	ELM14845	07/12/1971	Debe Nek, E Cape, S Africa	m	89	67	28.4	16.8	4.6	4.3	8.4
<i>rufuloides</i>	AM 2758	xx/06/1918	Kimberley, N Cape, S Africa	m	84	62	26.4	17.0	4.3	4.9	12.2
<i>rufuloides</i>	DM 34160	21/01/1984	Naudesnek, E Cape, S Africa	m	88	66	28.3	18.8	3.6	4.0	12.4
<i>rufuloides</i>	DM18239	25/09/1964	Frere, Natal, S Africa	m	91	68	28.3	16.9	4.4	4.4	10.3
<i>rufuloides</i>	DM 34166	20/01/1984	Naudesnek, E Cape, S Africa	m	85	63	28.0	18.3	4.2	4.5	10.1
<i>rufuloides</i>	DM34159	21/01/1984	Naudesnek, E Cape, S Africa	m	86	59	29.4	18.4	4.0	4.2	11.6