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Ornithology

Biometrics and moult of Grey-backed Sparrow-lark *Eremopterix verticalis* in the Karoo, September 2023

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Abstract

The biometrics of Grey-backed Sparrow-larks *Eremopterix verticalis* in the handbooks are based on small samples. We summarize wing-length, tail-length and mass of a sample of 130 Grey-backed Sparrow-larks mistnetted during ringing on the farm New Holme, Hanover District, Northern Cape, South Africa, in September 2023. The habitat was Grassy Karoo with, on average, March being the month of peak annual rainfall. The sample consisted of 58 females and 72 males. We examined birds for primary moult; 5% had moulted either one or two primaries, indicating that moult was commencing in the population as a whole. This observation, set in the context of an observation made in Namibia, suggests that this species undertakes a pre-breeding moult in spring and summer, prior to breeding in late summer and autumn.

Introduction

Within the Alaudidae (larks), del Hoyo et al. (2004) considered that there were 21 genera and 96 species (lark taxonomy is in revision – Alström et al. 2023). Only nine of the lark species are sexually dimorphic in plumage. These include seven of eight species genus *Eremopterix* and two of the six in *Melancorypha* (del Hoyo et al. 2004). Six of the seven dimorphic *Eremopterix* sparrow-larks occur in Africa south of the Sahara Desert, and there is one on the Indian subcontinent, in India, Pakistan, Bangladesh and Sri Lanka. The eighth member of the genus, Madagascar Lark *Eremopterix hova* was moved to this genus a decade ago (Alström et al. 2013). Multilocus phylogeny of the avian family Alaudidae (larks) reveals complex morphological evolution, non-monophyletic genera and hidden species diversity. Molecular Phylogenetics and Evolution 69:1043–1056. Although they are a particularly fascinating and distinct genus within the larks, they are relatively poorly studied, which is clear from the short lists of references for these species in del Hoyo et al. (2004).

The biometrics of the Grey-backed Sparrow-lark *Eremopterix verticalis* in the handguides are based on small samples (for example the measurements in Hockey et al. (2005) are based on samples of 12 females and 14 males, and the masses are based on 37 females and 34 males). This paper reports on wing-length, tail-length and mass, based on a larger sample than those in Hockey et al. (2005). This information is of value to biogeographers and macro-ecologists, who discern patterns of species distribution in relation to multiple variables including body-size (e.g. Ottaviani et al. 2006). Many species have been shown to be changing in size as a consequence of global climate change; one of the barriers to such studies is the lack of baseline data (Yom-Tov 2001, Yom-Tov et al. 2006). There are other areas of research that utilize basic biometric data; for example studies of allometry relate the mass of an animal to variables such as energy consumption, brain size, home-range size, duration of primary moult (Clingenberg 2016, Nagy 2022, Scott 2023).

Moult in the Alaudidae is poorly known; Scott (2023) compiled a database of 143 bird species to which the moult model of Underhill & Zucchini (1987) had been applied to estimate the parameters of moult. The larks are not represented in that database. Hockey et al. (2005) wrote 31 species texts for the larks occurring in southern Africa; for 15 of these species the section on moult was reduced to “no data”, and for the remainder the available knowledge can be summarized as severely incomplete. We therefore also report the primary moult data we observed.

Methods

We mistnetted Grey-backed Sparrow-larks at two waterholes at a windpump (30.8988°S, 24.6626°E) on the farm New Holme, Hanover, Northern Cape, on 3, 6 and 9 September 2023 (Figures 1–4). The vegetation in the area is Grassy Karoo (Allan et al. 1997). One of the waterholes was within 10 m of the concrete reservoir at the windpump, and the water consisting of the overflow, and of seepage when there was no wind. The other waterhole was 150 m distant and was purpose-built for birds, continuously fed by a trickle of water brought to the site by a plastic pipe from a sheep drinking trough. The birds used both water sources. This is likely to have been the only available water within a radius of several kilometres, and loose flocks of up to c. 100 birds arrived intermittently to drink. The mistnets were erected at about 08h00 and taken down by 12h00. The birds were ringed with Safring 2.3 mm-diameter rings. Birds were aged and sexed as described by Tippett (2023). Measurements were made, and primary moult recorded, as described by de Beer et al. (2000). Coincidently, the type specimen of Grey-backed Sparrow-lark was collected within 70 km of of this study site, at Colesberg, by Andrew Smith between 1834 and 1836 (Smith 1836).

Results and Discussion

We handled a total of 130 Grey-backed Sparrow-larks on the three fieldwork days (Table 1). On 6 September, the waterholes had completely frozen over, and the birds had to wait for them to thaw before coming to drink (Figure 4). On 9 September, there was a steady breeze by 08h00, and this resulted in fewer birds being trapped in the mistnets (Table 1). On 6 and 9 September, we made no retraps of birds ringed on previous days. We can make no realistic estimate of the number of sparrow-larks which used these two waterholes, but it was probably at least 1,000 birds.

Sex ratio. wing-length, tail-length and mass

Of the 130 birds handled, 55% were male (Table 1), but this was not significantly different from parity (z=1.23, P=0.22) (two-sided test of the null hypothesis that the proportions of males and females are 0.5, Underhill & Bradfield 1999).

The mean wing-lengths of females and males were 80.6 mm and 82.7 mm respectively (Table 2); these were significantly different (t_{128}=7.22, P<0.001) (two-sample t-test, Underhill & Bradfield 1999). Similarly the tail-lengths of females and males were significantly different (45.2 mm and 46.7 mm respectively, t_{128}=4.57, P<0.001). However, there is considerable overlap between males and females for both wing and tail (Table 2). The masses of females and males were both 17.5 g and 17.2 g respectively (Table 2), and were not significantly different (t_{128}=1.15, P=0.25). In summary, wing-length and tail-length were on average longer in males than females (by 2.6% and 3.3% respectively), but the average masses were not significantly different.

The wing-lengths in Hockey et al. (2005) are 77.7 mm for females and 80.4 mm for males, based on samples of sizes 12 and 14 respec-

Table 1: Numbers of female and male Grey-backed Sparrow-larks mistnetted at New Holme, Hanover, Northern Cape.

Date	Female	Male	Total
3 September 2023	27	29	56
6 September 2023	23	31	54
9 September 2023	8	12	20
Total	**58**	**72**	**130**

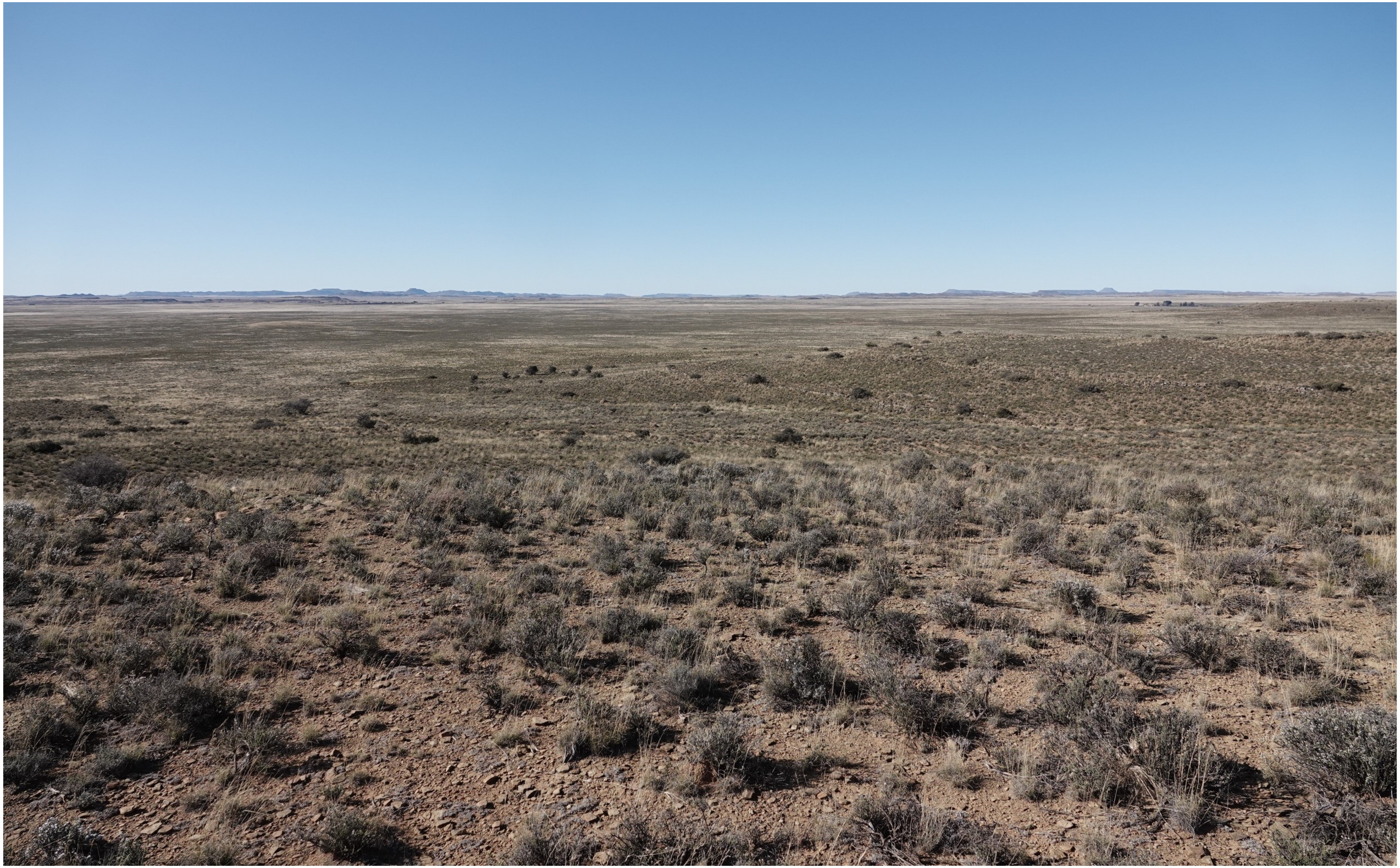

Figure 1: View of the habitat which the Grey-backed Sparrow-larks were occupying on the farm New Holme, Hanover District, Northern Cape, South Africa. This is classified as Grassy Karoo. The photo was taken on 7 September 2023. It shows the seasonal drought at the end of the harsh cold winter before the arrival of the summer rains. This area had experienced above average rainfall the previous summer. Photo credit: Les Underhill

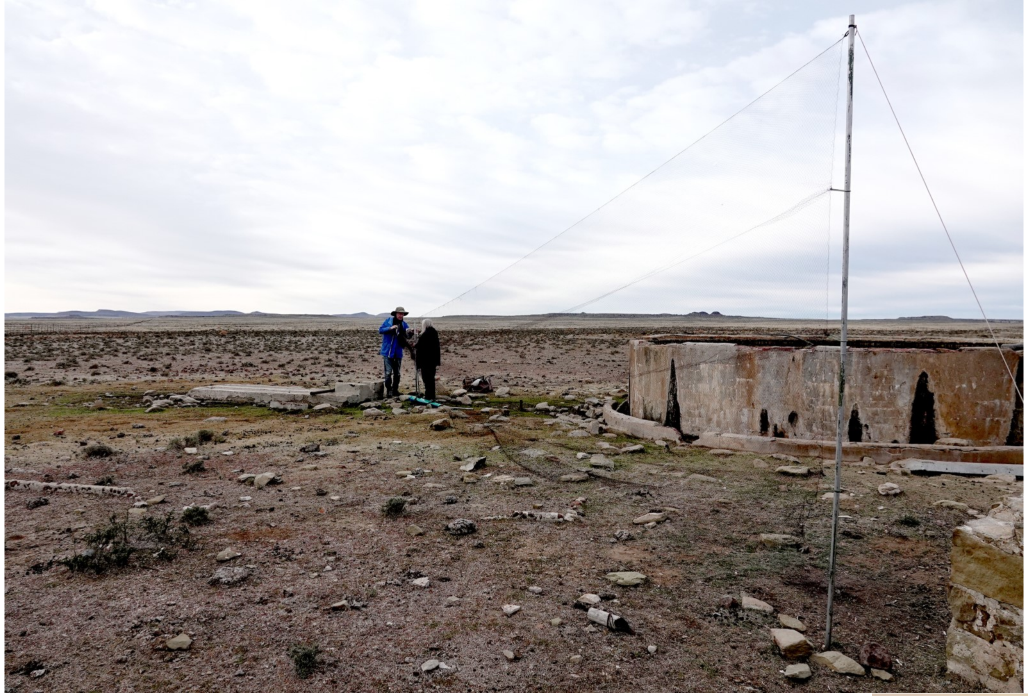

Figure 2: Setting up mistnets near the circular concrete reservoir on 3 September 2023. The area with green grass at the far end of the mist-net has standing water when the wind blows and the dam overflows.
Photo credit: Les Underhill

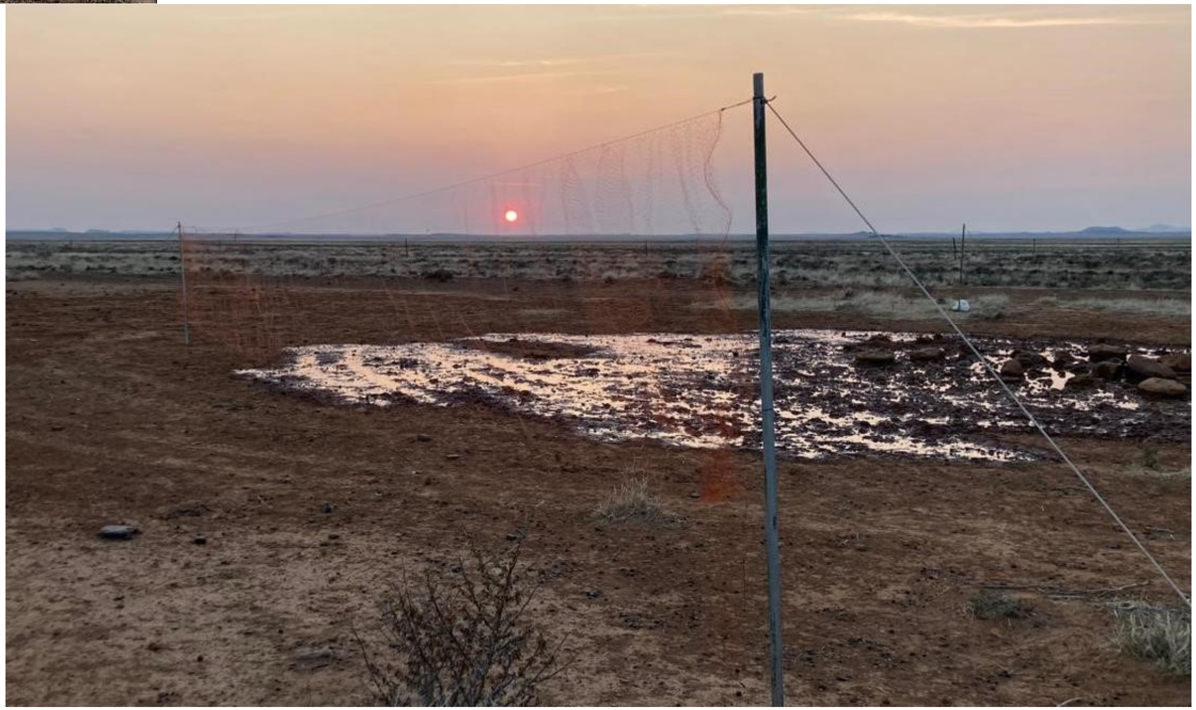

Figure 3: Mistnet set up at dawn on 9 September 2023 at the purpose-built waterhole fed by a trickle of water from the circular concrete reservoir of Figure 1.
Photo credit: Graeme Hatley

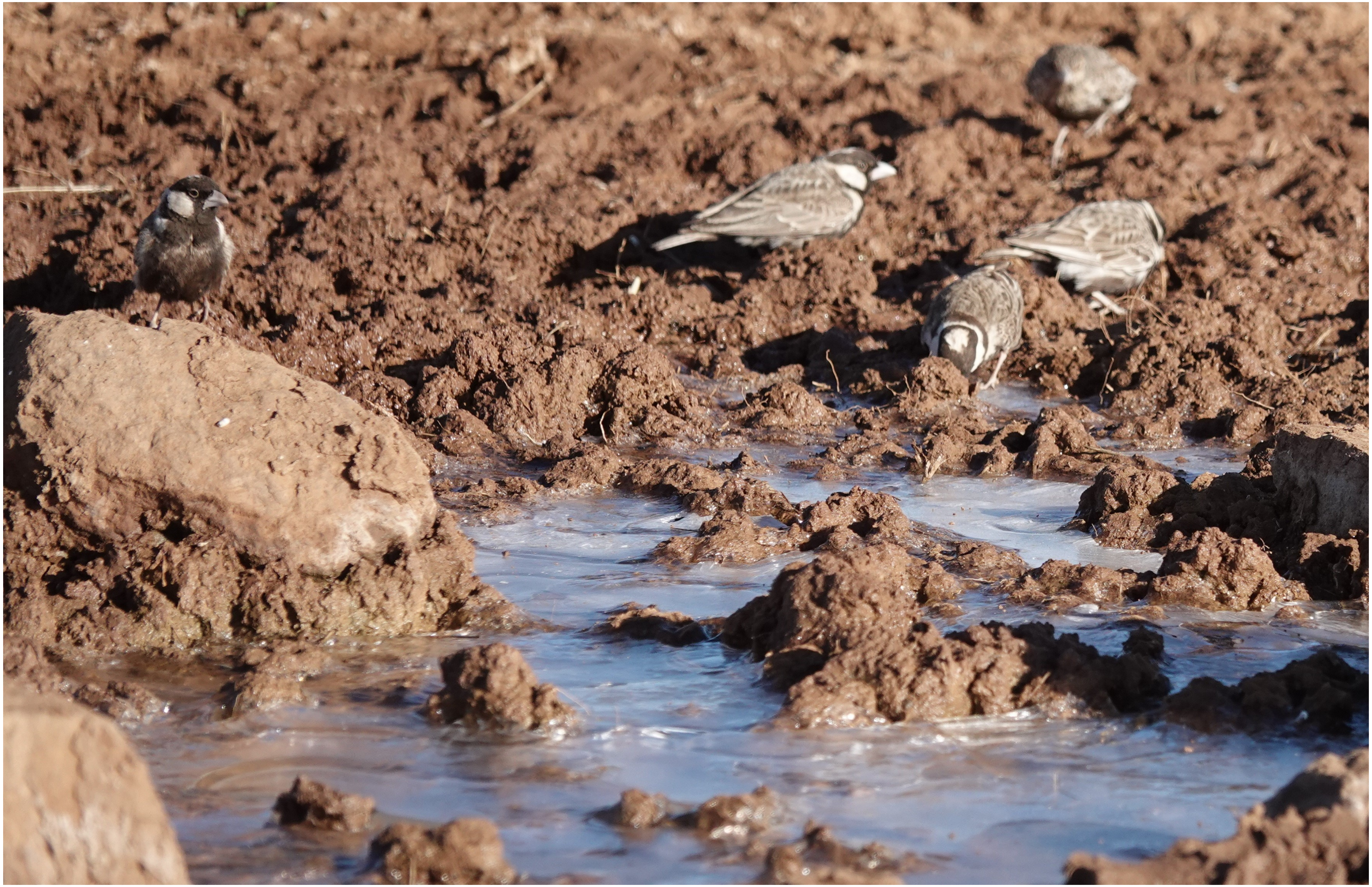

Figure 4: Grey-backed Sparrow-larks wait for the ice to thaw before they can drink on 6 September 2023. This is the waterhole of Figure 3. Photo credit: Les Underhill

Table 2: Summary statistics of wing, tail and mass measurements of Grey-backed Sparrow-Larks at New Holme, Hanover. The samples sizes were 58 females, 72 males and 130 in total; all measurements were made on each bird.

		Female	**Male**	**All**
Wing (mm)	Mean (SD)	80.6 (1.5)	82.7(1.7)	81.8 (1.9)
	Range	77.0–83.5	79.0–87.5	77.0–87.5
Tail (mm)	Mean (SD)	45.2 (1.2)	46.7 (2.1)	4 6.0 (2.0)
	Range	41.5–48.0	42.5–51.0	41.5–51.0
Mass (g)	Mean (SD)	17.5 (0.9)	17.2 (1.1)	17.3 (1.0)
	Range	16.1–20.3	13.9–19.5	13.9–20.3

tively, and 2.9 mm and 2.3 mm shorter than ours (Table 2). Their tail measurements are c. 4 mm longer than ours. The source of their measurements is not given, but it is likely that they were made on museum specimens, which are difficult to measure. Their average masses, 17.2 g for females and 17.4 g for males, are similar to ours, and are referenced to two sources (Willoughby 1971, Herholdt 1988).

Primary moult

Of 127 birds examined for primary moult, six (5%) had moulted their first one or two primaries. The most advanced moult score was 320^7 (using the standard protocol for describing moult: the first primary at growth stage 3, the second at stage 2, and the remaining seven primaries old (de Beer et al. 2000)).

During fieldwork in the Namib Desert, Namibia, in the summer of 1965/66, Willoughby (1971) found that primary moult started in late September and was completed during February, prior to the start of breeding in March, as evidenced by testicle size in males. Passerines generally moult their primaries after breeding. For example, in the weavers (Ploceidae), all species other than Seychelles Fody *Foudia sechellarum* moult their primaries after breeding (Oschadleus & Andersson 2023). In desert environments, there is frequently large variation in the timing of breeding, and the subsequent moult, with erratic rainfall events being the trigger.

The timing of the start of moult recorded by Willoughby (1971) coincides closely with our observations. The tentative conclusion is that Grey-backed Sparrow-lark undertakes a pre-breeding primary moult during spring and mid-summer. On average, but with considerable inter-annual variation, the month with the largest average rainfall is March, in both the Nama Karoo into which our study site falls, and at Willloughy's (1971) study site in the Namib Desert (Allan et al. 1997). Breeding takes place in late summer when arthropod abundance to meet the food demands of growing chicks is, on average, at its maximum (Willoughby 1971). For bird species which do not undertake long-distance migration, breeding and moult are the two most energy-demanding periods in the annual schedule. If primary moult took place after breeding for this species, it would occur during the cold winter period, when food abundance is minimal. It is thus an effective strategy to moult in spring to mid-summer. Even though conditions are, on average, too dry for food to be abundant, environmental conditions are warm, and conditions more favourable for moult than in winter.

Studies of the timing of breeding and moult are needed for the species that breed in the arid west of southern Africa. This is the region where, on average, the timing of peak rainfall is in late summer, so that food abundance is greatest in early autumn. For bird species that moult after breeding, the strategy used by the majority, they do so in winter, probably the most challenging period of the year. It will be interesting to see how many bird species in this arid western zone have switched to a pre-breeding moult strategy.

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References

Allan DG, Harrison JA, Herremans M, Navarro R, Underhill LG 1997. Southern African geography: its implications for birds. In Harrison JA, Allan DG, Underhill LG, Herremans M, Tree AJ, Parker V, Brown CJ (eds) The atlas of southern African birds. Vol. 1: Non-passerines. Johannesburg: BirdLife South Africa: lxv–ci.

Alström P, Barnes KN, Olsson U, Barker FK, Bloomer P, Khan AA, Qureshi MA, Guillaumet A, Crochet P-A, Ryan PG 2013. Multilocus phylogeny of the avian family Alaudidae (larks) reveals complex morphological evolution, non-monophyletic genera and hidden species diversity. Molecular Phylogenetics and Evolution 69:1043–1056.

Alström P, Mohammadi Z, Enbody ED, Irestedt M, Engelbrecht D, Crochet P-A, Guillaumet A, Rancilhac L, Tieleman BI, Olsson U, Donald PF, Stervander M 2023. Systematics of the avian family Alaudidae using multilocus and genomic data. Avian Research 14: 100095. Available online at https://www.sciencedirect.com/science/article/pii/S205371662300021X

de Beer SJ, Lockwood GM, Raijmakers JHFA, Raijmakers JMH, Scott WA, Oschadleus HD, Underhill LG 2000. SAFRING bird ringing manual. ADU Guide 5: 1–102. Available online at http://safring.adu.org.za/downloads/ringers-manual.pdf

del Hoyo J, Elliott A, Christie DA, 2004. Handbook of the birds of the world. Vol. 9. Contingos to pipits and wagtails. Lynx Edicions, Barcelona.

Ginn HB, Melville DS 1983. Moult in birds. BTO Guide 19. BTO, Tring.

Herholdt JJ 1988. Bird weights from the Orange Free State (Part II: Passerines). Safring News 17: 43–57.

Hockey PAR, Dean WRJ, Ryan PG (eds) 2005. Roberts Birds of southern Africa. 7th ed. John Voelcker Book Fund, Cape Town.

Klingenberg CP 2016. Size, shape, and form: concepts of allometry in geometric morphometrics. Development Genes and Evolution 226: 113–137. Available online at https://link.springer.com/content/pdf/10.107/s00427-016-0539-2.pdf

Nagy KA 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews Series B 71: 21R–31R.

Oschadleus HD, Andersson S 2023. Plumage dimorphism and moult patterns of weaverbirds – a review. Ostrich. DOI: 10.2989/00306525.2023.2234646

Ottaviani D, Cairns SC, Oliverio M, Boitani L 2006. Body mass as a predictive variable of home-range size among Italian mammals and birds. Journal of Zoology 269: 317–330. Available online at https://www.researchgate.net/profile/Daniela-Ottaviani-2/publication/229888697_Body_mass_as_a_predictive_variable_of_home-range_size_among_Italian_mammals_and_birds/

Scott T 2023. A contribution to understanding the primary moult of birds. Unpubl. PhD thesis, University of Cape Town.

Smith A 1836. Report of the expedition for exploring central Africa, from the Cape of Good Hope, June 23, 1834, under the superintendence of Dr. A. Smith. Government Gazette Office, Cape Town

Tippett RM 2023. Grey-backed Sparrow-lark *Eremopterix verticalis*. Biodiversity and Development Institute. Available online at http://thebdi.org/2023/09/11/grey-backed-sparrow-lark-eremopterix-verticalis/

Underhill LG, Bradfield DJ 1996. IntroSTAT (Second edition). Cape Town: Juta and Company: 1–350. Open access edition available online at http://open.uct.ac.za/bitstream/handle/11427/4150/INTROSTAT_ebook.pdf?sequence=1

Underhill LG, Zucchini W 1988. A model for avian primary moult. Ibis 130: 358–372.

Willoughby EJ 1971. Biology of larks (Aves: Alaudidae) in the central Namib Desert. Zoologica Aficana 6: 133–176. Available online at https://www.ajol.info/index.php/az/article/download/150907/140485

Yom-Tov Y 2001. Global warming and body mass decline in Israeli passerine birds. Proceedings of the Royal Society of London B 268: 947–952. Available online at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1088692/pdf/PB010947.pdf

Yom-Tov Y, Yom-Tov S, Wright J, Thorne CJR, du Feu R 2006. Recent changes in body weight and wing length among some British passerine birds. Oikos 112: 91–101. Available online at http://mondrian.tau.ac.il/lifesci/departments/zoology/members/yomtov/documents/recentchanges.pdf

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