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## Distribution and habits of the Sclater's Lark *Spizocorys sclateri* on the greater Aberdeen Plain, South Africa

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### Abstract

Sclater's Lark *Spizocorys sclateri* is classified as Near Threatened by the IUCN and is described as a species endemic to the arid Karoo biomes (hereafter 'the Karoo' unless otherwise stated), which stretch from the interior of South Africa through to central Namibia. It is a rare and poorly understood species. We report on intensive BirdMap sampling by author ST using the BirdLasser app across the Aberdeen Plain, that section of the Karoo south of the escarpment, to better understand patterns of occurrence for this subpopulation. We also report on incidental surveys across the Great Karoo region, and comment further on a formal survey across the Karoo conducted between 2017 and 2018. Surveys around Beaufort West indicate a strong preference for a specific type of veld associated with calcrete-derived soils, with the indicator plant species blomkoolganna *Salsola tuberculata*. We mapped these sites using their distinctive visual signature on Google Earth for the Aberdeen Plain, suggesting suitable available habitat covering a prime area of 158 km<sup>2</sup> and an area of mixed habitat suitability of 685 km<sup>2</sup>. Monitoring from 2017 to 2022 at water points for livestock indicates year-round occurrence, suggesting the species is resident in the Aberdeen Plain, with no evidence of nomadism. Validation expeditions to parts of the range north of the escarpment suggest the strong habitat association identified for the Aberdeen Plain also applies to that population. Due to the lack of a key predictor variable, namely distribution of blomkoolgannaveld, distribution modelling attempts were unsatisfactory due to overprediction, but still indicated the Aberdeen Plain as an isolated population, probably of no more than 1 000 individuals. We raise concerns regarding this habitat for 'big development' and suggest this species is flagged as a species of conservation concern during environmental impact assessments, especially as there are no populations in formally protected areas.

**Keywords:** Sclater's Lark, Karoo, *Salsola tuberculata*, habitat association, conservation, endemic species, citizen science, BirdMap

### Introduction

Sclater's Lark *Spizocorys sclateri* is endemic to southern Africa, its distribution being confined to the Nama Karoo (Dean 1995). Most records in the second Southern African Bird Atlas Project (SABAP2; est. 2007) are from the Northern Cape Province, with scattered records from southern Namibia and an isolated population east of Beaufort West in the Western Cape Province. It is uncommon and localized in occurrence, with Cinnamon-breasted Warbler *Euryptila subcinnamomea* the only Karoo endemic species reported less frequently according to bird atlas data (Lee *et al.* 2018). The ecology of Sclater's Lark is the least well-understood of the southern African larks: in a review of the distribution and status of larks from an ecological perspective, Sclater's Lark was classified as neither resident nor nomadic, but as a "nomad-insectivore?" (Dean and Hockey 1989). Note the uncertainty in the classification. This

publication later describes the same species as an "endemic nomad", with a distribution that "does not usually occur south and east of Beaufort West in the Karoo". Our observations will show that this statement does not currently apply to the Beaufort West / Aberdeen Plain subpopulation.

According to The Atlas of Southern African Birds (Dean 1997), Sclater's Lark is usually seen "singly, in pairs, or, when not breeding, in groups of up to 20 birds at drinking sites". Systematic surveys of the Nama and Succulent Karoo biomes failed to encounter the species frequently enough to inform density estimates nor, consequently, robust population estimates (Lee *et al.* 2018). Density estimates (1–2 individuals/km<sup>2</sup>) and resulting population estimates were modelled on a body mass-corrected formula based on SABAP2 reporting rates (Lee *et al.* 2019a), but have such a wide range as to be almost meaningless (between 20 000 and over half a million).



Dean (1997) further states: "Sclater's Lark inhabits arid to semi-arid gravelly and stony plains with scattered shrubs and grasses on shale soils and sparse dwarf shrublands on clays, sometimes where drainage is impeded and there are extensive bare patches... It is an opportunistic and nomadic species, moving into areas after rain, nesting, and then moving on." However, we suspect this observation may be informed by general patterns of nomadism seen for other granivorous species in the Nama Karoo, such as Lark-like Bunting *Emberiza impetuani* (Dean *et al.* 2009). A more recent description in popular literature suggests that the species is "virtually resident in some areas, but subject to irregular movements, especially towards edges of range. Occasional vagrancy indicated by a record of a single juvenile in SW South Africa (near Cape Town)" (Ryan 2020). These larks have also been observed to drink often, and may have benefited to some extent from the proliferation of stock water points (Steyn and Myburgh 1989), although individual visitation rates are unknown. In this paper we document regular visits to a well-known site for Sclater's Lark east of the town of Beaufort West by the citizen scientist (ST), as well as his visits to much of the surrounding Karoo during contributions to SABAP2 during the period 2017 to 2022. These observations represent our best understanding of the life-history patterns of this lark at the present time.

## Methods

### Study region

The Nama-Karoo biome is an arid zone ecoregion which covers between 25 and 30% of South Africa (Esler *et al.* 2006). Within this, our main study area was an approximate 100 km radius around the town of Beaufort West. Beaufort West lies below an escarpment that separates the high-altitude Great Karoo from the lower altitude Aberdeen Plain, centred on the Karoo town of Aberdeen. The greater Aberdeen Plain is a broad geographic region stretching roughly from the N12 highway south of Beaufort West in the west, through the town of Aberdeen, and eastwards to Pearston. The geology is dominated by sedimentary rocks such as shales, referred to as the 'Beaufort' group of the Karoo Supergroup, and perforated by dolerite intrusions (Dean and Milton 1999). The annual rainfall is usually less than 250 mm per year, increasing in the east, where vegetation changes from Nama Karoo to Albany Thicket (Esler *et al.* 2006). The area receives rainfall in summer.

### Experimental design

The survey methodology revolved around the BirdMap protocol (Brooks *et al.* 2022). This is the data collection protocol for SABAP2. In brief, surveys are undertaken in geographic units called pentads, measured as 5 x 5 minutes of latitude and longitude. With some variation depending on latitude, these pentads cover c. 70 km<sup>2</sup>. The temporal sampling interval is two hours minimum and five days maximum, although surveys are on average three hours in length. The data are collected using the BirdLasser mobile phone app (Lee and Nel 2020). BirdLasser automatically records the location of the observer at the time the bird was observed, with an option to assign a more spatially explicit location by the user if required. We examined spatial records of occurrence and non-occurrence of Sclater's Lark from these GPS locations.

### Habitat identification

Field observations by ST suggested a strong correlation between the occurrence of Sclater's Lark and a type of veld characterized by calcrete geological intrusions, distinctively with the presence of a small shrub *Salso-la tuberculata*, known locally as 'blomkoolganna'. On identifying this association between birds and veld type in the Beaufort West area, similar habitat was identified in the region using Google Earth, where this veld type was identifiable in satellite images by its smooth, greyish colour; likely a consequence of soil and associated vegetation. Field expeditions were also undertaken to a site with similar habitat north of Britstown in 2018, where the species had not previously been recorded, and were encountered where predicted. A similar expedition east of this site but which had only very small patches of habitat was visited in 2020, and no Sclater's Larks were encountered. Extensive tracts of 'blomkoolgannaveld' were identified south of Vosburg, and the species was conclusively documented there during an expedition in October 2022. Based on this field-tested validation of the visual interpretation of Google Earth images, suitable habitat was mapped across the Aberdeen Plain. However, the terrain towards Rietbron was characterised by very small sections of suitable habitat, and as such bounding polygons for these were created which encompassed large portions of unsuitable habitat. Our results are thus summarized as contiguous (all suitable) and dispersed (matrix of small sections of suitable habitat within large areas of unsuitable habitat).

As a microsite-specific experiment, ST conducted opportunistic but regular visits to a water source about 10 km east of Beaufort West on the farm Bulskop between 2019 and 2022. We report on seasonal and daily patterns of occurrence associated with these visits.

### Distribution modelling

A pentad-level species distribution model was created following the methods of Lee *et al.* (2023). In summary, we used percentage cover according to the Land Use Land Cover (LULC) dataset (DFFE 2020), as well as Worldclim data (Fick and Hijmans 2017), 40 predictor variables in all. We used the random forest machine learning methods as implemented through the 'ranger' package in R v4.1.0 (Wright and Ziegler 2017) using presence and absence from SABAP2 pentad data. Absence data were derived from pentads with high confidence of absence (0 records after 10 or more cards). Model validation was based on an 85/15 split of data. Model performance was evaluated using predicted presence and absence at the 0.5% threshold using standard machine learning performance measures: accuracy, sensitivity and area under the ROC (Receiver Operating Characteristic) curve.

### Results

SABAP2 results show Sclater's Lark is very rarely encountered across its relatively large range (Figure 1a). Extensive surveys between Beaufort West and Aberdeen by ST show the species has a strong affinity for a very specific veld type, which we refer to as blomkoolgannaveld (Figure 1a, Figure 2, Appendix 1). There is no corresponding vegetation type in the Vegetation Field Atlas of Continental South Africa, Lesotho and Swaziland (Mucina *et al.* 2014), with the identified habitat receiving a variety of habitat classifications varying by geographic location according to this reference. Using standard Google Earth imagery, ST documented nine sites with contiguous habitat and a surface area of >4.5 km<sup>2</sup>, with the largest measuring 65 km<sup>2</sup> (Figure 3). The total area of these contiguous habitat sites was 158.2 km<sup>2</sup>. The five polygons containing dispersed habitat (91–199 km<sup>2</sup>) represented a total area of 684.8 km<sup>2</sup>. This veld type is generally very flat, with a high utilization rate by livestock, usually various breeds of sheep. None of this habitat exists in the two formally protected areas in this geographic region, namely the Karoo and Camdeboo National Parks. In this region, Sclater's Lark can usually be found drinking in the early morning period, mostly within the first two

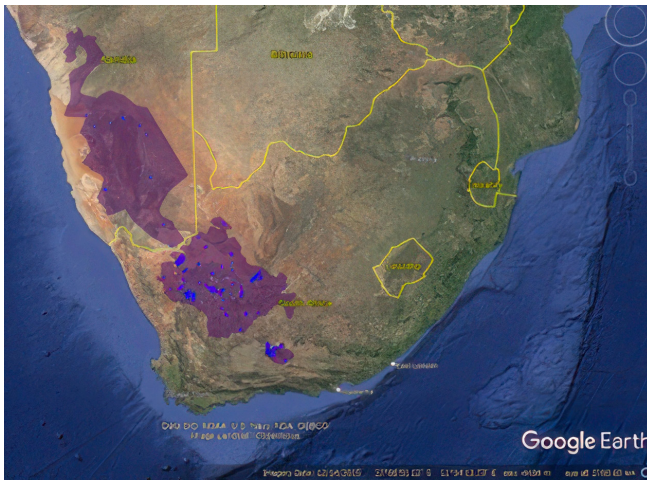
hours of sunlight (Figure 4). Visits to the Bulskop drinking site across four years (2019–2022) recorded the presence of the species at or near to the livestock drinking troughs for every month, suggesting no seasonal movement pattern. Average group size according to Threatened Species Cause data from across the species' range was 10 (median 3), with a maximum of 88. These most likely represent group sizes of birds at drinking sites (although this information is not indicated in that dataset). The largest single flock recorded at the Bulskop drinking site was 50 individuals.

The species distribution model presented here (Figure 1b) was trained on 131 pentads, with model specification parameters as follows: Accuracy = 0.99; Sensitivity = 1; Specificity = 0.79; ROC\_AUC = 0.99. The number of pentads with predicted probability of occurrence > 0.5 was 1275, i.e., a modelled range in South Africa of approximately 89 250 km<sup>2</sup>. A visual comparison of Figure 1a (blomkoolganna distribution) and Figure 1b (modelled Sclater's Lark range) indicate a close fit both in terms of shape and extent, with the isolated Aberdeen populations for each species apparent. Note, the blomkoolganna range polygon was not used to model Sclater's Lark distribution.

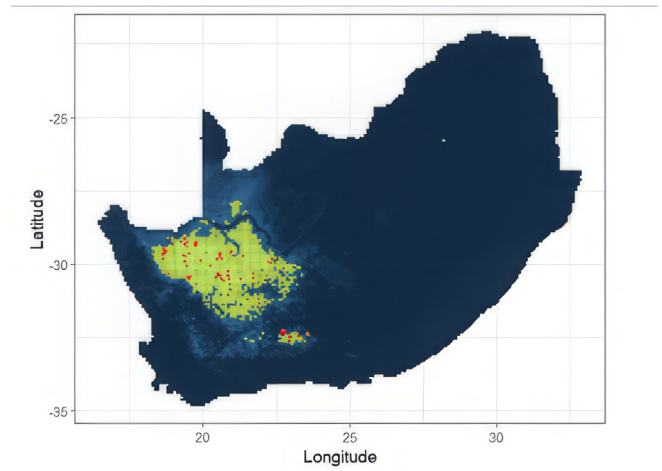
### Discussion

Insights presented in this manuscript rely heavily on the experience of the citizen scientist (ST). Regular bird observations by citizen scientists have been shown to provide ecologically useful information (Mullins and Craig 2020). The value of ST's observations was enhanced by the fact that Sclater's Lark is so rare and hard to find (there were only 16 photographs of this species on the iNaturalist citizen science database at the time of writing), so the identification of a site where the species could be reliably observed was an important tourism resource for the birdwatching community (J Claassen, pers. com.). The identification of the Bulskop drinking site close to the town of Beaufort West facilitated regular visitation opportunities.

ST's observations suggest that Sclater's Lark is associated with a very specific habitat, namely blomkoolgannaveld, at least in the subpopulation south of the escarpment. This pattern seems to be true of the population to the north of the escarpment, too, although further field surveys towards Namibia are required to confirm the pattern in that part of their range. This shrub-dominated veld typically has low grass cover, with a risk of overgrazing that leads to less suitable habitat for Sclater's Lark once



a



b

Figure 1a. A Google Earth image of South Africa including the distribution of *Salsola tuberculata* (purple polygon, from <http://redlist.sanbi.org/species.php?species=3590-110>); and presence of Slater's Lark in SABAP2 pentads as of 2020 (blue points).

Figure 1b. The presence of Slater's Lark (red points) according to BirdLasser contributions to BirdLife South Africa's Threatened Species Cause Programme (2019–2022) overlaid on a species distribution model for Slater's Lark based on a prediction using Worldclim and LULC variables with predictions at the pentad level. Here, yellow represents a prediction surface of probability >0.5, while the light blue represents probabilities of 0.01 to 0.49. Dark regions represent regions of predicted absence. Note that even though this prediction model is at a very coarse scale (pentad) and there is overprediction in the north-east (Upington area), the Aberdeen Plain's population in the south is isolated.

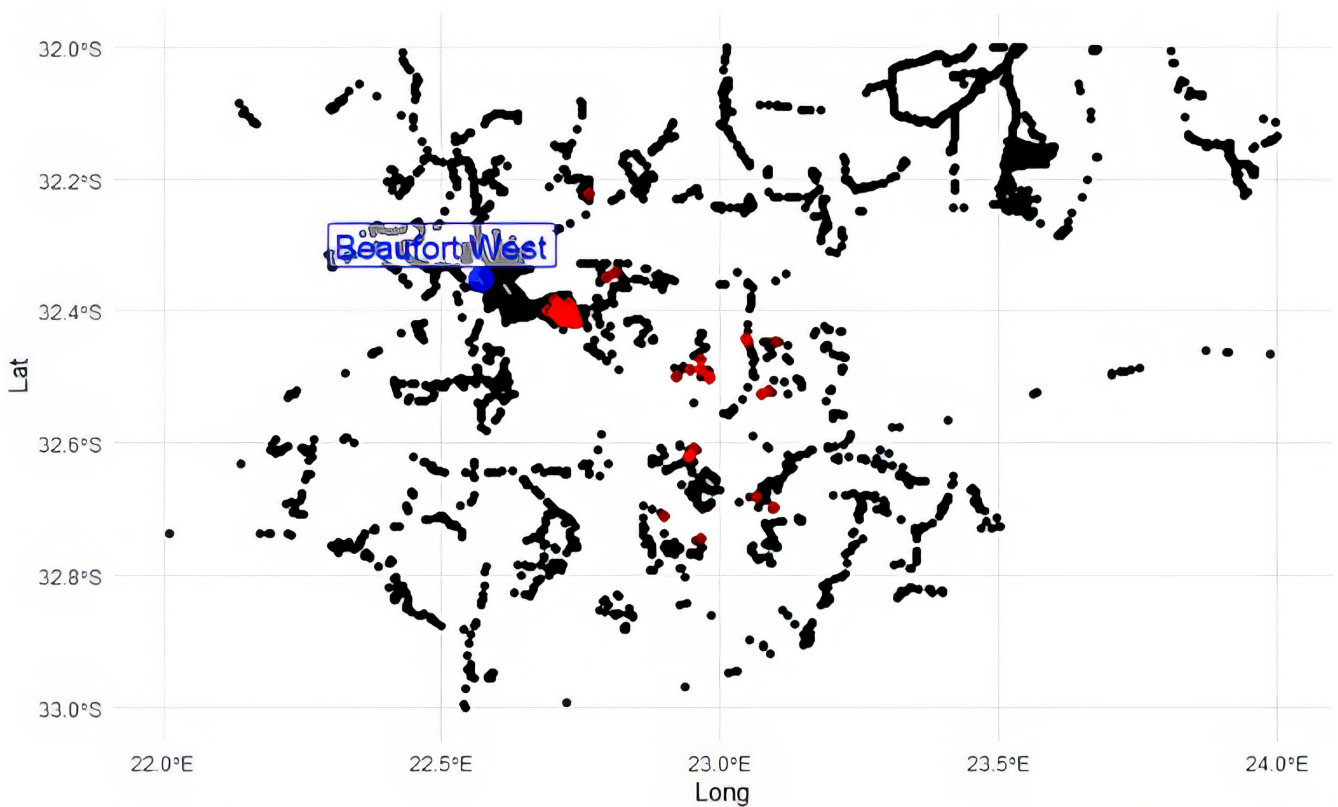


Figure 2. Sampling domain map of the region near Beaufort West indicating Slater's Lark (red points) and all other bird species (black points) recorded by ST.

barren soil becomes dominant (ST, pers. obs.). The reasons for the association are still unclear, and may not be due to the presence of *Salsola tuberculata* specifically. For instance, Lloyd (1999) observed that the species was a specialist grass feeder, being the only species that

could access seeds of *Enneapogon desvauxii*. However, the range of that grass species is far more extensive than the distribution of Slater's Lark. Regarding other comments on habitat associations (Dean 1997), we note that extensive clay-based soils are found



Figure 3. A Google Earth screenshot indicating the presence of suitable habitat for Sclater's Lark (blue polygons = contiguous habitat, brown = predicted dispersed) close to Beaufort West as evidenced by the occurrence of distribution records from BirdLasser (ST data). Contiguous Blomkoolgannaveld can be identified by smooth, grey regions of flat habitat.

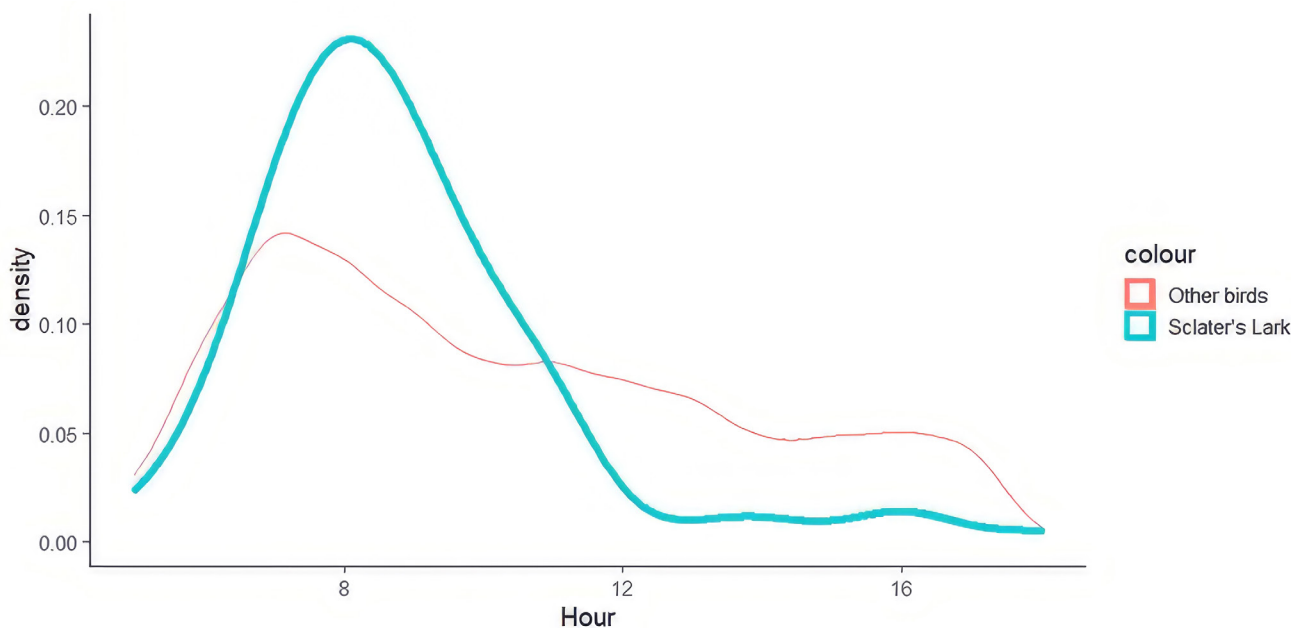


Figure 4. Density plots by hour for the timing of Sclater's Lark records by ST in relation to other bird species from Bulskop farm, east of Beaufort West. These mostly represent records from drinking sites.

across the Karoo wherever shale rock protrusions occur, but that clay is by no means an indicator of Sclater's Lark presence. While we did find an association between suitable habitat and calcrete-derived soils, field experience elsewhere suggests this feature alone is not a suitable

criterion for Sclater's Lark habitat identification, which may be driven by other soil criteria such as high pH or soil nutrient status.

The extensive 2017–2018 point count survey conducted by ATKL, consisting of over 2 800 counts in more

than 150 pentads across the Karoo in South Africa, resulted in only eight encounters with Sclater's Lark, with one of these occurring during a survey in the blomkoolgannaveld habitat close to Beaufort West. During that survey, midday rest periods between point counts were normally spent at waterholes, as these attracted large numbers of granivorous birds, notably Lark-like Bunting, Yellow Canary *Crithagra flaviventris*, Black-headed Canary *Serinus alario*, Cape Bunting *Emberiza capensis*, and Large-billed Lark *Galerida magnirostris*. However, at none of the >50 random waterholes visited by ATKL in this manner were Sclater's Lark encountered, which we attribute to a combination of uncharacteristic visitation times for this species and the likely absence of the species at these sites, but speaks to the localised habit of the species.

An inspection of waterholes where the species is known to drink, e.g., Brandvlei and between Williston and Carnarvon, indicated that these are waterholes in blomkoolgannaveld. At these pre-identified drinking locations, the birds are regularly encountered in general Karoo weather (dry and warm), although observations by ST after heavy rain at drinking sites have failed to record Sclater's Lark. Birds likely make use of ephemeral puddles during these times. Field observations suggest that the species prefers to drink on the ground, e.g., at leaking or overflowing troughs and cribs provided as a water source for livestock, rather than from the rim of these structures.

There are many microhabitat types across the Karoo, each with a distinctive community of birds (Lee and Wright 2020). Some of these are visually obvious to humans, such as aquatic environments with distinctive non-Karoo assemblages of waterfowl; Karoo homesteads, which in many cases host species generally not found in the wider landscape (e.g., Gabar Goshawk *Micronisus gabar*, Karoo Thrush *Turdus smithi*); or Karoo 'koppies' with Cinnamon-breasted Warbler, African Rock Pipit *Anthus crenatus* and various raptor species. Plains (or 'vlaktes') can be visually much harder to distinguish to the human eye and are likely lumped into a homogenous landscape by the casual observer. However, underlying geology and resulting soils and drainage capacity can result in subtle but significant variation in vegetation composition and structure, resulting in bird communities or bird-habitat associations that are trickier to identify. Some have been well documented (e.g., Red Lark *Calendulauda burra* in 'dunelands'), but other associations have yet to be clearly demonstrated. For example, the rarity of Karoo Eremomela *Eremome-*

*la gregalis* suggests an as yet unidentified habitat feature restricting its distribution.

Generally, we are confident that distribution and life history strategies of Sclater's Lark fits poorly with those better known for nomadism, e.g., Lark-like Bunting and Black-eared Sparrow-Lark *Eremopterix australis*. Both of these species have 2–3 eggs per clutch, and a distribution that varies depending on local rainfall patterns. By contrast, Sclater's Lark has an unusual single egg clutch size strategy (Lloyd 1999); which is more akin to the single kit reproductive strategy of the Karoo endemic Rivierine Rabbit *Bunolagus monticularis* (Duthie 1990) and Double-banded Courser *Rhinoptilus africanus* also has a one egg/clutch strategy. Sclater's Lark also showed no irruptive behaviour associated with nomadism during our years of observation, although these did correspond with drought years. That said, we speculate that the species does travel between patches of suitable habitat in those parts of the range with small habitat patches and dispersing juvenile birds may end up in marginal or unsuitable habitats.

As part of our investigations to understand Sclater's Lark, we also attempted several species distribution modelling pathways. However, given current covariate limitations (i.e., lack of fine scale mapping of blomkoolgannaveld), all models over-predicted the actual range of the species, even those that included soil layers in addition to traditional bioclimatic variables (Fick and Hijmans 2017). We stress that the modelled pentad coverage presented here in no way represents the Area of Occupancy for Sclater's Lark. Distribution model predictions often extended into the Karoo National Park, where we are highly confident that Sclater's Lark is absent, despite proximity to the main survey sites of this study. Despite overprediction, all these models still indicated the Aberdeen Plain population as separate from the population north of the escarpment. We explored the possibility of using the distribution of *Salsola tuberculata* to create a predictive layer, but were informed by SANBI that they were unable to provide data due to taxonomic uncertainties regarding the *Salsola* genus. As a result, we believe an accurate and suitable fine scale habitat suitability model for this species is some way off.

The regular counts at Bulskop allow an avenue to explore density and population estimates. The maximum number of birds recorded drinking during the targeted visits by ST to the Bulskop site was 50, implying a minimum density of 0.77 birds/km<sup>2</sup> if the assumption is made that this count represents the Bulskop population. This is just shy of the density estimate range provided by Lee *et al.* (2018) of

0.92–2.37. If the upper limit of this density estimate (2.37) is extrapolated across the mapped habitat (843 km<sup>2</sup>), this represents a value of nearly 2 000 Sclater's Larks for the Aberdeen Plain. However, given the extent of unsuitable habitat in our marginal habitat polygons, the effective population is likely to be less than half that value:  $0.77 * 843 = 649$ . By extension, the population range given by Lee *et al.* (2018) of between c 60 000 and 150 000 birds based on the size-range regression equation presented in the paper is very likely an overestimate given the large area of unsuitable landscape within the species range. The total SA population is likely ~50 000 individuals based on extrapolation of a density estimate of 0.77 to a range of 1 000 pentads.

There is still much to be learnt about Sclater's Lark, such as longevity, dependence on water, dispersal capacity, dietary specialization, and reproductive capacity. We are concerned that with 'big development' plans for the Karoo, a biome often viewed as homogenous in habitat and faunal composition, the specific requirements of Sclater's Lark and other habitat specialists may be overlooked. The study site where drinking observations were recorded (Bulskop) is now out of bounds due to a planned photo-voltaic energy development. As a species that drinks regularly, Sclater's Lark has already been identified as vulnerable to shale gas exploration through the potential for contamination of drinking sites (Lee *et al.* 2019b). In addition, the flatness of suitable habitat also means it is preferred by developers, given the lack of topographical impediments to construction. Furthermore, the lack of suitable habitat in any formally protected area is a great cause for concern and this species should receive special attention during Environmental Impact Assessments. In this respect, we advocate for the avoidance of mining development on blomkoolgannaveld, or that at least equivalent offset areas are identified for conservation. Our recommendations for spatial planning include that blomkoolgannaveld and Sclater's Lark are adequately represented in Critical Biodiversity Area Networks identified through systematic conservation planning, Strategic Environmental Assessments (which take place at a broader scale), as well as Protected Area Expansion Strategies.

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Appendix 1 - photos



Slater's Lark *Spizocorys sclateri* © Stefan Theron.



a



b



c



d

Images a-d: Close-up views of blomkoolganna *Salsola tuberculata* (a and b) and general views of blomkoolgannaveld (c-d) © Stefan Theron.