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Ornithology

Evidence for a possible range expansion of White-fronted Bee-eater *Merops bullockoides* into the Western and Eastern Cape Provinces, South Africa

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Abstract

Many bird species are undergoing rapid range shifts in response to habitat change, climate change, and anthropogenic factors. Although ranges shift, these shifts may not be accurately reflected in static range maps, particularly if range maps are not updated regularly. We observed a White-fronted Bee-eater (*Merops bullockoides*) while birding in the Western Cape province of South Africa, an area not currently covered by this species' known range. However, after investigating some other recent reports on the popular citizen science platform eBird, and comparing to changes in occurrence of this species from the Southern Africa Bird Atlas Projects, we suspect that this species is undergoing a range shift into the Western and Eastern Cape Provinces of South Africa. We illustrate this potential range shift with evidence from these citizen science platforms as well as from the literature. We conclude with a recommendation for conservation managers to adapt dynamic range maps for use in conservation decisions.

Introduction

White-fronted Bee-eater *Merops bullockoides* is a colourful bee-eater resident in central and southern Africa (Fry & Boesman 2020). This striking bird features an orange belly, green and blue wings, white forehead, and red throat, making it unmistakeable from other bee-eaters in the region (Chittenden 2007). In South Africa, this species is often found in scrubby habitats such as the Karoo region, and often associate with dry riverbeds, stony hillsides, and bushy pasture. This bee-eater is primarily insectivorous, feeding mostly on beetles near their cavity nests (Kopij 2018). White-fronted Bee-eaters are known to be attracted to exotic vegetation, such as eucalyptus trees (Fry & Boesman 2020).

This species has a wide range across southern and central Africa, occurring from coast to coast in central Africa (Gabon to Kenya), and southward through central and eastern South Africa (East Africa Natural History Society's Ornithological Sub-committee 1981, Wrege & Emlen 1991 Chittenden 2007, Fry & Boesman 2020). Although White-fronted Bee-eaters are a resident species, flocks of these birds forage up to 7 km from their breeding colony (Fry & Boesman 2020); vagrants have occasionally been recorded in Namibia and the southern coast of South Africa. Recently, WFBEs have begun to undergo a range shift south through South Africa into the Free State, the Northern Cape (Craig & Burman 1974, Herholdt & Earlé 1987). Additionally, for several decades, the White-fronted Bee-eater was considered to be a vagrant to the Eastern Cape (Skead 1967); however, since the first breeding record in 1998 (Martin 1999) this species has been considered a resident in the province (Barnes 1997, Craig et al. 2011, Hockey et al. 2011). It has benefited from human activities (Fry & Boesman 2020), and the creation of quarries and cuttings has provided appropriate nesting habitat for this species.

Observation

On 15 June 2022, at approximately 11h45 SAST, we observed a single White-fronted Bee-eater at the Fish Eagle Trail at the Van Loveren Family Vineyards (33.880°S, 20.001°E) (Van Loveren 2022), located in the town of Robertson, Western Cape, South Africa (Edwards & Binley 2022). We observed and photographed the individual for nearly 20 minutes (Figure 1), and watched as it foraged and hunted for insects. We continued on the trail for approximately 1.5 hours, and quickly rediscovered this individual when we returned to the area on our return. We did not spot any additional individuals of this species nearby.

The Fish Eagle Trail is located within the Little Karoo region of South Africa, and contains many features of typical Karoo habitat such as short scrubby vegetation growing on semi-arid soils. The first leg of the trail where we observed the bee-eater has a steep cliff on the west side of the trail, and the eucalyptus-lined Brede River on the east. These habitat features are typical within the known range of the species (Fry & Boesman 2020), so it is perhaps not surprising that a vagrant individual of this species would be found in this particular environment.

A possible range expansion into Western Cape and Eastern Cape

Our sighting of the White-fronted Bee-eater at the Fish Eagle Trail in the Western Cape prompted us to investigate other historical sightings in the area. We used the “Explore Species” function on the eBird website (Sullivan et al. 2014) to search for other submitted records of the species in the Western Cape, as well as in the Eastern Cape to corroborate previous evidence of a range expansion in that province as well. eBird is a semi-structured citizen science program that allows participants to submit checklists on birds observed in the field, then makes the data available to researchers and participants alike (Sullivan et al. 2014). We also consulted the Second Southern African Bird Atlas Project (SABAP2) (Lee et al. 2022) to look at occurrences of White-fronted Bee-eaters in these provinces over the last two atlases. SABAP2 surveyors follow a structured monitoring protocol, recording all birds heard or seen within a 5' × 5' grid cell (referred to as a ‘pentad’). Southern Africa is currently undertaking its second bird atlas; the first of these atlases was conducted between 1987 and 1992, and the second started in 2007 (Harrison et al. 1997, Underhill 2016, Brooks et al. 2022, Lee et al. 2022).

To our surprise, we found several records of this species on eBird additional to our submitted record in the Western Cape. The earliest record listed on eBird for the Western Cape was submitted 1 July 2012 near Plettenberg Bay (Buckham 2012). Other records were submitted semi-regularly starting in 2016, totalling 12 observations at present. Some checklists provide additional write-ups as part of the eBird rare bird submission process, including details that suggest they potentially breed in the area. In the Western Cape, a checklist submitted 24 July 2022 that reported two observed WFBEs noted that they are “known to breed at Calitzdorp” and that the “individuals have been observed in this area for a few months” (Skead 2022). Another checklist submitted 5 February 2022 that reported six observed WFBEs noted that they are “resident at this site” (the site being an area along the Gamkarivier near Calitzdorp) (Hardaker 2022).

In the Eastern Cape, we found a relatively high number of regularly-recorded individuals and colonies of breeding WFBEs. This was somewhat expected based on the previous literature we had read about an increase of breeding activity in this province, but we were still surprised at the number of records that were submitted to eBird. The earliest record submitted to eBird in the Eastern Cape was on 7 February 2015 (Vrey, 2015). Although this particular checklist did not include information about abundance, nor any comments, a checklist submitted in the same area roughly one month later on 1 March 2015 noted that this species was “[a]pparently resident in the region in recent years” (Bruce, 2015). A checklist submitted 5 May 2018 noted that “these bee-eaters are resident in this area” and that “the distribution is off” (Oswald, 2018). Another checklist submitted 4 May 2019 that recorded 20 individuals of this species note that the birds are “residents” and that there are “breeding individuals for several years”; this checklist also included the breeding code “ON - Occupied Nest” to signify confirmed breeding (Taute, 2019).

Figure 1: White-fronted Bee-eater at Fish Eagle Trail, Robertson, Western Cape. The individual often perched on the rocky ledge to watch for insects flying nearby, before actively hunting.

In addition to these sightings on eBird, SABAP2 has also reported several new sightings of WFBE over the last decade. In Western Cape, the first atlas only had a very small number of reports of WFBE, with only two pentads having a reporting rate of 0.071% each. In contrast, the second atlas currently has 15 pentads with reported WFBE. Thirteen of these pentads have reporting rates of 0.001 - 5%, and two have a reporting rate over 5%, including the pentad that overlaps with the region north of Calitzdorp where they have been known to breed according to eBird observers. This demonstrates an overall increase in reporting rate of WFBE in Western Cape from SABAP 1 to SABAP 2 (SABAP2, 2022). The story is much the same in the Eastern Cape, but with more dramatic increases in reporting rates. For example, a pentad on the north shore of Algoa Bay reports a relative increase of 28.3% from SABAP 1 to SABAP 2. Indeed, this coincides with the area containing many eBird checklists that note this species is a regular breeder in the area.

Finally, we note that although we have only formally consulted eBird and SABAP, there are undoubtedly numerous other records of this species that have simply gone unreported to these major platforms. For example, we note a webpage from a game reserve in the Eastern Cape that wrote a blog post on WFBEs on their property in 2014, one year earlier than the earliest record on eBird for the province (*Rare White Fronted Bee Eaters*, 2014). Additionally, several observations submitted to the popular citizen science platform iNaturalist also precede those on eBird. These are in addition to the several observations that have been presented in previous studies that talk about a possible range expansion into the Eastern Cape (Skead 1967, Barnes 1997, Martin 1999. Craig et al. 2011).

Comparison with Static Range Maps of Known Distributions

To illustrate this possible range expansion of White-fronted Bee-eater into the Western and Eastern Capes, we obtained a range map of this species as reported from the IUCN Red List (BirdLife International & Handbook of the Birds of the World 2010), and overlayed this static range map with points of the location and abundance of the first report of the species for each year X location combination as reported on eBird (Figure 2). In the case where there are multiple reports of the same individuals or colonies of WFBEs (for example, at a hotspot), we plotted the maximum count for that location/year combination. Through a visual inspection, we noted that the distribution shown on IUCN Red List map closely matches the distribution that is shown in the static range map in the Birds of the World Reference (Fry & Boesman 2020), as well one of our main birding resources in South Africa: 7th Edition of Roberts Bird Guide (Chittenden 2007). The range maps appear to acknowledge the range expansion south into Free State, but do not show the range expanding past there.

However, another one of our primary resources when birding in South Africa, the Roberts Bird Guide 2 Android application (Gibbon 2022), does show patchy areas of species presence in Western and Eastern cape that appear to at least acknowledge potential colonies in these areas. These patchy areas appear to match the locations of some of the points shown in Figure 2 that fall outside of the current accepted range. Additionally, although the species text in the Robert's Bird Guide application notes the "range expanding in Free State and Eastern Cape" (Gibbon 2022), it still does not mention any expansion into Western Cape as reported by eBird and SABAP2 observers.

Conservation Implications

We feel that the dynamic nature of the observations reported on eBird, and the citizen science effort and derived maps of SABAP1 and SABAP2 provide more accurate and timely insights to the current range status of this species than do static distribution maps. Static maps are often used to inform decisions on conservation action and policy (Gonzalez et al. 2023), but with climate change and other anthropogenic factors causing range shifts, contractions, and expansions in several species (Chen et al. 2011, Rushing et al. 2020, Stiels et al. 2021), there is increasing potential that these static maps may be inadequate. Recent evidence demonstrates that citizen science observations can be used to develop updated range maps that more accurately reflect the current distributions of species (Lin et al. 2022). Our observation (Edwards & Binley 2022), while certainly rare for the Western Cape and outside of the current accepted range, is one of

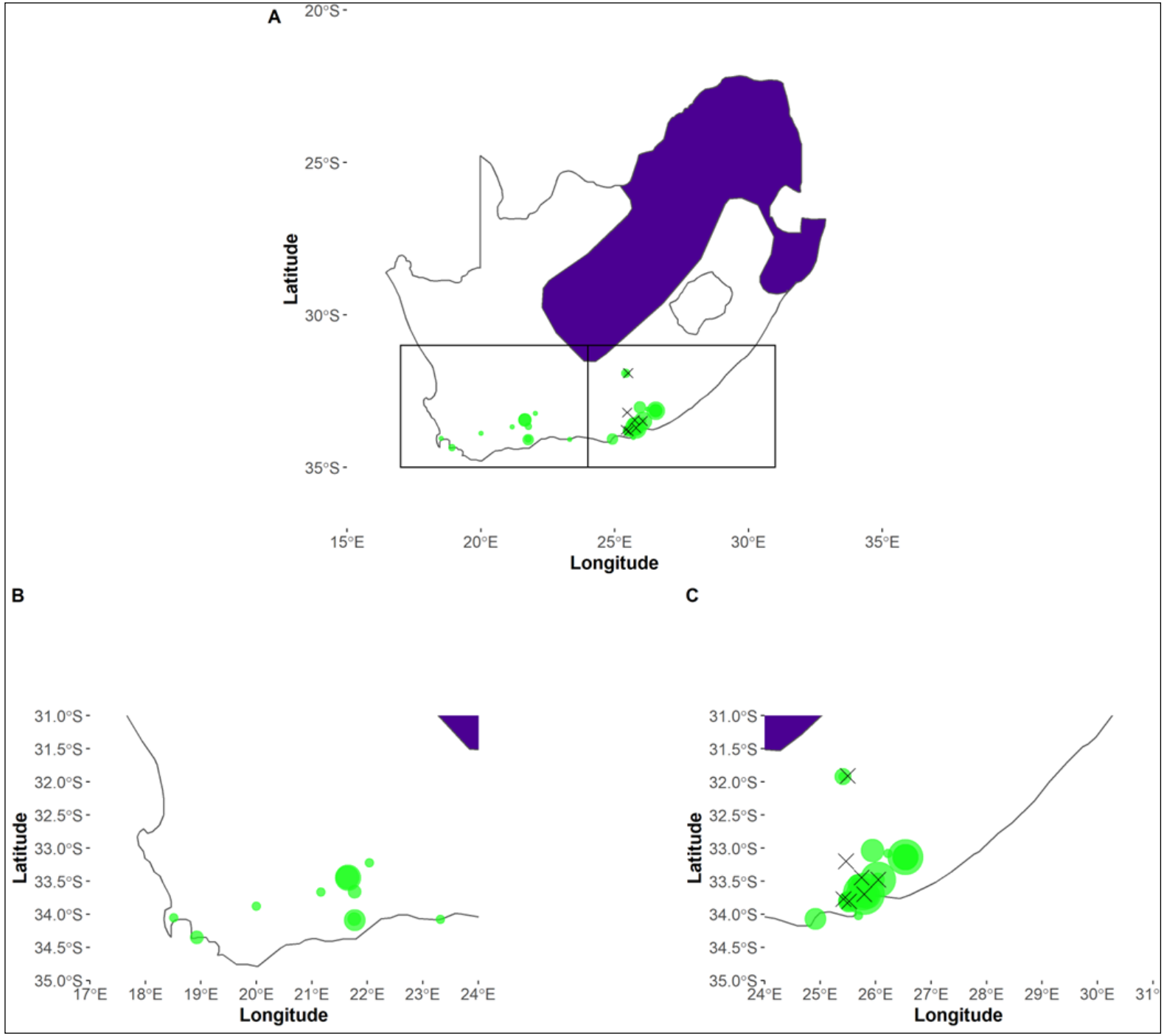

Figure 2: Map showing current static range of White-fronted Bee-eater (purple polygons) in South Africa (A) according to IUCN Red List, with additional eBird observations (green circles and black crosses). We focus here on the observations from the Western Cape (B) and the Eastern Cape (C). Size of each point corresponds to the log reported abundance for that particular location on eBird. Black crosses indicate that no abundance was reported to eBird, but the bird was reported in that particular location. In situations where there were multiple reports of White-fronted Bee-eater at the same location to eBird (e.g., at eBird hotspots), we have mapped the first observation for each year, for each location.

several increasing records for the province according to records submitted by citizen scientists, and reinforces the growing calls for the increased use of citizen science for monitoring biodiversity (Binley et al. 2021, Soroye et al. 2022). It also emphasizes the importance of long-term monitoring programs such as SABAP for detecting changes in biodiversity over time.

With the continual digital transition of well-known resources such as the Birds of the World (Billerman et al. 2022), the creation of digitized field-guide applications such as the Roberts Bird Guide 2 (Gibbon 2022), and the sheer volume of data submitted to citizen science platforms such as eBird and SABAP, we recommend that these digital range maps be updated on a regular basis in order to more closely match the expected range of a species. The changes in the range map over time, especially if done on a regular basis as more information is available, can help conservation managers to make better decisions about where to protect for species at risk, and can highlight potential habitat areas of concern across taxa.

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