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SPECIAL ISSUE: GLOSSY IBIS ECOLOGY & CONSERVATION

Glossy Ibis *Plegadis falcinellus* in South Africa, Lesotho and Swaziland

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ABSTRACT

This paper first reviews the historical literature on the Glossy Ibis *Plegadis falcinellus* in the southern African bird literature, focusing on three countries: South Africa, Lesotho and Swaziland. Secondly, it extends the comparison of the species distributions in these three countries as revealed by the First and Second Southern African Bird Atlas Projects.*

*Keywords and Abstract have been written by the editors.

Introduction

In the southern African bird literature, the Glossy Ibis *Plegadis falcinellus* does not have a single full-length paper devoted to any aspect of its biology; there are only a series of "short notes", and species accounts in field guides, atlases and reviews of groups of species (Barnes 2005). The longest paper published to date which focuses on this species only is a comparison of the distributions as revealed by the First and Second Southern African Bird Atlas Projects (Underhill *et al.* 2016).

This paper extends and expands that comparison. The geographical limitations are South Africa, Lesotho and Swaziland. It makes use of two sections. The first reviews what was understood about the status of the Glossy Ibis during the 19th and 20th centuries and consists of a literature review. The second section considers the information related to the distribution of the species from the bird atlas projects. Note that in this paper the seasons are austral: summer refers broadly to the period October–March, and winter to the period April–September.

The historical status of the Glossy Ibis in southern Africa up to the 1980s

The early books on southern African birds described the Glossy Ibis (Figure 1) as a migrant to the region from the Palearctic with most records being made in summer. For example, in the first fieldguide Leonard Gill described the Glossy Ibis as "an irregular migrant to South Africa from Southern Europe and Asia" (Gill 1936). Austin Roberts (1940) wrote: "*It is a rare migrant to South Africa from the Northern Hemisphere*." But several decades earlier, at the start of the 20th century, Stark and Sclater (1906) were more cautious and simply noted: "*The Glossy Ibis is not known to breed in South Africa*". It is completely unknown if "Palaearctic migrant" was the real status of the species in the region until the first half of the 20th century, or whether breeding had simply been

overlooked.

Breeding was first recorded in southern Africa in September 1950, when 10 nests were found at spring in Gauteng in a heronry, containing also nests of Western Cattle Egret *Bubulcus ibis*, Black-crowned Night Herons *Nycticorax nicticorax*, Purple Herons *Ardea purpurea* and African Sacred Ibis *Threskiornis aethiopicus* (Anon 1951; Tarboton 1968; Tarboton *et al.* 1987). The way in which this event was reported in 1951 is remarkably matter-of-fact. This contrasts strongly with the hype surrounding the first discovery of breeding by species considered to be Palearctic migrants to South Africa. For example, White Storks Ciconia ciconia were first reported as breeding in 1941 (Roberts 1941a) and this was treated as a milestone event in African ornithology (e.g. Roberts 1941b, 1942; Broekhuysen 1942; Priest 1942), as was the discovery of breeding Leach's Storm Petrels Oceanodroma leucorhoa in 1995 (Whittington and Dyer 1995; Whittington 1996; Underhill 1998; Whittington *et al.* 2001; Underhill *et al.* 2002). The lack of enthusiasm associated with the discovery of breeding of Glossy Ibis in South Africa in 1951 suggests that breeding had been long-suspected, and was at last finally proven. The species was by then already known to breed on the Kafue Flats and Barotse Plain in Zambia (Anon 1951). The first recorded breeding attempts in the Western Cape were made in 1955 (not successful) at Rondevlei Bird Sanctuary, Cape Peninsula) and then in 1967 (successful) at the farm Kersefontein, in the Hopefield district, along the Berg River (Middlemiss 1955; Hartley *et al.* 1968).

It breeds colonially, often a minor species in a large heronry, and so its breeding is generally hard to detect. For example, Ernest Middlemiss (1995), the professional ornithologist at Rondevlei Bird Sanctuary, wrote "*I never saw the two Glossy Ibises [myself] during the 39 days they were known to be present. [The first observation was made by] a carpenter building a shore observation tower who reported that he had seen two strange, dark birds with long, curved beaks flying over the water*." This breeding occurrence was discovered more by accident than by design. Likewise, the description of the breeding event at Springs in Gauteng indicates that it took some detective work to find the nests on the third visit "*about 20 yards from the edge of the reeds*" and they "*could only be reached after wading through water and mud waist deep and knee deep respectively*" (Anon 1951). It seems plausible that the idea hinted at by Stark and Sclater (1906), that there was a breeding population, but it had simply not yet been discovered, is the appropriate status for the Glossy Ibis in southern Africa in the first half of the 20th century.

In the decade before fieldwork for the First Southern African Bird Atlas started in 1987, a series of regional atlases were published, and most contained a succinct account of the status of each species in the region. These paint a valuable picture of the abundance and distribution of the Glossy Ibis in the late 1970s and early 1980s. The remainder of this paragraph quotes the key points in each of these species accounts. In describing status of the Glossy Ibis in the area south and west of the Olifants and Breede Rivers of the Western Cape, Hockey *et al.* (1989) wrote: "*Uncommon resident and summer visitor, breeding September to February. Although uncommon, both numbers and range are increasing*." They attributed this increase to the construction of artificial waterbodies, such as farm dams and sewage works. In KwaZulu-Natal, Cyrus and Robson (1980) wrote: "*Encountered, often in flocks, on the edges of open stretches of water on the littoral plain and, to a lesser extent, inland vleis, dams and sewage farms*." Their distribution map showed most records were from the north-eastern section of the province, adjacent to Swaziland and southern Mozambique, and showed no clear pattern of seasonality. In Swaziland (where fieldwork for the atlas was 1985–1991), Parker (1994) wrote: "*An uncommon summer visitor to all regions, encountered in small flocks of up to 10 birds*". For the Transvaal (now roughly the provinces of Gauteng, Limpopo, Mpumalanga and North West), Tarboton *et al.* (1987) wrote (summarizing fieldwork from 1960–1986, but mainly 1983–1985): "*Occurs widely but sparsely in all regions, but most common on the Highveld*" and "*The 80% decline in numbers in winter is assumed to be the result of a seasonal movement to the tropics.*" In the Free State (1983–1986), the range and status of the Glossy Ibis was described by Earlé and Grobler (1987) as "*Uncommon to fairly common in specific localities.*

Can probably be expected everywhere as it is expanding its range." Their seasonal maps show that records were mostly made in summer. At the eastern end of the Eastern Cape, in the former Transkei, Quickelberge (1989) noted: "*The only record is a bird shot by Gould at Matetiele at the turn of the century*" (i.e. around 1900). In Barnes (2005) it is stated that the Glossy Ibis does not occur in Lesotho, quoting Osborne and Tigar (1990). This is an error; Osborne and Tigar (1990) knew of four records since 1970, but did not observe the species themselves while they were doing the bird atlas of Lesotho.

The status of all bird species in southern Africa (defined as Africa south of the Kunene and Zambezi Rivers) is provided in the 1980 checklist of the Southern African Ornithological Society (S.A.O.S. List Committee 1980). For the Glossy Ibis, List Committee wrote: "*Recorded breeding locally south-western Cape, Zululand, Transvaal, Botswana and northern Namibia (Ovamboland), and occurs in small numbers elsewhere. Status uncertain, but Palaearctic migrants also conceivably reach South Africa*."

That essentially summaries the perceived status of the Glossy Ibis at the time the first bird atlas started. It had been an enigmatic species for the previous eight decades.

Methods and Results

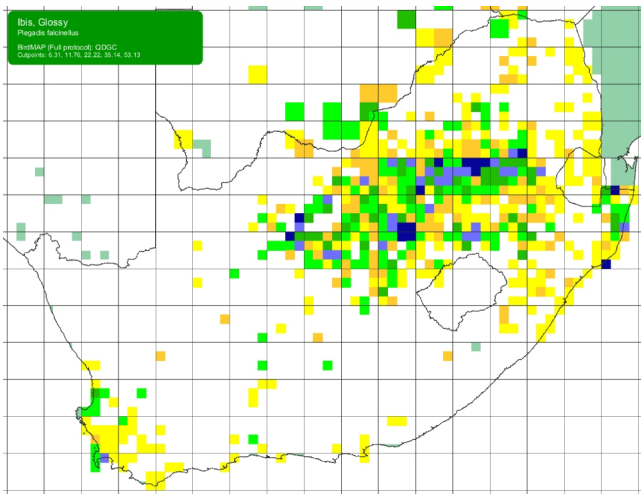
The definitive status of the Glossy Ibis in southern Africa: bird atlas insights

SABAP1 distribution

The First Southern African Bird Atlas Project (SABAP1) used a 15-minute grid, generating what are known in the region as quarter degree grid cells (there are actually 16 of these per degree cell), and they have sides of about 27 km (Harrison *et al.* 1997; Harrison and Underhill 1997). Fieldwork for SABAP1 was mainly in the period 1987–1991, but the project included data from compatible projects for smaller regions from 1980 onwards, and can be viewed as generating a snapshot of overall bird distributions in the 1980s. The SABAP1 distribution map shows that the bulk of the distribution in South Africa was in the Grassland Biome which covers much of central South Africa (Harrison and Underhill 1997) (Figure 1).

The grid cells in Figure 1 with the dark blue shading indicate the core of the range of Glossy Ibis during SABAP1; the main centres of abundance are on the eastern Witwatersrand, Gauteng where many of the wetlands are artificial, a by-product of gold-mining, and in the panveld around the towns of Welkom and Virginia, in the Free State; where the mining industry of the Free State Goldfields pumps freshwater to the surface, supplementing the pans and creating artificial wetlands. The core of the distribution in Gauteng lies precisely in the region where breeding was first recorded in 1950.

Figure 1. SABAP1 distribution map for the Glossy Ibis in South Africa, Lesotho and Swaziland, and a quarter degree grid scale, downloaded 3 April 2018. The species was not reported in grid cells shaded white. The species was recorded in grid cells shown in colour, with shades based on reporting rate ranges: yellow 0–5.7%, orange 5.7–11.7%, light green 11.7–22.2%, dark green 22.2–34.6%, light blue 34.6–53.5% and dark blue 53.5–100%. These cutpoints were determined by SABAP2 calculations, see Figure 2. There were no checklists for grid cells shaded turquoise



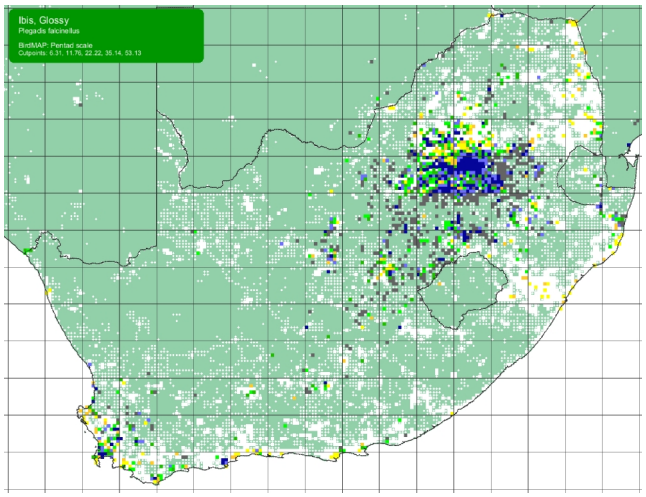
SABAP2 distribution

The Second Southern African Bird Atlas Project (SABAP2) uses a five-minute grid, generating grid cells known as pentads (Underhill 2016). It started in 2007 and is ongoing. The two atlas projects are about

two decades apart. There are nine SABAP2 pentads per quarter degree grid cell, as used by SABAP1, so the distribution maps are produced on a finer scale.

The interpretation of the pentad-scale distribution maps derived from SABAP2 data is fully described by Underhill and Brooks (2016a). In brief, reporting rates are shown in colour for pentads with four or more checklists – white: not reported, probably absent; and then six colours ranging from yellow, low reporting rates, to dark blue, high reporting rates, arranged so that the number of pentads in each of these six colours is an even as possible). For pentads with fewer than four checklists, grey indicates presence, and a small white dot indicates not reported, possibly absent. Pentads without data are shaded turquoise.

Figure 2. SABAP2 distribution map for the Glossy Ibis, on pentad scale, downloaded 3 April 2018. The detailed interpretation of this map is provided by Underhill and Brooks (2016a). Pentads with four or more checklists are shaded white if the species was not recorded, or in colour, with shades based on reporting rate ranges: yellow 0–6.3%, orange 6.3–11.8%, light green 11.8–22.2%, dark green 22.2–35.1%, light blue 35.1–53.1% and dark blue 53.1–100%. These cutpoints were determined in such a way that the number of pentads shaded each colour are as equal as feasible with integer arithmetic. In pentads shaded grey or with white dots, there are one, two or three full protocol checklists, or there are ad hoc lists, or incidental records. In pentads shaded grey, the species was recorded as present; in pentads with white dots the species has not been recorded. If a pentad has four or more checklists, and the species has been recorded on an ad hoc checklist or as an incidental recorded, it is shaded yellow, indicating that the species has a small reporting rate



The overall impression of the SABAP2 distribution map for the Glossy Ibis (Figure 2) is that the distribution is fragmented compared to SABAP1 (Figure 1); this is a false conclusion, and is a consequence of the change of size of grid cells between the two projects. Glossy Ibis, being a waterbird, is restricted to pentads containing wetlands. On the pentad scale, the SABAP2 distribution map (Figure 2) shows that the core of the range of the Glossy Ibis remains in southeastern Gauteng, in the one-degree grid cell having S 26° and E 28° in its northwestern corner. Many of the pentads in this degree cell are shaded dark blue, indicating a

reporting rate exceeding 53.23% and those shaded light blue have a reporting rate between 35.29% and 53.25% (Figure 2). From this core region, the distribution extends mainly westward and eastward across the grasslands of the Free State and Mpumalanga, with another focal point in the Senekal-Bethlehem-Harrismith district of the southeastern Free State. With declining output from the Free State Goldfields, the Glossy Ibis hotspot around Welkom seems to have dissipated. Elsewhere in South Africa, Lesotho and Swaziland there are centres of abundance in northwestern KwaZulu-Natal and in the Western Cape, on the Cape Flats near Cape Town, on the West Coast along the Berg River estuary and at Verlorenvlei, and near the estuary of the Gouritz River at the western end of the Garden Route. Elsewhere there is scattering of records, where Glossy Ibises have been observed in many pentads, presumably mainly at wetlands (Figure 2).

Seasonal distribution maps, based on the SABAP2 data, show a striking difference between summer and winter (austral seasons) (Figures 3 and 4). The distribution in summer, defined as the four months from November to February, is similar to the overall distribution of Figure 2, except that the core parts of the range are now highlighted. The distribution in winter (Figure 4), defined as May to August, is sparse in relation to the summer distribution of Figure 3. There is clearly not a total migration of Glossy Ibises from South Africa, but especially there is a large winter emigration of birds from the core of the range in Gauteng. Night time temperatures in Gauteng are often below 0°C in the winter months. The subtropical coastal plain of KwaZulu-Natal is warm in winter, but there is not a hint of suggestion of increased reporting rates there, so Glossy Ibises from Gauteng do not migrate westwards to the coastal plain, either here, or farther north in southern or central Mozambique (Figure 2, Parker 1999; 2005).

Figure 3. Summer SABAP2 distribution map for the Glossy Ibis, on pentad scale, downloaded 3 April 2018. The austral summer was defined as the months November, December, January and February. The interpretation is the same as in Figure 2, and uses the same cutpoints as used in Figure 2. Pentads shaded white, or in colour, had four or more checklists in these midsummer months

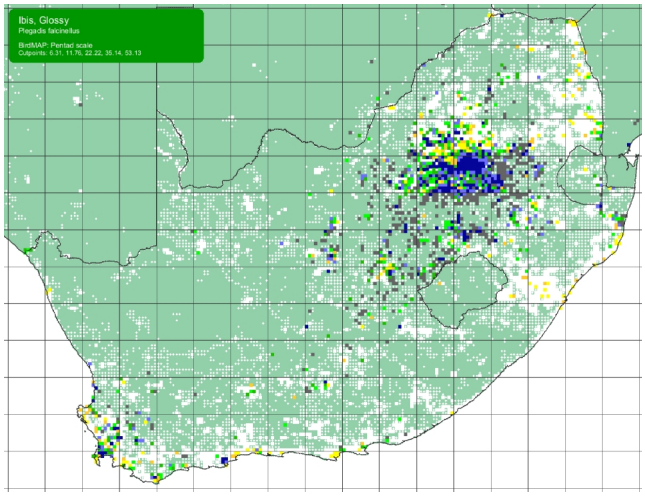
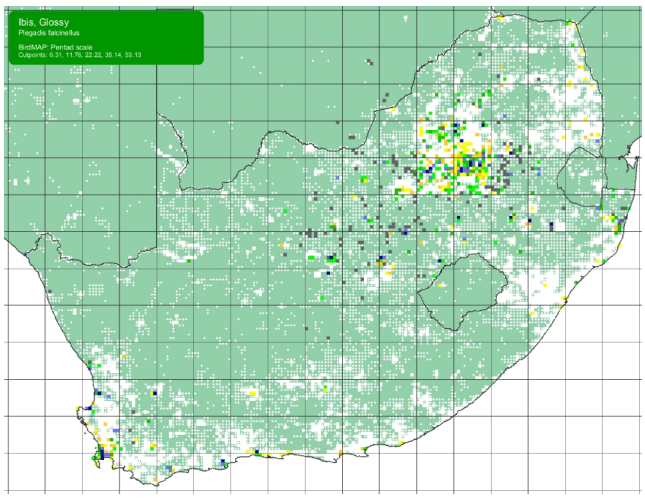


Figure 4. Winter SABAP2 distribution map for the Glossy Ibis, on pentad scale, downloaded 3 April 2018. The austral winter was defined as the months May, June, July and August. The interpretation is the same as in Figure 2, and uses the same cutpoints as used in Figure 2. Pentads shaded white, or in colour, had four or more checklists in these midwinter months



There is one ring recovery from Gauteng northwards to Zambia; a nestling ringed in Benoni in November

1970 was recovered in the Senanga District of Zambia (S 15° 39', E 23° 02') in August 1973. 1,300 km north of the ringing site (Underhill *et al.* 1999; Safring ring 710061). This recovery was made in the vast Barotse/Zambezi floodplain, so it is feasible that the non-breeding destination of South African Glossy Ibis lies here and on the floodplain of the Kafue Flats (Dowsett *et al.* 2008). However, Dowsett *et al.* (2008) provide no hint of a suggestion that there might be an influx of Glossy Ibis in the austral winter, but they do state that flocks, numbering hundreds and thousands have been observed at various sites, and that "these are suggestive of long-distance movements". Thus the huge Zambian wetlands are likely to prove the non-breeding grounds of the Glossy Ibis which move out of South Africa during the austral winter.

Range change between SABAP1 and SABAP2

The interpretation of the range-change maps showing how distributions have changed between SABAP1 and SABAP2 has been described by Underhill and Brooks (2016b). The key quantifies in the comparison are the reporting rates for quarter degree grid cells calculated for SABAP1 and SABAP2. The SABAP2 reporting rate is computing by combining all the checklists for the nine pentad with the quarter degree grid cell. In Figure 5, the Underhill and Brooks (2016b) approach was used to classify the quarter degree grid cells into six categories of increase and decrease. The relative increases and decreases are estimated by applying the Griffioen transformation to the SABAP1 and SABAP2 reporting rates (Underhill and Brooks 2016b). The quantitative estimate of proportional change involves an assumption that, in pentads where Glossy Ibis occurs, they are randomly distributed across the landscape, i.e. they are not clustered or in flocks. For the Glossy Ibis, this is not true, so the quantitative estimates of relative change suggested by the Griffioen transformation need to be treated cautiously; and they are regarded qualitatively here.

Results are shown in Figure 5 for only the 779 quarter degree grid cells for which there are four or more checklists for both SABAP1 and SABAP2 and in which Glossy Ibis occurred in either SABAP1 or SABAP2 (Table 1). In other words, grid cells in which Glossy Ibis did not occur in either project are not included in this analysis.

Figure 5. Range-change map between SABAP1 and SABAP2 for the Glossy Ibis, downloaded 3 April 2018. Each quarter degree grid cell shown in colour received at least four checklists in both SABAP1 and SABAP2. All these grid cells had Glossy Ibis recorded in them either in SABAP1 or in SABAP2 or in both. Red, orange and yellow represent quarter-degree grid cells with very large, large, and small relative decreases and blue, dark green and light green represent grid cells with very large, large and small relative increases. A count of the number of grid cells in each category is provided in Table 1. Fuller information on the interpretation of this range-change map is provided in Underhill and Brooks (2016b)

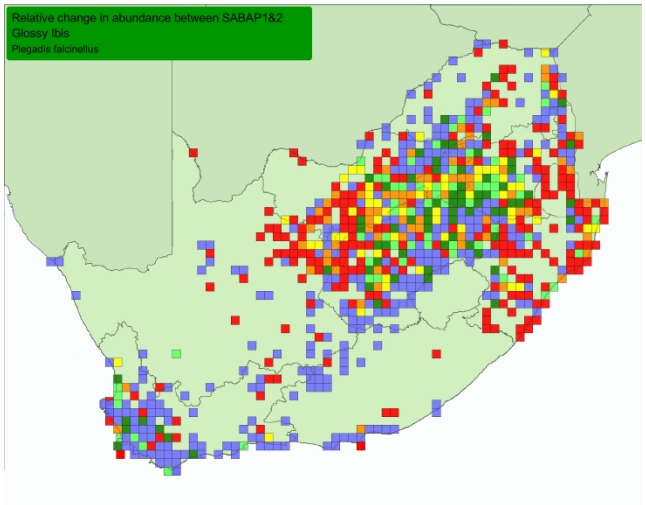


Table 1. Range-change summary for the Glossy Ibis between SABAP1 and SABAP2. The table provides a count of the number of quarter degree grid cells of each colour in Figure 5. Also shown are the same summaries when the analysis is restricted to grid cells with at least 30 checklists for both SABAP1 and SABAP2

Status	Four checklists for both SABAP1 & SABAP2		30 checklists for both SABAP1 & SABAP2	
	Count	%	Count	%
Red (very large decrease)	217	28	107	24
Orange (large decrease)	70	9	46	10
Yellow (small decrease)	54	7	35	8
Light green (small increase)	62	8	50	11
Dark green (large increase)	71	9	45	10
Blue (very large increase)	305	39	167	37
Total	**779**	**100**	**431**	**100**

Of these 779 quarter degree grid cells, the numbers of grid cells shaded blue (very large increase) and dark green (large increase) are 305 (39%) and 71 (9%) respectively. At the other end of the scale 217 (28%) grid cells are red (very large decrease), and 70 (9%) are orange (large decrease). The groups of blue grid cells suggesting very large increases extend across the Western Cape, along the Eastern Cape coastal strip, and along an axis running from Beaufort West in the Western Cape, just west of Lesotho to Volksrust in the Free State. There is also an axis of blue running from Rustenburg in North West to Polokwane in Limpopo. Over the central highveld, in the grassland biome around Gauteng, greens, yellow and orange grid cells predominate, suggesting that populations are fairly stable in this region. There are large groups of red cells over much of KwaZulu-Natal. It needs to be borne in mind that some of the increases and decreases are off a low base (see Figure 1). Apart from in the Western Cape, the patterns of increases and decreases are complex. In the Western Cape, the comment of Hockey *et al.* (1987) almost certainly remains true: "*both numbers and range are increasing*."

Repeating the quantitative count of Figure 2 and Table 1 using grid cells with 30 or more checklists in both SABAP1 and SABAP2, the sampling error is considerably smaller than with four checklists for both projects, but there are now only 431 grid cells which meet this criterion (Table 1). In this restricted analysis, 34% of grid cells show large or very large decreases and 47% show large or very large increases. The two sets of results are similar.

Discussion

Overall, the conclusion has to be that the Glossy Ibis has increased in both range and abundance over the Western Cape in the two-decade period between SABAP1 and SABAP2. Its fortunes appear to be mixed over the remainder of South Africa, with some clear regions of increase, some regions of stability and some clear regions of decrease. The atlas database does not provide reasons for the changes, it only highlights the patterns, which then need further and more detailed investigation.

The Glossy Ibis is not an easy species to monitor using regular waterbird counts. It is erratic in occurrence at particular wetlands, and numbers tend to vary considerably (Taylor *et al.* 1999). Ring recoveries also point to nomadic movements (Underhill *et al.* 1999).

This is clearly an interesting and enigmatic species, and poorly studied in southern Africa. Genetic analyses would probably reveal whether the species did indeed only start breeding in South Africa in the middle of the 20th century. We still do not know if any of the Glossy Ibis currently occurring in South Africa are migrants from Eurasia, but this does seem doubtful. This is a species for which tracking devices would generate fascinating data. We have little preconceived ideas of what such a study would reveal. The only safe prediction is that, given the species is nomadic, the devices would show patterns of movement. But we do not know the extent to which this movement, in individual birds, is on scales of tens of kilometres, hundreds of kilometres or thousands of kilometres. Given that this species is a partial migrant, this is likely to be highly variable at the individual level.

Acknowledgements

This paper is celebrates the contributions of thousands of citizen scientists to the databases of the first and second bird atlas projects in southern Africa (SABAP1 and SABAP2).

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